

Coloproctology 2
Series Editor: Carlo Ratto

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Carlo Ratto · Angelo Parello
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Hemorrhoids

Coloproctology

Volume 2

Series Editor

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Coloproctology is a modern discipline covering a vast area of medicine, including all diseases and disorders of the colon, rectum, and anus. Physicians and non-physician personnel are very interested in the field owing to the high prevalence of these clinical conditions in the general population, the severity of secondary symptoms and/or disabilities, the diagnostic and therapeutic issues, and the personal and social implications. In particular, a variety of specialties and subspecialties are involved in the clinical management of colon and anorectal diseases/disorders, which frequently entails a multidisciplinary approach. This book series will provide detailed coverage of a wide range of topics in Coloproctology, focusing particularly on recently introduced and emerging diagnostic and therapeutic techniques. Each volume will be a reference work on a specific disease or disorder. The core aim is to provide a sound and productive basis for clinical practice, and to this end some of the most highly regarded experts worldwide will contribute as co-editors and authors. The series will also help researchers and all those interested in the field to identify key issues in Coloproctology in order to foster the development and implementation of further new technologies.

More information about this series at <http://www.springer.com/series/13364>

Carlo Ratto • Angelo Parello
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Hemorrhoids

With 112 Figures and 52 Tables

 Springer

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Foreword

Of all the topics in coloproctology there is nothing quite like the subject of hemorrhoids to get a journal club or clinical meeting animated. Everyone has their own prejudice or pet technique. In this excellent book, all the possible treatments from the most established to the very novel have been carefully put together and the evidence for their efficacy clearly outlined. Carlo Ratto and his colleagues are to be congratulated on a fine achievement.

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Preface

Coloproctology is an amazing field of modern medicine that fascinates many surgeons, but also many others in the medical field. The evolution of knowledge and continuous progress in technologies has significantly changed this discipline over the last 20 years, and it is difficult to define its “state of art” today. To address this continuum of advances in this field, our book series is being published in both an electronic and printed format, allowing us to avoid trying to pinpoint the progress of coloproctology at this point in time (which would result in the information being “old” in a few months). Thanks to the “Major Reference Works” formula, in which living editions of reference works can be updated as scientific developments warrant, readers can access further evolutions of each chapter after publication of the print edition by consulting the updated electronic contents. The purpose of this project is to provide a panoramic view of the topic, ranging from the basics (including anatomy and physiology of the colon, rectum, and anus, oriented at immediate application in diagnosis and treatment) to principles of patient management. The first volume is dedicated to the basic anatomy, physiology, and principles of diagnosis in order to offer the keys of access to this specific discipline. Due to the variety of different clinical conditions, the following volumes of *Coloproctology* have been structured as several monographic books, dedicated to hemorrhoids, anal fistula and abscess, fecal incontinence, constipation and obstructed defecation, chronic inflammatory bowel diseases, miscellaneous benign colorectal and anal diseases, and neoplasms of the colon, rectum, and anus. Functional disorders, inflammatory diseases, benign neoplasms, malignant tumors, infectious diseases, and miscellaneous abnormalities and disorders affecting the colon, rectum, and anus are also all addressed. Each book aims to discuss the main open questions regarding the pathophysiology and diagnosis of each topic along with current points of view, thereafter debating the actual strategies for treatment. Wherever the choice between a variety of diagnostic and therapeutic options would be controversial, a “virtual round table” has been set up, giving readers the pros and cons of different leading opinions. As would be expected, the panel of contributors is of the highest worldwide scientific level, reflecting the best clinical practice on each topic, and ranges from surgeons to gastroenterologists, oncologists, radiotherapists, radiologists, internists, specialists in abdominal and pelvic diseases and disorders, etc. When appropriate, an updated review of the literature is summarized in tables within the chapters, and a number of figures provide useful examples of cases diagnosed using different modalities of imaging and treated

with different surgical approaches. This book series aims to be a reference for not only coloproctologists, but for all specialists involved in the management of disorders and diseases of the large bowel and anus, medical students, and other professionals training in healthcare. Finally, we are delighted that our *Coloproctology* book series is accessible to a wide audience through SpringerLink (<http://link.springer.com/>), the publishing platform for Springer's major reference works.

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About the Editors



Carlo Ratto He was born in Naples, Italy, on July 6, 1962.

He graduated in Medicine and Surgery at the Catholic University of Rome in 1987.

He is Researcher at the Department of Surgical Sciences, Catholic University, Rome.

His clinical practice, at the University Hospital Agostino Gemelli, concerns particularly the colo-recto-anal disorders and diseases. He is the Chief of Proctology Unit.

He is actively involved in research on:

- Anorectal physiology, in particular concerning anorectal manometry, electrophysiology studies, and endoanal ultrasound in benign anorectal disorders. In particular, he is actively involved in the clinical application of three-dimensional endoanal ultrasound.
- Fecal incontinence and constipation, in particular concerning pathophysiology and treatment with traditional and novel therapeutic modalities (sphincteroplasty, graciloplasty, sacral neuromodulation, bulking agents).
- Hemorrhoids, in particular concerning pathophysiology and treatment with traditional and novel therapeutic modalities (THD procedure).
- Fistula-in-ano, in particular concerning the assessment of fistula and abscess with endoanal ultrasound related to surgery results.
- Rectocele, in particular concerning pathophysiology and modalities of clinical presentation and treatment options.

- Anal cancer, in particular concerning staging and restaging of the tumor and integrated therapies (chemoradiation).
- Colorectal cancer, in particular concerning diffusion modalities of the tumor and prognosis, integrated therapies (surgery, chemoradiation, intraoperative radiation therapy), and molecular biology.

He is author of a number of scientific publications on international journals and has presented results of his research at national and international scientific meetings.

He is Editor of the book entitled *Fecal Incontinence. Diagnosis and Treatment*, Springer Ed., May 2007.

He is active member of:

- American Society of Colon and Rectal Surgeons (ASCRS), Fellow
- European Society of Coloproctology (ESCP)
- Italian Society of Colorectal Surgery (SICCR)
- International Anal Neoplasia Society (IANS)

He was National Scientific Secretary of the Italian Group for Sacral Neuromodulation (GINS).

He was Delegate of Italy to the European Society of Coloproctology (ESCP).

He was General Secretary of the Italian Society of Colorectal Surgery (SICCR), 2006–2007.

He was Vice-President of the Italian Society of Colorectal Surgery (SICCR), 2015–2017.

He is member of the Editorial Board of *Techniques in Coloproctology* and *World Journal of Gastroenterology*.



Angelo Parello He was born in Agrigento, Italy, on October 17, 1980. He graduated with honors in Medicine and Surgery at the Catholic University of Rome in the first session of the academic year 2003–2004.

From 2004 to 2010, he was resident in General Surgery at Catholic University of Rome, which he attended with particular interest directed to diagnosis and treatment of coloproctologic diseases.

His clinical practice is mainly directed to diagnosis and treatment of colorectal-anal diseases, and he is an expert in performing both anorectal and pelvic floor diagnostics tests (e.g., anorectal manometry and endoanal and transrectal ultrasound) and treatment (e.g., transanal hemorrhoidal Doppler-

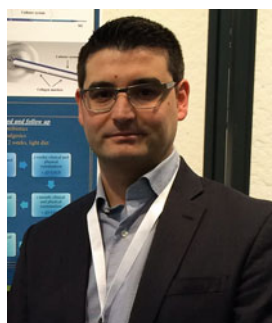
guided dearterialization for hemorrhoidal disease, sacral neuromodulation for fecal incontinence, and constipation).

He collaborated in the development of a novel minimally invasive surgical approach to treat fecal incontinence – THD implant Gatekeeper – now available for use in the world.

He is active member of the Italian Society of Colorectal Surgery (SICCR), and in 2007–2008 was member of the Guidelines Commission on behalf of this society.

He was teacher and tutor in many national and international courses conducted in Italy and in other European countries.

He is author of several scientific publications on international journals, author of several chapters in books, and has presented results of his research at national and international scientific conferences.



Francesco Litta He was born in Matera, Italy, on April 25, 1983. He graduated in Medicine and Surgery at the Catholic University of Rome in 2008 with first class honors (110/110 cum laude). He is a specialist in General Surgery.

He is an attending physician at the Proctology Unit of the “Fondazione Policlinico Universitario Agostino Gemelli,” Rome, Italy, directed by Prof. Carlo Ratto, M.D., F.A.S.C.R.S.

His clinical practice focuses mainly on the diagnosis and treatment of diseases of the colon and the rectum, and all proctological diseases. He is involved in the anorectal physiology testing, with particular interest in the evaluation of benign and malignant disease by means of anorectal manometry and three-dimensional endoanal ultrasound.

His research activity is mainly based on the evaluation and treatment of patients affected by fecal incontinence, constipation, anal fistula, hemorrhoidal disease, obstructed defecation, and inflammatory bowel diseases (Crohn’s disease, ulcerative colitis), with studies concerning the pathophysiology and the surgical treatment by means of traditional and new minimally invasive therapeutic options.

He is author of several scientific publications on international journals, author of several chapters in books, and presented results of his research at national and international scientific conferences. He is teacher in a series of national and international courses on the management of coloproctologic diseases.

He is active member of the Italian Society of Colorectal Surgery (SICCR) and is member of the Guidelines Commission on behalf of this society.

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Part I

Basics on Hemorrhoids



Epidemiology of Hemorrhoidal Disease

1

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Abstract

Hemorrhoids are vascular cushions that underlie the distal rectal mucosa and contribute approximately 15–20% of the resting anal pressure, ensuring complete closure of the anal canal.

Hemorrhoids became symptomatic when enlarged, inflamed, thrombosed, or prolapsed, and the most common symptom is painless rectal bleeding, which is why hemorrhoids are one of the most frequent causes of severe acute lower gastrointestinal bleeding.

Defining the term “hemorrhoids” and their epidemiology has always been controversial.

Unfortunately, at present, even after years of articles, debates, and pathogenetic theories, we do not know the extent of this phenomenon.

In this chapter, we will discuss the epidemiology of hemorrhoidal disease and compare the most important studies in the literature.

1 Introduction

Hemorrhoidal disease is one of the oldest and most common proctologic diseases that has been described (Trompetto et al. 2015) and studied (Serra et al. 2016). In the United States, it is estimated that more than 50% of the population over 50 years of age has experienced hemorrhoid problems (Gencosmanoglu et al. 2002).

We can find traces of their description in both the Old Testament and Buddhist scriptures (Burkitt and Graham 1975; Hyams and Philpot 1970). Furthermore, Hippocrates (460 BC) was the first to use the term “hemorrhoid” (from the ancient Greek word “hema,” blood, and “rhoos,”

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flow) meaning flow of blood (Yang 2014). More recently, historical study shows signs of the presence of hemorrhoids even in battle. Everybody knows that 200 years ago (18 June 1815), Napoleon Bonaparte was defeated at Waterloo by the Duke of Wellington, who was joined by the Prussians and an invisible enemy, “hemorrhoids.”

Literature is poor in data on the current incidence and prevalence of hemorrhoidal disease in the general population, especially because most people have no symptoms and often hide this disease out of a sense of embarrassment.

Nevertheless, the number of terms used to define hemorrhoids when pathological has generated enormous confusion.

2 Epidemiology of Hemorrhoidal Disease

Over the years, several epidemiological investigations have demonstrated the influence of environmental factors in the development of hemorrhoidal disease.

Hyams and Philpot were among the first in the modern age to study the prevalence of hemorrhoids, just a few years before Burkitt's theory (Hyams and Philpot 1970). They classified patients according to age, sex, socioeconomic status, race, religion, bowel habits, and pregnancy. The most important finding was that one in four individuals over 30 years had a certain degree of hemorrhoidal disease.

Following the theory of Burkitt in the early 1970s (Burkitt 1972, 1975; Burkitt and Graham 1975), according to which hemorrhoids were causally related to constipation, Johanson and Sonnenberg (1990a) performed an epidemiological investigation comparing the epidemiology of hemorrhoids with the epidemiology of constipation and failed to demonstrate any correlation.

In fact, constipation, in contrast to hemorrhoids, was more common with increasing age, among blacks and among those with low socioeconomic status and less education.

The results, which were similar regardless of sex, showed a prevalence rate of hemorrhoidal disease of 4.4% with a peak between 45 and 65 years old and a decline after age 65. Moreover, hemorrhoids were

uncommon in patients under 20 years old. Conversely, whites were affected 1.5 times more frequently than blacks, and in England and Wales (but not in the United States), higher social class was linked with an increasing prevalence of hemorrhoids (1.8 times more common). According to the authors, this trend was due to the difference in social classification. In fact, in England and Wales social class was closely related with occupation.

Interestingly, a theory about the role of occupation on the etiopathogenesis of hemorrhoids was developed by Prasad et al. (1976). They noted that most of their patients (66%) with hemorrhoids had occupations involving prolonged sitting.

An earlier article by Johanson and Sonnenberg (1991) claimed that physician visits, hospital discharges, and surgical procedures for hemorrhoids in the USA had considerably decreased over the past 25–30 years. The authors used only statistics based on the International Classification of Disease (ICD) and consequently not based on patient self-diagnosis.

There may be many reasons for this decrease: increased use of conservative treatment, self-medication with over-the-counter preparations, and the increased use of stool softeners and fiber supplements.

The fact that the epidemiology of hemorrhoids has always been a topic of interest was demonstrated in a letter to the editor by Haas (1992) in response to the latter debated articles of Johanson and Sonnenberg.

Haas criticized the definition of hemorrhoids used by the authors [“a dilation of hemorrhoidal plexus that protrudes into the lumen of the anal canal” (Johanson and Sonnenberg 1990b)] and started his letter with the first sentence in paragraph two of the “Practice Parameters for the Treatment of Hemorrhoids” (1990): “haemorrhoids are normal components of human anatomy,” i.e., if hemorrhoids are a normal component of the human body, then their prevalence should be 100% without any provocation.

According to Haas, the criteria used by Johanson and Sonnenberg, which were based on the definition of hemorrhoids written in the ICD, in determining the prevalence and occurrence of hemorrhoids were wrong.

Therefore, how could the epidemiology of hemorrhoids be established without defining it properly?

The answer by Johanson and Sonnenberg (1992) was quick to come, and even to this day the term hemorrhoids continues to be used to describe a pathological rather than a normal anatomic entity.

A few years previous, Haas et al. (1983) reviewed the records of 835 patients seen in their clinic. They had performed routine rectal examinations consisting of inspection of the anal area, digital examination, anoscopy, and sigmoidoscopy. The examinations were performed by five surgeons who were not advised of the purpose of the study to prevent selection bias.

Hemorrhoidal disease was diagnosed in 720 patients (86%): 198 (198/241; 82%) among the asymptomatic group and 522 among the symptomatic group (522/594; 88%). There were no significant differences between men and women with respect to prevalence, and socioeconomic factors do not influence the incidence of hemorrhoids. Interestingly, women were more likely to be symptomatic than men.

In the twenty-first century, there was a reduction in epidemiological studies on the prevalence of hemorrhoidal disease. However, chronologically, four studies deserve to be mentioned.

In a mini-review published by Everhart and Ruhl (2009), hemorrhoidal disease was classified as the fourth leading outpatient digestive system diagnosis in the United States, with only gastroesophageal reflux disease, chronic constipation, and abdominal wall hernia being more common. There was an estimated 2 million ambulatory care visits with hemorrhoids as the first listed diagnosis and 3.3 million visits as a diagnosis listed at all. Visit rates were highest among patients older than 65 years and among whites. There were no differences between genders.

Riss et al. conducted an epidemiological cross-sectional study to determine the prevalence of hemorrhoids in adults that also tried to define associated risk factors (Riss et al. 2012).

The authors included in the study all patients between 2008 and 2009 consecutively who underwent colorectal cancer screening in four Austrian medical institutions.

They highlighted an overall prevalence of 39% (380/976) in the current adult population with only 17% of patients complaining of symptoms related to hemorrhoids, while the remaining 22% of patients reported they did not have any problems.

In a prospective, observational, national study conducted in France, Tournu et al. (2017) investigated the management of anal symptoms in general practice.

Among 1061 patients treated by 57 general practitioners, anal symptoms were found for 166, and hemorrhoids was the most frequent diagnosis (42 pts.; 25.8%). First-line treatment consisted of addressing constipation and dyschesia, supporting previous studies that sought to correlate hemorrhoids with constipation (Burkitt and Graham 1975; Johanson and Sonnenberg 1990a; Delco and Sonnenberg 1998; Riss et al. 2011; Johannsson et al. 2005).

Last, a prospective 1-year follow-up study was conducted investigating the relationship between habitual bidet toilet use and the incidence of hemorrhoids or urogenital infections (Kiuchi et al. 2017). Although this study was not designed purely for research on the epidemiology of hemorrhoids and given the degree of embarrassment associated with this disease, web-based questionnaires may be the best option in the future to better investigate the prevalence of hemorrhoids due to their anonymity and privacy of respondents' feelings (van Gelder et al. 2010). In a univariate analysis, the authors failed to find any potential risk factors except for BMI, which showed a significant correlation with the risk of developing hemorrhoids ($p = 0.0391$).

The authors failed to demonstrate a correlation between hemorrhoids and a history of childbirth in women, even though symptomatic hemorrhoids are the most common disease during pregnancy (Brown and Lumley 1998; Thompson et al. 2002).

3 Hemorrhoids During Pregnancy

Hemorrhoidal disease during pregnancy is a separate chapter because the prevalence changes completely. Pregnant women represent a high-

risk category for developing hemorrhoidal disease (Altomare and Giannini 2013).

In fact, hemorrhoids are present in 85% of woman during the second and third trimesters of pregnancy (Gojnic et al. 2005) with a thrombosed hemorrhoid rate of 7.9% in the last 3 months (Abramowitz et al. 2002).

Abramowitz identified constipation and late delivery (after 39.7 weeks of pregnancy) as independent risk factors for hemorrhoids during the third trimester of pregnancy and the puerperium.

A prospective observational cohort study tried to define the incidence of hemorrhoids, fissures, and other perianal diseases during pregnancy and the puerperium (Poskus et al. 2014). A total of 280 pregnant women were followed with physical examination and anoscopy through 1 month after delivery. In all, 123 (43.9%) developed perianal symptoms. Of these 123 women, 114 (92.7%) had a diagnosis of hemorrhoids and 7 (5.7%) had hemorrhoids and an anal fissure. Furthermore, 64 women (52.9%) were diagnosed with thrombosed hemorrhoids.

4 Conclusion

Even though hemorrhoidal disease is one of the most common diseases in the world, its true epidemiology is unknown. In addition to the confusion generated by the use of the term hemorrhoids to describe both a pathological and physiological state as well as false positives on colonoscopy, another source of bias is definitely related to the embarrassment that patients feel that leads them to self-medicate instead of presenting to their physician.

There is no doubt that hemorrhoids are more frequent in industrialized countries. In fact, the changes and improvements in hygiene and diet that have led to a decrease in mortality from infectious diseases and better growth in children have, at the same time, been associated with increases in several diseases such as hemorrhoids, gallstones, and ischemic heart disease (Barker 1989).

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Anatomy, Physiology, and Pathophysiology of Hemorrhoids

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Abstract

The understanding of anatomy, physiology, and pathophysiology of hemorrhoids is fundamental to selecting an appropriate treatment of hemorrhoids, improving treatment outcomes, developing novel methods for managing hemorrhoids, and preventing recurrent diseases. This chapter deals with some essential knowledge and current views of applied anatomy, anorectal physiology, and pathophysiology of hemorrhoids – which includes four main concepts of hemorrhoid

formation: sliding anal cushions (loss of fixation network), vascular abnormality (dysregulation of vascular tone, high arterial blood flow, venous hypertension of anorectal vascular plexus, vascular hyperplasia, and neovascularization), rectal redundancy, and an increased pressure on anorectal vascular plexus.

1 Introduction

The understanding of anatomy, physiology, and pathophysiology of hemorrhoids is fundamental to selecting an appropriate treatment of hemorrhoids, improving treatment outcomes, developing novel methods for managing hemorrhoids,

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and preventing recurrent diseases. This chapter deals with some essential knowledge and current views of applied anatomy, anorectal physiology, and pathophysiology of hemorrhoids.

2 Applied Anatomy of Anal Canal and Hemorrhoids

The anal canal is about 2.5–4 cm in length and encircled with anal sphincter complex. The subepithelial space of the anal canal is uneven. There are prominences of anal mucosa, known as “anal cushions” – formed by loose connective tissue, smooth muscle, arteriole, venule, and anorectal vascular plexus (hemorrhoidal plexus). The formation of anal cushions is evident since the late stage of fetal development (Morgado et al. 1988). The functions of anal cushions are to maintain anal continence and to allow greater anal distension during defecation. As anal sphincter complex cannot completely close the lumen of anal canal, the presence of anal cushions is essential to fill the gap within the sphincter ring thus resulting in complete

fecal continence. Physiologically, anal cushions contribute about 15% of resting anal pressure (Lestar et al. 1989). When defecating, external anal sphincter muscles relax and allow decongesting vascular plexus within anal cushions.

Anal cushion is supported by an arrangement of fibroelastic tissue and anal subepithelial smooth muscle. This subepithelial smooth muscle, known as the mucosal suspensory ligament or Treitz’s muscle, is the continuity of outer longitudinal muscle fibers of the rectum passing internally and caudally through the internal anal sphincter to form a supporting framework of the submucosa vascular spaces (Loder et al. 1994). Within each anal cushion, there is an anorectal vascular plexus formed by direct arteriovenous communication between the terminal branches of superior, middle, or inferior rectal arteries and their corresponding veins (Aigner et al. 2009) (Fig. 1). Within anorectal vascular plexus, there are several sphincter-like structures formed by a thickened tunica media of venous vessels containing 5–15 layers of smooth muscle cells which facilitate venous drainage (Aigner et al. 2009).

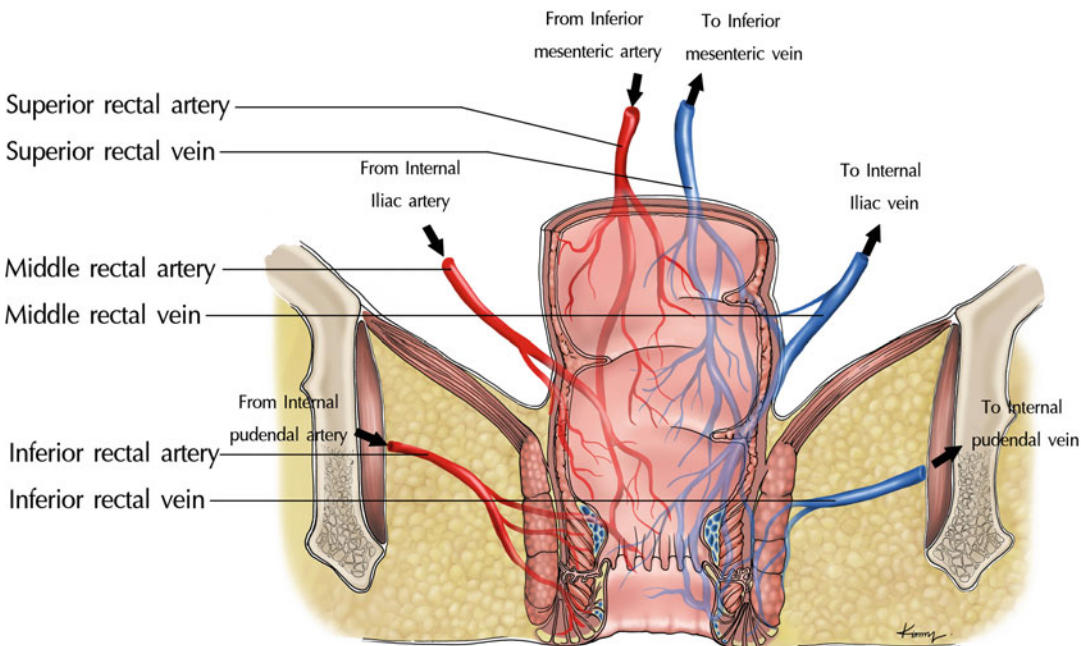


Fig. 1 Anatomy of anorectal vasculature (Lohsiriwat 2015b)

Fig. 2 Diagram of common sites of major anal cushions (a) and internal hemorrhoids; (b) and (c) two examples of hemorrhoidal cushions locations (Lohsiriwat 2015c)

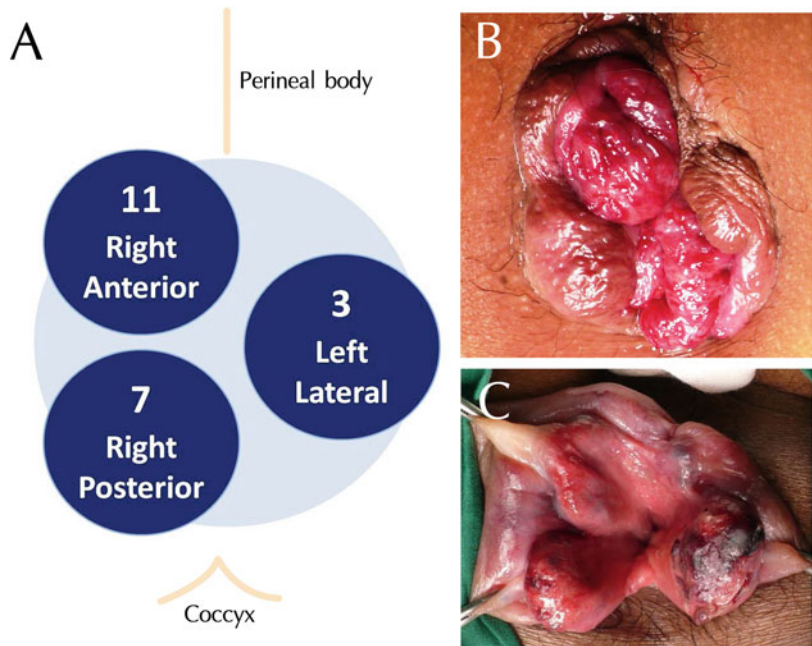
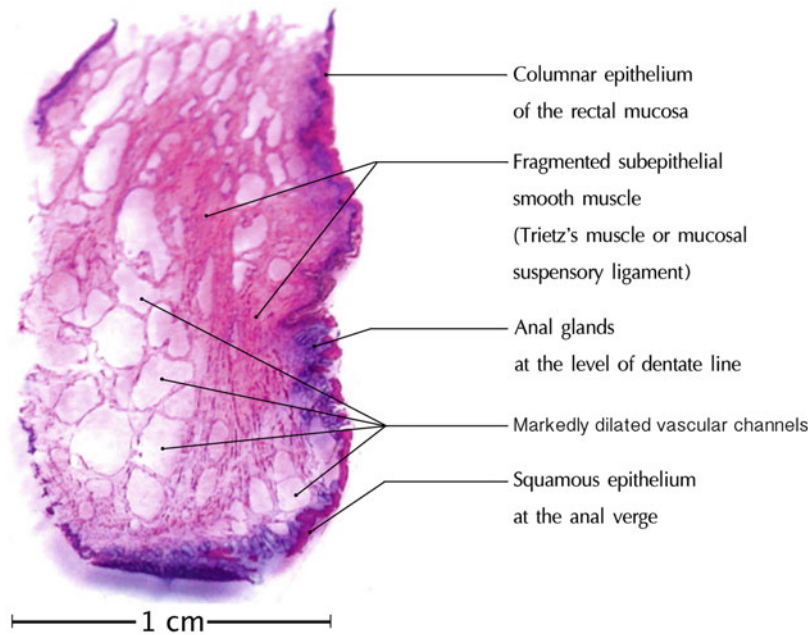


Fig. 3 Histopathologic changes in advanced hemorrhoids (Lohsiriwat 2015c)



Typically, there are three major cushions located in right anterior, right posterior, and left lateral aspect of the anal canal. However, there could be a various number of minor anal cushions lying between them (Lohsiriwat 2012) (Fig. 2). In general, hemorrhoids are referred to abnormally congested

anal cushions and/or downward displacement of anal cushions (Lohsiriwat 2012). The anal cushions of patients with hemorrhoids show significant pathologic changes including markedly dilated vascular channels, venous thrombosis, and fragmented subepithelial smooth muscle (Fig. 3).

Classified by their location, internal hemorrhoids originate from hemorrhoidal plexus lining above the dentate line and external hemorrhoid is formed by that lining below the dentate line. Since external hemorrhoid is covered by anoderm and perianal skin, it is somatically innervated and sensitive to pain stimulus.

3 Anorectal Physiology of Patients with Hemorrhoids

There are a relatively small number of studies examining physiologic changes in the anal canal of patients with hemorrhoids. In 1992, Sun and his colleagues performed anal manometry and ultrasonography in 20 patients with hemorrhoids and 20 age-matched normal controls (Sun et al. 1992). They found that mean resting anal pressure was significantly higher in patients with hemorrhoids, but no significant differences in maximal basal and squeeze pressures between the two groups. During rectal distension, maximum residual pressure was significantly higher in patients with hemorrhoids. Pressures recorded during coughing and straining were also significantly higher in patients with hemorrhoids. However, there was no difference in the thickness of internal anal sphincter between normal subjects and patients with hemorrhoids suggesting that the high anal pressure in patients with hemorrhoids is of vascular origin. Interestingly, another physiologic study showed that patients with bleeding hemorrhoids had a higher resting anal pressure than those with prolapsing, non-bleeding hemorrhoids (Hiltunen and Matikainen 1985).

In 1995, Ho and coworkers studied the effect of hemorrhoidectomy on anorectal physiology in 24 patients with prolapsed hemorrhoids and compared the results with 13 sex- and age-matched normal individuals (Ho et al. 1995). They found that patients with hemorrhoids had significantly higher resting anal pressures, lower rectal compliance, and more perineal descent. However, these abnormalities reverted to normal value within 3 months after an operation – suggesting that anorectal physiologic changes were more likely to be an effect, rather

than the cause, of hemorrhoids. This suggestion is supported by other small studies (Chen 1999; Vyslouzil et al. 2010).

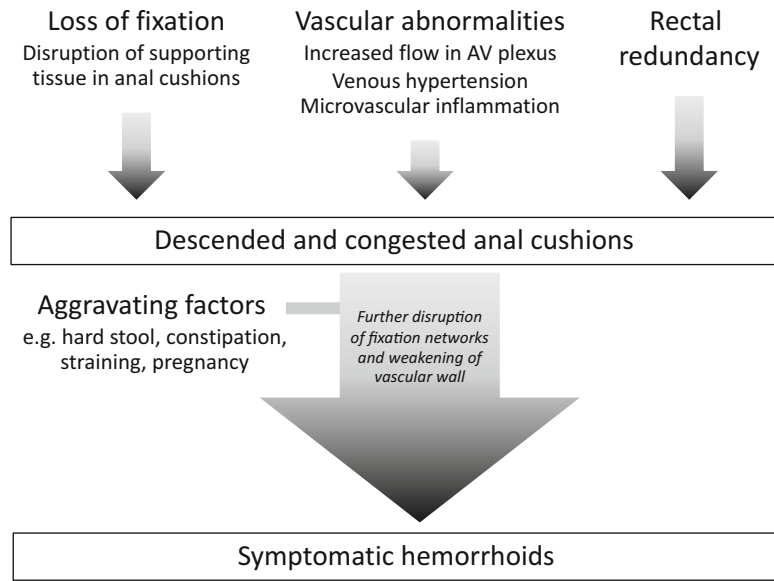
4 Pathophysiology of Hemorrhoids

Although the exact pathophysiology of hemorrhoids remains unknown, it is considered that hemorrhoids primarily result from abnormally congested and descended anal cushions. It was assumed that hemorrhoids were a variety of anorectal varices. However, there is clear evidence that hemorrhoids and anorectal varices are distinct entities. In fact, patients with portal hypertension and varices do not have a higher incidence of hemorrhoids than normal individuals (Goenka et al. 1991).

Since the development of hemorrhoids are multifactorial, several risk factors have been reported to be associated with the formation of hemorrhoids – such as pregnancy, elderly, constipation, chronic diarrhea, and internal rectal prolapse (Lohsiriwat 2013, 2015a). The concepts of hemorrhoid formation could be categorized into four groups: sliding anal cushions (loss of fixation network), vascular abnormality, rectal redundancy, and an increased pressure on anorectal vascular plexus (Fig. 4) (Lohsiriwat 2012).

4.1 Sliding Anal Cushions

Today, the concept of sliding anal cushions or sliding anal canal lining is widely accepted (Thomson 1975). It proposes that hemorrhoids develop when the supporting tissues of the anal cushion disintegrate or deteriorate. The fundamental structures of supporting tissue are elastic fiber, collagen, and subepithelial smooth muscle (the mucosal suspensory ligament or Treitz's muscle). While elastic fibers provide elasticity to anal cushions, collagen and smooth muscle are responsible for their tensile strength. The shearing force of fecal material, particular hard and bulky stools, causes muscle fibers and connective tissue within anal cushions to tear – resulting in the downward displacement of anal cushions. The malposition of anal cushions could

Fig. 4 Schematic diagram of hemorrhoid formation

compromise venous drainage leading to the venodilatation of hemorrhoidal plexus. Increased intraabdominal pressure and straining are more likely to push the cushions out of the canal and further interfere their venous return.

Besides a direct injury of stool passing to anal cushions, an increased expression of enzymes relating to the degradation of supporting tissues was evident in hemorrhoid specimens. For example, matrix metalloproteinase-9 (MMP-9), a potent zinc-dependent proteinase involving proteolysis of the extracellular matrix such as elastin and collagen, was overexpressed in hemorrhoid tissue of Asian people (Han et al. 2005). A greater level of immunoreactivity of other MMPs and neutrophil gelatinase-associated lipocalin (NGAL), a regulator of MMP activity and a marker for leukocyte activation, was observed in hemorrhoid tissue of Western individuals (Serra et al. 2016). Interestingly, a gene expression of MMP-1, 2, and 3 was significantly increased in the serum of patients with low-graded hemorrhoids compared to that of healthy controls. A higher serum level of MMP-3, 7, 8, and 9 was also seen in patients with high-graded hemorrhoids or thrombosed hemorrhoids (Serra et al. 2016). Notably, patients with high-graded hemorrhoids had a significantly higher serum level of all MMPs than patients with low-graded hemorrhoids (Kisli et al. 2013).

Inflammation may be involved in a degenerative change of supporting tissue of anal cushion since leukocyte and its biomarkers, e.g., NGAL (Serra et al. 2016), are presented in some hemorrhoid specimens especially those with mucosal ulceration, strangulation, and extensive thrombosis (Morgado et al. 1988). Neutrophils express and release pro-inflammatory cytokines which mediate tissue injury and enhance proteolytic activity of MMP. Activation of MMP-2 and MMP-9 was also associated with the disruption of capillary bed, fluid leak, and tissue edema (Yoon et al. 2003).

The abnormalities in collagen composition and its metabolism could in part contribute to the protrusion of anal cushions and the formation of hemorrhoids. The quality and quantity of collagen fibers in patients with hemorrhoids have been studied. Several investigators consistently reported a decreased level of collagen type I (mature and strong fibrils) and an increased level of collagen type III (reticular fibrils) in hemorrhoid specimens compared to normal anal cushions (Willis et al. 2010; Nasserri et al. 2015). Hyperplasia of collagen type III was also observed in distal rectal mucosa and rectal wall above hemorrhoids (Zhang et al. 2009). A significantly lower collagen/protein ratio was evident in hemorrhoid tissue – where the profound reduction was seen in grade III–IV hemorrhoids. However,

there was no correlation of collagen type and collagen/protein ratio with patient's age and gender (Willis et al. 2010; Nasseri et al. 2015).

4.2 Vascular Abnormality

Based on the bleeding symptoms of prolapsing and “non-prolapsing” hemorrhoids and the histologic findings of marked venodilatation in hemorrhoid specimens, vascular abnormality and the dysregulation of blood supply to, from, and within anal cushions might be associated with the formation of hemorrhoids (Lohsiriwat 2012). Several mechanisms are responsible for the regulation of anorectal blood flow. Some mechanisms originate from within blood vessels, e.g., intrinsic vascular tone and endothelial factors, whereas others originate from the surrounding tissue, cytokines and hormones. Imbalance between vasoconstrictor and vasodilator substances causes the dysregulation of vascular tone.

An increase in potent vasodilatory substances such as nitric oxide was evident in hemorrhoids. Inducible nitric oxide synthase was upregulated in hemorrhoid tissue (Han et al. 2005). Characteristics of endothelin (ET) receptor, a G protein-coupled receptor controlling the activity of vascular smooth muscles, in hemorrhoid tissue were studied using autoradiography, immunohistochemistry, and western blotting (Lohsiriwat et al. 2017). The density of vasodilatory ET-B receptors was about three times greater than that of vasoconstrictive ET-A receptors, and hemorrhoids had a higher protein expression of ET-B receptors than rectal tissue. Although both ET-A receptors and ET-B receptors were localized to vascular smooth muscle, only ET-B receptors were present on the endothelium.

Hemodynamic study of the anorectal vascular plexus using transperineal color Doppler ultrasound with spectral wave analysis showed significant higher peak velocities and acceleration velocities of afferent vessels in patients with hemorrhoids compared to normal controls (Aigner et al. 2009). The arterial blood flow was also significantly higher in patients with hemorrhoids. The terminal branches of the superior rectal artery supplying the anal cushion in patients with hemorrhoids had a

significantly larger diameter than those of healthy volunteers. Interestingly, an increase in arterial caliber and flow was well correlated with the grades of hemorrhoids (Aigner et al. 2006).

Venous hypertension could be another cause of hemorrhoid formation. Venous hypertension may be a result of insufficient venous drainage (e.g., increased intraabdominal pressure and pregnancy) and venous reflux. A recent study of women with pelvic vein reflux showed that hemorrhoids were identified on a transvaginal duplex ultrasound via direct tributaries from the internal iliac veins in about one-third of such cases, and the incidence of hemorrhoids increased with the number of pelvic trunks involved (Holdstock et al. 2015). A long-standing increase in venous pressure of an arteriovenous communication, like a hemorrhoidal plexus, is damaging to the vascular wall. Using chronic venous disease of the lower limbs as a model, venous hypertension was associated with the infiltration of leukocytes into vascular wall and surrounding tissue, the activation of proteolytic enzymes and inflammatory mediators, the induction of reactive oxygen species, and the alternation of shearing stress on endothelium – thus resulting in tissue inflammation, microangiopathy, vascular dilatation, and weakening of surrounding connective tissue (Bergan et al. 2006).

Besides the high arterial blood flow and venous hypertension of anorectal vascular plexus, vascular hyperplasia and neovascularization were evident in patients with hemorrhoids (Lohsiriwat 2012). For example, Chung and coworkers reported that endoglin, a receptor for transforming growth factor β and a marker for proliferative endothelial cells, was expressed in a majority of hemorrhoid specimens compared to none in normal anorectal mucosa. This biomarker was prominently seen in venules larger than 100 μm (Chung et al. 2004). An increase in microvascular density was observed in hemorrhoids with a high expression of angiogenesis-related protein including vascular endothelial growth factors (Chung et al. 2004; Han et al. 2005).

Contrary to normal anorectal vascular plexus which has focal thickening of muscular wall (sphincter-like constriction formed by a thickened tunica media containing 5–15 layers of smooth muscle cells) on the venous site (Aigner et al.

2009), hemorrhoids contain remarkably dilated, thin-walled venules and veins with absent or nearly flat sphincter-like structures (Lohsiriwat 2012). Using an immunochemical approach, hemorrhoids also exhibited nonuniform arterioles with smooth muscle dysplasia and fibrotic deposition in the walls – which were associated with the progression of hemorrhoids (Li et al. 2015).

4.3 Rectal Redundancy

The pathophysiology of hemorrhoids may be beyond the anal cushions. Many physicians believe that circumferential prolapsing hemorrhoids are associated with an internal rectal prolapse or rectal redundancy (Lohsiriwat 2012). Rectal redundancy might interfere the proper fixation of supporting tissue within anal cushions to the rectal wall. High-graded internal rectal prolapse usually lead to several symptoms of obstructed defecation including straining and frequent stool passing which result in congested and prolapsed hemorrhoids. In a daily practice, stapled hemorrhoidopexy or procedure for prolapse and hemorrhoids (PPH) uses a trans-anal circular stapler to remove a ring of redundant anorectal mucosa just above hemorrhoids thus repositioning prolapsing hemorrhoids back up into the anal canal (Corman et al. 2003; Lohsiriwat 2015a). Stapled hemorrhoidopexy also reduces blood supply to hemorrhoid tissue causing the shrinkage of hemorrhoids (Lohsiriwat 2013).

4.4 An Increased Pressure on Anorectal Vascular Plexus

Defecation involves the integration and coordination of sensorimotor function of colon, rectum, anal canal, pelvic floor muscle, and its related nerve supply (Palit et al. 2012). Practically, if intrarectal pressure is over 50 mmHg, e.g., by presence of fecal material in the rectal ampule, a reflex expulsion will occur. Efficacy of defecation is also influenced by voluntary contraction of abdominal muscle and assumption of squatting position. Both maneuvers lead to an increased intraabdominal pressure and subsequently to an

increased intrarectal pressure. Intrarectal pressure is markedly high in patients with functional constipation or those with obstructed defecation disorder (Morio et al. 2005). An abnormally high intraabdominal pressure and intrarectal pressure affect the venous drainage of anorectal vascular plexus thus resulting in venous engorgement of anal cushion and the formation of hemorrhoids. Several conditions related to an increased intraabdominal pressure are believed to be the cause of hemorrhoids or the aggravating factor for acute hemorrhoid symptoms. These conditions include pregnancy, constipation, chronic cough, abdominal obesity, straining, strenuous exercise, and weight lifting (Lohsiriwat 2015a).

5 Summary of Different Concepts Regarding the Pathophysiology of Hemorrhoids and Related Therapeutic Approaches

Concept	Short description	Therapeutic approach
Sliding anal cushions (loss of fixation network)	Hemorrhoids develop when the supporting tissues of anal cushions disintegrate or deteriorate	Rubber band ligation, plication of hemorrhoids, hemorrhoidectomy
Vascular abnormality	The high arterial blood flow and venous hypertension of anorectal vascular plexus and/or structural changes of anorectal vasculature lead to the formation of hemorrhoids	Oral or topical phlebotonics, injection sclerotherapy, laser treatment, Doppler-guided hemorrhoidal artery ligation
Rectal redundancy	Prolapsing hemorrhoids are associated with an internal rectal prolapse	Stapled hemorrhoidopexy or procedure for prolapse and hemorrhoids

(continued)

Concept	Short description	Therapeutic approach
An increased pressure on anorectal vascular plexus	An increased pressure on anorectal vascular plexus results in the development of hemorrhoids or aggravates the symptoms of hemorrhoids	Dietary and lifestyle modification

6 Conclusions

Although much has been learned about the anatomy and physiology of anorectal region and hemorrhoids, the exact etiology and pathophysiology of hemorrhoids remains unclear. The future challenge is not only to determine the precise pathophysiology of hemorrhoids (which is likely to be multifactorial and highly complex) but also to identify factors aggravating the symptoms of hemorrhoids or the recurrence of disease.

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Classification of Hemorrhoidal Disease and Impact on the Choice of Treatment

3

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Abstract

The ideal classification of hemorrhoidal disease remains uncertain, with numerous frameworks proposed. Classification may be based on anatomical findings or symptom severity, with

advantages and disadvantages inherent in each. Careful history and examination in an ambulatory setting are required and will be typically coupled with additional investigations to rule out other differentials before a final diagnosis and classification can be reached. Depending on anatomical findings (position of hemorrhoids), various treatment options are recommended which may include lifestyle advice (grade I), ambulatory treatments (grade I–II), or various surgical procedures (grade II–IV). A recommended treatment algorithm is described, but must be considered in the context

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of symptom severity. Several symptom severity scoring frameworks are described, though validity evidence for these is mixed.

1 Assessment and Classification of Hemorrhoidal Disease

The assessment and classification of hemorrhoidal disease will typically take place in an outpatient or ambulatory setting and should be performed by an appropriately qualified clinician subspecializing (i.e., colorectal surgeon), or with an accredited specialist interest, in coloproctology. As with any disease, focus will be placed on thorough history and physical examination to guide assessment and in turn consideration of treatment options.

1.1 History

The most common symptoms described by patients with hemorrhoids are:

- Rectal bleeding
- Perianal pain/discomfort
- Pruritus
- Prolapse

Other symptoms that may be associated with symptomatic hemorrhoids include perianal swelling, soilage, mucus discharge, or tenesmus (Sanchez and Chinn 2011).

However, it is of the utmost importance to gain a full and detailed description of the symptoms experienced in order to rule out the more concerning diagnoses on the list of differentials (see Table 1) (Garg et al. 2011).

Hemorrhoids most typically cause bleeding as their primary symptom. The blood is normally bright red in color (often described as “fresh”), and may appear on the paper while wiping, or can drip into the pan. It is normally painless in nature. It is important to ask about the details of the bleeding, as passing darker blood, clots, or blood mixed in with the stool may indicate a more proximal cause for the bleeding.

Internal hemorrhoids typically cause painless bleeding, unless they prolapse and result in thrombosis. External hemorrhoids can cause pain again if thrombosis occurs and can cause bleeding when ulceration happens as a result of pressure necrosis (Sanchez and Chinn 2011).

Clinicians should also question further into diet, history of constipation or diarrhea, prolonged sitting or heavy lifting, weight loss, abdominal pain, and onset and duration of symptoms. Other areas to be covered include other medical conditions, coagulation history, and family history.

Given the extensive list of differential diagnoses, it is important to complete a thorough history and perform a physical examination in order to correctly achieve the correct diagnosis.

1.2 Physical Examination

As well as a general physical examination, it is important to perform at rectal examination in an outpatient setting. This should comprise external examination of the rectum/anus, digital rectal examination, and anoscopy or proctoscopy. This is best performed with the patient in the left lateral decubitus position, with their knees drawn up to their chest. By gently spreading the buttocks, a full inspection of the perianal area can be completed. From this examination, specific signs that can be found include skin tags, which may indicate previous hemorrhoids (although could also indicate the presence of an anal fissure, particularly when located at the 6 o'clock or 12 o'clock positions). Anal fissures or evidence of fistulae may be seen, and evidence of perianal sepsis from an abscess or fistula should be ruled out. Rectal prolapse or prolapsing hemorrhoids can also be identified at this point of the examination.

Digital rectal examination can identify any distal rectal masses, can elicit tenderness in the presence of abscesses or fissures, and can demonstrate mucus discharge or blood. Internal hemorrhoids are not normally palpable unless thrombosed. It is also important to evaluate sphincter tone at this point, both to assess for differentials such as rectal prolapse and, in those who have described symptoms

Table 1 Differential diagnoses associated with rectal bleeding

Presentation of rectal bleeding	Associated features	Differential diagnosis
Fresh blood	Can be painful	External hemorrhoids
Fresh blood	Rarely painful	Internal hemorrhoids
Fresh blood	Fecal incontinence/soiling Mucus discharge	Rectal prolapse (complete/partial/ mucosal)
Fresh/alterd blood	Change in bowel habit Mucus discharge	Rectal polyp
Fresh/alterd blood	Change in bowel habit Tenesmus Weakness/fatigue Anemia Abdominal pain/bloating Mucus discharge	Rectal or anal carcinoma
Fresh blood	Pain on defecation	Anal fissure
Fresh blood	Discharge Pain Abscess formation	Anal fistula
Past history of bleeding	Pruritus Swelling	External skin tag
Fresh blood	Symptoms of cirrhosis/portal hypertension	Rectal varices in portal hypertension
Fresh/alterd blood	Loose stools Abdominal pain/cramping Fatigue Fever Weight loss Reduced appetite	Inflammatory bowel disease
Fresh (rarely)	Pruritus Discharge	Anal condylomata
Fresh/alterd	Abdominal pain/cramping Change in bowel habit	Diverticular disease
Fresh/alterd	Anemia Weakness/fatigue Shortness of breath	Colonic angiodysplasia

of soiling/fecal leakage, to predict potential issues after any future anorectal treatment procedures.

Anoscopy or proctoscopy should complete the ambulatory examination when investigating for hemorrhoids. Again, this should be completed with the patient lying in the left lateral decubitus position, with knees drawn up to the chest. A proctoscope is a hollow speculum with an introducing obturator and a light source. Typically these are now of a single use, disposable plastic variety, although they come in many different makes and materials. With the use of lubrication, the proctoscope is inserted through the anus and into the rectum, to the extent of its length. The obturator is then

removed. On gentle and slow withdrawal of the scope, the rectum and anal canal is inspected. From this point, it may be possible to identify hemorrhoids, fissures, the internal openings of fistula tracts, polyps, and on request of the Valsalva maneuver, may replicate symptoms of prolapse. It is also at this point, on identification of hemorrhoids, that certain office-based therapies may be performed (see later in chapter).

The patient may describe some mild discomfort on introduction of the anoscope, which is to be expected. However, the experience of significant pain may indicate a cause of symptoms more likely to be attributed to causes other than

hemorrhoids, such as an anal fissure or fistula, and it is not wise to continue the examination at this point, to minimize patient pain and distress.

It has been shown that viewing hemorrhoids on anoscopy is the most accurate way as it allows the hemorrhoidal tissue to prolapse into the barrel of the instrument (Kaidar-Person et al. 2007). There is a greater percentage of anorectal lesions identified on anoscopy than seen on flexible sigmoidoscopy, as demonstrated in a prospective study by Kelly et al., where it was found that 99% of anal lesions were identified on anoscopy whereas 78% and 54% were identified on colonoscopy on straight withdrawal and retroflexion, respectively (Kelly et al. 1986). It is important to note, therefore, that while endoscopic investigation of symptoms (see below) is important to rule out other pathologies, it should not be considered a replacement for ambulatory proctoscopy.

1.3 Flexible Sigmoidoscopy and Colonoscopy

Flexible sigmoidoscopy or colonoscopy should be considered in order to rule out other more serious pathology that may present in a similar way as hemorrhoids. The more suspicious symptoms of altered blood or clots or change in bowel habit would raise the concern for an alternative diagnosis, and such patients should undergo more expensive investigation of the colon, through the means of flexible sigmoidoscopy or colonoscopy (see Table 2). Referral criteria should meet local and national policies.

As mentioned previously, flexible sigmoidoscopy or colonoscopy is not as accurate in the identification of hemorrhoids. The distension of the rectum on retroflexion during colonoscopy causes flattening of the internal hemorrhoids and thus leads to underestimation of the extent of the internal hemorrhoidal disease. In over inflation, the only hemorrhoids visible would be external in origin (arising from below the dentate line). It is therefore suggested that partial deflation allows more adequate evaluation of the area (Ganz 2013). Other limiting factors in the assessment of hemorrhoids on colonoscopy are the difficulty in

Table 2 Suggested indications for colonoscopic investigation of rectal bleeding (2015 UK National Institute for Health and Care Excellence (NICE) Guidelines)

Symptoms	Age
Unexplained weight loss and abdominal pain	>40 years
Unexplained rectal bleeding	>50 years
Iron deficiency anemia	>60 years
Change of bowel habit	>60 years
Positive test for occult blood in feces	Any age
Rectal or abdominal mass	Any age
Rectal bleeding plus Abdominal pain Change in bowel habit Weight loss Iron deficiency anemia	>50 years

orientation of the hemorrhoidal cushions, and can lead to discrepancies in the description of findings. When in doubt, repeat anoscopy following endoscopy can be a useful adjunct.

1.4 Other Investigations

Final investigations can be considered in patients who present with symptoms of soiling or fecal leakage. Endoanal ultrasound and anorectal manometry can be useful in the evaluation of the sphincter complex and mechanisms of action. This is important in the assessment prior to intervention for hemorrhoids, as this may influence the type of intervention the surgeon decides upon, dependent on the risk of developing incontinence after surgery (Kaidar-Person et al. 2007). Alternative management techniques for hemorrhoids have been found to have no effect on the anal physiology post-procedure and thus could influence decision making (Ratto et al. 2011).

2 Classification of Hemorrhoids

Classification of hemorrhoids remains a subject of contention, with manifold classification frameworks developed over time, the most common or relevant of which are described here. Historically, hemorrhoids have been classified by either anatomical origin, their degree of prolapse or by

severity of symptoms. Such classification systems have their drawbacks; other staging systems have been devised to try to combine the salient features from traditional descriptors in order to aide decisions making when planning for treatment.

2.1 Anatomical Classification Systems

Hemorrhoids may be classified by their relation to the dentate line. These may be defined as of internal, external, or mixed origin. The dentate line is described as lying 2 cm from the anal verge and is the area of demarcation between the upper anal canal (lined with columnar epithelium) and the lower anal canal (lined with sensate squamous epithelium) (Nisar and Scholefield 2003). Those originating from the inferior hemorrhoidal venous plexus above the dentate line are described as internal hemorrhoids. External hemorrhoids develop from below the dentate line and are as a result of dilated venules of the external hemorrhoidal plexus (Lohsiriwat 2012). Mixed hemorrhoids (interno-external) originate from both above and below the dentate line.

Historically, and indeed most commonly, internal hemorrhoids have been according to the degree of prolapse as suggested by Banov et al. (Thomson et al. 1992) and are graded I–IV. Grade I hemorrhoids are defined as those that bleed but do not prolapse, grade II hemorrhoids are those which prolapse but reduce spontaneously, grade III where hemorrhoids prolapse but can be reduced manually, and grade IV hemorrhoids are where they are permanently prolapsed and cannot be reduced (Table 3).

Other classification systems have been described on alternative clinical findings, such

as hemorrhoidal position. As previously described, the three main anal cushions are situated in the left lateral, right anterior, and right posterior areas of the anal canal. Symptomatic hemorrhoids may therefore be described according to their anatomical relation to these cushions and described as primary (at the sites of the mentioned anal cushions), secondary (between the anal cushions), or circumferential (Lunniss and Mann 2004).

Fault can be found in the use of these systems. The umbrella of symptoms experienced due to hemorrhoids stretches further than just that of bleeding. Such symptoms of soiling, anal discomfort, or pruritus, which can all be attributed to the presence of hemorrhoids, are not addressed in the traditionally used classification systems. As such, it can be assumed that combinations of the previously mentioned classifications may potentially provide a more robust and true reflection of severity of symptoms.

An alternative staging system from Lunniss et al. (Table 4) aims to further differentiate internal hemorrhoids, with an aim to aide decision making in the management of such hemorrhoids.

Still, there is yet to be a single classification system that bridges the gap of disparity between a patient's symptoms, the severity of their symptoms, and physical signs seen. The aim of management of hemorrhoids is symptomatic relief, yet many of the decisions made in type of management are influenced by anatomical factors, and a patient's description of symptoms (Lunniss and Mann 2004). We recommend, therefore, a combined approach of anatomical descriptive classification (Banov) together with an objective measure of symptom severity, below, to guide management.

2.2 Symptom Severity Classification of Hemorrhoidal Disease

It is widely accepted now that the consideration of a patient's quality of life has an impact on the outcomes of surgical care and should be one of the determining factors procedures indicated for benign disease. It is critical to realize that the

Table 3 Banov et al. classification of internal hemorrhoids (Schrock 1991)

Grade I	Hemorrhoids without prolapse
Grade II	Hemorrhoids with bleeding and protrusion, with spontaneous reduction
Grade III	Hemorrhoids with bleeding and protrusion that require manual reduction
Grade IV	Irreducible hemorrhoids

Table 4 Luniss et al. Hemorrhoids – Internal staging

Stage	Morphology	Principal presentation	Possible additional features	Visual confirmation related to size	Presentations	Common conventional management
<i>Nonprolapsing</i>						
0	Anal cushions	Bleed very rarely No prolapse	None	No definite increase	Present from birth	Dietary/ lifestyle advice; medications; consider sclerotherapy or IRC for nonresponders
1	Small hemorrhoids	Bleed intermittently No prolapse	None	Minor definite increase seen on proctoscopy	Adolescence onwards, but usually before middle age	Sclerotherapy/ IRC Consider banding or stapling for nonresponders
<i>Prolapsing</i>						
2	Intermediate hemorrhoids	Prolapse but return spontaneously Bleed frequently and sometimes profusely	Pruritus Skin tags rare	Moderate increased size of individual pile masses which prolapse on straining	Adults (30+ years)	Banding/ stapling Consider surgery for nonresponders
3	Large hemorrhoids	Prolapse, and need aid to reduce Bleed frequently and often profusely	Pruritus Discomfort Some skin tags common	Major increase in size, including circumferentially Prolapse easily and require replacement	Middle age onwards (40+ years)	Operation by usual techniques
4	Very large hemorrhoids +/- additional features (intero-external hemorrhoids)	Prolapse which is permanent and irreducible Bleed profusely which can soil underwear	Pain Pruritus Soiling Many skin tags usual Complications, e.g., Thrombosis	Extreme increase in size with hemorrhoids also in secondary positions and skin tags	Middle age and older	Operation, frequently by modified technique

IRC infrared coagulation

clinical or objective improvement of hemorrhoids through surgical treatment will not always be accompanied by a corresponding improvement in patient-perceived symptoms or reported quality of life. By determining the effect a group of symptoms has on the quality of life of a patient, patient expectations may also be assessed and, if required, the differences between this and reality can be bridged (O'Boyle 1992).

At least one investigation has even suggested that patient-reported quality of life and symptom severity is entirely unrelated to clinical severity or disease. Riss et al. (2011) reported no statistical difference in the quality of life measured outcomes for those with symptomatic or asymptomatic hemorrhoids, where the hemorrhoids were scored up to grade III, and suggested that the number of interventions for hemorrhoids should

be avoided where possible (Riss et al. 2011). A further paper by Sailer et al. (1998) also assessed quality of life questionnaires in the measurement of patients with benign anorectal diseases. Again, they found that the main symptom of bleeding did not have an effect on quality of life.

Accordingly, several symptom-based classifications have been developed for hemorrhoidal disease.

2.2.1 Kraemer Proctological Symptom Scale

Kraemer et al. describe the proctological symptom scale, which measures the four main proctological symptoms on visual analogue scales (1–10), these being:

- Pain
- Itching
- Discharge
- Bleeding

Authors of this scale report that the use of this scale demonstrated an objective measure of the severity of the symptoms, was easy to use to evaluate success of intervention following therapies, and was useful in monitoring disease progression (Kraemer et al. 2015). Its initial validation compared scores between patients with acknowledged proctological symptoms or diagnoses, and otherwise “healthy” controls. Symptomatic patients reported significantly higher scores. Following surgical therapies, symptom scores improved significantly in a majority of patients, most patients who did not experience significant improvement were subsequently referred for further treatment.

While useful, the Kraemer score should be used with caution. It has not been shown to differentiate for degrees of symptoms severity within a symptomatic group, nor has it been validated in any wider trials. However, its initial evaluation suggests it is able to differentiate between symptomatic and asymptomatic patients, and demonstrates a degree of validity evidence regarding its ability to note improvements in symptoms following treatment.

2.2.2 Sodergren Hemorrhoid Symptom Severity Score

Another severity score that has been suggested is the Sodergren hemorrhoid symptom severity (Table 5) scoring system described by Pucher et al. which again takes into consideration the symptoms of hemorrhoidal disease which appreciate to have greatest effect on the quality of life of patients (Pucher et al. 2015). The score was developed using established methods and cross-validated using a split patient cohort, wherein half of the patient population was used to develop the score, and the other half to validate it. Patients are asked to describe the frequency or severity of symptoms of pruritus, pain, and prolapse, with a weighted point allocation assigned for a final score of 0–14.

Initial validity evidence has suggested that the score is concordant with subsequent clinical decision making, with higher symptom scores a good predictor of those patients likely to proceed to surgical treatment. A cutoff score of 5 or greater, the authors suggested, should be considered for operative (nonambulatory) treatment. Again, this score requires further assessment, and no assessment of score improvement following successful therapy has yet been shown.

Use of such scales in regular assessment of patients with hemorrhoids may enhance and provide a more robust evaluation in a condition that is governed more by a patient’s experience than that of clinical and anatomical findings. However, existing scores as described above remain in a developmental state and require further assessment and robust validity evidence before their broader use can be advocated.

2.3 Providing Information on Classification and Assessment to Patients

The volume of patient information on hemorrhoids is vast. With the expansion of the Internet, and other social media outlets, it becomes difficult to assess or recommend information of a high, evidence-based quality. There are websites dedicated by recognized associations with validated information and material that is of a suitable quality.

Table 5 Sodergren hemorrhoid symptom severity scoring system

Have you considered or excluded other pathology?			
Does the patient suffer from rectal bleeding?			
Only proceed with questionnaire if YES answered to both above questions.			
How often have you had any of the following symptoms, at or around your anus, in the last month?			
Symptom			Points scored
How severe are your symptoms of itching or irritation? (circle number from 1 to 5)	0	No symptoms	0
	1	Mild/do not really bother me	0
	2		0
	3	Moderately bothersome	0
	4		4
	5	Severe	4
How severe are your symptoms of pain or discomfort at rest? (circle number from 1 to 5)	0	No symptoms	0
	1	Mild/do not really bother me	0
	2		0
	3	Moderately bothersome	3
	4		3
	5	Severe	3
How severe are your symptoms of pain or discomfort on opening your bowels? (circle number from 1 to 5)	0	No symptoms	0
	1	Mild/do not really bother me	0
	2		0
	3	Moderately bothersome	0
	4		3
	5	Severe	3
How often to you feel that you might have a lump at your anus (prolapse)?	0	Never	0
	1	Less than once a month	0
	2	More than once a month	0
	3	More than once a week	0
	4	Every day	4
			Final score (0–14)

However, studies have been performed to analyze the quality of information on hemorrhoids that is available to patients on the Internet. It has been found that the quality of information is widely variable, with many websites lacking accuracy and validity checking (Yeung and D’Souza 2013). It is therefore recommended that clinicians should provide a list of endorsed sources of information to their patients.

3 Treatment of Hemorrhoids

Treatment choices can be broadly separated into lifestyle, medical, ambulatory (outpatient), and surgical. Each is described in greater detail in later chapters of this book, readers are referred to the corresponding chapter for further in-depth

discussion of treatment methods; focus in this chapter is placed upon how the clinician may decide upon which to recommend.

3.1 Treatment Options: An Overview

3.1.1 Lifestyle Changes

Lifestyle measures should be recommended in all patients both as a primary treatment and to reduce the risk of recurrence in those who require further intervention. Patients should be advised to include more fiber in their diet and increase oral fluid intake with the aim to reduce constipation, straining, and poor toileting habits. Advice about toilet habits, such as the use of sitz baths and the avoidance of straining

may also be useful, although there is limited scientific evidence to support this.

3.1.2 Medical Therapy

Medical therapy may include the use of usually fiber-based laxatives to maintain soft stools and avoid straining. While numerous topical treatments are available on the market in the forms of creams, ointments, and suppositories, there is no convincing evidence of their efficacy. These include various combinations of local anesthetics, corticosteroids, vasoconstrictors, antiseptics, and astringents. They may provide some short-term symptomatic relief but, particularly in the case of corticosteroid-containing preparations, should not be used long term as they may be associated with thinning of the skin and ulceration. Again, evidence for these agents is poor. Phlebotonics (such as oral flavonoids) may have some role in the control of acute symptoms and may be useful in reducing symptoms after surgical treatment (Perera et al. 2012) although conclusive evidence is here, again, lacking.

3.1.3 Ambulatory Procedures

Ambulatory, outpatient, or office-based non-surgical treatments include injection sclerotherapy, rubber band ligation (RBL), infrared coagulation, bipolar diathermy, and cryotherapy. These may be carried out in an outpatient setting without the need for anesthetic.

Injection sclerotherapy and RBL are the most widely practiced. Injection sclerotherapy can be carried out using various different substances (most commonly 5% oily phenol) which are injected into the submucosa at the base of the hemorrhoid (not into the hemorrhoid itself) and cause sclerosis and local thrombosis of the hemorrhoidal vessels.

RBL can be carried out using either a forceps ligator or disposable suction applicator which allows placement of a band over the base of the hemorrhoidal pedicle. It is important not to position the band too close to the dentate line as this is associated with sometimes severe discomfort. The posited method of action is that the inflammatory reaction and necrosis caused by the band fixes the loose mucosa to the underlying muscular layer

and therefore reduces prolapse. Rubber band ligation appears to be the most effective of these treatments (Macrae and Mcleod 1995) although injection sclerotherapy may still have a role in patients with bleeding tendencies.

3.1.4 Surgical Procedures

Surgical treatments fall into three main categories: formal excisional surgery, stapled hemorrhoidopexy, also known as procedure for prolapsed hemorrhoids (PPH), and hemorrhoidal artery ligation (HAL), also known as Doppler-guided hemorrhoidal artery ligation (DGHAL), and is typically performed in combination with sutured mucopexy. HAL is also known as trans-anal hemorrhoidal dearterialization (THD) or hemorrhoidal artery ligation operation (HALO).

Excisional surgery involves excising the external component of the hemorrhoid along with its vascular pedicle. This is most commonly done using an open (Milligan et al. 1937) or closed (Ferguson and Heaton 1959) technique where the proximal part of the vascular pedicle is suture ligated and divided after dissection has been carried out with either scissors or diathermy. It can also be carried out with energy devices that can seal and divide the vascular pedicle without the need for sutures. The advantages and disadvantages of these techniques will be discussed later in more depth.

Stapled hemorrhoidopexy (also known as stapled hemorrhoidectomy) involves using a circular stapling device to resect a ring of redundant mucosa from above the hemorrhoidal bundle (Longo 1998). This has the effect of lifting up the prolapsing hemorrhoids and repositioning them higher above the anal canal and also leads to some degree of disruption to the blood supply to the hemorrhoids.

HAL is a relatively new procedure which disrupts the blood supply to the hemorrhoidal cushions by suture ligating the distal hemorrhoidal arterial branches using Doppler guidance (Morinaga et al. 1995). It is carried out using specialized equipment that combines a modified proctoscope with a Doppler probe. There are several versions of this available on the market, each with their own advantages and disadvantages.

There is generally a window in the proctoscope that allows suture ligation of the vascular pedicle once it has been identified using Doppler. There may also be another window which allows plication of any redundant tissue to lift it up and reduce prolapse symptoms. There is no clear consensus as to how many sutures are needed; some surgeons advocate placing a suture wherever a Doppler signal is detected whereas others always carry out a six ligations as standard. There is some interest in whether the Doppler probe is actually necessary or whether the sutures can be placed blindly. Small randomized controlled trials have shown no benefit in using Doppler but may have been underpowered and did not include long-term follow (Schuurman et al. 2012; Gupta et al. 2011); further research is therefore needed.

3.2 Determining Treatment Based on Classification of Hemorrhoids

The anatomical grade of hemorrhoids may be an important factor in determining the best treatment, although it is important to remember that this does not always correlate with the severity of symptoms. Patients with subjectively severe symptoms may merit treatment even in the presence of minor hemorrhoids, whereas other patients may choose to forego treatment even with significant disease. Patient communication and shared decision making with the patient is therefore crucial. Severity scoring scales such as described earlier in this chapter are intended as useful adjuncts in this setting, though as yet most scales demonstrate only preliminary validity evidence.

Generally, grade I hemorrhoids can be treated conservatively in the first instance, and this can often take place in a primary care setting. Lifestyle and toileting habit advice may suffice, with either review in 3–6 months or advice to the patient's general practitioner to re-refer if symptoms persist or worsen.

In the setting of failed conservative management of grade I disease, or grade II–III hemorrhoids, office-based procedures may be indicated.

It is important to acknowledge the broad (and potentially subjectively assessed) spectrum represented by grade II–III hemorrhoids. Larger grade III hemorrhoids may respond better to surgical treatments, whereas smaller grade II disease may resolve without intervention. Grade IV hemorrhoids will typically require surgical excision. It is common and sensible to take a stepwise approach in treatment, trying the least invasive treatments first then moving on to those associated with greater risk of complications and morbidity if the initial treatments fail.

An important distinction also needs to be made between prolapsing internal (i.e., arising above dentate line) and external hemorrhoids. The importance of careful clinical examination can therefore not be overstated. External hemorrhoids should not be banded as they have cutaneous innervation and RBL in this setting will cause severe pain. If there are both internal and external hemorrhoids present, the internal component could be banded if the patient's main complaint is bleeding although clearly this will not remove the “lumps” the patient may be aware of so expectations need to be managed carefully.

3.2.1 Other Factors Influencing Treatment Choice

Choice of treatment should depend firstly on the degree of symptoms. Asymptomatic hemorrhoids should not be treated, regardless of their clinical appearance (as illustrated by the old adage “it is hard to make an asymptomatic patient feel better”). Time should be taken to obtain a thorough history of the nature of the symptoms and how the patient is affected by them. Many patients may have initially attended due to concerns about more serious underlying pathology such as bowel cancer, and when this has been ruled out and hemorrhoids have been identified as the cause of the bleeding, they may not wish to pursue any further treatment. Patients may have a significant external component to their hemorrhoids, but it is important to establish whether this is something that causes them significant symptoms. Additionally, it is not uncommon for anal skin tags to be mistaken for hemorrhoids by the nonspecialist, or for hemorrhoids to be described as suspicious

anorectal masses. The appearance on examination may not correlate well with the problems that the patient describes so it is important to establish and manage the patient's expectations of treatment. Treatments such as hemorrhoidal artery ligation may be effective at reducing or stopping rectal bleeding but will not remove the external component of the hemorrhoids.

Patient choice and expectation may play a major part in deciding on treatment. Each patient will have an individual attitude to risk and perceived tolerance of pain which should be explored when treatment options are discussed. Some patients may choose to try an office-based procedure for large hemorrhoids even though the success rate may be low as they are concerned about the risks or wish to avoid the significant pain associated with excisional surgery. Conversely patients who have suffered greatly from their hemorrhoidal symptoms may choose to go straight for a formal operation, accepting the risks and likelihood of post-operative pain, to give them the lowest chance of recurrence.

Comorbidities and medical factors may also affect the choice of treatment. One is likely to have a higher threshold for considering surgical treatments requiring general or regional anesthesia in those patients with significant comorbidities and instead choose to persevere with conservative treatment or repeated office-based measures to avoid the associated anesthetic risks. Patients taking anticoagulant or antiplatelet medications or with other bleeding tendencies are generally unsuitable for ambulatory rubber band ligation due to the unacceptably high risk of delayed hemorrhage. Injection sclerotherapy is possibly a safer option in these patients. The risks and benefits of temporarily stopping these medications to allow treatment to be carried out needs to be weighed in each individual patient as this will depend on the reasons they are taking the medication and the risk of an adverse event when it is stopped. Discussion with other specialists involved in the patient's care may therefore be necessary to reach a consensus of the safest management option for the patient.

3.3 Evidence for Efficacy of Treatments According to Grade of Hemorrhoids

3.3.1 Grade I Hemorrhoids

Grade I hemorrhoids can be treated with only conservative measures in most cases. There is little evidence for most conservative measures but as they are generally cheap and safe, they are commonly recommended. The exception to this lack of evidence is fiber-containing laxatives; a Cochrane review of seven randomized controlled trials in 2005 found that there was a 47% reduction in prolapse, pain, and itching and a 50% reduction in bleeding in patients taking additional fiber (Alonso-Coello et al. 2006). This should therefore be recommended to all patients with hemorrhoids both as primary treatment as secondary prevention if other treatment is needed.

3.3.2 Grade II–III Hemorrhoids

Office-based procedures are often the first line treatment in patients with grade II and III hemorrhoids. The two most common procedures are RBL and injection sclerotherapy, although infrared coagulation, bipolar diathermy, and cryotherapy are also practiced by some specialists. RBL has been shown to be the most effective of these treatments with a lower risk of long-term recurrence than injection sclerotherapy and infrared coagulation (Macrae and Mcleod 1995; Johanson and Rimm 1992).

The Hubble trial (Brown et al. 2016) was a recent open label multicenter randomized controlled trial which attempted to determine whether RBL or HAL was more successful for the treatment of grade II and III hemorrhoids. In the 337 patients included in the analysis, they found a significantly higher recurrence rate at 12 months in those treated with RBL (49% recurrence) compared with HAL (30% recurrence). However, many of the recurrences in the RBL group were successfully treated with a repeated session of RBL treatment. In a post hoc analysis, the authors allowed a second treatment with RBL and did not count these patients as having a recurrence if they were symptom free at

12 months; recurrence in the RBL group then fell to 37.5% and the difference between the two groups was no longer significant. Of note some of the patients in the HAL group with recurrent symptoms were also successfully treated with RBL, but this was still counted as a recurrence. There was a significantly higher rate of serious complications in the HAL groups (7% vs. 1%). This included excessive bleeding, urinary retention, sepsis, pain requiring hospital admission, and vasovagal episode.

The authors carried out a cost analysis and found that treatment with HAL cost significantly more than RBL (£1750 vs. £723). HAL was not cost effective in terms of quality-adjusted life years (QALYs) gained. The conclusion of the authors was that it may be better to carry out RBL with repeated sessions where necessary as this was likely to be cheaper and associated with fewer complications.

For large grade III hemorrhoids, or those that had failed to respond to less invasive treatments, previously stapled hemorrhoidopexy was recommended as it had been shown to have a shorter operating time and less postoperative pain than excisional hemorrhoidectomy. However, longer term follow-up has shown a significantly higher risk of recurrence (Burch et al. 2009). Given the risk of rare but serious complications with stapled hemorrhoidopexy, such as rectovaginal fistula, anal stenosis, and pelvic sepsis, it may be best reserved for patients with circumferential hemorrhoids which would not be amenable to excision (e.g., where it would not be possible to leave adequate skin bridges) and have failed less invasive treatments.

HAL has perhaps started to replace stapled hemorrhoidopexy in the management of grade III hemorrhoids which have failed office-based treatments but do not warrant excisional surgery. A 2013 systematic review which compared HAL with stapled hemorrhoidopexy found no difference in postoperative complications or recurrence of symptoms but a shorter operating time and less postoperative pain in those undergoing HAL (Pucher et al. 2013).

Excisional hemorrhoidectomy has been shown to be a more successful treatment for grade II and III hemorrhoid than office-based

procedures but has a higher complication rate and higher degree of postoperative pain (Macrae and Mcleod 1995). In comparison with HAL for grade III hemorrhoids, small randomized controlled trials have been carried out (De Nardi et al. 2014; Elmer et al. 2013) but were powered to detect differences in early postoperative pain scores and not recurrence in symptoms. There is some inconsistency in the literature as to whether this really does present a less painful option. Some authors have reported that when plication sutures are also performed, there is no significant difference in postoperative pain when compared with excisional hemorrhoidectomy (De Nardi et al. 2014; Elmer et al. 2013). Of note these studies were small and possibly underpowered with the raw data showing a lower pain score in the HAL group which not statistically significant. Other authors have confirmed the common view that HAL is less painful (Bursics et al. 2004).

3.3.3 Grade IV Hemorrhoids

It has been generally accepted in the past that symptomatic grade IV hemorrhoids require excisional surgery. More recently some authors have reported the success of HAL combined with plication sutures (also termed mucopexy or rectoanal repair (RAR)) in grade IV disease (Faucheron et al. 2011; Festen et al. 2009; Ratto et al. 2015; Walega et al. 2010); however, evidence from large randomized controlled trials and long-term follow-up is currently lacking.

There are several techniques that can be used for excisional hemorrhoidectomy, the most common being the open (Milligan-Morgan), closed (Ferguson), and sutureless techniques using an advanced energy device such as LigaSure™ (Valleylab, Boulder, Colorado, USA), Harmonic® (Ethicon Endo-Surgery, Cincinnati, Ohio, USA), or bipolar diathermy scissors. The sutureless techniques have been shown to be associated with less blood loss and lower postoperative pain scores than other methods but are more expensive due to the cost of disposable equipment (Chung and Wu 2003; Chung et al. 2002). The evidence as to whether open or closed hemorrhoidectomy is superior is contradictory. Two meta-analyses have been published on this subject since 2015 and reported conflicting

results. The first reported that there were significantly more postoperative complications with the closed technique and therefore recommended the open procedure (Simillis et al. 2015); the second reported more postoperative pain and bleeding with the open technique (Bhatti et al. 2016). In light of the unclear evidence currently, we would suggest that decisions are made based on the surgeon's own expertise and preference.

3.4 Patient Follow-Up

Patients with minor symptoms or grade I hemorrhoids can be safely followed up in primary care and referred back to the coloproctologist if their symptoms worsen. Those undergoing office-based treatments warrant follow-up after a suitable period of time (6–12 weeks) as there is a possibility that further treatment sessions or escalation up the treatment algorithm may be required in the event of ongoing symptoms. Patients undergoing surgical treatments should be followed up after a similar time period to assess whether their treatment has been successful.

Decisions about follow-up should be made on an individual basis as there are many factors which may have an effect on how soon patients should be seen again. It may be clear on initial treatment that more than one session will be required; for example, when carrying out RBL most clinicians will only band three pedicles per session and bring patients back for a second procedure if more pedicles than this are evident.

When carrying out excisional hemorrhoidectomy, many surgeons will choose to routinely send the excised hemorrhoids for histopathological assessment to rule out anal squamous cell carcinoma or other pathology; others will be more selective in their approach and only request histopathology of hemorrhoids which are atypical in appearance or where there are associated risk factors or concerns. Regardless of the individual choice made, if a histopathology specimen has been sent off one must ensure that this is followed up appropriately and the findings communicated to the patient if necessary.

3.5 Management of Treatment Failure and Recurrent Symptoms

In the event of failed therapy or symptom recurrence, it may be preferable to carry out a less invasive office-based procedure more than once rather than proceed to formal surgery, both in terms of patient morbidity, preference and cost. This was illustrated in the Hubble trial (Brown et al. 2016) where a number of patients had successful RBL if they suffered recurrent symptoms after the first treatment. This was significantly cheaper than a single HAL procedure. RBL was also carried out successfully in a number of patients who had further symptoms after HAL. HAL can also be safely repeated in patients with recurrent symptoms. While there is no theoretical limit on the number of times which RBL or HAL may be repeated, clearly the decision must be taken in discussion with the patient, considering the interval to recurrence, preferences for treatment, and associated risks and expected success rates for the procedure.

Many surgeons choose to follow a stepwise management plan starting with the least invasive treatment options first. In a benign disease, this is certainly reasonable but it is therefore inevitable that recurrences will occur and require escalation to the next step in the pathway. Patients need to be counseled adequately to explain this acceptance of possible failure in order to avoid the risks and morbidity of more invasive surgical options which may not be necessary.

4 Recommended Classification-Based Algorithm for Treatment of Hemorrhoids

Clearly there is no “one size fits all” approach to the management of hemorrhoids and patient preference, medical factors, comorbidities, and surgical expertise all need to be taken into account in making management decisions individually tailored to each patient and situation. With the above proviso in mind, the following algorithm is a suggested stepwise approach to treatment according to the grade of hemorrhoids in symptomatic patients (Fig. 1).

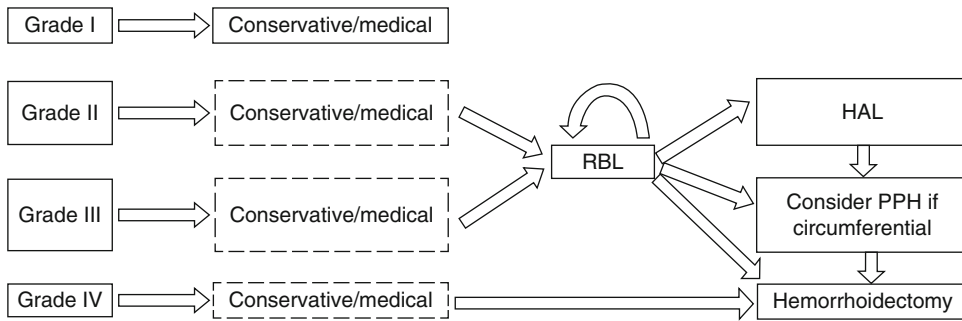


Fig. 1 Algorithm for the management of hemorrhoids by grade. (*RBL* rubber band ligation, *HAL* hemorrhoidal artery ligation, *PPH* procedure for prolapsing hemorrhoids)

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Clinical Assessment of Hemorrhoids

4

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Abstract

An accurate clinical assessment is fundamental in patients affected by hemorrhoidal disease. It is based on the evaluation of patient's history (concerning characteristics of bowel movements and other concomitant

diseases), symptoms (including bleeding and prolapse, pain/discomfort, mucorrhea, pruritus, etc.), and physical examination. Instrumental examination should provide anoscopy and, when necessary or indicated, more extended endoscopy.

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1 Introduction

An adequate clinical assessment is crucial in patients affected by hemorrhoidal disease. Diagnosis must include the accurate evaluation of patient's history and symptoms and his/her physical examination (Lorenzo-Rivero 2009; Sneider and Maykel 2010; Jacobs 2014; Hollingshead and Phillips 2016; Cintron and Abcarian 2017; Davies and Bailey 2017; Guttenplan 2017; London and Tichauer 2017; Mott et al. 2018). Classification of hemorrhoidal diseases is based on these features, and the therapeutic decision making should be significantly correlated to the findings across these steps of clinical assessment in order to provide the most reliable treatment fitting the stage of disease.

2 Patient's History

Taking a careful history can address the diagnosis: the color and character of the bleeding eventual prolapsing hemorrhoids, anal/rectal discomfort/pain, and the circumstances of these events (including the extent, severity, and duration of symptoms) are of primary importance. Their correlation with history of constipation or either diarrhea or frequent bowel movements can explain pathophysiological reasons of the hemorrhoidal disease. Then, all clinical condition causing such bowel disorders should be deeply investigated. Moreover, in order to exclude other possible causes of the above mentioned symptoms, examinations previously performed should be collected. In women, correlations with eventual previous pregnancies and deliveries should be established. Moreover, being very frequent in female patients, acquired history of obstructed defecation symptoms, leading or worsening the hemorrhoidal symptoms, should be précised. Familiarity for cancer (in particular if located to colon and rectum) and diagnosis of inflammatory bowel disease can clearly address the clinician to investigate these clinical conditions to be differentiated from the hypothesis of hemorrhoidal disease. Concerning hypothetical heredity of

hemorrhoidal disease, there is no firm evidence or an inherited predisposition to this condition; when a family history seems clear, it should be related to altered diet and defecation habits as common characteristics of those family members affected by the disease (Acheson 1960; Brondel and Gondran 1976; Cleave 1965).

Another significant aspect concerns the patient's defecation habits. Even if not scientifically demonstrated, it is frequently observed that many patients with hemorrhoidal disease refer to sit for a long time (even more than 10–15 min) on a comfortable lavatory, maybe reading the newspaper or using modern electronic devices. Others are obsessed by the necessity to have a regular defecation and remain in the toilette until they do, frequently straining all the time. It seems rationale to advice the patients about the possible worsening the hemorrhoidal symptoms if they will continue these practices.

3 Symptoms and Signs

A variety of symptoms, with varying degrees, are experienced by patients with hemorrhoidal disease. The most frequent are bleeding, anal swelling, prolapse, discomfort, pain, discharge, hygiene problems, and pruritus. Severity of piles engorgement and prolapse is usually correlated to the severity of symptoms.

3.1 Bleeding

This is the most common symptom of the hemorrhoidal disease and usually the earliest in its development. However, this should be not considered as a rule. The blood is invariably bright red and is often first noticed at the altered defecation on the lavatory paper; in this condition, the stools already passed are not bloodstained. This feature is usually significantly different than what occurs in presence of rectal neoplasm or ulcerative proctitis (bright red blood but with bloodstained stools). On the other hand, if bleeding is secondary to anal fissure, few

traces of bright red blood can be seen on the paper and/or lavatory and invariably associated to anal pain or severe discomfort.

In more advanced hemorrhoidal disease, particularly when the piles are congested by the sphincters (more frequent in younger patients with hypertonic sphincters), the bright red bleeding may be much more abundant (up to anemia), spattering and staining the lavatory. In other circumstances, when associated with significant hemorrhoidal prolapse, the bright red bleeding can occur mixed to mucous discharge.

However, even if hemorrhoidal piles seem affected by significant congestion, possibility of other causes of the bleeding must be taken in consideration, and further investigation should eventually be addressed by colonoscopy, that is, particularly important in those groups of patients at risk of colorectal neoplasms.

3.2 Prolapse

Hemorrhoidal (external protrusion of the piles only) or muco-hemorrhoidal prolapse (piles protrusion associated to prolapse of the rectal mucosa/submucosa) is a very frequent symptom of the hemorrhoidal disease. Hemorrhoidal and muco-hemorrhoidal prolapse must be distinguished by full-thickness rectal prolapse, expression of a disease completely different in pathophysiology, and diagnostic and therapeutic approach. In hemorrhoidal disease, reduction of prolapse can be spontaneous or performed by the patient digitally or manually. Most frequently, attempts to classify the hemorrhoidal disease are based on the severity of prolapse and its reducibility into the anal canal. Therefore, judgment of prolapse severity should be considered much more reliable if referred to the defecation (as reported by the patient) than either at the proctologic visit or during the evaluation under anesthesia. However, possible interpretation confusion could arise when the patient reports prolapsed irreducible piles; the objective physical examination should assess if the patient is referring to

either skin tags only or hemorrhoidal piles really irreducible. Using modern, largely available devices (i.e., smartphones, small cameras, etc.), patients could take a picture at home at the end of defecation and show it to the clinician, then helping him in evaluating the severity of prolapse at the most reliable condition.

3.3 Pain and Discomfort

Usually an uncomplicated hemorrhoidal disease could be painless, despite its severity in terms of bleeding and prolapse. On the other hand, when the patient complains of pain or significant anal discomfort, hypothesis of complicated hemorrhoidal disease should be taken in consideration, and also, other possible causes of anal pain (such as fissure, abscess, or carcinoma) should be excluded. Of course, the presence of one or more thrombosed pile(s), external or internal, suggests that the anal pain is strictly related to this complicated hemorrhoidal disease: in this situation, pain is continuous or subcontinuous, frequently severe and needing medications, exacerbated by the stool transit through the anal canal. Milder pain or mainly burning can occur in case of inflamed anal canal mucosa, frequently associated with severe piles congestion and prolapsing hemorrhoids.

3.4 Mucorrhea, Hygiene Difficulties, and Pruritus

Significant prolapse of internal piles, covered by mucosa, beyond the anal verge can lead to mucous discharge from the anus; addition of even small amount of blood can stain light red the mucous secretion. Mucorrhea can cause discomfort to the patients due to the soiling their underclothes and skin maceration.

Skin tags are frequently source of discomfort. When large and fibrotic, they are probably the result of old hemorrhoids congested, prolapsing, and affected several times by thrombosis;

difficulty in anal hygiene, anal discomfort, and pruritus are all possible correlated symptoms. Even if of more recent appearance, and then soft, they can cause pruritus and problematic anal hygiene.

4 Physical Examination

Given the importance of all information collected during the patient interview, the following physical examination has the fundamental roles to confirm the features reported by the patient, interpret the referred symptoms, exclude other diseases in the anorectal area, and plan additional investigations. In this diagnostic phase, the patient's position should allow a reliable investigation by the clinician and deserve good compliance by the patient. There is no accordance on which is the preferable patient's position during the in-office physical examination between left-lateral, lithotomic, or prone. Our preference is toward the left-lateral decubitus which couples enough diagnostic accuracy for the physician and less-discomfortable examination for the patient.

4.1 Inspection

During visual inspection, with the patient at rest, first finding visualized are the skin tags which, sometimes, can be associated with true prolapsing external hemorrhoids. For many patients with hemorrhoidal disease, skin tags are almost ever matter of worry because they are the only tissue which is appreciated (by touching or observing with a mirror). Then, patients can be convinced that the skin tags are the real affected hemorrhoids. Also, they could evaluate the success (or the failure) of a given treatment in terms of presence versus absence of the skin tags. Consequently, for the clinician (in particular for the surgeon), taking some time to explain the true differences between skin tags and real hemorrhoids can be valuable also in prospecting a

surgical operation and, then, saving personal relationship with the patient.

In more advanced cases, a more or less significant prolapse of the internal pile(s) can result evident. Of course, prolapse could be more clearly seen during the requested patient's straining. When occurred, it is of interest to note the eventual spontaneous reduction of the prolapse into the anal canal. In the most advanced cases, the prolapsing piles are already outside the anal verge when the patient is laying down at rest: in those cases, it is necessary to investigate if the piles can be reduced inside pushing them carefully by the investigator's hand, or this maneuver results impossible due to the fixity of fibrotic piles. False negative observations could frequently be derived by the patient's position (really different than the more typical sitting on the lavatory), patient's embarrassment during straining (due to the fear that some feces could come out), and hypertonic anal canal (like in association with anal fissure, when the hemorrhoidal prolapse can be masked). During straining, it can be differentiated the hemorrhoidal/muco-hemorrhoidal prolapse from the true full-thickness rectal prolapse (the latter is frequently associated with patulous anus). Presence of some serum or blood-stained secretion should be interpreted as consequence of hemorrhoidal prolapse or sign of an anal fistula or other anal diseases, requiring further physical and instrumental investigations.

4.2 Digital Anorectal Examination

Anorectal examination performed by finger should always follow the external inspection. It is an important step of diagnostic process to confirm the suspected hemorrhoidal disease but also to exclude other diseases. This maneuver is usually expected by the patients as an invasive and traumatic experience and, then, must be performed gently by the physician, slowly and with adequate lubrication. Anal pain (due to either a complicated hemorrhoidal disease or other

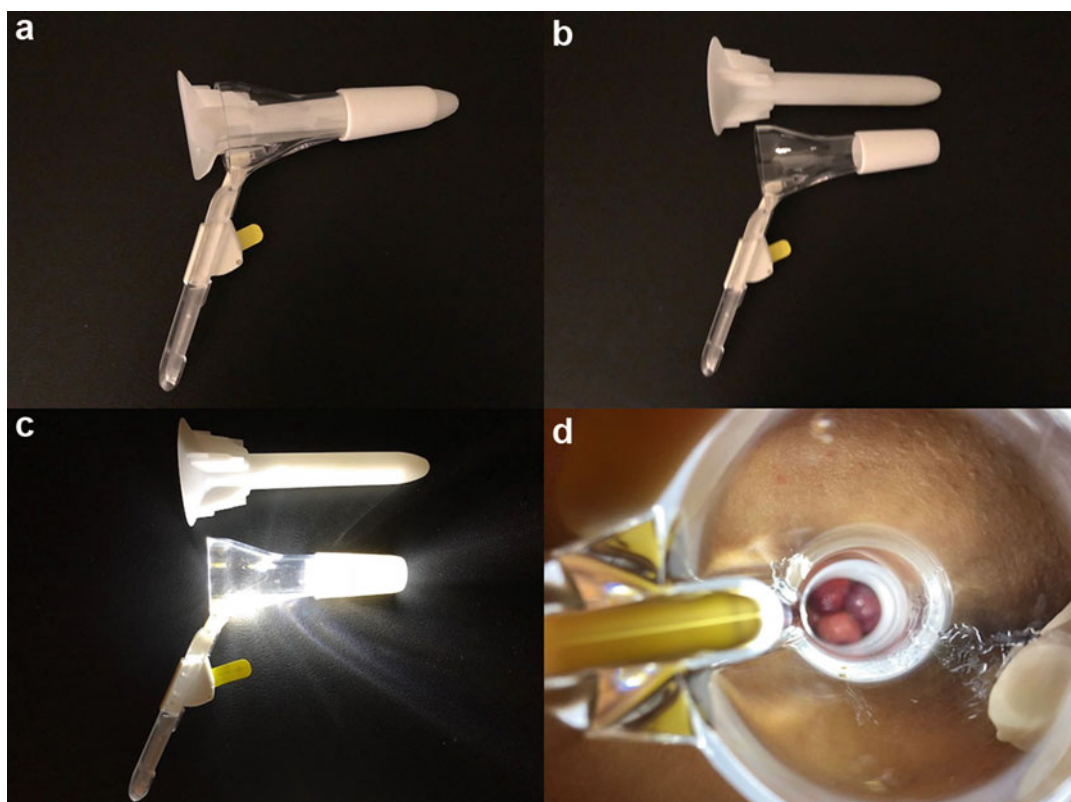


Fig. 1 Self-illuminated model of anoscope: (a) the device ready to be used; (b) the introducer was removed; (c) the light was switched on; (d) example of the hemorrhoidal piles as appear through the anoscope

altered local conditions) could impede the digital examination (and, then, other kind of more invasive investigation), requiring a further evaluation under anesthesia.

The principles of a correct digital examination are based on accurate evaluation of the resting anal pressures, squeeze, anal pressure, and relaxation of the sphincter anorectal complex; evaluation of the anal and rectal mucosa to assess the presence of induration, fibrosis, thickening, ulceration, protrusions, and irregularities; and evaluation of the finger after its removal, to assess the presence of blood, pus, mucus, and serum secretions and to observe the feces color. Then, piles engorgement can be felt, also protruding into the low rectal ampulla. Sometimes induration of one

or more external/internal pile(s) can be identified (often also very painful), characteristic of a hemorrhoidal thrombosis. Painful examination can also suggest the presence of an anal fissure (particularly if associated with a hypertonic anal canal), perianal abscess, and abnormalities of anorectal mucosa (suggesting anal/rectal carcinoma, anal dysplasia, or condiloma). Particularly in female patients (if referring obstacle and incomplete defecation), signs suggesting an obstructed defecation syndrome (rectocele, rectal intussusception, enterocele) should be always researched during the digital anorectal examination, associated with transvaginal inspection and examination; moreover, a solitary rectal ulcer may sometimes be identified by palpation. However,

Fig. 2 Examples of: (a) skin tags; (b) external piles prolapse; (c) external and internal (only on the left side) piles prolapse; (d) both external and internal piles prolapse; (e) mucohemorrhoidal prolapse; (f) both external and internal piles prolapse with fibrotic component; (g) mucohemorrhoidal prolapse with significant congestion

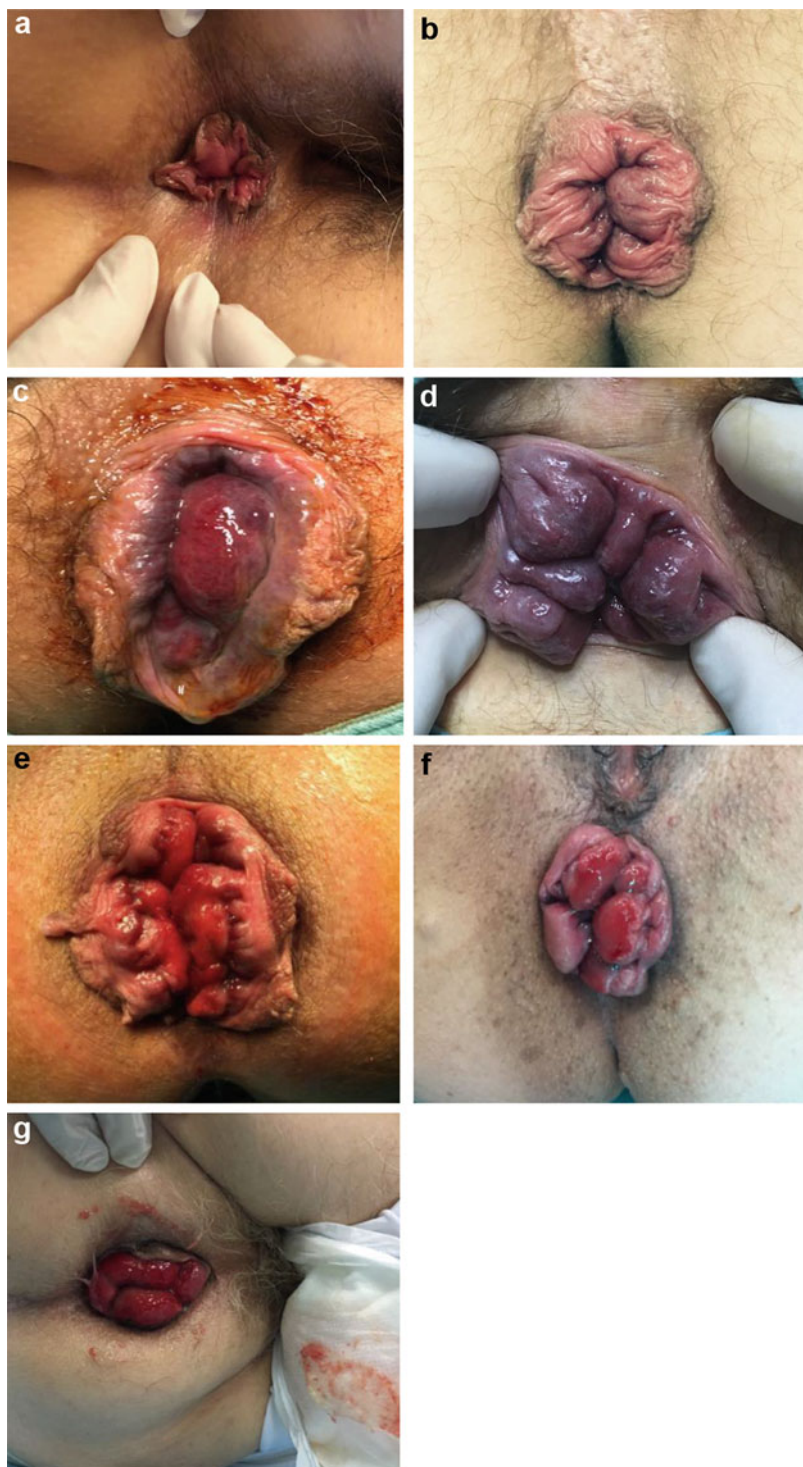


Fig. 3 Examples of hemorrhoidal thrombosis with significant edema. In (a) edema of external hemorrhoids was significant; in (b) edema, engorgement, and mucosal exfoliation were significant

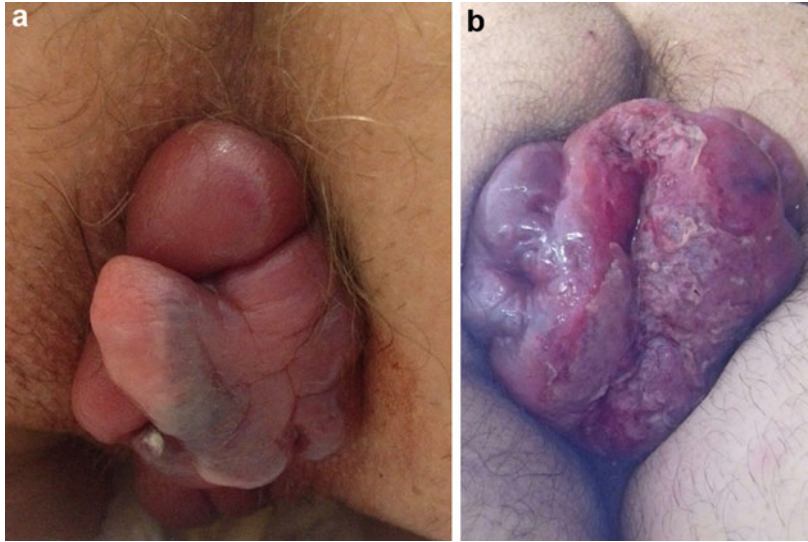


Fig. 4 Differential diagnosis between hemorrhoidal disease and the full-thickness rectal prolapse: in both examples shown, no any hemorrhoidal prolapse can be observed while the entire wall of rectum is exposed



Fig. 5 Differential diagnosis between hemorrhoidal disease and the full-thickness rectal prolapse: in this case a significant muco-hemorrhoidal prolapse is shown: only rectal mucosa is prolapsed and can be observed



never this evaluation is exhaustive, requiring further proctogram. Attention paid to a deep evaluation of eventual evacuation obstacles is useful not only to explain the possible pathophysiologic mechanisms leading to the hemorrhoidal disease, but also to choose the right modality and timing of patient management.

5 Instrumental Investigation

5.1 Anoscopy

In case of suspected hemorrhoidal disease, anoscopy should be considered as mandatory. The device to be used should be wide enough to give a good visualization of the anal canal lumen (but also not too large causing relevant discomfort or risk of damage to the patient); good illumination

of the anal field is also important (self-illuminated anoscopes represent the most reliable models). After the well-lubricated anoscope is gently inserted up to reach the low rectum, it is progressively and slowly retracted through the entire anal canal to observe the conditions of the anal mucosa (if inflamed or eroded, or the presence of other diseases), hemorrhoidal piles (engorgement, possible bleeding, and tendency to the prolapse under several attempts of straining, during progressive device retraction), and dentate line (in advanced engorgement it can be disappeared).

5.2 Other Diagnostic Procedures

In some particular conditions, other diagnostic procedures can be necessary or useful. Endoscopic examination of the rectum and colon should be

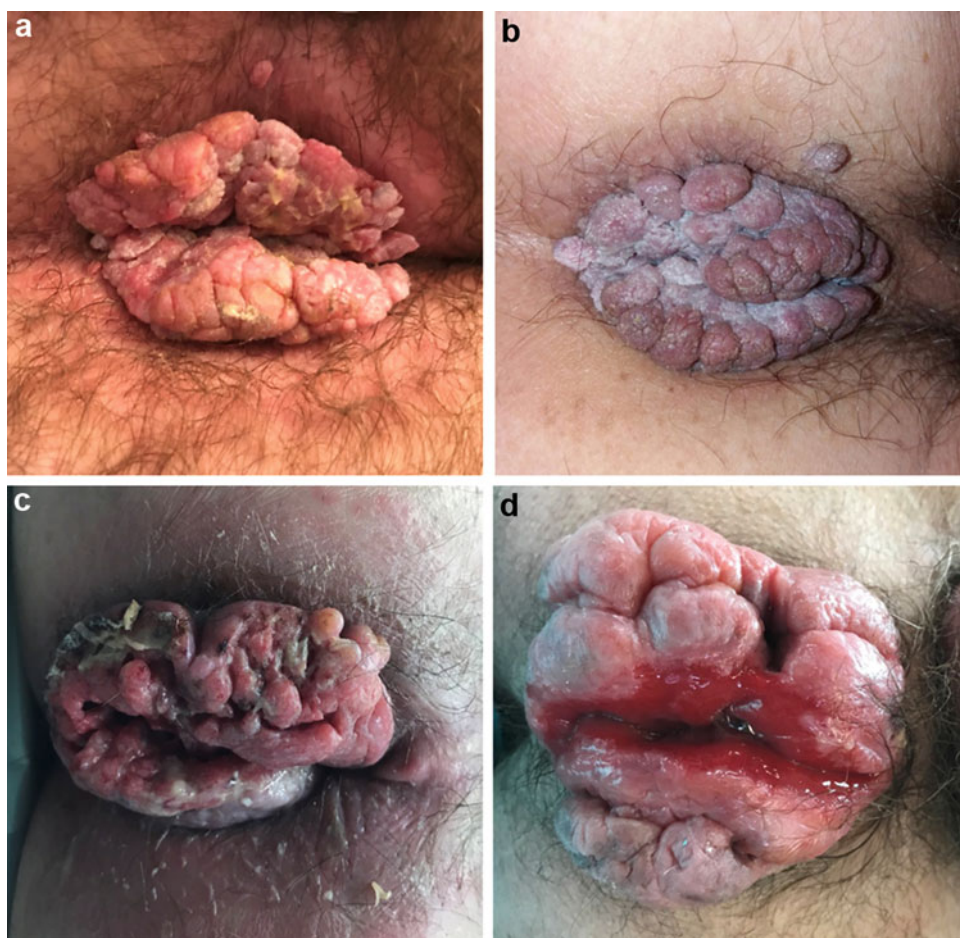


Fig. 6 Differential diagnosis between hemorrhoidal disease and other anal diseases: (a) and (b) diffuse anal condylomatosis; (c) anal margin squamous carcinoma; (d) muco-hemorrhoidal prolapse

provided according to the international guidelines for prevention of colorectal cancer. That is particularly true if the patient refers bleeding apparently not justified by the appearance of the hemorrhoids and whenever blood is mixed with the stool. Moreover, endoscopic assessment is able to exclude also inflammatory bowel diseases and solitary rectal ulcer. Preference toward endoscopy limited to rectum or extended to sigmoid colon or to the rest of the colon is still debated.

Physiological studies (by anorectal manometry) or anorectal imaging (by endoanal ultrasound, barium, or magnetic resonance defecography) are not necessary for the diagnosis of hemorrhoidal disease itself. Only in case of suspected coexistence of other disorders (anal fissure, anal fistula or abscess, obstructed defecation syndrome, fecal incontinence), they should be taken in mind (Figs. 1, 2, 3, 4, 5, 6, and 7).

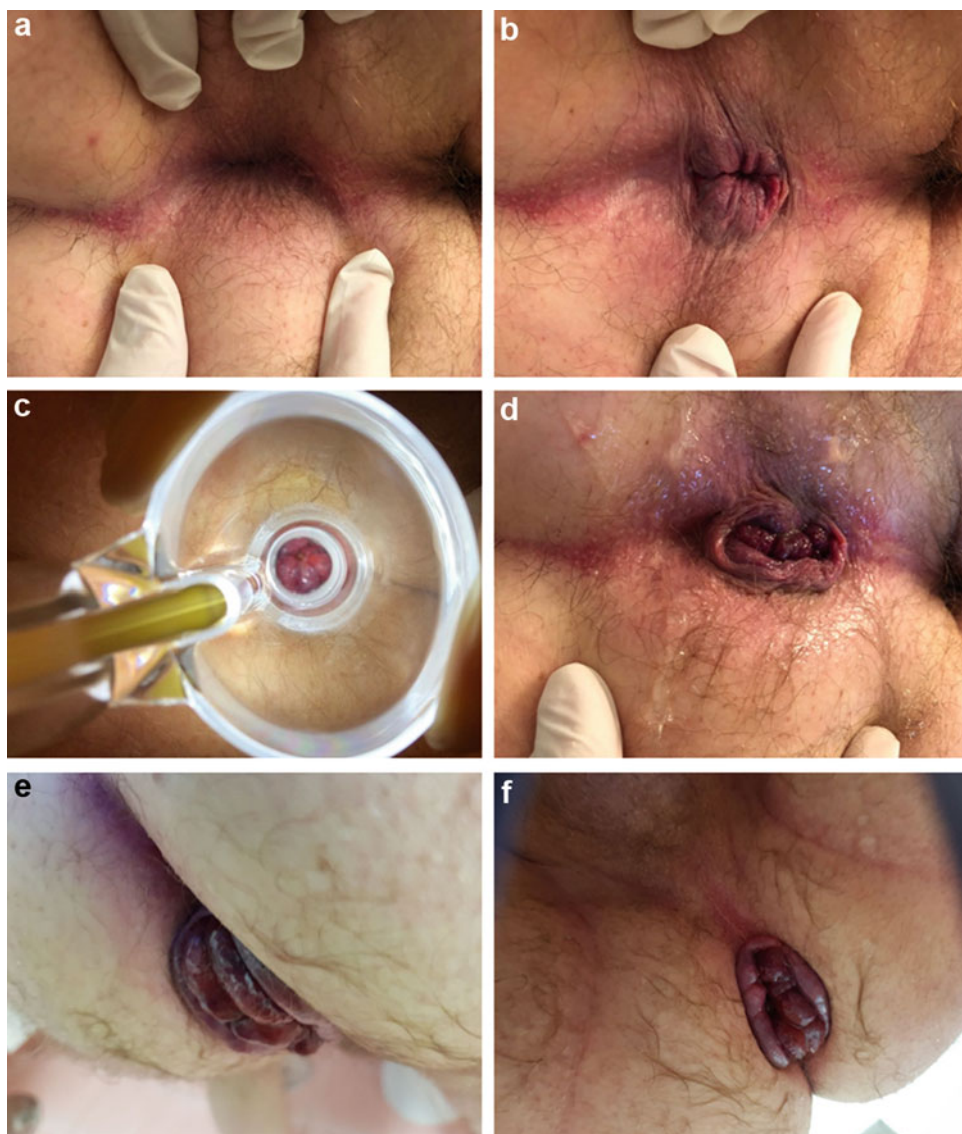


Fig. 7 Example of failure of clinical examination in assessing the severity of hemorrhoidal disease. A.R., a 51-year-old man referred to our Center for bleeding and severe hemorrhoidal prolapse requiring manual reduction. In (a) feature during physical inspection at rest (no any anomaly); in (b) feature during physical inspection at straining (only a mild engorgement of external hemorrhoids); in (c) feature at the anoscopy (engorgement of internal piles); in (d) feature at the end of anoscopy after

straining (mild prolapse of the internal hemorrhoids); (e) and (f) photos taken by the patient at home by his own camera at the end of defecation, showing prolapse of both external and internal hemorrhoids, not spontaneously reducible and needing manual reduction. The true assessment of the 3-degree hemorrhoidal disease was much more reliable if based on the symptoms referred by the patient (as confirmed by his own photos) than the in-office clinical evaluation performed by the physician

6 Cross-References

- [Anatomy, Physiology, and Pathophysiology of Hemorrhoids](#)
- [Classification of Hemorrhoidal Disease and Impact on the Choice of Treatment](#)
- [Critical Aspects of Modern Surgical Approach to Hemorrhoids](#)
- [Selection of Patients to the Surgical Treatment of Hemorrhoids](#)

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Part II

Therapeutic Approach to the Hemorrhoidal Disease



Medical Therapy of Hemorrhoidal Disease 5

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Abstract

Hemorrhoids can occur normally as part of the vasculature of the anal canal, however; in some patients they can also be the source of a number of bothersome perianal problems. These problems encompass a condition referred to as hemorrhoidal disease. The cardinal features of this condition include anal pruritus, prolapse, bleeding, and pain in the case of thrombosis. Symptomatic hemorrhoids have a prevalence ranging from 4.4% in the general

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population, to 36.4% in the population attending general practitioners (Johanson and Sonnenberg, *Gastroenterology* 98:380–386, 1990), and are known to have an increased prevalence during pregnancy and postpartum (Johanson and Sonnenberg, *Gastroenterology* 98:380–386, 1990).

Medical treatment of hemorrhoidal disease include the treatment of the associated disorders like constipation and the active treatment of hemorrhoidal disease.

The therapy for hemorrhoidal associated constipation is discussed in Sect. 2. Briefly, constipation is a common and sometimes disabling condition worldwide, above all among patients presenting hemorrhoids. A variety of traditional and novel treatment options are nowadays available. Fiber has been indiscriminately recommended for the treatment of constipation. As a matter of fact, an increase in the amount of dietary fiber is an almost universal recommendation in the primary care management of constipation and more in general in the management of hemorrhoids. Insoluble fibers appear to have the greatest impact on stool frequency and output. Traditional laxatives are effective at inducing bowel movements, but data for their role in long-term management and on efficacy on constipation-associated abdominal symptoms are limited. Long-term studies are available for polyethylene glycol (Macrogol), confirming sustained efficacy. The critical importance of the enteric microbiota to intestinal and, especially, colonic function, together with some limited clinical evidence to suggest some changes in the flora in the constipated subject provide a rationale for the use of probiotics and prebiotics in constipation. However, with the exception of the constipated IBS subject, clinical trial data on these agents in constipation, per se, is very scanty. Large-scale, high-quality, trials are indicated and are clearly feasible given the prevalence of the complaint. When patients fail to respond to standard therapy, the colonic secretagogue lubiprostone, or the 5-HT₄ agonist prucalopride, or linaclotide, a GC-C receptor agonist, are available as the next step in management. In controlled trials in chronic constipation,

these drugs were shown to significantly improve constipation and its associated symptoms, and both seem to have a favorable safety record, although a high incidence of nausea was reported with lubiprostone. Among the new therapeutic agents Plecanatide, another GC-C agonist, has been proven to be effective in the treatment of constipation, although its long-term risks and benefits remain to be determined. The accessibility of multiple drugs with different mechanisms of action will continue to benefit patients suffering from chronic constipation as well as the hemorrhoids-associated one. The treatment of constipation has become easier with the exciting development of new medications and effective biofeedback therapy over the past decade. Other therapies on the horizon should further improve health care providers' ability to effectively treat symptoms of hemorrhoids and its complications.

The active therapy for hemorrhoidal disease is discussed in Sect. 3. Briefly, conservative approaches are recommended in particular for low-grade internal hemorrhoids and non-thrombosed external hemorrhoids (grade I hemorrhoids), which can generally be effectively treated with dietary and lifestyle modifications. The main goal of medical treatment is to control hemorrhoidal symptoms. Several drugs are available in various forms including tablet, suppository, cream, and wipes. Oral therapy is based on flavonoids, mesoglycan, calcium dobesilate, and herbal extracts. Local therapy is based on corticosteroids, analgesics, vasoconstrictors, and barrier cream including several active ingredients such as sodium hyaluronate, aloe vera, and other herbal extracts. Flavonoids are a heterogeneous class of drugs with venotonic properties, capable of increasing vascular tone, reducing venous capacity, decreasing capillary permeability, and facilitating lymphatic drainage in addition to having anti-inflammatory effects. Mesoglycan is a set of glycosaminoglycans of venous vascular diseases due to its fibrinolytic effect. Calcium dobesilate is a venotonic drug, which is capable of controlling symptoms of a hemorrhoidal attack, reducing microvascular permeability, decreasing platelet aggregation, and

having antioxidant properties. Oral supplementation with herbal extracts as *Aesculus hippocastanum*, *Ruscus aculeatus*, *Centella asiatica*, and *Hamamelis virginiana* may help control hemorrhoidal symptoms. Pharmacological mechanisms of action are very similar to those of the flavonoid drug class, by improving circulation and reducing inflammation. Several dietary factors including a low-fiber diet, spicy or fatty foods, coffee, alcohol, and others may be implicated in the pathogenesis of hemorrhoidal disease, but reported data in most cases is inconsistent or conflicting. Increasing dietary fiber intake and oral fluids are both recommended to manage hemorrhoidal disease and reduce the likelihood of recurrence. Spicy food is one of the most important dietary risk factors for hemorrhoidal crisis. Alcohol is another possible risk factor for hemorrhoidal disease, and although reliable data in the literature is sparse, patients should still avoid alcohol consumption during a hemorrhoidal crisis. Smoking is not associated with an increased risk of hemorrhoid. Local anesthetics reduce hemorrhoidal symptoms by exerting a local anesthetic effect, which eliminates the burning and itching associated with hemorrhoidal prolapse. They have less of an effect on bleeding, although they are frequently used for this indication. Antispasmodic agents, glyceryl trinitrate (GTN), and nifedipine are used to relieve symptoms associated with anal sphincter spasm and high resting anal canal pressures. Topical GTN treatment has also resulted in a decrease rectal bleeding, an improvement of anal pain, throbbing, itching, and irritation. Nifedipine ointment has good efficacy particularly in the treatment of acute thrombosed external hemorrhoids and chronic anal fissures. Phenylephrine is a vasoconstrictor which provides temporary relief of acute symptoms of hemorrhoids, such as bleeding and pain on defecation. Anti-inflammatory topical therapy is based on hydrocortisone acetate or 5-aminosalicylic acid (5-ASA), both with similar anti-inflammatory effects, and suppository forms are more useful than cream to treat internal hemorrhoids.

Several botanical extracts have been shown to improve hemorrhoidal symptoms. Aloe vera is one of the most commonly used extracts for treating acute and chronic wounds. The gel of aloe vera reduces the pain, swelling and itching of burns, and skin irritation. Topical therapy with herbal extracts, such as *Aesculus hippocastanum*, *Ruscus aculeatus*, *Centella asiatica*, and *Hamamelis virginiana*, may also help control hemorrhoidal symptoms, these are often prescribed in clinical practice due to their effectiveness and the very few reported side effects.

1 Introduction

Hemorrhoids can occur normally as part of the vasculature of the anal canal, however; in some patients they can also be the source of a number of bothersome perianal problems. These problems encompass a condition referred to as hemorrhoidal disease. The cardinal features of this condition include anal pruritus, prolapse, bleeding, and pain in the case of thrombosis. Symptomatic hemorrhoids have a prevalence ranging from 4.4% in the general population, to 36.4% in the population attending general practitioners (Johanson and Sonnenberg 1990), and are known to have an increased prevalence during pregnancy and postpartum (Johanson and Sonnenberg 1990).

Medical treatment of hemorrhoidal disease include the treatment of the associated disorders like constipation and the active treatment of hemorrhoidal disease.

The therapy for hemorrhoidal associated constipation is discussed in Sect. 2, while the active therapy for hemorrhoidal disease is discussed in Sect. 3.

2 Treatment of Hemorrhoids-Associated Constipation

Constipation is a common cause of hemorrhoids (Choung et al. 2007). The pathophysiology underlying this association is not completely understood; however structural and/or vascular changes

are thought to be involved (Abcarian et al. 1994) and chronic straining has been inconsistently associated (Johanson and Rimm 1992). One hypothesis is the role of reduced fluid intake (Petticrew et al. 2001); however the clinical effectiveness of increasing fluid intake as a treatment for constipation still remains unknown. Dietary fiber intake has been positively associated with increased bowel movement frequency and overall stool volume in individuals with occasional or mild constipation (Bennett and Cerda 1996; Spiller 1994), suggesting that frequency and volume of stool may be important factors in the susceptibility to constipation. Other types of laxatives (stimulant laxatives, osmotic agents, and fecal softeners) have shown effectiveness in treating constipation in randomized trials (Petticrew et al. 2001; Kenny and Dkelly 2001; Tramonte et al. 1997; Jones et al. 2002). In addition, a variety of over-the-counter preparations are available for the treatment of constipation, and hemorrhoidal disease overall, and patients often seek medical attention only after these modalities have failed. Thus, patients presenting to physicians most likely represent those with a more severe form of disease. Several options are available for the treatment of constipation, and most patients will have relief with conservative or noninterventional treatment approaches.

Therapy for constipation in patients with hemorrhoids is similar to that of the general population. The first approach is to reassure the patient, encourage adequate fluid intake and exercise, and ensure adequate fiber ingestion (20–35 g/day). In addition osmotic laxatives such as polyethylene glycol (8–25 g/day) and lactulose (15–30 ml/day) can be used if needed. Recent interest in the relation of the enteric microbiota to intestinal mainly colonic function, alongside some limited clinical evidence of an altered flora in constipated patients, has provided the rationale for the use of probiotics and prebiotics in constipation. However, aside from IBS associated constipation IBS, the clinical data on the role of these agents overall in constipation is very sparse (Quigley 2011). More recent advancements in the understanding of the physiopathology of constipation have led to the availability of newer agents such as

linaclotide and prucalopride. Each of these approaches will be discussed in further detail.

2.1 Fiber Supplementation

The recommendation of fiber supplementation for the treatment of constipation dates back to at least the sixteenth century. More recently, epidemiological studies have linked low fiber diets with a lower stool output and constipation to seemingly related disorders including diverticular disease, appendicitis, colon cancer, and gallstones. Fiber refers to the poorly digestible components of grains, vegetables, and fruits and is composed largely but not exclusively, of non-starch polysaccharides. Two types of fibers can be distinguished based on their chemical properties and physiological actions: *water soluble fibers* such as pectins, gums, and mucilages, and *insoluble fibers* such as cellulose, hemicelluloses, and lignins. The former, though highly effective in retaining water to form a highly viscous solution, have a modest effect on stool output and little effect on colon transit; while the latter have a negligible effect on water retention but significantly increased stool output and are potent stimuli of colon transit (Spiller 1994). Several mechanisms of action have been proposed to explain the laxative effects of fiber and include the simple bulking effect of undigested fiber particles; the aforementioned water-holding effect; acceleration of colon transit time; the promotility effects of products of bacterial fermentation, such as short-chain fatty acids; the stimulation of bacterial populations (which normally contribute significantly to stool dry weight); and the increased production of gases and other metabolic by-products that increase fecal mass and, thereby, also promote transit (Spiller 1994; Cummings 1984). Regardless of their mechanism of action, fiber and fiber supplements are widely recommended as a therapy for constipation. The general recommendation is to increase fiber intake 20–30 g/day (Lembo and Camilleri 2003).

Despite the virtual ubiquity of the recommendation of increased fiber intake for the management of constipation, the evidence base on which

this advice rests is somewhat sparse. However, in many systematic reviews (Alonso-Coello et al. 2006), fiber has showed an effective beneficial effect in the treatment of symptomatic hemorrhoids, and in particular of constipation. The risk of persistent or nonimproving symptoms decreased on average by 47% in the patients using fiber, with a significant reduction in the risk of bleeding also observed. In studies with multiple intervals of follow-up, usually at 6 and 12 weeks, the results for later time points were very similar to earlier time points. Results are also compatible with large beneficial effects of fiber in relation to prolapse, pain, and itching.

Fiber is generally used in patients suffering from first and second-degree hemorrhoids, therefore with a lesser component of prolapse. Most trials have evaluated grade I–II hemorrhoids, and those that included mixed populations failed to provide data according to grade of severity. Although fiber might also be effective in patients with more advanced stages of hemorrhoidal disease, this issue remains largely unaddressed.

Overall the quality of evidence can be considered as moderate (The GRADE Working Group 2004), leading to moderately strong inferences concerning the benefits of fiber. Thus, while future trials will likely confirm the observed effect, the relatively small number of patients enrolled in trials to date could argue for the need for additional larger trials.

2.2 Laxatives

Patients who respond poorly to fiber, or who do not tolerate it, may require alternative laxatives to bulk-forming agents (Table 1).

2.2.1 Bulk-Forming Laxatives

Bulk-forming laxatives include psyllium seed (e.g., Metamucil), methylcellulose (e.g., Citrucel), calcium polycarbophil (e.g., FiberCon), and wheat dextrin (e.g., Benefiber). They are natural or synthetic polysaccharides or cellulose derivatives that primarily exert their laxative effect by absorbing water and increasing fecal mass. These laxatives are effective in increasing the frequency

and softening the consistency of stool with minimum adverse effects. They may be used alone or in combination with an increase in dietary fiber. Despite substantial anecdotal clinical experience indicating the benefit of bulk-forming laxatives, objective evidence regarding the effectiveness has been inconsistent.

2.2.2 Surfactants

There is little evidence to support the use of surfactant agents in constipation. Stool softeners such as docusate sodium (e.g., Colace) are intended to lower the surface tension of stool, thereby allowing water to more easily enter the stool. Although these agents have few side effects, they are less effective than other laxatives. A systematic review concluded that stool softeners may be inferior to psyllium for improvement in stool frequency.

2.2.3 Osmotic Agents

There are many studies comparing various non-bulk-forming laxative options (American College of Gastroenterology Chronic Constipation Task Force 2005). The risk of side effects from these agents is minimal. Thus, their use is based upon cost, ease of use, patient preference, and response to empiric treatment.

Polyethylene glycol (PEG), composed of poorly absorbed or nonabsorbable sugars, and saline laxatives cause intraluminal water secretion and thereby increase stool frequency. Excessive use of these agents may result in electrolyte and volume overload in patients with renal and cardiac dysfunction (Lembo and Camilleri 2003).

- Macrogol – PEG electrolyte solutions (e.g., GoLYTELY) and powdered preparations (e.g., MiraLAX) that do not contain electrolytes are available for the treatment of chronic constipation. A systematic review has found that polyethylene glycol is effective in improving stool frequency and consistency (Bharucha et al. 2013). The usual dosage is to start with 17 g of powder dissolved in 8 oz. of water once daily, with the indication to titrate up or down (to a maximum of 34 g daily) based on the clinical effect. No benefit is shown if PEG is

Table 1 Medications for treatment of constipation

Medication	Usual adult dose	Onset of action	Side effects
Bulk-forming laxatives			
Psyllium	Up to 1 tablespoon (\cong 3.5 g fiber) 3 times per day	12–72 h	Impaction above strictures, fluid overload, gas and bloating
Methylcellulose	Up to 1 tablespoon (\cong 2 g fiber) or 4 capsules (500 mg fiber per capsule) 3 times per day	12–72 h	
Polycarbophil	2–4 tabs (500 mg fiber per tab) per day	24–48 h	
Wheat dextrin	1–3 capsules (1 g fiber per caplet) or 2 teaspoonsful (1.5 g fiber per teaspoon) up to 3 times per daily	24–48 h	
Surfactants (softeners)			
Docusate sodium	100 mg 2 times per day	24–72 h	Well tolerated. Use lower dose if administered with another laxative. Contact dermatitis reported.
Docusate calcium	240 mg 1 time per day	24–72 h	
Osmotic agents			
Polyethylene glycol (macrogol)	8.5–34 g in 240 mL (8 oz) liquids	1–4 days	Nausea, bloating, cramping
Lactulose	10–20 g (15–30 mL) every other day. May increase up to 2 times per day.	24–48 h	Abdominal bloating, flatulence
Sorbitol	30 g (120 mL of 25% solution) 1 time per day	24–48 h	Abdominal bloating, flatulence
Glycerin (glycerol)	One suppository (2 or 3 g) per rectum for 15 min 1 time per day	15–60 min	Rectal irritation
Magnesium sulfate	One to two teaspoonsful (\cong 5 to 10 g) dissolved in 240 mL (8 oz) water 1 time per day	0.5–3 h	Watery stools and urgency. Caution in renal insufficiency (magnesium toxicity).
Magnesium citrate	200 mL (11.6 g) 1 time per day	0.5–3 h	
Stimulant laxatives			
Bisacodyl	10–30 mg as enteric coated tab 1 time per day	6–10 h	Gastric irritation
	10 mg suppository per rectum 1 time per day	15–60 min	Rectal irritation
Senna	2–4 tab (8.6 mg sennosides per tab) or 1–2 tab (15 mg sennosides per tab) as a single daily dose or divided twice daily	6–12 h	Melanosis coli
Other			
Lubiprostone	24 mg 2 times per day	24–48 h	Nausea, diarrhea
Linaclotide	145 mg 1 time per day	12–24 h	Diarrhea, bloating

Taken and revised by UpToDate 2017

used more than once daily. If patients do not respond, the dose of PEG can be decreased to 8.5–17 g daily, with the addition of a stimulant laxative every other to every third day as needed.

- Synthetic disaccharides – Lactulose (e.g., Enulose) is a synthetic disaccharide, which is not metabolized by intestinal enzymes;

therefore water and electrolytes remain within the intestinal lumen due to the osmotic effect of the undigested sugar. Lactulose requires some time (24–48 h) to achieve its effect. Sorbitol is an equally effective and less expensive alternative. A systematic review found evidence that lactulose is effective in improving both stool frequency and consistency (Bharucha

et al. 2013). Both lactulose and sorbitol may cause abdominal bloating and flatulence. PEG, however, is superior to lactulose.

- Saline – Saline laxatives, such as milk of magnesia, magnesium citrate, or water containing high volumes of magnesium sulfate, are poorly absorbed and act as a hyperosmolar solution. Hypermagnesemia, seen primarily in patients with renal failure, is a major potential complication.

2.3 Prebiotics and Probiotics

2.3.1 Prebiotics

Prebiotics are defined as nondigestible, but fermentable, foods that beneficially affect the host by selectively stimulating the growth and activity of one species or a limited number of bacterial species in the colon. Compared with probiotics, which introduce exogenous bacteria into the human colon, prebiotics stimulate the preferential growth of health-promoting commensal flora already residing in the colon, especially, but not exclusively, *lactobacilli* and *bifidobacteria*.

The only prebiotics for which sufficient data have been generated to allow evaluation of their classification as functional food ingredients are the inulin-type fructans. They are present in significant amounts in many fruit and vegetables, including wheat, onion, chicory, garlic, leeks, artichokes, and bananas. Because of their chemical structure, prebiotics are not absorbed in the small intestine but are fermented in the colon, by endogenous bacteria to form energy and metabolic substrates, with lactic and short-chain carboxylic acids as end products. It must also be remembered that substances, including fiber, fiber supplements, and lactulose also exert a prebiotic effect. Among prebiotics, inulin is the main product that displays promising data as a coadjuvant for chronic constipation.

Data on prebiotics in constipation is very limited and there is currently insufficient evidence from large, randomized, placebo-controlled clinical trials on which to base therapeutic recommendations. Nevertheless, we can assume that the use of prebiotics, by stimulating the “good”

microbiota, helps the intestinal environment that eventually can have a positive effect on stool frequency.

2.3.2 Probiotics

Probiotics, derived from the Greek and meaning “for life,” are defined as live organisms that, when ingested in adequate amounts, exert a health benefit to the host. There are several commercially available supplements containing viable microorganisms with probiotic properties. The most commonly used probiotics are lactic acid bacteria and nonpathogenic yeasts. While probiotic “cocktails” have also been advocated to maximize the effect, it needs to be noted that some probiotic combinations have been proven to be antagonistic, rather than synergistic, in certain situations. Possible modes of action revealed in such studies include: competitive metabolic interactions with pathogens, production of chemical products (bacteriocins) that directly inhibit other bacteria or viruses, inhibition of bacterial movement across the gut wall (translocation), enhancement of mucosal barrier function, and signaling with the epithelium and immune system to modulate the inflammatory/immune response. Of particular relevance to constipation, probiotics may also produce other chemicals, including neurotransmitters, which may modify other gut functions, such as motility (Quigley 2007; Bueno et al. 2007) or sensation (Rousseaux et al. 2007; Ait-Belgnaoui et al. 2006).

While probiotics and, to a lesser extent, prebiotics have been extensively studied in irritable bowel syndrome, data on the impact of probiotics on constipation is lacking, to say the least. There are, however, some human studies supporting the ability of probiotics (with or without a prebiotic) to accelerate colonic transit and stimulate motility, effects which would invariably benefit the patient with slow-transit constipation. In a systematic review of probiotics in constipation, Chmielewska and Szajewska identified a total of five randomized controlled trials involving a total of only 377 subjects (Chmielewska and Szajewska 2010). They concluded that pending the arrival of further data, the use of probiotics and prebiotics for the treatment of constipation can

be considered exploratory. Some support for the use of probiotics in constipation comes from IBS studies particularly those involving constipated IBS subjects. *Bifidobacterium infantis* was shown to normalize stool consistency (as assessed by the Bristol stool scale) and reduce straining among constipated IBS subjects, without an apparent effect on stool frequency. The possibility that probiotics may alleviate hemorrhoid-related symptoms and constipation has also been suggested by the reported benefit among “normal” subjects with “minor” gastrointestinal symptoms (Higashikawa et al. 2010) and their ability to facilitate colonic preparation prior to colonoscopy.

2.4 New Therapeutic Agents

Over the past decade, the treatment of chronic constipation as well as the hemorrhoid-associated constipation has advanced well beyond the standard therapy of stool softeners and fiber. A better understanding of the physiology and pathophysiology has paved the way for the development of new therapeutic agents that are both effective and safe. When patients fail to respond to standard therapy, lubiprostone, a stimulant of the CIC-2 channel, or linaclotide, a GC-C receptor agonist, are available as the next step in management (Koliani-Pace and Lacy 2017). The accessibility of multiple drugs with different mechanisms of action will continue to benefit patients suffering from chronic constipation and hemorrhoids. Other therapies on the horizon are likely to further improve health care providers’ ability to effectively treat symptoms of constipation.

2.4.1 Linaclotide

Linaclotide (brand name Linzess®) was approved by the FDA in 2012 and is a minimally absorbed 14-amino acid peptide which activates guanylate cyclase type C (GC-C). Stimulating GC-C ultimately causes an increase in cyclic guanosine monophosphate (cGMP) from guanosine triphosphate, which in turn causes electrolytes to be secreted into the lumen of the intestine. The end result causes an increase in gastrointestinal transit (Bryant et al. 2010; Busby et al. 2010).

Linaclotide has been approved by the US Food and Drug Administration for the treatment of chronic idiopathic constipation at a dose of 145 micrograms daily (FDA 2012).

2.4.2 Plecanatide

Plecanatide has been approved by the US Food and Drug Administration for the treatment of chronic idiopathic constipation at a dose of 3 mg daily. The safety and efficacy of plecanatide was evaluated in two 12 week, placebo-controlled trials. Patients treated with plecanatide were more likely to experience improvement in the frequency of complete spontaneous bowel movements as compared with placebo. The most common adverse effect was diarrhea which led to discontinuation of treatment in approximately 1% of patients treated with plecanatide.

2.4.3 Lubiprostone

Lubiprostone is a locally acting chloride channel activator that enhances chloride-rich intestinal fluid secretion (Johanson and Ueno 2007). Its approval was based upon two placebo-controlled trials that included a total of 479 patients with chronic idiopathic constipation, randomly assigned to active treatment for 4 weeks (Lang 2008). Significantly more patients receiving active treatment achieved the primary endpoint (an increase in spontaneous bowel movements to at least three per week) during each week of observation. Corresponding improvement was observed in abdominal bloating, discomfort, stool frequency, and straining, although the role of lubiprostone in the treatment of chronic constipation remains to be determined. There have been no comparisons with other options for the treatment of severe constipation, and its long-term safety has not yet been established. Until further data becomes available (and due to its cost compared to other options and the high frequency of reported nausea), it is currently best reserved for patients with severe constipation in whom other approaches have been unsuccessful.

2.4.4 Prucalopride

Available in Europe and Canada, but not in the United States, this 5HT₄ prokinetic agent at a

dose of 1–4 mg once daily has been shown to be superior to placebo in 4–12-week trials, and is safe and well tolerated in patients age 65 or older (Quigley et al. 2009; Yiannakou et al. 2015). The improvement in quality of life scores observed at the end of the 12-week trials was maintained for up to 18 months. A non-inferiority comparison study found that PEG 3350-electrolyte solution was not inferior to prucalopride and may have some advantages including lower costs (Cinca et al. 2013).

3 Medical Therapy for Hemorrhoids

Therapeutic management of hemorrhoids ranges from dietary and lifestyle modifications to radical surgery, depending on their grade. Conservative approaches are recommended initially for patients with low-grade disease. Such approaches are also preferred for most patients who are pregnant, debilitated, or immunocompromised, patients with coagulation disorders and patients with Crohn's disease or conditions that confer a predisposition to poor healing. In particular low-grade internal hemorrhoids and nonthrombosed external hemorrhoids (grade I hemorrhoids) can be effectively treated with dietary and lifestyle modifications (Lohsiriwat 2015). Furthermore there are several modern and traditional medications used which are available in a variety of formats including tablets, suppositories, creams, and wipes. The main goal of medical treatment is to control acute symptoms of hemorrhoids. Oral therapy is based on flavonoids, mesoglycan, and calcium dobesilate. Local therapy is based on corticosteroids, analgesics, vasoconstrictors, and barrier creams composed of several active ingredients such as sodium hyaluronate and aloe vera (Lohsiriwat 2012).

3.1 Oral Medications

3.1.1 Flavonoids

Flavonoids are a heterogeneous class of drugs extracted from plants and are also called

phlebotonics due to their effect on the capillary and venous system. These venotonic drugs were initially used in the treatment of chronic venous insufficiency and edema. They appeared to be capable of increasing vascular tone, reducing venous capacity, decreasing capillary permeability, and facilitating lymphatic drainage in addition to their anti-inflammatory effects. Their precise mechanism of action remains unclear and the efficacy of flavonoids in the treatment of hemorrhoids is still a matter of debate, although several trials, reviews, and meta-analyses have demonstrated their role in both the prevention and control of hemorrhoidal symptoms. Recent evidence suggests a potential benefit in the use of phlebotonics for both acute and chronic symptomatic hemorrhoids, in addition to symptom relief post-hemorrhoidectomy; where they have been shown to improve recovery time and reduce the risk of edema and thrombosis. Micronized purified flavonoid fraction (MPFF) [Daflon 500 mg twice daily], consisting of 90% diosmin (450 mg) and 10% hesperidin (50 mg), is the most common flavonoid used in clinical treatment. The micronization improves its solubility, absorption, and shortens its onset of action. A recent meta-analysis of flavonoids for hemorrhoidal treatment suggested that flavonoids decreased the risk of bleeding by 67%, persistent pain by 65%, and itching by 35%, and also reduced the recurrence rate by 47%. Some investigators have reported that MPFF can reduce rectal discomfort, pain, and secondary hemorrhage following hemorrhoidectomy (Giannini et al. 2015; Perera et al. 2012; Lyseng-Williamson and Perry 2003).

3.1.2 Mesoglycan

Mesoglycan, a set of glycosaminoglycans, is extracted from porcine intestinal mucosa and is composed of heparan sulfate, dermatan sulfate, and minimal quantities of chondroitin sulfate. Evidence suggests that mesoglycan may be useful in the management of venous vascular diseases such as phlebitis, deep venous thrombosis, and chronic venous insufficiency due to its fibrinolytic effect. Heparan and dermatan sulphate are thrombin inhibitors acting through complementary pathways, antithrombin III (AT III) and heparin

cofactor II, respectively, and heparan sulphate also inhibits activated factor X (FXa). Pharmacological activity of mesoglycan may also possibly involve the liberation of a small amount of tissue plasminogen activator (tPa). The mean dose of mesoglycan was 50 mg twice per day (Scondotto et al. 1984; Andreozzi 2007; Tufano et al. 2010).

3.1.3 Calcium Dobesilate

Calcium dobesilate is a venotonic drug that is widely prescribed for three main indications: chronic venous disease, diabetic retinopathy, and the symptoms of an acute hemorrhoidal attack. Its main mode of action is related to a reduction in microvascular permeability, thereby increasing capillary resistance and reducing capillary permeability. Additionally, this medication decreases platelet aggregation and reduces serum viscosity, which results in a reduction of tissue edema. It also has an antioxidant effect, preventing damage from free radicals. This effect may be explained in part by the antioxidant properties of calcium dobesilate and its action on endothelium via the synthesis of nitric oxide, increasing endothelium-dependent relaxation. Furthermore it may also protect vascular endothelial function by acting directly as an antioxidant protecting lipids from peroxidation. The typical dose of calcium dobesilate in hemorrhoidal disease is 500 mg twice per day to 3 weeks followed by 500 mg once daily. The risk of an adverse effect of calcium dobesilate 500–1500 mg/day is very low and constant over time. Adverse events can occur with the following frequencies: fever (26%), gastrointestinal disorders (12.5%), skin reactions (8.2%), arthralgia (4.3%), and agranulocytosis (4.3%), (however the estimated prevalence of agranulocytosis to be 0.32 cases/million treated patients). Calcium dobesilate can be used during pregnancy only if the benefit to the mother outweighs the risk to the child, and its use while breastfeeding should be avoided. Together with diet and lifestyle recommendations, oral calcium dobesilate treatment provides an efficient, fast, and safe symptomatic relief from acute symptoms of hemorrhoidal disease. This symptomatic improvement is also associated with a significant improvement in the endoscopically observed inflammation (Allain

et al. 2004; Berthet et al. 1999; Tejerina and Ruiz 1998; Menteş et al. 2001).

3.2 Herbal Oral Therapy

Oral supplementation with herbal extracts, such as *Aesculus hippocastanum*, *Ruscus aculeatus*, *Centella asiatica*, and *Hamamelis virginiana*, may prevent time-consuming, painful, and expensive complications of varicose veins and hemorrhoids. Pharmacological mechanisms of action are very similar to that of the flavonoids drug class (MacKay 2001).

Aesculus hippocastanum (Horse Chestnut) seed extracts (HCSE), 50 mg aescin twice daily, are used clinically to relieve subjective symptoms and reduce objective signs of chronic venous insufficiency. The active component of the extract is thought to be aescin, a triterpenic saponin. *Aesculus* has a venotonic and anti-inflammatory activity, in addition to free-radical scavenging properties. It inhibits the activity of the enzymes elastase and hyaluronidase, both involved in enzymatic proteoglycan degradation. These properties make HCSE ideal for the treatment of both varicose veins and hemorrhoids. HCSE appears to reduce abnormally increased capillary permeability and the associated edema (MacKay 2001; Facino et al. 1995).

Extract of *Ruscus aculeatus* (butcher's broom) is effective in increasing venous tone because of its anti-inflammatory and astringent properties. The active biochemical constituent is proposed to be the saponin glycoside ruscogenin, clinically used for the treatment of varicose veins and hemorrhoids. Available data suggests a reduction in macromolecule permeability due to the increasing effects of bradykinin, leukotriene B₄, and histamine on endothelium. Clinical trials showed that patients with chronic venous insufficiency given oral *Ruscus* extract demonstrated maintenance of venous tone and improved venous emptying in comparison to placebo-treated patients both for chronic venous insufficiency given and hemorrhoids (MacKay 2001; Facino et al. 1995).

Centella asiatica is a tropical medicinal plant with a long history of therapeutic use for varicose

veins and hemorrhoids. Oral pharmaceutical preparations are based on pentacyclic triterpene derivatives: Asiatic acid, madecassic acid, and asiaticoside. Most clinical trials of *Centella* used one of the following extracts: TECA, TTFCa, or TTF. The extracts TECA (titrated extract of *Centella asiatica*, 120 mg/day or 60 mg/day) and TTFCa (total triterpenoid fraction of *Centella asiatica*, 30 mg three times daily) are combinations comprised of Asiatic acid (30%), madecassic acid (30%), and asiaticoside (40%). The *Centella* extract TTF (total triterpenic fraction, 180 mg/day or 90 mg/day) is comprised of asiatic acid and madecassic acid (60%) in a ratio not clearly defined, in combination with asiaticoside (40%). Clinical investigation has demonstrated the potential of *Centella* to enhance connective tissue integrity, elevate antioxidant levels in wound healing, and improve capillary permeability. These plant extracts are also available for topical use (Gohil et al. 2010; MacKay 2001).

Witch hazel (*Hamamelis virginiana* extract) has a long therapeutic tradition and is used primarily for its astringent, anti-inflammatory, and local hemostatic effects, both in oral and topical form. Witch hazel decoctions are easily found on the shelf of most pharmacies, yet the literature available regarding its efficacy and mechanism of action is limited. This extract is also available for topical use in minor injuries of the skin, local inflammation of the skin and mucous membranes, hemorrhoids, and varicose veins. The pharmacological mechanism appears to be due to inhibition of alpha-glucosidase and human leukocyte elastase, both enzymes which contribute to the degradation of connective tissue and compromise vasculature (MacKay 2001).

3.3 Dietary and Lifestyle Advices

Several dietary factors including, a low fiber diet, spicy or fatty foods, coffee, alcohol, and others may be implicated in the pathogenesis of hemorrhoidal disease, however the published literature in most cases is inconsistent or conflicting. Increasing the daily intake of dietary fiber and oral

fluids are both recommended as initial steps in managing hemorrhoidal disease and reducing the likelihood of recurrence (Lohsiriwat 2012).

Spicy food is one of the most important dietary risk factors for a hemorrhoidal crisis. Data reported in the literature confirms a greater frequency of hemorrhoids in patients had reporting recent consumption of spicy food. However there is a definite lack of data regarding standardization and the definition and typology of spicy food consumed in clinical trials and observational studies. Its consumption should be avoided in patients with a history of hemorrhoids, younger patients, those in a current hemorrhoidal crisis, patients with acute anal fissures, and in pregnant women – due to the overall increased risk of developing hemorrhoids. The pathological mechanism resulting in an increased disease risk in people ingesting spicy diets has not yet been well defined (Pigot et al. 2005; Gupta 2008).

Alcohol is another possible risk factor for hemorrhoidal disease, however specific data in the literature is conflicting. Similarly to dietary factors, it is likely that the current differences between published clinical studies are due to the lack of quantification of the amount of alcohol consumed in studied populations (Pigot et al. 2005; Lee et al. 2014; Peery et al. 2015). However, it has been suggested that expression patterns, ethanol-metabolizing activities, and cellular localization of alcohol and aldehyde dehydrogenases (ADH and ALDH) in the human colon have shown differences between certain racial populations due to functional polymorphisms. In particular, ALDH2*2 polymorphism is known to be associated with hemorrhoids, and acetaldehyde, an immediate metabolite of ethanol, is proposed as an etiological factor in the pathogenesis of certain colonic diseases (Chiang et al. 2012). Despite the lack of definite evidence, patients with hemorrhoids should still avoid alcohol consumption during a hemorrhoidal crisis. Smoking is not known to be associated with an increased risk of hemorrhoids.

Other lifestyle modifications suggested for patients with hemorrhoidal disease include engaging in regular exercise and improving anal hygiene. In particular, sitz baths and bidets have

been shown to be effective, seemingly as a result of internal anal-sphincter relaxation causing diminution of the rectal neck pressure under the conditions of a low or medium warm water jet (Ryoo et al. 2011; Shafik 1993). Improving anal hygiene is also useful in pregnancy women (Staroselsky et al. 2008).

3.4 Medications – Topical Therapy

The primary objective of most topical treatment is to control the symptoms rather than to cure the disease, meaning that other therapeutic treatments may be subsequently required. Several topical preparations are available including creams and suppositories, and most can be bought without a prescription due to the known safety, and lack of serious side effects. However, strong evidence in the literature supporting the true efficacy of these treatments is lacking. These topical medications can contain various ingredients such as local anesthetics, antispasmodic agents, vasoconstrictors, corticosteroids, hyaluronic acid, and other anti-inflammatory drugs (Johanson 2002; Clinical Practice Committee, American Gastroenterological Association 2004).

3.4.1 Local Anesthetics

Local anesthetics can reduce hemorrhoidal symptoms by exerting a local anesthetic effect, which eliminates the burning and itching associated with hemorrhoids. They have less of an effect on bleeding, although they are frequently used for this indication. Several topical preparations are available alone or combined with other pharmacological classes. The most commonly used formulation is an ointment containing nifedipine 0.3% and lidocaine 1.5%, which is safely used in both patients with low grade hemorrhoids and those post-hemorrhoidectomy. Despite their frequent use, to date there have not been any strong clinical trials supporting the efficacy of any of these products. However the use of local anesthetics such as lidocaine is safe with low systemic plasma concentrations, taking into account any clinically relevant findings with respect to vital signs or ECG findings. Possible side effects

include local allergic reactions, irritation, and pruritus. The pharmacological action of lidocaine is due to an alteration in the signal conduction of neurons by blocking the fast voltage-gated Na⁺ channels in the neuronal cell membrane responsible for signal propagation. Following sufficient blockage, the membrane of the postsynaptic neuron will not depolarize and will thus fail to transmit an action potential. This creates an anesthetic effect by stopping them before they begin (Johanson 2002; Zimmermann et al. 2007; Perrotti et al. 2009). Other topical anesthetics used in clinic practice include pramoxine, which can be used safely in late pregnancy without any association to adverse fetal effects on birth weight, gestational age, rates of prematurity, or pre- or postnatal complications (Ebrahimi et al. 2011); dibucaine, often used in combination with prednisolone (Marsicano et al. 1995); and chetocaine which has a pharmacological action similar to lidocaine.

3.5 Antispasmodic Agents

Antispasmodic agents are used to relieve symptoms associated with anal sphincter spasm and high-resting anal canal pressures. The most effective treatments are topical ointments based on glyceryl trinitrate (GTN) or nifedipine used alone, or combined with another drug class such as local anesthetics or anti-inflammatory agents.

3.5.1 Glyceryl Trinitrate

Current data show that topical GTN 0.2% ointment, on 2 week treatment, reduced the resting anal canal pressures in patients with first and second degree hemorrhoids with a high maximum resting anal canal pressure. Topical GTN treatment has also been shown to result in decreased rectal bleeding, along with an improvement in anal pain, throbbing, itching, and irritation. Side effects include headaches – reported in 43% of patients, dizziness, nausea, vomiting, and pruritus. The pharmacological activity occurs due to the release of nitric oxide. Nitric oxide has two major effects, producing vasodilatation of venous vessels, and reducing the muscle tone of the

internal anal sphincter (chemical sphincterotomy) (Tjandra et al. 2007).

3.5.2 Nifedipine

The local application of nifedipine ointment also has good efficacy, especially in the treatment of acute thrombosed external hemorrhoids and chronic anal fissures. The most commonly used formulation is an ointment containing nifedipine 0.3% and lidocaine 1.5%. Side effects are rare but include headaches, sphincter pain, hypertension, fecal incontinence, nausea, and vomiting. The pharmacological effect of topical application of nifedipine is thought to be due to the blockage of nitrate and calcium channels. Clinical effects leading to the symptomatic relief of hemorrhoids may be a consequence of causing relaxation on the internal anal sphincter, rather than directly on the hemorrhoidal tissue where a predominantly vasodilatory effect might be anticipated (Perrotti et al. 2001, 2002, 2010).

3.5.3 Phenylephrine

Other topical treatments are based on vasoconstrictor drugs such as phenylephrine, used alone or in combination with other suppositories or ointment formulations. The most commonly prescribed formulation is Preparation-H[®] (Pfizer, United States), which contains 0.25% phenylephrine, petrolatum, light mineral oil, and shark liver oil. The pharmacological effect of phenylephrine is due to vasoconstriction, having a preferential vasopressor effect on the arterial site of circulation, acting on α_1 adrenergic receptors, whereas the other ingredients are considered protective against further irritation of the rectal mucosa. Phenylephrine provides temporary relief of the acute symptoms of hemorrhoids, such as bleeding and painful defecation. No major side effects have been reported; however, local side effects could occur due to the influence on the tone of the internal anal sphincter (Sneider and Maykel 2010).

3.6 Anti-Inflammatory

Additionally, anti-inflammatory topical therapy is often prescribed and comprises both topical

corticosteroid and nonsteroidal anti-inflammatory drugs (NSAIDs).

3.6.1 Hydrocortisone Acetate

Hydrocortisone acetate 1%, in cream or suppository form, is one of the most commonly prescribed topical corticosteroids, generally combined with lidocaine 3%. It is a synthetic acetate salt form of hydrocortisone, a corticosteroid with anti-inflammatory and immunosuppressive properties. The pharmacological effect of hydrocortisone is based on its interaction with the cytoplasmic glucocorticoid receptor; causing translocation of the receptor-ligand complex to the nucleus where it initiates the transcription of genes encoding anti-inflammatory mediators, such as cytokines and lipocortins. Lipocortins inhibit phospholipase A2, thereby blocking the release of arachidonic acid from phospholipid membranes and preventing the synthesis of prostaglandins and leukotrienes. Suppository forms are more useful than cream to treat internal hemorrhoids. Potential side effects include local allergic reactions and potential chronic perianal dermatitis due to long-term use. Hydrocortisone can be safely used in late pregnancy (Johanson 2002; Ebrahimi et al. 2011; Sanchez and Chinn 2011; Jancic-Stojanović et al. 2010).

3.6.2 5-Aminosalicylic Acid

Among NSAIDs, the only compound in which a randomized clinical trial has been performed was looking at 5-aminosalicylic acid (5-ASA) suppositories 500 mg. 5-ASA was shown to reduce the intensity of pain, bleeding, and tenesmus, likely due to its anti-inflammatory activity, and to significantly decrease the congestion of the hemorrhoidal venous plexus. 5-ASA is a bowel-specific amino-salicylate drug that is metabolized in the gut and has its predominant action there, resulting in fewer systemic side effects. As a derivative of salicylic acid, 5-ASA is also an antioxidant that traps free radicals, which are potentially damaging byproducts of metabolism. The mechanism of action of 5-ASA is not fully understood; but it is likely to reduce inflammation by blocking cyclooxygenase and inhibiting prostaglandin production in the colon and rectum. The advantages

include fewer side effects than topical steroid therapy and the possibility of long-term use (Gionchetti et al. 1992; Punchard et al. 1992).

3.7 Hyaluronic Acid

Hyaluronic acid is often used in topical preparations for hemorrhoidal disease. It is an anionic, nonsulfated, *N*-glycosaminoglycan distributed widely throughout connective and epithelial tissues and is a ubiquitous polymer that is part of the extracellular matrix. Hyaluronic acid has also been used in the synthesis of biological scaffolds for wound-healing applications. These scaffolds typically have proteins such as fibronectin attached to the hyaluronan to facilitate cell migration into the wound. Among hyaluronic acid topical preparations, the only randomized clinical trial performed was on a gel medical device (Proctoal[®]) containing hyaluronic acid with tea tree oil and methyl-sulfonyl-methane (MSM) as major components. MSM is a natural compound, which takes part in the terrestrial sulphur cycle, and has also been shown to have anti-inflammatory and antioxidant effects in vitro. In addition, MSM has been shown to inhibit the release of pro-inflammatory mediators through a signal mediated by downregulation of NF- κ B. Treatment seems to improve pain during evacuation, pruritus, irritation, and reduces bleeding. However there are not currently any clinical studies comparing this preparation to other topical formulas (Joksimovic et al. 2012).

3.8 Herbal Topical Therapy

Several botanical extracts have been shown to improve hemorrhoidal symptoms, by having similar effects as local pharmacological therapy. In addition, several herbal extracts are used in oral form, for the treatment of varicose veins. The main effects seen are in improving pain and pruritus related to hemorrhoids by improving microcirculation and capillary flow, and reducing vascular tone and local inflammation. Several herbal extracts are used in combination with

hyaluronic acid and zinc oxide to improve mucosal healing (Gurel et al. 2013).

3.8.1 Aloe Vera

Aloe vera is one of the most commonly used extracts in the treatment of acute and chronic wounds. The gel of aloe vera reduces the pain, swelling and itching of burns, and skin irritations. It contains a mix of different glycoproteins, which have analgesic and anti-inflammatory qualities. The evidence to date suggests that aloe vera is also important in reducing healing time following hemorrhoidectomy; however there is a need for data on the effectiveness of aloe vera compared to other available topical therapies (Dat et al. 2012).

3.8.2 Other Herbal Preparations

Aesculus hippocastanum seed extracts (HCSE) are also used in various rectal preparations such as ointments and gels, 0.7–1.5%, for the treatment of hemorrhoids. However, available data is lacking concerning the actual effectiveness, and they are often used in combination with other preparations (MacKay 2001; Facino et al. 1995).

Extract of *Ruscus aculeatus* is mainly used in suppository preparations for hemorrhoidal disease. Clinical trials have shown an improvement in hemorrhoidal symptoms; however, again there is a lack of data available concerning its real effectiveness compared to other therapies (MacKay 2001; Facino et al. 1995).

Topical pharmaceutical preparations of extracts of *Centella asiatica* include ointment, suppository and spray formulations. Topical Centella is often associated with hyaluronic acid and other herbal extracts (Gohil et al. 2010; MacKay 2001).

Witch hazel (*Hamamelis virginiana* extract) is mainly used in ointment preparation for skin erythema and hemorrhoidal disease. Available literature regarding its efficacy and mechanisms of topical action is lacking for the treatment of hemorrhoids, however, is often prescribed in clinical practice owing to its effectiveness and a few reported side effects. It is usually mixed with other formulations as it is less effective than topical hydrocortisone acetate (MacKay 2001; Korting et al. 1993) (Table 2).

Table 2 Medications for treatment of hemorrhoids

Medication	Usual adult dose	Treatment duration	Therapeutic indication	Therapeutic effect	Side effects or notes
Oral pharmacological therapy					
Flavonoids (90% diosmin 10% hesperidin)	500 mg twice daily	At least 12 weeks	Past history of hemorrhoids; hemorrhoidal crisis; posthemorrhoidectomy	Decrease risk of bleeding, persistent pain and itching; reduced recurrence rate	None reported
Mesoglycan	50 mg twice per day	Symptomatic treatment	Prevention and treatment of hemorrhoidal thrombosis	Manage phlebitis and deep venous thrombosis	None reported
Calcium dobesilate	500 mg twice per day (A) 500 mg once daily (B)	3 weeks (A) Symptomatic treatment (B)	Hemorrhoidal crisis; prevention of hemorrhoidal thrombosis	Decrease pain and itching; improve endoscopically observed inflammation	Fever, gastrointestinal disorders, skin reactions, arthralgia and agranulocytosis
Oral herbal therapy					
<i>Aesculus hippocastanum</i> (horse chestnut) seed extracts (HCSE)	50 mg twice daily	Symptomatic treatment	Lack clinical evidence	Reduce capillary permeability and associated edema	None reported
<i>Ruscus aculeatus</i> (butcher's broom)	37.5 mg twice daily or 75 mg daily (no clinical evidence)	Symptomatic treatment	Lack clinical evidence	Improve venous tone and emptying	None reported
<i>Centella asiatica</i>	180 mg daily; 90 mg daily or 60 mg daily			Improve wound healing and capillary permeability	None reported
Witch hazel (<i>Hamamelis virginiana</i> extract)	2 g of dried leaves three times daily or as a tea			Astringent, anti-inflammatory, and hemostatic effects	Internal use of extracts is not recommended because of the tannin content
Topical pharmacological therapy					
Local anesthetics					
Lidocaine	Ointment 1.5% up to 3.0%	Symptomatic treatment	Pain, burning, and itching associated with hemorrhoid	Provides temporary relief of acute symptoms of hemorrhoids	Less of an effect on bleeding; possible local allergic reaction, irritation, and pruritus
Pramoxine	Ointment 1%	Symptomatic treatment	Pain, burning, and itching associated with hemorrhoid	Provides temporary relief of acute symptoms of hemorrhoids	Less of an effect on bleeding; possible local allergic reaction, irritation, and pruritus
Dibucaine	Ointment 1%				
Chetocaina	Ointment 1%				
Antispasmodic agents					
Glyceryl Trinitrate (GTN)	0.2% ointment	2 weeks	First- and second-degree hemorrhoids with a high maximum resting anal canal pressure	Reduce the resting anal canal pressures; decrease rectal bleeding, anal pain, throbbing, itching, and irritation	Headache, dizziness, nausea, vomiting, and pruritus

(continued)

Table 2 (continued)

Medication	Usual adult dose	Treatment duration	Therapeutic indication	Therapeutic effect	Side effects or notes
Nifedipine	0.3% ointment	Symptomatic treatment	Acute thrombosed external hemorrhoids and chronic anal fissure	Symptomatic relief; relaxation effect on the internal anal sphincter	Headaches, sphincter pain, hypertension, fecal incontinence, nausea and vomiting
Vasoconstrictors					
Phenylephrine	0.25% ointment	Symptomatic treatment	Pain, burning, and itching associated with hemorrhoid; Pain on defecation	Provides temporary relief of acute symptoms of hemorrhoids, such as bleeding and pain on defecation	Influences tone of the internal anal sphincter
Anti-inflammatory agents					
Hydrocortisone acetate	1% ointment	Symptomatic treatment	Pain, burning and itching associated with hemorrhoid	Provides temporary relief of acute symptoms of hemorrhoids	Local allergic reaction and potential chronic perianal dermatitis due to long-term use
5-aminosalicylic acid (5-ASA)	Suppositories 500 mg			Reduces intensity of pain, bleeding, and tenesmus; decreases congestion of the hemorrhoidal venous plexus	Fewer side effect than topical corticosteroids
Topical herbal therapy					
Aloe vera	No standardized dosing	Symptomatic treatment	Pain, burning, and itching associated with hemorrhoid; After hemorrhoidectomy	Reduces pain, swelling, and itching of burns; Reduces healing time after hemorrhoidectomy	None reported
<i>Aesculus hippocastanum</i> seed extracts (HCSE)	Ointment 0.7–1.5%		Lacks clinical evidence	Reduce capillary permeability and associated edema	
<i>Ruscus aculeatus</i> (butcher's broom)	Suppositories 1,000 mg three times per day, providing 50–100 mg of ruscogenins per day		Lacks clinical evidence	Improve venous tone and emptying	
<i>Centella asiatica</i>	Ointment 0.7–1.5%			Improve wound healing and capillary permeability	
Witch hazel (<i>Hamamelis virginiana</i> extract)	No standardized dosing		Pain, burning, and itching associated with hemorrhoid	Astringent, anti-inflammatory, and hemostatic effects	

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4 New Therapeutic Horizons for Hemorrhoidal Disease

Hemorrhoids are a very widespread and extremely troublesome disorder in the general population, and have a negative impact on both social and professional life, reducing quality of life and representing a heavy economic burden. For this reason, more and more attention is being placed on scientific research to improve our knowledge of the pathogenesis and treatment.

Nowadays, many new therapeutic options are under investigation and will be soon available. Among them we will describe both drug classes already in new formulations, and novel ones. Due to the wide variation in the clinical manifestation of hemorrhoidal disease, clinical trials range from those looking at conservative treatment of grade I and II disease, to the management of postsurgical adverse outcomes.

4.1 Conservative Treatment

4.1.1 *Malva Sylvestris*

Constipation, as extensively described, is both a risk factor and a complication of hemorrhoidal disease. Indeed, a major aim of current research is directed at finding drugs with similar properties as the marketed drugs, serving as powerful laxative agents, but without significant side effects. In this context, the World Health Organization (WHO) has strongly encouraged research based on medicinal plants for the treatment of constipation.

Mallow (*Malva sylvestris* L.) is a medicinal plant, traditionally used for its effect as an antacid, laxative, and antihemorrhoidal supplement, in addition to its culinary use as a food. The mechanism of protective effect of the aqueous extract of *Malva sylvestris* leaves has been studied in multiple studies, in particular by a Tunisian team, as Mallow is very common as a food in Tunisia (Joksimovic et al. 2012). This study was carried out to evaluate the protective effect of *Malva sylvestris* aqueous extract (MSAE) on constipation-induced by Loperamide. The effect of this plant against Loperamide-induced constipation is due to a combination of an increase in

gastrointestinal motility, a stimulation of water intestinal secretion, and antioxidant properties. The laxative effect conferred by *M. sylvestris* aqueous extract may be due to the richness of leaves in mucilages. In fact, mucilages are the main compounds with laxative activity in mallow leaves (Tomoda et al. 1989). Mucilages consist mainly of glucose, galactose, glucuronic acid, rhamnose, fructose, galacturonic acid, trehalose, sucrose, arabinose, fucose, and mannose. Mucilages are exceptionally effective fibers, which swell on contact with water and have thickening, adhesive, and softening properties (Jabri et al. 2017). The mucilages of *M. sylvestris* leaves contain soluble fibers and polysaccharides, which are transformed into a somewhat viscous and gelatinous mass, hence this ability of the extract to stimulate peristalsis. Unlike chemical laxatives, the mucilage MSAE is not irritating because it envelops the stomach and the colon. It has also been shown that MSAE can increase gastrointestinal transit (GIT) in a significant and dose-dependent manner. This stimulatory effect of gastrointestinal motility can be attributed to phenolic compounds, which are abundant in the leaves of *M. sylvestris* (Karawya et al. 1971; Pourrat et al. 1990).

4.1.2 *Allium ampeloprasum* subsp. *iranicum* (Leek)

Another very promising herbal topical preparation is *Allium ampeloprasum* subsp. *iranicum* (Leek), which has been traditionally used in anti-hemorrhoidal topical herbal formulations. Its most important active constituents are flavonoids and saponin. Flavonoids have shown beneficial effects in patients with hemorrhoidal diseases and saponins have also shown steroidal, anti-inflammatory, and antiulcerogenic activity. Patients evaluated in a pilot study showed a decrease in the grade of bleeding severity and painful defecation similar to those in an anti-hemorrhoid cream group following treatment, with no significant difference between the leek and other antihemorrhoid creams with regard to mean changes in outcome measures. Topical use of leek cream can be as effective as a standard antihemorrhoid cream (Herold et al. 2012).

4.1.3 Catechins and Epicatechins

Several studies have assessed the use of flavonoids for management treatment for grade I and II hemorrhoids; these are oral preparation also used for other venous disease. A new oral preparation, Roidosanal[®], is under investigation and is composed of catechins and epicatechins, which are monomers of naturally occurring proanthocyanidins. Proanthocyanidins are a class of polyphenols (a subclass of flavonoids) found in a variety of plants (apples, most of the pine species, cinnamon, aronia fruit, cocoa beans, grape seed, grape skin, bilberry, cranberry, black currant, green and black tea). Plant parts rich in proanthocyanidins have been used for years in the treatment of various anorectal diseases and are known to have a number of effects including free radical scavenging, antioxidant anti-inflammatory, anti-allergic, and vasodilatory activity. Roidosanal[®] is a preparation processed from a mixture of four herbs; gum-resin from *Commiphora molmol* (50%), gum-resin from *Gardenia spp.* (16.6%), inflorescence from *Tagates erecta* (16.7%), and *Mesua ferrea* (16.7%). It is made in the form of capsules, currently available in the Indian market, and standardized to contain not less than 7% of total catechins and epicatechins. Current evidence suggests that Roidosanal[®] is equally effective as Daflon[®] 500 mg (the most commonly prescribed flavonoid) in improving anorectal conditions. Effects on the associated signs and symptoms of hemorrhoids were seen to be equal including: subsiding inflammation and preventing infection in the anal region, preventing bleeding from the rectum, relieving itching in the anal region, and relieving constipation. No adverse events were found to be associated with the use of Roidosanal[®] (Mosavat et al. 2015).

4.1.4 Streptokinase Suppositories

The initial treatment of hemorrhoidal illness consists of general conservative measures (hygiene, dietetic, life style changes, and symptomatic treatment) to restore intestinal habit and to diminish local symptoms. However, as the focus of treatment is more on symptom control rather than slowing the progression of disease, a significant

group of patients do require a more definitive solution. In such cases, surgical or other invasive procedures are indicated (hemorrhoidectomy, ligation, sclerotherapy, infrared photo-clotting, cryo- and laser-therapy), all of which carry the risk of complications. An innovative therapy for hemorrhoidal disease, currently under investigation, is based on Streptokinase (SK).

Streptokinase (SK) is an indirect fibrinolytic agent that interacts with plasminogen, forming an active complex with protease action that activates plasminogen into plasmin. There are three domains to streptokinase, denoted α (residues 1–150), β (residues 151–287), and γ (residues 288–414). Each domain binds plasminogen, although none can activate plasminogen independently. Plasmin is produced in the blood to breakdown fibrin, the major constituent of blood thrombi, thereby dissolving clots. The efficacy of SK has been demonstrated in acute myocardial infarct and in other thrombotic diseases. Several novel clinical trials have investigated local application of recombinant SK (rSK) suppositories on hemorrhoids, where thrombosis and/or inflammation with microthrombi may be present. These studies assessed the effect and safety of rSK suppositories with or without sodium salicylate versus placebo (Aggrawal et al. 2014); versus 0.25% phenylephrine suppositories (Hernández-Bernal et al. 2013); and versus hydrocortisone acetate suppositories (Hernández-Bernal et al. 2014). The evidence suggests that rSK suppositories had a dose-dependent effect, with a significant effect over placebo and other tested drugs, was obtained using the 200,000 IU rSK preparation. Sodium salicylate had only a marginal, nonsignificant effect on resolution of the hemorrhoidal episode. At day 10, phenylephrine suppositories led to a resolution of the disease in 25% of cases compared with 80% of the patients treated with rSK suppositories. Likewise at 10 days, hydrocortisone acetate suppositories led to a resolution of the disease in 26% of cases compared with 90% of the patients treated with rSK suppositories. All patient groups treated with rSK suppositories had shorter response time, which is of particular interest due to the potential impact on patients' quality of life. The rSK-treated groups showed a reduced need for thrombectomy, likely due to the mechanism of action of SK as

a thrombolytic agent. Any significant adverse events were associated with topical rSK. Of particular note, there were no bleeding complications in the rSK group and rSK suppositories do not seem to alter systemic hemostasis. The thrombolytic effect of the rSK suppositories on microthrombi in the local capillary structures could improve permeability and its action on the lymphatic local system, which could diminish the inflammation, exudates, and local edema. This may explain the rapid improvement following application, even if macrothrombosis is not present. Further controlled, large trials are required to confirm efficacy data, to compare their use with other currently used medications and to explore other ways of optimizing the cost-benefit ratio. This drug has completed the requirements for product approval in Cuba by the National Regulatory Authority.

4.1.5 Intra-Anal Iferanserin

Despite the prevalence of internal hemorrhoid disease (HD), there remain a few pharmacologic options. Iferanserin, a selective serotonin receptor antagonist, is currently being evaluated for use in the treatment of hemorrhoidal disease. Bleeding, often painless and bright red in color, is one of the most frequent complaints (the Greek root of hemorrhoid means “blood flow”). Bleeding occurs as a result of erosion or trauma of the mucosal lining or inflammation damaging the underlying blood vessels.

Iferanserin is a selective 5-HT receptor antagonist with an affinity for 5-HT receptors. It has been hypothesized that an intra-anal ointment application of iferanserin might modify the vascular effects occurring in hemorrhoids and thereby reduces or eliminates the most frequently occurring symptoms. In a recent trial, the efficacy and tolerability of twice-daily iferanserin intra-anal ointment versus inactive vehicle (placebo) was evaluated, in the cessation of bleeding and other symptoms associated with hemorrhoidal disease. In patients with hemorrhoids and bleeding, treatment with intra-anal iferanserin was associated with a significant reduction relative to placebos in patient-reported severity of daily bleeding from day 1 to study end (day 14), and in patient-reported severity of daily itching from day 2 to study end. Iferanserin use was not associated with significant improvements in the

severity of other hemorrhoidal symptoms, including pain, tenderness, defecation difficulties, fullness, throbbing, and flatulence. Treatment with intra-anal iferanserin was associated with a significant reduction relative to placebo, in physician-assessed frequency of bleeding between baseline and the end of treatment. The prevalence of adverse events did not differ significantly between the two treatment groups; being predominantly gastrointestinal, mild, and infrequent (Alesiani et al. 2007).

4.2 Medical Management Postsurgery

In the case of failure of medical treatment or postsurgical complications, newer treatments are required. Numerous medications for these indications have been developed, and three will be discussed in further detail.

4.2.1 Venoplast[®] (Diosmin, Coumarin Glycosides, and *C. asiatica*)

In 1993, stapled anopexy was proposed as an alternative method for surgical management of hemorrhoids. It works by reducing the size of internal hemorrhoids by interrupting their blood supply and thereby reducing the amount of rectal mucosa that can prolapse. Several complications can occur in the first 7 postoperative days: bleeding (prevalence, 0–68%), thrombosis of internal hemorrhoids, and thrombosis of external hemorrhoids. These complications are usually treated conservatively, with only very few cases experiencing postoperative bleeding with severe enough anemia to necessitate further surgical intervention. In addition, postoperative pain is common, reported in 24% of patients undergoing stapled anopexy. Patients with grade I or II hemorrhoids, for which surgical management is not recommended, are generally administered medications containing micronized purified flavonoid fraction (Perera et al. 2012). As previously emphasized several studies and meta-analysis have reported that flavonoids can reduce the incidence of postoperative bleeding, but there is no evidence that these compounds have an effect on postoperative pain and thrombosis (di Visconte et al. 2017).

Melilotus officinalis is a species of legume containing coumarin, with prolymphokinetic and proteolytic actions. Coumarin reduces edema and inflammation in tissues and leads to an improvement in capillary permeability; however, the mechanisms underlying its pharmacologic activity are not known. It may be possible to increase the beneficial therapeutic effect of coumarin by using it in combination with other compounds. *Centella asiatica* is a small, herbaceous, frost-tender, perennial plant that reduces endothelial permeability and capillary filtration. Capillaroscopy has shown that *C. asiatica* affects microcirculation and inhibits inflammation. In a recent study (Hernández-Bernal et al. 2015), the efficacy of oral administration of a mixture of diosmin, coumarin glycosides, and *C. asiatica* (Venoplant®; Aesculapius, Brescia, Italy) has been evaluated in the prevention of bleeding, pain, TH, and THE in patients who have undergone SA. In this study, the prevalence of TH was significantly lower in Venoplant-treated patients than in patients treated with placebo. This was possibly due to the antiedema activity of coumarin, which has activity against the colloid osmotic pressure involved in edema formation. Coumarin causes the activation of macrophages and other circulating immune cells, which can produce proteolytic enzymes. The latter transform proteins in the perivascular interstitium into small molecular fragments, which can be readily drained from this site.

Venoplant was therefore found to be efficacious in the management of postoperative bleeding, particularly in the first 2 weeks, becoming less effective from 2–4 weeks following SA. Venoplant administration also effectively reduced the incidence of TH and reduced postoperative pain compared to placebo. The data provided here could be used as the basis for undertaking a much larger randomized clinical trial on the effects of Venoplant on the prevention of bleeding, thrombosis, and pain after SA.

4.2.2 Diltiazem Gel

Postoperative pain when resting or defecating after hemorrhoidectomy is the most bothersome complication for both patients and doctors. In

cases where pain can be managed adequately, hemorrhoidectomy can be performed in the outpatient setting and patients may not hesitate to undergo the procedure, however, the mechanism of pain after hemorrhoidectomy remains unclear. It is thought that the pain following hemorrhoidectomy is caused by spasm of the internal anal sphincter. Secondary infection of the surgical site may also cause pain. Several agents, such as glyceryl trinitrate, botulinum toxin, and metronidazole, have been tried and have been reported to relieve pain by relaxing the internal anal sphincter or by controlling infection. Among agents used for pain relief following hemorrhoidectomy, nitroglycerin ointment has been studied most extensively. Although this agent showed initial promise, patients were prone to severe headaches and the subsequent need for nonnarcotic medications. Diltiazem, a calcium channel blocker, acts by blocking calcium uptake in the myocyte; therefore it has been used to decrease the contraction of the internal anal sphincter in the treatment of anal fissures. In the case of hemorrhoidectomy, the efficacy of topical diltiazem ointment on postoperative pain is still unclear, although a few of small randomized clinical trials have been reported. The effect of topical diltiazem on postoperative pain after hemorrhoidectomy has been evaluated in a recent trial (Sugimoto et al. 2013). This study did not reach statistical significance on either postoperative pain scores or the number of analgesic tablets consumed between the groups. Nevertheless, topical diltiazem had some potential as a pain reliever during defecation, and NSAID tablet use in the diltiazem group tended to be lower during the postoperative course. In previous reports, where topical diltiazem ointment showed a significant effect on reducing postoperative pain, the standard closed hemorrhoidectomy (Ferguson method) and the standard Milligan Morgan method had been performed. In the mentioned study, hemorrhoidectomy was performed with an ultrasonic activated scalpel. This study may not have reached statistical significance on the postoperative pain scores because this procedure performed with the harmonic scalpel has been reported to cause less pain than the traditional method. In fact, pain

scores in the placebo group in our study were lower than those of the placebo groups in the previous studies. There are no reported standard dose delivery systems available for the administration of topical diltiazem. Furthermore, its ideal concentration and application method have not yet been established. Carapeti et al. conducted a study on volunteers and reported that topical 2% diltiazem ointment offers significant reduction of anal sphincter pressure with no side effects. From the incidence and severity of side effects in this study, the pain relief provided by the 2% diltiazem concentration seemed to be acceptable for most of the patients. The efficacy of topical diltiazem on wound healing after hemorrhoidectomy has not yet been reported. However, topical glyceryl trinitrate, which has been used for pain control in the treatment of anal fissures, has also been reported to enhance wound healing by increasing anodermal blood flow. Although topical diltiazem is expected to have a favorable effect on wound healing, the recent studies failed to demonstrate any such effect.

In conclusion, it has been demonstrated that topical application of 2% diltiazem gel after hemorrhoidectomy has the potential to reduce postoperative pain during defecation. Nevertheless, further controlled trials are warranted.

5 Cross-References

- [Intra- and Postoperative Management in Patients Submitted to Operation for Hemorrhoids](#)
- [Main Disadvantages of Outpatient Treatments for Hemorrhoids](#)

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Endoscopic Treatment of Internal Hemorrhoids

6

Alessandra Bizzotto, Manuela Codazzi, and Cristiano Spada

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Abstract

Hemorrhoids represent pathological changes in the physiological anal cushions and are one of the most common ano-rectal diseases. Hemorrhoids are divided in two main groups, internal and external. Internal hemorrhoidal complexes are furthermore conventionally categorized in IV grades according to their extent, tendency to prolapse, and reducibility

(Goligher's classification). Regardless to pathogenesis, the appropriate assessment of hemorrhoids is crucial to treatment. Once non-hemorrhoidal reasons for complaints have been ruled out, patients suffering from symptomatic low-graded internal hemorrhoids are initially best served with medical conservative behavioral approach with the aim of relief symptoms. When conservative treatments fail, patients are amenable to nonsurgical ablative office-based procedures. Rubber band ligation, injection sclerotherapy, and infrared coagulation are the three viable evidence-based treatment alternatives. These treatment modalities are well-established, relatively well-tolerated, almost effective, and furthermore repeatable procedures and can be performed using an anoscope or proctoscope or during flexible endoscopy, the latter with

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substantial advantages and minimal or no adjunctive equipment. According to the available literature, rubber band ligation is associated with better long-term efficacy and lower sessions needed for treatment with acceptable complication rates and is therefore advised as the first-line treatment option. However, sclerotherapy and infrared thermocoagulation may still be suitable in specific circumstances and subset of patients. Despite grade of disease and patients' conditions and expectations, the choice between the different options ultimately depends on local expertise, preferences, and facilities.

1 Introduction

Hemorrhoids represent pathological changes in the physiological anal cushions and are one of the most common ano-rectal diseases.

Though a complete comprehension of their pathogenesis has not yet been reached, the understanding of hemorrhoids anatomy is crucial to appropriate assessment and treatment.

Hemorrhoids are divided into two main groups, internal and external, according to their location with respect to the dentate line. Internal hemorrhoids arise at the transition zone above the dentate line, whilst external hemorrhoids arise below the dentate line, with distinct blood supply and drainage, epithelialization, and innervation (Jacobs 2014). External hemorrhoids have somatic innervations and are spanned by anoderm, while internal hemorrhoids are covered with mucosa and have visceral innervation and are therefore more likely to respond to heat and pressure stimuli rather than present with pain.

Internal hemorrhoidal complexes are furthermore conventionally categorized in IV grades according to their extent, tendency to prolapse, and reducibility (Goligher's classification) regardless of severity of bleeding (Goligher 1980).

Patients suffering from hemorrhoids typically report painless, intermittent, scant hematochezia, pruritus, anal discomfort, soiling, mucous

discharge, pinching sensation, lump feeling, mucosal protrusion, or a combination (Jacobs 2014).

Once nonhemorrhoidal causes of the patient's anorectal complaints have been ruled out, the primary first-line approach to symptomatic hemorrhoid disease is conservative.

Nonoperative conservative treatment encompasses life-style and dietary adaptations (increased fluid intake, fiber supplementation, stool softeners, avoidance of unnecessary straining, warm sitz bath) and medical treatment. Over-the-counter topical medication (analgesics, steroids, and antispasmodics) and oral flavonoids-based phlebotonics are commonly used to provide symptoms relief (Jacobs 2014), although there is no clear evidence supporting their beneficial effects and true efficacy for prevention or long-term treatment of hemorrhoidal disease (Lohsiriwat 2012; Hollingshead and Phillips 2016).

Among the nonsurgical procedures band ligation proves better long-term efficacy; however, sclerotherapy and infrared thermocoagulation may still be beneficial and appropriate in specific circumstances (Wald et al. 2014). Patients undergoing surgical hemorrhoidectomy have a better response to treatment than have patients treated with nonsurgical procedures, although complications and postprocedural pain are higher.

A care plan to treat hemorrhoidal disease should include a complete evaluation of the patient allowing to identify any factor that may compound the symptoms.

Considering the variety of available treatments, the cure should be tailored on the single patient.

2 Role of Endoscopy in the Treatment of Hemorrhoids

Low-grade symptomatic engorged anal cushions – grade I, grade II and selectively grade III hemorrhoids – refractory to conservative medical therapy are suitable to minimally invasive office- or endoscopy suite-based procedures. Surgery is

indicated in low-graded hemorrhoids refractory to nonsurgical treatment, high-graded or mixed type hemorrhoids, and strangulated hemorrhoids.

	Grade I	Grade II	Grade III	Grade IV	Complicated
Diet lifestyle modification					
Medication					
Office procedures (Endoscopy)					
Non excisional surgery					
Surgical hemorrhoidectomy					

(Lohsiriwat 2015)

Rubber band ligation, injection sclerotherapy, and infrared coagulation are the available evidence based validated nonexcisional ablative treatment alternatives (Wald et al. 2014; Rivadeneira et al. 2011; Trompetto et al. 2015; Higuero et al. 2016; SSAT 2008) and can be performed using flexible endoscopy.

	Grade I	Grade II	Grade III	Grade IV	Complicated
Rubber band ligation (Endoscopy)					
Sclerotherapy (Endoscopy)					
Infrared coagulation (Endoscopy)					

(Lohsiriwat 2012)

All methods share the same principle: decrease vascularization, reduce redundant tissue, and cause fibrosis and fixation of the internal hemorrhoid to the rectal wall, downsizing the anal cushion, minimizing prolapse, and preventing development of new hemorrhoidal tissue (Rivadeneira et al. 2011; Cocorullo et al. 2017).

These treatment modalities are well-established, relatively well tolerated, almost effective, and furthermore repeatable procedures, though the potential need for multiple sessions requiring several outpatients visits may neutralize the advantages of an office-based minimalist procedure (MacRae and McLeod 1995, 1997).

3 Rubber Band Ligation

Elastic band ligation for the treatment of internal hemorrhoids was first described by Blaisdell (1958). After introducing a rigid proctoscope, forceps were used to capture the hemorrhoids before placement of elastic bands around the base of the tissue. Placement of the band caused ischemic necrosis, and the hemorrhoid tissue became thrombosed and sloughed off about 7–14 days later, resulting in rectal wall connective scar tissue. Thirty years later, Stiegmann et al. (1989) introduced the elastic band ligation for the treatment of esophageal varices by using a flexible endoscope. Nine years later Trowers et al. (1998) reported on the feasibility of this technique for the treatment of hemorrhoids. Since then, band ligation demonstrated to be an effective treatment modality in selected group of patients.

Patients with symptomatic internal hemorrhoids (grade I-II and, in some cases, grade III) not responding to conservative treatment are candidate for office-based procedures. Among the office procedures, rubber band ligation is the most frequently used treatment modality (Beattie et al. 2002) and appears to have the lowest incidence of recurrent symptoms (Lohsiriwat 2015). Rubber band ligation can be performed in the outpatient setting and with both endoscopic (with the ligator placed on the tip of a flexible endoscope) and nonendoscopic (with the ligating system introduced through a rigid proctoscope) ligating devices.

Patients with first-, second-, and in some cases third-degree symptomatic (bleeding, prolapse, rectal tenesmus, anal irritation, incontinence) internal hemorrhoids, refractory to conservative medical treatment or who request a nonsurgical therapeutic modality or cannot tolerate a surgical option, are suitable for banding. Patients with grade IV hemorrhoids or patients with any level of hemorrhoids, but with additional anorectal problems, or patients with failed attempt of office treatment should be candidates to surgical hemorrhoidectomy.

Contraindications to the procedure include: severe coagulopathy and use of anticoagulants or

antiplatelet agents for the increased risk of delayed bleeding (Nelson et al. 2008), immunosuppression (possible bacterial translocation), unfavorable anatomic features (significant rectal prolapse or patients in which insufficient tissue is available to be pulled inside the band ligator cap), large IV degree hemorrhoids (high recurrence rate), acute hemorrhoidal external prolapse or thrombosis, and septic-inflammatory process in the anorectal region (anal fistulas, perianal abscesses).

All the ligating devices act by means of capturing a small amount of tissue, while a small diameter latex or soft-rubber circular band is deployed around the base of the tissue to get compression resulting in vascular compromise (or hemostasis) followed by thrombosis, necrosis, and sloughing. The technique is comparable to that used for esophageal variceal band ligation. Before treatment, diagnostic rectoscopy is usually performed to confirm the grade and the position of the hemorrhoids. For the treatment, a specific device is placed on a standard endoscope. All commercially available band ligation devices are cleared by the FDA for single use. The band ligation device consists of a short, transparent, cylindrical cap with preloaded elastic bands (from 1 to 10 stretched bands depending on the device) (Fig. 1). During the procedure, by

applying suction the target hemorrhoid is pulled into the cap. When all the endoscopic field view is completely occupied by the tissue, the band is deployed around the hemorrhoid cushion. The proper position of the band should be at the base of the hemorrhoid root (Fig. 2) or over the bleeding site. Dentate line banding should be avoided in order not to pinch somatic nerves of the anal canal. For this reason, once identified the dentate line, ligation should be performed from 2 to 20 mm proximally to the dentate line. Treatment should start from the largest internal hemorrhoid and proceed with the smaller ones (Fig. 3). Band ligation may be repeated over the time. Retreatment is generally performed every 2 or 3 weeks until cessation of bleeding and eradication of hemorrhoids.

With regard to outcomes, several studies demonstrated that endoscopic band ligation is safe and effective. Recurrence occurs when symptoms are still present despite one or more treatment sessions. Table 1 shows the results of the four major studies describing flexible endoscopic hemorrhoid band ligation outcomes.

Data available in literature suggest that up to 90% of patients experience hemorrhoids reduction of at least one grade (according to Goligher's hemorrhoids grading), after the first session of endoscopic band ligation (Fig. 4) (Su et al.

Fig. 1 Rubber band ligation: white band indicates that the penultimate band has been used

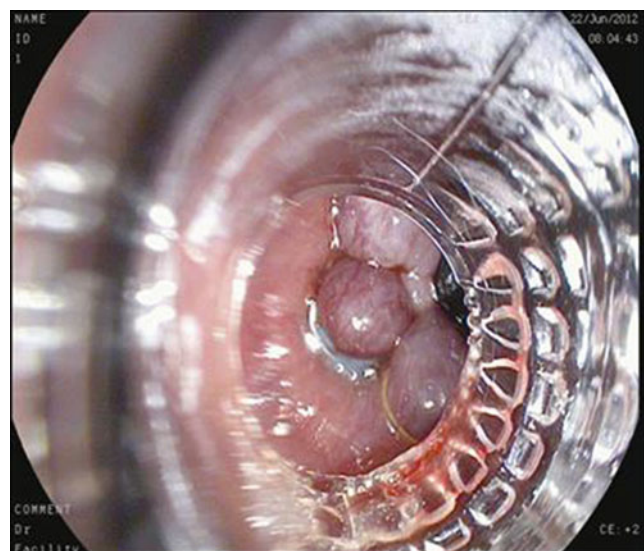


Fig. 2 Rubber band
ligation: first band applied

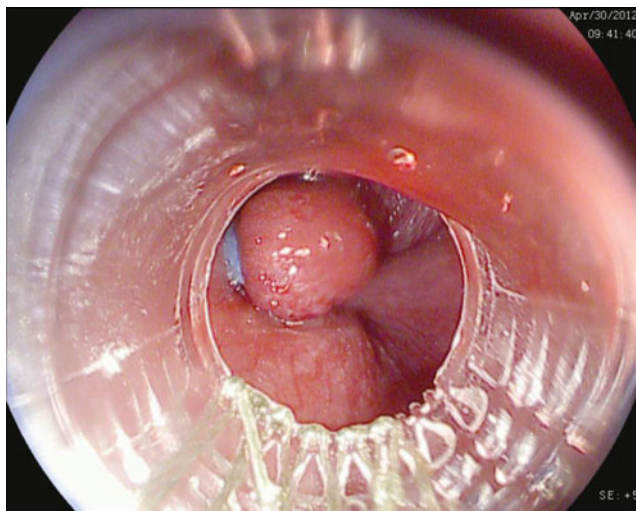
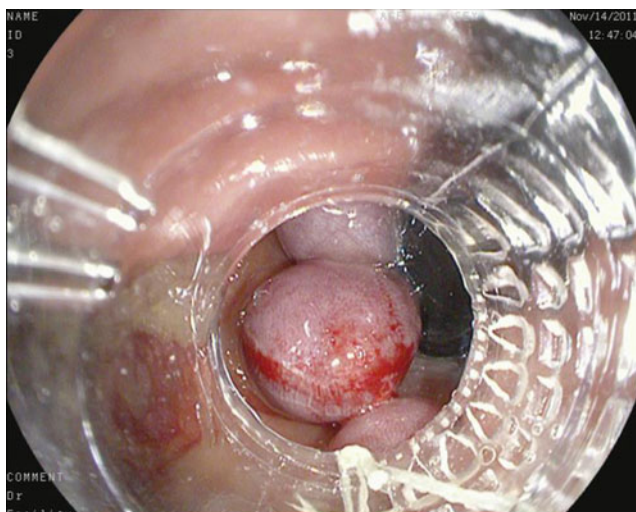


Fig. 3 Rubber band
ligation: multiple banding



2003a), significant reduction of bleeding (from 1.26 to 0.93 on a 0 to 3 scale) (Fukuda et al. 2004), and a good long-term response in 89% of patients. Patients with stage II hemorrhoids are more likely to have beneficial treatment compared to those with stage III hemorrhoids (Berkelhammer and Moosvi 2002). Symptoms improvement is higher in bleeding (98%) patients than in patients with prolapsed hemorrhoids without bleeding (82%) (Su et al. 2011). When compared to other medical and endoscopic treatment modalities (medical treatment, sclerotherapy, infrared coagulation), band ligation was superior in term of effectiveness (88% of patients

both for bleeding and prolapse) and recurrence rates (19% of patients with recurrent bleeding and 2–34% with recurrent prolapse) (Table 2). One possible explanation of the better outcomes observed in patients who receive band ligation is the submucosal scar following the band ligation that prevents recurrence of new hemorrhoids.

In 2005 a Cochrane review (Shanmugam et al. 2005) compared band ligation and excisional hemorrhoidectomy. The authors showed a higher long-lasting efficacy of surgical hemorrhoidectomy, especially for grade III hemorrhoids (two trials, 116 patients, RR 1.23, CI 1.04 to 1.45; $p = 0.01$). Nevertheless, surgical treatment

Table 1 Grade II – III hemorrhoids RBL treatment outcomes

	Pts (n)	Follow-up (months)	Symptoms			Band (mean number)	Sessions (n)		Results		Complications (mild)		
			Bleeding (%)	Prolapse (%)	Pain		1 (%)	≥ 2 (%)	Excellent Good (%)	Poor (%)	Bleeding (%)	Pain (%)	Recurrence (%)
Ming-Yao Su et al. (2011)	759	45–92	77	23	na	2.69	82	18	90	10	6.3	12.3	3–17
Berkelhammer (2002)	83	1–52	96	4	na	1.2	87	13	80	20	9	29	na
Fukuda et al. (2004)	82	3–40	na	na	na	8.1	92	8	89	11	17	27	2
Jalihal et al. (2013)	280	1–36	69	31	na	2.8	na	na	96	4	6	15	na

Fig. 4 Long-term outcome of endoscopic rubber band ligation

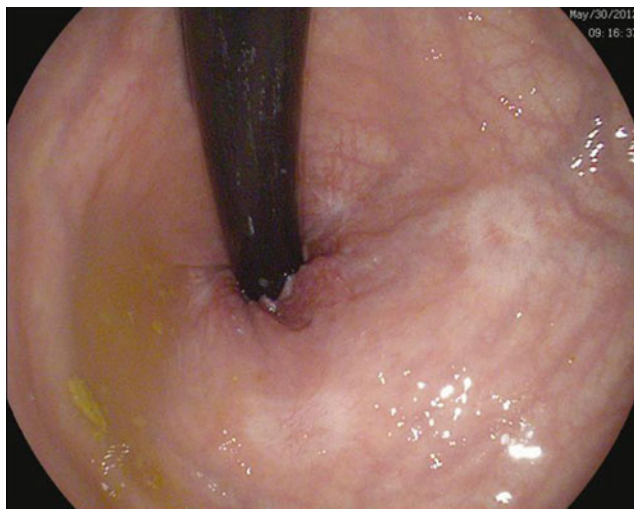


Table 2 Nonsurgical treatments results

		Rubber band ligation	Infrared coagulation	Injection sclerotherapy
Effectiveness	Bleeding	88%	50%	69%
	Prolapse (grade II)	88%	58%	35%
	Prolapse (grade III)	80%	20%	
Complications	Pain	35%	54%	36%
	Bleeding	22%	25%	3%
Recurrence	Follow-up (months)	12	3	10
	Prolapse	18%	56%	na
	Bleeding	19%	14%	na

Cocorullo et al. (2017): the nonsurgical management for hemorrhoidal disease. A systematic review

was associated to higher pain occurrence (three trials, RR 0.20 CI 0.09 to 0.40; $p < 0.00001$), higher short-term complications – first among all postoperative pain (three trials, RR 1.94, 95% CI 1.62 to 2.33; $p < 0.00001$) and higher time off work. Although surgical treatment was associated to an overall higher “complete remission of symptoms” (pain, bleeding, and prolapse), surgical and endoscopic treatment showed comparable results in patients with grade II hemorrhoids.

Little data are available comparing the use of rigid proctoscope and flexible endoscope for elastic band ligation of internal hemorrhoids. The long-term efficacy and safety of the two methods seems to be similar. However, when elastic banding is performed under flexible endoscopic control, significantly fewer treatment sessions are

required, likely due to a wider field of view (Wehermann et al. 2004): to achieve the same therapeutic aims, patients treated with flexible endoscopy required a mean of 1.8 ligating sessions versus 2.4 of the rigid proctoscope group ($p < 0.01$), and the total number of bands applied was significantly lower (2.8 in the flexible endoscopy group vs. 3.7 during rigid proctoscopy; $p < 0.01$).

Slightly discordant data were published by Cazemier et al. in 2007 showing that pain after ligation was more frequent in patients treated with flexible endoscopy (10 patients vs. 3 patients treated with rigid proctoscopy, $p < 0.05$), probably due to a higher mean of band applied with a flexible endoscope. Some studies reported indeed that patients who received a higher number of

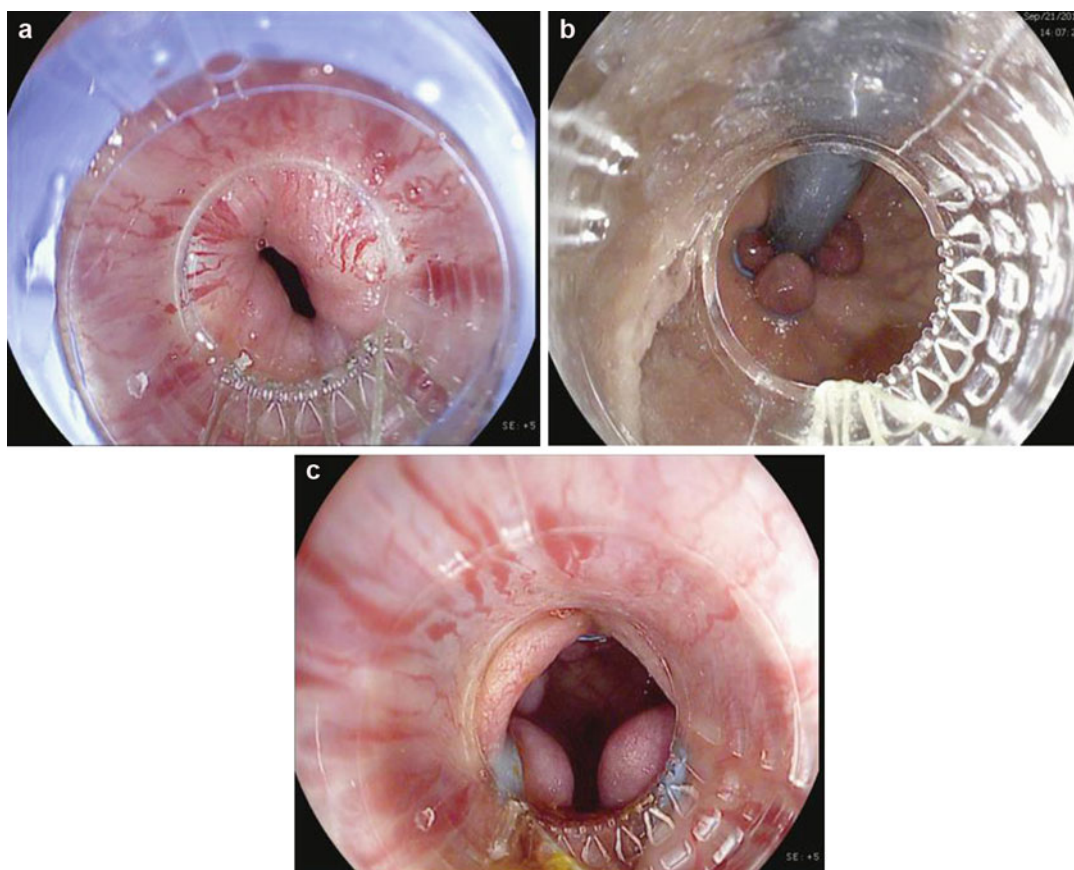


Fig. 5 (a) Anterograde vision, (b) retroflexion, (c) anterograde postprocedural vision. In the retroflexed position the operator has a 360° view to the rectal ampoule

ligations experienced an increase in incidence of pain, need for analgesics, urinary symptoms, swelling, and edema.

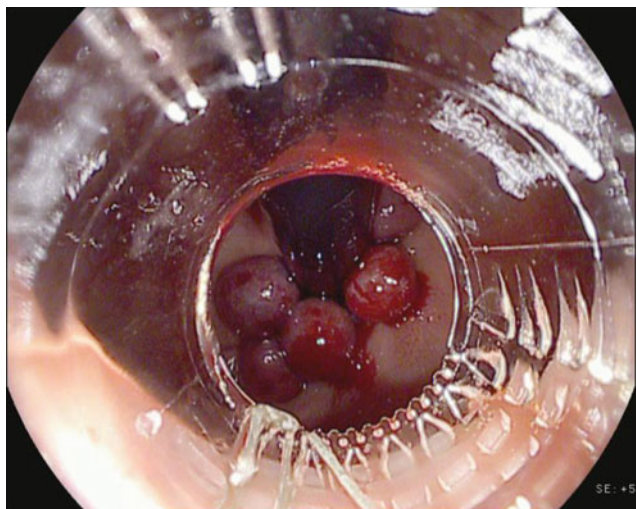
Complications (postprocedural and delayed pain and bleeding) and recurrence rates associated to the two methods (i.e., flexible and rigid endoscopy) are similar. No significant difference was observed in terms of long-term bleeding, occurring in 14–20% of patients at 5 years, for both the procedures. Both techniques are easy to perform and have an immediate effect (Cazemier et al. 2007) (Fig. 5a–c).

Number of ligations depends on size and number of hemorrhoids, but also on the endoscope diameter. In a study comparing ligation performed with a 9 mm and a 13 mm scope diameter (Su et al. 2003b), the device with a smaller diameter was associated with a higher number of ligations.

Treatments performed with the two different sizes of endoscope appeared equivalent with regard to treatment outcomes and complications. In this study most of patients had their hemorrhoids reduced by at least one Goligher's grade (83% in the 9 mm device group and 90% in the 13 mm device group, $p = 0.1$, nonsignificant) with no significant differences in pain (10% in the 9 mm group and 11% in the 13 mm group) nor in bleeding (7.3% in the 9 mm group vs. 5.5% in the 13 mm group).

A multicenter, open-label, randomized controlled trial, the HubBL trial, comparing arterial Doppler-guided ligation (HAL), and band ligation (RBL) under rigid proctoscope control has, almost recently, been published (Brown et al. 2016). The study shows that rubber band ligation is cheap and associated to less pain and serious complications

Fig. 6 Mild postprocedural bleeding treated conservatively



than artery ligation: the mean pain (assessed using the VAS 1–10 scale) the day after the procedure was 3–4 (SD 2–8) in the RBL group and 4–6 (SD 2–8) in the HAL group ($p = 0.002$). Rubber band ligation is associated with a higher recurrence rate, in particular when the prolapsed component is relevant: at 1 year follow-up 49% of patients in the RBL group and 30% of patients in the HAL group had hemorrhoid recurrence ($p = 0.0005$).

A common disadvantage to all the non-excisional methods is that histopathological examination of the hemorrhoidal tissue is impossible. It is reported that 1/20000 hemorrhoids specimens contain occult malignancy (Altomare et al. 2006). To further reduce this risk, a careful evaluation of the mucosal pattern of the hemorrhoids is mandatory before treatment.

Minor complications such as mild transient pain, thrombosed prolapsed hemorrhoids, slippage of bands, minor rectal bleeding, transient longitudinal ulcer, urinary distress occur in 4.7% of the band ligation procedures. Serious complications rate is low, having being reported in 1–3% of patients (Albuquerque 2016).

Mild transient pain is the most frequent complication: about 25–50% of patients experience pain after band ligation. In order to reduce the periprocedural pain, local anesthetics after ligation can be used. Moreover, if the patient complains of discomfort during the procedure,

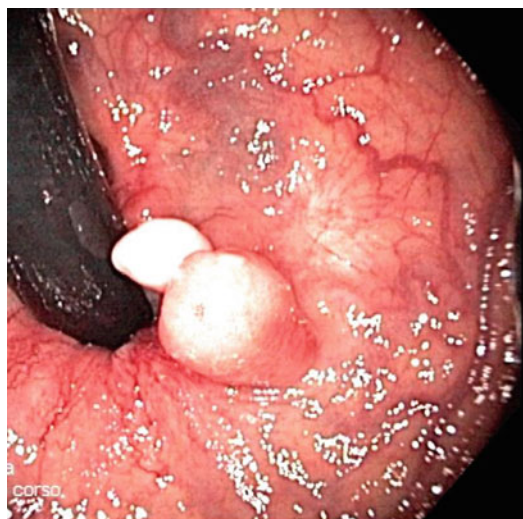


Fig. 7 Patient with recurrent bleeding after rubber band ligation

an immediate removal of the band followed by a ligation in another site might be indicated (Albuquerque 2016).

Bleeding is the second most frequent complication (Figs. 6 and 7), occurring in 1.7% of the procedures. Bleeding normally occurs after 10–14 days, probably due to the sloughing of the ligated hemorrhoids. In most of the cases, bleeding is effectively managed endoscopically. Patients under antiplatelet or anticoagulant medication have a higher risk of secondary bleeding. Infectious complications have also been reported

following band ligation including pelvic sepsis, Fournier's gangrene, liver abscesses, tetanus, and bacterial endocarditis. Deaths due to these infectious complications were also reported. One of hypotheses is related to the transmural necrosis or slough following banding that facilitates the development of deep infection by migration of the bowel bacterial flora, which can spread to adjacent tissues (Albuquerque 2016).

4 Injection Sclerotherapy

Injection sclerotherapy involves injecting a sclerosing agent in the hemorrhoidal complex, at the apex or base of an internal hemorrhoid, never the hemorrhoid itself. It is easy to perform, safe, and cost-effective and does not require special equipment.

After its first description dating back to more than one century ago (Yeomans 1931), this treatment for uncomplicated grade I or II internal hemorrhoids has evolved in the wake of the innovations in the field of sclerotherapy for varicose veins and has been the orthodox treatment for many years until, over the past decades, rubber band ligation gained favor.

To date, sclerotherapy is indicated for early-stage uncomplicated hemorrhoids (grade I or II) providing mainly short-term benefits in particular with regard to the control of bleeding. As to the efficacy of injection sclerotherapy for the treatment of grade III hemorrhoids, conventional sclerosants are reported to be ineffective on prolapse (Ono et al. 2005; Greca et al. 1981). Short-term effectiveness in terms of disappearance or improvement of symptoms reaches 70–90%, but in the long term (after 4 years) only 20–30% of patients treated with sclerotherapy remain asymptomatic (vs. 50% in case of banding) (Higuero et al. 2016; Kanellos et al. 2000; Santos et al. 1993). Recurrences are frequent and retreatment is safe.

Patients usually do not need to take the day off and can immediately resume their work, but the higher need for repeated treatment compared with banding (MacRae and McLeod 1995, 1997) might affect the advantage of the procedure.

Injection sclerotherapy can be accomplished free-hand through a slotted anoscope or rigid proctoscope (despite limited maneuverability and field of vision and absence of documentation) or using a retroflexed flexible endoscope, with short-term success rates as high as 75–90% (Nijhawan et al. 2011). In 1991 Ponsky et al. reported their initial experience using hypertonic saline solution during flexible endoscopic treatment of symptomatic internal hemorrhoids with good technical and clinical success (Ponsky et al. 1991). Flexible endoscopy displays the clear advantage of better maneuverability and wider field of view and the advantage of the procedure to be achieved during colonoscopy or sigmoidoscopy performed for assessment of lower gastrointestinal bleeding without the need for further equipment. Transparent caps attached to the tip of the flexible endoscope can further stabilize the position, obtain a better exposure of the operative field, and protect against iatrogenic injury due to misplaced injections (Zhang et al. 2015).

Sclerotherapy is performed with slow submucosal injection through a 23–25 Gauge 5 mm retractable needle (or through a long injection needle such as lumbar puncture needle when using an anoscope or rigid proctoscope) of the lowest effective volume and concentration of a sclerosing agent to raise a weal (0.5–1 to 5 ml depending on the solution). There is no need for specific intestinal preparation beside topical enemas and no need for sedation. The use of many sclerosing agents has been described (ASGE Technology Assessment Committee, Croffie et al. 2007) with variable success rates though none has emerged as the ideal one. Detergents, alcohols, osmotic agents such as ethanalamine oleate, polidocanol, sotradecol (sodium tetradecyl sulfate), quinine, 5% phenol in almond oil, concentrated salt water (23.4% hypertonic saline solution) are available for use (ASGE Technology Committee, Siddiqui et al. 2014). Not all sclerosants are overall used nor approved. Conventional sclerosants are mainly effective for hemorrhage but insufficient on prolapse (MacRae and McLeod 1995; Takano et al. 2006).

Whatever sclerosing substance is used, the technique and goals are the same. Injecting the solution causes disruption of vascular flow,

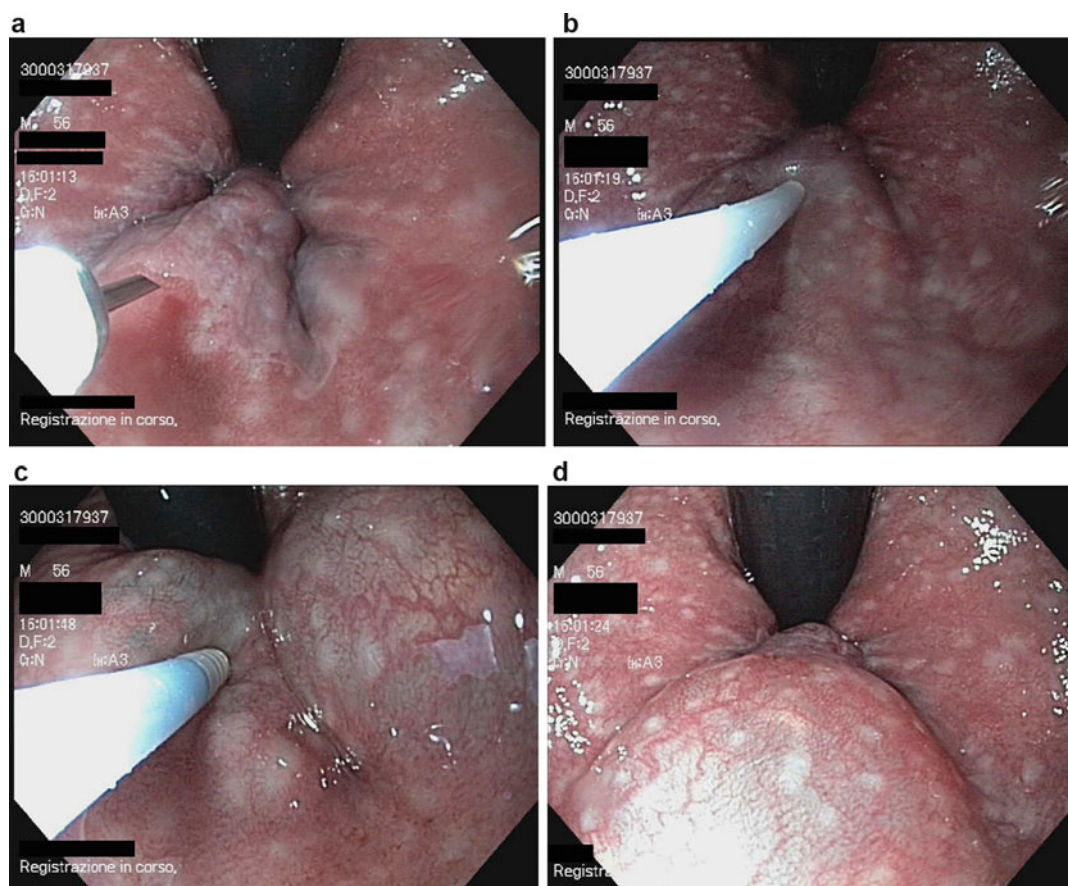
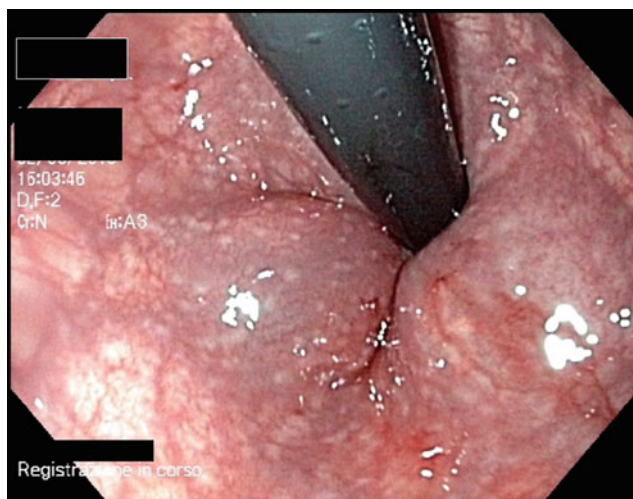


Fig. 8 Injection sclerotherapy technique and result. (a) The hemorrhoidal complex before treatment. (b) Palpation prior to injection. (c) Submucosal light swelling appearing during injection. (d) The obliterated hemorrhoid

fibrosis and obliteration of the bleeding vessel, retraction and fixation of the hemorrhoidal cushion. Injection should be delivered at the base or apex of the hemorrhoid, rather than intravascularly (ASGE Technology Committee, Siddiqui et al. 2014). Prior to injection, the hemorrhoidal plexus is palpated with the sheath of the needle to assess consistency, elasticity, and possible thrombosis (Benin and D'amico 2007). Up to three hemorrhoidal nodes at 3, 7, and 11 o'clock, positions may be treated with injection during a single session (Fig. 8a–d and Video 1). Caution should be exercised during injection at the 11 o'clock anterior hemorrhoid cushion, in particular in males for the genito-urinary structures being close to this site. If painful, injection should be promptly stopped (Marti 2013). Ease of injection and the circumferential spreading of the sclerosant

through the submucosal plane with a light swelling confirm the appropriate injection. If minor bleeding appears (Fig. 9) additional sclerosant may be added to stop the bleeding (Chiappone and Malpas 1992). Depth of injection is crucial as an injection that is too deep or too superficial harbors the risk of complications such as recto-urethral fistula, embolism, impotence, or mucosal ulceration or necrosis (Cocorullo et al. 2017). If the injection is too superficial, the mucosa will become tense and blanched and injection should be stopped to avoid mucosal necrosis. If no submucosal weal appears, injection should be stopped, raising the concern of deep needle placement (Chiappone and Malpas 1992). Sclerosant concentration, volume, and mixture are as important as the sclerosant itself. Compared to traditional liquid sclerotherapy, polidocanol

Fig. 9 Injection sclerotherapy: mild transient bleeding at the injection sites



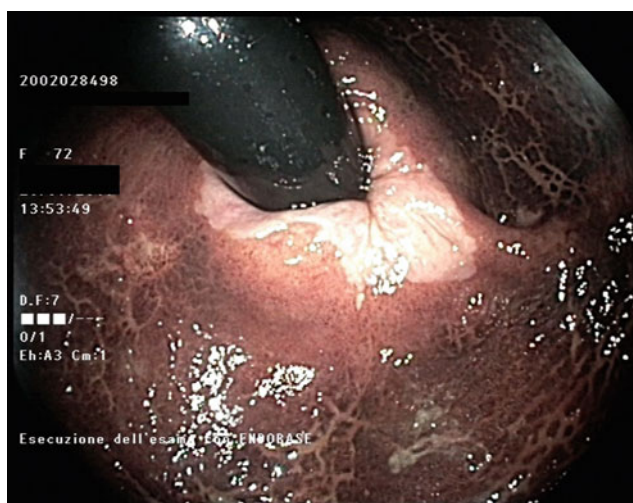
and sotradecol foam sclerotherapy (obtained by mixing the sclerosing agent with air) through both rigid and flexible endoscopy proved effective and demonstrated advantages due to major adhesiveness, major compactness, and increased contact surface, namely: a smaller amount of the sclerosing agent required for treatment success, minor number of treatment session, good safety profile, low complication rates with no major complications, echovisibility and last but not least high degree of patients' acceptance and satisfaction (Benin and D'amico 2007; Moser et al. 2013).

Recently, the use of the technique with a novel sclerosing agent – aluminum potassium sulfate and tannic acid (ALTA OC-108) – has been successfully described in Japan, in particular in case of high-grade III-IV prolapsing internal hemorrhoids, provided that the prolapse is not due to loss of sphincter control. In clinical studies, ALTA injection sclerotherapy for severe internal hemorrhoids proved to be highly effective not only on bleeding but on prolapse too, with comparable to surgical ligation + excision hemorrhoidectomy effects (94% vs. 99% short-term disappearance rate of prolapse) with lower incidence of pain beside less-invasiveness (Takano et al. 2006). When compared to other sclerosing agents, ALTA has been successfully used to treat grade III hemorrhoids in comparison with phenol in almond oil confirming its effectiveness on the prolapse in case of severe internal hemorrhoids

(Yano and Yano 2015), while the efficacy of 5% phenol in almond oil for the treatment of prolapse results inadequate (Santos et al. 1993). Furthermore, one of the drawbacks of sclerotherapy is that it provides only short-term benefits in the majority of patients (Santos et al. 1993; Kanellos et al. 2000). The long-lasting therapeutic effect of ALTA is probably due to the dense structure that it exhibits in the site of injection, in contrast with a spongy structure associated with phenol in almond oil (Ono et al. 2005). ALTA sclerotherapy can be safely performed in the outpatient setting, does not require anesthesia, and is rapid and effective, with similar to surgery effectiveness (up to 96%) and shorter operative time without any severe pain or complication (Tokunaga and Sasaki 2013). Safety and clinical profile of ALTA sclerotherapy has been successfully described by Tomiki et al. in flexible endoscopy as well. They reported a very good clinical remission rate (over 97% when considering the combination of symptoms disappearance plus improvement) with acceptable recurrence and complication rates (9.6% and 4.8%, respectively) (Tomiki et al. 2015). ALTA, as for polidocanol, is not FDA approved.

Sclerotherapy is a relatively safe technique. Adverse events and complications related to sclerosing injection therapy are infrequent and mainly due to improper technique. Complications are usually minor and they can be local or systemic.

Fig. 10 Injection sclerotherapy complication: anal stricture



After sclerotherapy, patients may complain of mild transient pain (12–70%), pressure, bleeding, discomfort, and tenesmus. Complications include mucosal erosions at the injection site, ulcerations, abscesses, bacteremia, fistulas, impotence, necrotizing fasciitis, anal strictures by scarring incurring in 3.8% of patients (Fig. 10), abdominal compartment syndrome, chemical hepatitis, respiratory distress syndrome, allergic reactions (Nijhawan et al. 2011; Marti 2013; Lohsiriwat 2012; Ganz 2013; Elram and Wasserberg 2007; Schulte et al. 2008; Suh et al. 2013). Due to the absence of an eschar creation, postprocedural bleeding is uncommon. Therefore, this is the procedure that should be offered to patients at high risk of bleeding such as those on anticoagulants (Jacobs 2014).

The triad “pain, urinary retention, fever” should raise concern over perineal sepsis, a rare but potential life-threatening complication, and prompt the patient adequately advised to seek immediate medical attention. Serious complications can result from erroneous injection. Complications are usual minor, but cases of systemic effects and cases of ano-recto-sigmoid necrosis or rectal perforation caused by anal stricture have been reported as well (Schulte et al. 2008; Murray-Lyon and Kirkham 2001; Elram and Wasserberg 2007; Lohsiriwat 2016). Care should therefore be taken to avoid injection of a too large (one session or cumulative) amount of

sclerosant and to observe an adequate free interval (>3–4 weeks) between sessions (Elram and Wasserberg 2007).

Antibiotics are not routinely administered (Zhang et al. 2015); however, given the possibility of bacteremia after sclerotherapy (up to 8%), antibiotic prophylaxis is advocated for patients at high risk such as patients with compromised host defense, cirrhosis, or with predisposing valvular heart disease (Adami et al. 1981).

Contraindications to sclerosis are pregnancy, inflammatory bowel diseases, and septic anal lesions. As already mentioned in a subset of comorbidities such as immunocompromised patients, patients treated with blood thinners, patients with cirrhosis or portal hypertension (in whom bleeding hemorrhoids have to be distinguished from bleeding ano-rectal varices, the latter potentially benefiting from the treatment of portal hypertension), any approach should be conservative for the risk of sepsis, poor tissue healing, or profound secondary postprocedure bleeding. If ablative treatment is required, injection sclerotherapy is preferable to banding that is generally not recommended or contraindicated (Lohsiriwat 2015; Yano et al. 2013; Rivadeneira et al. 2011).

In prospective trials comparing injection sclerotherapy with rubber band ligation at 1-year follow-up although banding caused more discomfort it demonstrated better long term efficacy, a

possible reason being the difference in depth of tissue destruction (Johanson and Rimm 1992). According to the results of a small randomized trial comparing injection sclerotherapy versus bulk laxatives alone in the treatment of bleeding hemorrhoids at 6 months, it surprisingly appeared that sclerotherapy may be even equal to conservative medical treatment (Senapati and Nicholls 1988).

It should be critically pointed out that when considering the clinical success of injection sclerotherapy literature data are sparse, heterogeneous, and based on small scale clinical trials and a direct comparison between studies may be inappropriate. Of note in this regard: definition of clinical success (total disappearance of symptoms, disappearance plus improvement), definition of symptoms and complications (objective bleeding, subjective pain), success and recurrence measurements (after one session or multiple sessions), and the variable length of follow-up. A cornerstone meta-analysis covering 18 randomized controlled trials and comparing various treatment methods for symptomatic grade I to III hemorrhoids with respect to response to therapy, need for further therapy, complications, and pain, concluded that though associated with more pain or postprocedural discomfort rubber band ligation is more effective than sclerotherapy and infrared coagulation for all hemorrhoids and for hemorrhoids stratified by grade, is less likely to require additional therapy for symptom recurrence, and provides higher long-term remission (up to 90% at 6 months). The authors therefore recommend it as the procedure of choice for grade I to III hemorrhoids reserving surgical hemorrhoidectomy to patients who fail with rubber band ligation treatment (MacRae and McLeod 1997). Other authors, despite identical findings, indicate infrared coagulation as the initial optimal nonoperative procedure for first- and second-degree hemorrhoids for its lower postprocedural pain (Johanson and Rimm 1992).

Finally, injection and band ligation simultaneous treatment for low-graded first- and second-degree symptomatic hemorrhoids has been assessed in two different trials with an advantage over sclerotherapy alone, but without

any significant advantage of the combination over banding on its own (Kanellos et al. 2003; Chew et al. 2003).

5 Infrared Coagulation

Infrared coagulation consists in conversion of infrared light to heat with its direct application at the base of the hemorrhoid inducing tissue destruction to a depth of 3 mm, protein denaturation, inflammation leading to fibrosis and subsequent scarring, shrinkage, and fixation of the redundant hemorrhoid tissue to the underlying muscular layer.

Infrared coagulation is a well-established treatment alternative for symptomatic low-grade internal hemorrhoids. It can be performed with a specific nonendoscopic unit with the probe placed through an anoscope or with a novel dedicated disposable 3.2 mm outer diameter, 300 cm in length flexible fiber-optic probe (the Precision Endoscopic Infrared Coagulator™) introduced through the working channel of a flexible endoscope (ASGE Technology Committee, Siddiqui et al. 2014). As for the other less invasive ablative therapies, endoscopic infrared coagulation can be executed at the time of lower endoscopy performed to rule out other sources of bleeding with the advantage of improved maneuverability and procedural visibility. In a retroflexed position, the tip is gently placed in contact with the hemorrhoid just above the tissue column with a light mechanical pressure but without embedding it and 1–5 s pulses of infrared radiation generated by a control box are delivered by pressing a pedal releasing so to the area the appropriate amount of thermic energy. The probe is applied with three to five applications per hemorrhoid in an overlapping semilunar W-shaped fashion (McLemore et al. 2012). Satisfactory coagulation appears as a pale whitish decoloration of the mucosa 3 mm in diameter (Templeton et al. 1983) while a longer exposure time, leading to desiccation and carbonization, might be helpful for its hemostatic effect in case of active bleeding. One or two hemorrhoids are treated per session with sessions repeated at intervals (Ganz 2013).

Since its introduction in the late seventies, conventional infrared coagulation proved safe, easy to perform, fast, painless, suitable, and effective for grade I and II hemorrhoids with reported success rates of 67–96% in randomized controlled trials (Walker et al. 1990; Dennison et al. 1990). It compares favorably with rubber band ligation with significantly lower side effects and lack of serious complications. Complications are minor and include transient moderate pain and minimal rectal bleeding, exceptionally heavier bleeding, with maximum discomfort experienced as a heat sensation during the procedure. No life-threatening complications have been reported as a consequence of infrared coagulation (Ganz 2013; Higuero et al. 2016; Templeton et al. 1983). However, despite these advantages, the need for more retreatments than banding and higher recurrence rates requiring additional therapy outweigh the benefits of this noninvasive office-based procedure (Ganz 2013). Rubber band ligation is more efficacious in symptom control and long-term outcome but more painful than infrared coagulation. Greater tissue destruction obtained with banding may justify the positive long-term outcome at the cost of higher pain and increased rate and severity of complications (Johanson and Rimm 1992).

As for the endoscopic infrared coagulation therapy for symptomatic internal hemorrhoids, posttherapy results are satisfying with significant improvement in global symptoms up to 87.6% after a single session without any adverse event. However, no comparison has been made with the standard nonendoscopic delivery system (McLemore et al. 2012).

Despite high safety profile with low bleeding risk, side effects, and complication rates, in patients at high risk for complications in whom banding is not recommended or is contraindicated, sclerotherapy is the suggested alternative rather than infrared coagulation (Lohsiriwat 2015). Finally, it should be pointed out that regardless of the modality (endoscopic or conventional anoscopic) the infrared coagulation procedure requires a dedicated expensive equipment, and this represents a constraint on its widespread use (Ganz 2013).

6 Conclusion

In the endoscopic or conventional nonendoscopic office-based treatment of low-graded symptomatic internal hemorrhoids, unresponsive to conservative approach, band ligation, injection sclerotherapy, and infrared coagulation are equally effective in short term, but band ligation is associated with higher long-term efficacy, lower recurrence rates, and fewer sessions needed for treatment although with a higher rate of post-treatment pain. Rubber band ligation is therefore the best option and should first be offered to patients with first- to second- and selectively third-degree hemorrhoids. In specific comorbid conditions, rubber band ligation is contraindicated or not recommended and patients are best treated with injection sclerotherapy. Both infrared coagulation and sclerotherapy can treat bleeding hemorrhoids that are too small to be amenable to ligation.

Flexible endoscopy is an attractive alternative versus anoscopy-proctoscopy procedures and draws the advantage of better maneuverability, wider field of view, and documentation. Moreover, symptomatic hemorrhoids can be treated at the time of lower endoscopy performed to rule out other causes of bleeding.

Although rubber band ligation is the most popular and to date effective office treatment for internal hemorrhoids, it has not unequivocally demonstrated a substantial superiority, and the choice between one treatment modality over another depends ultimately on local expertise and preferences, facilities, and patients' conditions and expectations.

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Selection of Patients to the Surgical Treatment of Hemorrhoids

7

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Abstract

Some patients with prominent hemorrhoids will present with symptoms requiring some kind of treatment. Although a majority of patients will be successfully managed by conservative treatment and office procedures, some will need an operation. Surgical indication is mainly settled after failure or contraindication of local treatments or in Grade III and IV hemorrhoids.

Several surgical strategies have been proposed and can be graded by their effectiveness

and complications rates. Patients need to be informed on those on the basis of their main symptoms and general and proctologic baseline health.

After a full assessment of patients and their hemorrhoidal condition, a number of issues have to be considered and discussed in order to plan a tailored strategy for each specific scenario that balances benefits and risks with adjusted patient expectations.

General concepts that need to be understood by patients and surgeons when dealing with hemorrhoids are summarized. Different criteria to assess patients' condition and to choose surgical operation are discussed. Finally, the rationale to individualize treatment strategies for different grades of hemorrhoids is presented.

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1 Introduction

Definition of the so-called piles or hemorrhoids has been a matter of discussion that still goes on. Leaving apart the external hemorrhoid and whatever the anatomy and pathogenesis of internal hemorrhoids is, clinicians would agree to recognize as such mucovascular cushions at the level of the anorectal junction present in any individual that become prominent and symptomatic in some, mainly by bleeding or prolapsing. Complaining from “hemorrhoids” is very frequent in clinics and, although not so much, proper hemorrhoid symptoms are also very frequent in the general population. However, most patients with prominent hemorrhoids remain asymptomatic and would only be diagnosed on examination or colonoscopy.

Even if guidelines have established indication for surgery and some general ideas are well recognized for long time, discussion continues in relation to the gold standard of surgical care. Indeed, many techniques have been proposed as well as different ways of performing those. Lately, debate focuses on nonexcisional strategies and tailored management.

This chapter tries to explain the rationale of different criteria that help clinicians to select patients for surgery at a point of the symptomatic process and to select different techniques for specific patients.

2 Premises

2.1 Ideas to Keep in Mind and to Put into Patients' Minds

2.1.1 Benign Condition

Even if quality of life can be compromised by symptomatic hemorrhoids, this condition exceptionally threatens patients' life (Hollingshead and Phillips 2016). Moreover, hemorrhoids are considered normal anatomical structures with a role in fine continence of the anal canal and in defecation. Therefore, surgery aims to control symptoms and/or recover as much as possible normal anatomy of the symptomatic hemorrhoid cushions.

2.1.2 Most Patients Are Asymptomatic or Need Advice Rather than Treatment

Most patients with prominent hemorrhoids do not complain or seek for treatment (Crosland and Jones 1995). Of those who need treatment, a vast majority would improve on hygiene and diet measures and some would need outpatient's procedures. Only about 10% of patients will finally need surgical management (Madoff and Fleshman 2004). Serious complications secondary to hemorrhoids, such as anemia or hemorrhoid emergencies, are not a frequent indication for surgery. Referral for an operation is usually based on failure of management of bleeding or symptoms from prolapse that give discomfort to the patient chronically. Despite the low indication of surgical management, surgeons are very often the only or the first doctor the patient is referred to. This can give the patient the false impression that his condition has a strictly surgical management (Table 1). However, surgeons will first explain and help to change habits before even thinking of an operation.

This is to say that, in many cases, the patient would be reassured and relieved by the explanations about his condition and the understanding of how to help himself. Fear of cancer is many times “the” concern that brings the patient to the doctor. Epidemiology and some indication of endoscopy is the answer the patient needs. Besides, teaching the patient on fiber and liquids intake, physical activity, not straining, trying to acquire regularity on defecation habits and proper care and hygiene of perianal skin is enough for many patients. Some more will need some kind of office treatment. In this way, many patients can omit surgery, improve their defecation function and live together comfortably with piles. Explaining and convincing is time consuming. It can also be difficult nowadays when people tend not to care on diet and healthy habits, rush in their everyday life, neglect some physiologic habits, and look for immediate solutions to any problem.

2.1.3 Exclusion of Underlying Anorectal Conditions

Modesty and ignorance, both of patients and, sometimes, their doctors, are a dreadful

Table 1 Selection criteria of patients and techniques for surgical management hemorrhoids

Patients medical characteristics	Type of patient	Pros and cons balance and consent	Technique characteristics	Hemorrhoids characteristics	Hemorrhoid symptoms
Gender Medical conditions and medical treatments History related to Deliveries Anal conditions Previous treatments for hemorrhoids Bowel habit	Life style Type of work Traveling habits Medical access Type of patient Anxiety Discipline Understanding	Efficacy Pain Recurrence Complications Return to normal activity	Difficulty/ experience Office/ ambulatory/ inpatient Cost/efficacy	Internal/ external component Grade I–IV Circumferential/ no Size	Bleeding pattern Grade of prolapse Soiling/ itching/ discomfort Swelling episodes

combination that leads to both misdiagnosis and delay in diagnosis. What the patient calls “hemorrhoids” *must* be translated into the correct observation and examined from first consultation with the specific differential diagnosis in mind.

It has been reported how often patients are prescribed topical ointments the year before colorectal cancer is diagnosed (Hansen et al. 2015).

Excluding underlying conditions is important for diagnosis as well as for the choice of technique. It is also related to the pathologic examination of any tissue excised during surgery.

2.1.4 Previous Anatomy and Function

In general, surgery in the anorectal region has specific risks for continence. Asymmetry of perianal skin folds, scars and stenosis, lesions or stretching of internal and external sphincters, loose of transition epithelium, and ectropion of rectal mucosa are all problems that can merge after surgery and may alter continence. This applies, in particular, to techniques that imply excision of hemorrhoids or deal with external component of those.

Therefore, it is important to have a detailed idea of the individual risk when indicating surgery, choosing technique, and consenting the patient.

Anamnesis from age and sex to previous medical conditions, functional scales, surgery on the

anal canal or in the colon and digestive tract, previous treatments for hemorrhoids, if any, and recovery from those, gynecologic and obstetric history or sexual habits must be investigated to assess the baseline of continence and the risk of a specific patient. Fecal continence depends on a correct balance of anatomy, function, and feces consistency and its baseline can be altered by apparently subtle changes. It is important to rule out previous problems such as irritable colon syndrome, diverticular disease, inflammatory bowel disease, or any tendency to diarrhea. Previous risk procedures for the anal complex such as episiotomy and dystocia or previous procedures on the sphincter complex itself need to be evaluated in order to deeply assess continence baseline. An old lady with chronic diarrhea and mobilization difficulties who sporadically bleeds may need a different management from that of a young and big man slightly constipated that tends to heavily bleed and presents with prolapsed hemorrhoids.

Although not systematically indicated, endosonography and anal manometry may help to assess some patients (Trompetto et al. 2015; Kaidar-Person et al. 2007) and have medicolegal implications. Suspicion of low pressure or damage of the sphincter complex must be investigated when deciding on excision of hemorrhoids and taken into consideration during surgery to minimize further lesions.

2.2 When Thinking of Surgery

2.2.1 Basic Guideline

Practice parameters of the American society of colon and rectal surgeons states that “Surgical hemorrhoidectomy should be reserved for patients who are refractory to office procedures, who are unable to tolerate office procedures, who have large external hemorrhoids, or who have combined internal and external hemorrhoids with significant prolapse (grades III to IV). Grade of Recommendation: Strong recommendation based on moderate-quality evidence 1B” (Rivadeneira et al. 2011).

This is a well-accepted strategy for the surgical management of hemorrhoids throughout the published literature (Kaidar-Person 2007).

2.2.2 Stepped Management: Less Aggressive First

It is also an accepted principle to start with non-invasive management of hemorrhoids based on the natural history of the condition as well as on the drawbacks of surgical management that will be later discussed.

As already explained, this implies diet, hygiene, and habits modification first and office procedures (discussed elsewhere in this manual) as a second stage. This applies for patients with uncomplicated hemorrhoids, no contraindication for office management and, in general, who seek advice at a not very advanced stage of their condition (Jacobs 2014).

Surgery as a first step is indicated in cases of thrombosis, strangulation, sepsis (which is an infrequent scenario), chronic and settled external component of internal hemorrhoids, and very symptomatic skin tags. In the absence of specific criteria, patients should not be selected for surgery before a trail of noninvasive treatment has been attempted.

2.2.3 Pain Associated with Surgical Management

Postoperative pain is also a well-known and feared issue of surgical management by both surgeons and patients. Similarly to the straight association patients make of hemorrhoids and surgery,

there is a popular knowledge that associates pain to surgery.

Surgeons look for effective postoperative management and surgical technique to minimize pain. However, it should be accepted that there will be some level of pain to deal with. Patients, who may delay treatment due to this fear, should be reassured on the basis of specific management strategies for postoperative pain (Hollingshead and Phillips 2016).

Not only is it an unpleasant consequence of surgery, pain is a major factor that delays return to work after treatment. Rapid reassuming normal activities may be a necessity for the patient in some cases while, in others, the patient may have time to recover.

2.2.4 Complications After of Surgery

The anal canal is delicate and refined. A short, small, and complex anatomic structure bears a very important role in continence. It is not easy to repair anatomy or to restore function to restore. Over time the anal canal loses strength, its anatomy varies by gender and it can be subjected to stress by delivery, chronic constipation, or anal sepsis. Thorough knowledge of the anatomy is needed to fairly ponder consequences of any procedure.

Patients are not usually aware of these specific considerations and tend to trivialize proctologic surgery. Therefore, it is important that both surgeons and patients consider the usual complications of surgery and weight them appropriately before deciding on any operation.

To a certain point, some complications are implicit by technique. Excisional procedures imply the postoperative decrease in hemorrhoidal cushions and alteration of the anal mucosa as well as scars in the anoderm. This can be translated by changes in fine continence, sensibility and discrimination, complete coalescence of anodermal folds and in flexibility of the anodermal line.

Other changes may derive from inappropriate technique as would be the case of injury to the sphincter complex, extremely thin mucosal bridges leading to incapacitating stenosis (Trompetto 2015). Whatever the cause, small changes in anatomy after surgery may lead to functional deficit in patients at risk.

Bleeding and skin tags have been described after surgery and could be difficult to understand for the patient.

Although rare, severe complications, even mortality, have been reported after surgical treatment of hemorrhoids. Manipulation of the anal canal is not usually prone to infection in the immunocompetent patient. However, serious septic complications may occur in any patient (McCloud et al. 2006) after office procedures or surgery. Besides, stapled hemorrhoidopexy has been associated with rare but specific and serious complications such as chronic pain, fistula, or rectal perforation. Although those have been also related to poor technique and learning curve, it must be considered when selecting techniques and patients (Aly 2015).

2.2.5 Recurrence After Treatment

Some of the factors that may result in hemorrhoid symptoms remain unchanged after treatments and different treatments deal with all or some of the symptoms. Thus, recurrence is one of the issues of hemorrhoid management and, sometimes, is better understood as predicted persistence. Surgical options have different recurrence rates that need to be considered when selecting patients for each operation.

Even if treatments can be repeated in the long term, each with its specific indications, it also needs to be taken into consideration that surgery in itself is a risk factor for continence and the aim is not to repeat it many times.

2.2.6 Balancing Risks and Benefits

All the above-mentioned issues as well as efficacy of proposed technique and alternatives need to be fully explained to the patient before he decides surgery and a specific procedure. Patient expectations, priorities, and preferences are most important for success and satisfaction with the planned management strategy (Hollingshead and Phillips 2016; Simillis et al. 2015).

Assuring control of fixed prolapse may compensate postoperative pain and 2 weeks off work for a long-distance truck driver. Similarly, stopping daily bleeding over a week end may be enough for young and busy business woman even

if symptoms may recur in some months. However, isolated episodes of prolapse without bleeding in coincidence with not frequent constipation periods may not justify surgery for a mature lady mother of five with flatus incontinence.

2.3 Selecting Technique

2.3.1 Ideal Procedure

The operation any patient and surgeon would like to select would be effective in the long term, with an easy and painless postoperative recovery, with low risk of complications, ease to learn, and reproducible. That operation has not been described.

Instead, several techniques have been proposed over time since first statement by Lockart-Mummary (Lockart-Mummary 1925) on hemorrhoidectomy. Some of those, in modern ages, have postulated to be the “definitive” treatment to approach the ideal operation. Alternatives and new techniques aim to reduce postoperative pain and risk of incontinence maintaining the best efficacy proved by excisional operations. However, initial enthusiasm has lately not been confirmed even if improvements in pain control can be observed. Either pain levels are not as low as predicted, or long-term efficacy does not reach the same levels. In general, the more effective the operation is, the more painful it has been proved and, inversely, better pain control, as in hemorrhoidopexy or arterial ligation, often associates a higher recurrence rate.

Moreover, evidence does not strongly help in selection of technique. Small sample numbers, absence for long-term follow up, lack of stratification for hemorrhoid grade, difficulty in proving improvement in quality of life, randomly comparing two of the many possible operations, and pairwise meta-analysis are some of the methodological problems that explain why selection of treatments and patients are not completely evidence based (Hollingshead and Phillips 2016; Simillis et al. 2015; Yeo and Tan 2014).

2.3.2 Overlapping Indications

Various authors have illustrated how management options overlap for a same grade of hemorrhoid

(Lohsiriwat 2015; Sun and Migaly 2016). Not only lifestyle modifications and medication that may apply for any patient, a same operation may be indicated for three or four different clinical scenarios. It is particularly true for grade three hemorrhoids where it would seem that “any” operation is advisable with, probably, a strong grade of consensus if one should ask opinion to the scientific community. The same could be said for open hemorrhoidectomy that could be argued to suit “any” kind of patient.

It may result confusing for a young trainee and this ambiguity can be difficult to deal with. Clues to solve this apparent puzzle would be to understand the patient’s main problem, to know the specificities of different surgical options and to keep an open and flexible mind in the decision and selection process with the participation of the patient.

2.3.3 Tailored Operation

In general, the aim of surgery is to reduce blood flow into hemorrhoidal cushions and to fix or reduce excessive and prolapsing tissue.

Not only the need for surgery but the choice of a specific operation also needs to be tailored. Even more, sequential or combined treatments need to be assessed in order to find the best strategy possible for a particular individual and his circumstances to achieve these aims. Some techniques can, themselves, be modified in relation to symptoms of a specific patient.

2.4 Selection Criteria

From a myriad of possible clinical scenarios and patients circumstances, treatment needs to be guided by type of hemorrhoid, by severity of symptoms, and by type of patient. Besides, there are logistics factors to be considered when deciding definitive treatment.

2.4.1 Type of Hemorrhoid

As described elsewhere, hemorrhoids are classified, on the one hand, into external and internal depending on the anatomic structure that is referred to and, on the other hand, for the last category, in 4 grades (I to IV) depending on the presence and reversibility of prolapse outside the anal canal.

However, some other features, not described by this classification, are determinant for the choice of technique and its feasibility.

Number of symptomatic cushions: academically described as three, those can prolapse from an isolated location to a circumferential appearance. Circumferential mucosal prolapse needs to be ruled out and attention must be paid to anodermal bridges in case of performing some excisional techniques, particularly in these circumstances.

Size: banding of internal hemorrhoids is a first step for many patients that can be very satisfactory, even if repeated, for different grades of hemorrhoids. However, size of the prolapsing cushion can preclude this management. When the different cushions prolapse in different degrees and sizes, a combination of techniques can be proposed either simultaneously or as subsequent treatments.

External component: whether the patient presents with symptomatic skin tags from external hemorrhoids or has a chronic prolapse that affects the anoderm extensively, surgery is the only option of treatment although not all techniques deal with it. It is important to assess its presence and to interrogate the patient on how much discomfort it causes. It can be addressed by one or a combination of procedures. However, being conservative with the anoderm is always a wise approach to prevent stenosis that needs to be understood by the patient (Kanellos et al. 2000; Shanmugam et al. 2005).

2.4.2 Predominant Symptom and Severity

Besides grade of prolapse, patients usually identify one of the symptoms as their main concern or cause of discomfort and control of this specifically should be the aim of management and/or surgery.

Except for external thrombosed hemorrhoids, emergency care for complicated hemorrhoids is unusual. In that case, surgery is usually advised at the first phase of the process. Septic or strangulated internal hemorrhoids are a rare scenario where surgical attitude is controversial (Hardy and Cohen 2014).

Most patients do not experience problems from skin tags. However, big size of redundant anoderm can make difficult correct hygiene, render the anus moist and trap small amounts of

detritus and mucus. This will result in discomfort, itching, or even dermatitis and fungal infection. Some patients may suffer from recurrent swelling skin tags that traduces in recurrent pain episodes. When skin tags become a clinical problem, this is only amenable to control by excision of the redundant skin at the appropriate localization (usually not circumferential) always bearing in mind a conservative management of the anodermal folds.

Bleeding needs to be characterized properly concerning the amount and pattern and the presence or absence of any accompanying prolapse in order, first, to indicate surgery and, later, to choose technique. It is infrequent, although possible, that bleeding from hemorrhoids explains anemia. Other causes are to be excluded first, particularly over 50 years of age. Some patients will refer staining clothes with blood in recurrent episodes of heavy bleeding. Quantity may not be important over time for these patients but episodes quite cataclysmic. Most patients will present with bleeding not mixed with feces, at the end of defecation, staining the WC and fearing some other diagnosis. They may not be very concerned once properly examined and reassured. Many times, surgery is avoided in favor of conservative management by education on daily habits and office procedures. However, frequency of episodes, association of prolapse, need to avoid the uncertainty of bleeding due to a particular life style, size of bleeding cushions, concomitant medication such as those interfering with hemostasis, concomitant uncontrolled tendency to constipation or diarrhea that exacerbates bleeding or failure of conservative management will be indications for surgery with the main aim of diminishing blood supply to hemorrhoids.

Prolapse will provoke a series of symptoms that can be very distressing. Unlike in case of spontaneous or manually and easy occasional reduction of hemorrhoids, fixed chronic prolapse will give the patient continuous discomfort. Mucus discharge, dermatitis, ulceration, sensation of continuous bulk at the anus, difficulty in hygiene after defecation, or even trouble during defecation are all symptoms of grade IV hemorrhoids that are not treatable without surgery.

Tools to try to measure severity of symptoms and quality of life have been described (Moussa

et al. 2017). However, clinical practice assesses severity based on examination, description of symptoms, its frequency, and eventual complications. Once the patient is informed and has tried conservative management, it is important to pay attention to how much daily activity disruption is due to hemorrhoids.

2.4.3 Patient Comorbidities

Apart from any medical condition or medication that may alter bowel habit and feces consistency or anatomy of the anorectal region as already discussed, history of some specific problems must be also considered when planning treatment. Immunocompromised patients are prone to sepsis, chronic corticosteroids may impair healing, antiplatelet or anticoagulant medication or cirrhosis and hepatic dysfunction may increase risk of severe bleeding and hemorrhoids in the context of Crohn's disease must be managed specifically.

2.4.4 Ambulatory Surgery

It has been proposed (Vinson-Bonnet et al. 2015) that surgical treatment of hemorrhoids can be organized as day case independently of the operation. Apart from general selection criteria for ambulatory surgery, special attention must be paid to urinary retention and pain management during surgery and after discharge when performing arterial ligation, hemorrhoidopexy, or hemorrhoidectomy. Distant control the day after and properly scheduled outpatient follow-up are cornerstone to success of ambulatory strategy.

2.4.5 Cost Efficacy Considerations

Aiming to improve pain control and continence, different changes have been introduced in technique. Some of those have implied the use new technology or new devices specifically designed for hemorrhoids or adapted from general surgical uses. The use of specific staplers, Doppler guidance, or sealing modern devices has increased cost of procedures. Despite not being the first step in hemorrhoid management for most patients, surgery is a frequent procedure as hemorrhoids are highly prevalent. Increase in costs can be balanced either by reducing operative time and/or inpatient management or by improving clinical

benefits. Although some improvement has been shown concerning pain control after hemorrhoid-ectomy, arterial ligation or when using LigaSure™ for hemorrhoidectomy (Nienhuijs 2009), long-term results do not show consistent benefit or are even inferior to conventional open hemorrhoidectomy, with respect to efficacy in symptoms control (Altomare et al. 2008). With the same idea of balancing costs and benefits, the necessity of Doppler guidance has also been contested with no clear conclusion at present.

2.4.6 Surgeon Expertise

It is of maximum importance to take into consideration the single surgeon's experience with different approaches to hemorrhoids as well as his expertise with specific techniques. Although a modern management of hemorrhoids needs a varied armamentarium, some operations and the use of some instruments are easier to understand and perform than others.

Some complications have been claimed to depend on poor technique and/or poor anatomic knowledge of the anorectal region (Gravié 2014). As already discussed, some complications may be devastating and even life threatening. Even in case of minor complications, those will negatively impact on quality of life and it needs to be remembered that its improvement was the aim of treatment. Poor technique could, in the end, change the cause of the symptom (from disease to complication) without improving comfort baseline of the patient. Whether soiling depends on partial prolapse of hemorrhoids or is a consequence of internal anal sphincter lesion will not make a great difference for the patient. Similarly, pain from skin tags swelling could be substituted by pain from a fissure in the context of stenosis after too extensive excision of perianal anoderm.

A frequent and not very complex operation for a benign disease deserves, in any case, not to be vanquished. Proper training in more complex techniques and/or devices needs to be granted. The better surgeons weigh eventual complications and their difficult solutions the safer the procedure becomes. Specialist proctologist or colorectal surgeons would agree it is not a minor procedure.

3 Specific Scenarios

3.1 External Hemorrhoids

External hemorrhoids need surgery in two distinct scenarios.

As already discussed, elective surgery is planned in relation to symptomatic skin tags, not directly to their presence. The patient must understand he needs his anoderm as intact as possible and must not interpret skin tags as an esthetic matter. Very often understanding, correcting or avoiding some hygiene habits, not straining and maintaining anoderm clean and hydrous is enough. However, uncontrolled constant discomfort, scratching injuries, and secondary infection or recurrent severe pain will need excision of redundant folds.

Emergency surgery is a well-established indication for surgery in the first 48–72 h from onset of thrombosis (Grosz 1990). In that period window, discomfort from surgery is balanced by relief of pain and pressure in the anoderm. Afterwards, symptoms decrease and benefit from surgery is not so clear unless pain remains severe or ulcer develops. Operation is easy and safe under local anesthesia in the emergency room. Pregnant women are prone to this problem and do not need to be excluded from surgical relief.

3.2 Internal Hemorrhoids

3.2.1 Upgrading Treatment Level

Some patients may not be good candidates for office control and need surgical indication early. This would be the case of banding contraindication after altered coagulation or medication; patients who would require numerous banding; patients with important and symptomatic external component or fixed chronic prolapse and, in the not very frequent event, of thrombosed or strangulated internal hemorrhoids.

3.2.2 Excisional and Nonexcisional Procedures

Milligan and Morgan operation in Europe and Ferguson Operation in America remained the

synonyms for surgical treatment of hemorrhoids for a long time and proved their efficacy. These operations treat hemorrhoids by excision of internal and external component of hemorrhoids in the three anatomical locations of those. Pain in the postoperative period and concern with complications related to continence have more recently impulse the development of new strategies.

“Minimally invasive” and “nonexcisional” have been the labels of new ideas. Basically, the excision of hemorrhoidal cushions has been substituted by ligature of arteries nourishing hemorrhoids and pexy of redundant and prolapsing mucosa. The rationale after this concepts is minimizing pain by avoiding injury to the anoderm, on the one hand, and a more respectful and pathogenic management of prolapse that “restores” normal anatomy, on the other. These two ideas have brought on the scene stapled hemorrhoidopexy, and different methods of artery ligation or even arterial embolization of hemorrhoids.

The armamentarium for the treatment of hemorrhoids has therefore become varied permitting a more tailored management. Different strategies are discussed in the chronologic order of technique description.

3.2.3 Milligan-Morgan, or Excisional Strategies

Milligan-Morgan’s and Ferguson’s Operations, open and closed hemorrhoidectomies respectively, have been the baseline gold standard of surgical treatment and have been taught as such. One could hypothesize this would be one of its advantages in low volume and less-experienced hands trained in a single procedure. However, complication rate is to be remembered and modern management asks for diverse approaches.

Open hemorrhoidectomy is also the most suitable option for patients with strangulated internal prolapsed if it is to be managed surgically. Emergency surgery has proved to be a safe management option (Kaidar-Person et al. 2007) although others have proposed new alternatives in the emergency scenario (Cavazzoni et al. 2013).

There is also consensus it treats appropriately patients with chronic and fixed external component although alternatives are also proposed for

that scenario and patients seeking treatment of sin tags.

In a tailored approach, it can be combined with banding when cushions do not prolapse in many locations. Inversely, it may difficultly suit circumferential hemorrhoids that may need stepped surgery or alternative techniques.

When consenting patients, it would be correct to explain that hemorrhoidectomy offers the best efficacy in the long term with the worst pain control in the two postoperative weeks implying longer delay to return to work. Modern energy sealing devices used for dissection during hemorrhoidectomy help to improve results concerning pain control (Simillis et al. 2015).

3.2.4 Stapled Hemorrhoidopexy

Designed to control pain after hemorrhoids operation, this technique conceptually changed the approach to surgical treatment. A circumferential mucosectomy well above the dented line would restore anatomy to the anorectal junction thus facilitating control of prolapse of the hemorrhoidal cushions although not treating any external component (Longo 1998).

Hemorrhoidopexy has been proposed as an alternative to conventional hemorrhoidectomy with the main advantage of being less painful. However, pain control may not compare that well when hemorrhoidectomy is performed with modern energy devices. The benefit and risk balance also presents worse long-term results in terms of recurrence in front of hemorrhoidectomy (Simillis et al. 2015).

Circumferential prolapsed hemorrhoids would be the more specific indication always insisting in the fact that any external component would remain untreated or need additional procedures either simultaneously or at a second operation (Lohsiriwat 2012).

Contraindication for stapled hemorrhoidopexy includes sepsis, preoperative stenosis, or any incontinence grade or sphincter injuries (Kaidar-Person et al. 2007).

A drawback of hemorrhoidopexy, to be discussed with the patient or taken into consideration as an institution, is cost of the stapler although it can be argued that earlier return to work

compensates it, where it does (Simillis et al. 2015). However, the main concern with this option has been the report of severe complications in the short and long-term that, to some authors (Aly 2015), even puts into question if stapled hemorrhoidopexy is still a reasonable option for the treatment of hemorrhoids. In any case, the role this technique has played in the idea of pain control by avoiding excision of perianal skin and focusing above the dented line has been well recognized.

3.2.5 Arterial Ligation and Mucopexy or Nonexcisional Strategy

Arterial ligation techniques (THD[®], HAL[®]) aim to decrease inflow into the hemorrhoidal cushions to control bleeding. Localization of arteries may be Doppler guided with specific devices. This strategy, highly respectful with the anorectal anatomy, is truly nonexcisional when dealing with prolapse, in which case, a mucopexy is added to the arterial ligation.

Even if long-term results are still to be completely evaluated, the general comparison with other surgical procedures associates THD[®] or HAL[®] with less pain and less complications at a price of higher recurrence.

It suits precisely the indication of surgery due to bleeding in patients grade II–III. Grade IV hemorrhoids may also be managed in this way as far as no fibrosis prevents cushions to be reduced to its anatomical location (Giordano et al. 2009; Ratto et al. 2011). In that sense, patients having received sclerotherapy may be bad candidates for mucopexy. Emergency bleeding control in high risk patient on antiplatelet has also been successful (Cavazzoni et al. 2013; Ratto et al. 2015).

Enthusiasm concerning pain control has been re-evaluated lately although in the low range of surgical procedures. Postoperative pain depends on technique and on the addition, or not, of a mucopexy to arterial ligation (Ratto et al. 2015).

A specific characteristic of this operation is the possibility to adapt it to the specific symptoms of each patient. Adding mucopexy to more or less locations is tailored to individual clinical presentation.

Cost issue also compares favorably to other operations. The need for Doppler guides location of arteries has been questioned and could also have cost implications.

Lower postoperative pain and complications as well as comparatively reduced costs even with a higher rate of recurrence are criteria to propose arterial ligation and mucopexy a possible first step before considering more aggressive treatments (Simillis et al. 2015).

4 Cross-References

- ▶ [Anatomy, Physiology, and Pathophysiology of Hemorrhoids](#)
- ▶ [Classification of Hemorrhoidal Disease and Impact on the Choice of Treatment](#)
- ▶ [Clinical Assessment of Hemorrhoids](#)
- ▶ [Critical Aspects of Modern Surgical Approach to Hemorrhoids](#)
- ▶ [Dearterialization of Hemorrhoids and Mucopexy: Techniques and Results](#)
- ▶ [Epidemiology of Hemorrhoidal Disease](#)
- ▶ [Literature Data on the Hemorrhoidal Disease Management](#)
- ▶ [Modern Hemorrhoidectomy: Techniques and Results](#)
- ▶ [Stapled Hemorrhoidopexy: Techniques and Results](#)
- ▶ [Traditional Hemorrhoidectomy: Techniques and Results](#)

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Critical Aspects of Modern Surgical Approach to Hemorrhoids

8

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Abstract

Debate still continues in 2017 as to which is the best surgical procedure for the treatment of symptomatic hemorrhoids. Hemorrhoidectomy, first published by Milligan and Morgan, has been the only surgical treatment

for hemorrhoids during nearly 50 years and is still considered as the main option. However, this “conventional” hemorrhoidectomy is associated with significant postoperative pain, perianal discharge, irritation, and late complications such as anal incontinence and stenosis.

In an effort to decrease postoperative complications and to better respond to hemorrhoids pathophysiology, several procedures have emerged in the end of the twentieth century and can be considered as modern surgical approach to hemorrhoids.

These procedures are thermofusion hemorrhoidectomy, Doppler-guided hemorrhoidal artery ligation, suture ligation and mucopexy without Doppler guidance, stapled

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hemorrhoidopexy, and embolization. In summary, the less painful the procedure, the more likely it is to be associated with recurrence, so that there is not a “one-size-fits-all” option.

The aim of this chapter is to present the technique, advantages, drawbacks, and results of all these procedures, based on a recent review of the literature and our personal experience. The main question when facing a patient with hemorrhoids should be: which surgical options for which patients and which hemorrhoids. . .

1 Introduction

Modern surgical approach to symptomatic hemorrhoids is based on anatomy, pathophysiology, severity of the disease, patients’ general status, literature review on technical and functional results of hemorrhoidal surgery, and patients’ expectations.

Hemorrhoids or “piles” are cushions of non-pathologic vascular tissue in the anal canal, which microscopically correspond to sinusoids because they do not have any muscle as do veins (Thomson 1975). These vascular entities receive blood from the superior rectal artery branches. Schuurman et al. have demonstrated from an anatomical study that the superior rectal artery divided in many twisting branches penetrating the bowel wall about 4 cm above the dentate line, emerging towards the mucosal surface about 2–3 cm above it, and continuing in the submucosa down to the dentate line where they diverged to form the hemorrhoidal plexus (Schuurman et al. 2009). In average, authors like Aigner et al. found about eight arteries in the distal rectum, all originating in the superior rectal artery and circumferentially arranged with more or less equal distances between them (Aigner et al. 2004). Ratto et al. more recently also looked at the depth and location of the vascular arterial blood supply of the anorectal area in details using color duplex imaging (Ratto et al. 2012).

Hemorrhoids may be internal or external depending on their relation to the dentate line. There are four grades of hemorrhoids as described by Goligher, and they can be described using the

definition in Table 1 (Salvati 1999). While this classification of internal hemorrhoids may be useful in the definition of severity of the disease, the selection of treatment, and comparison of therapeutic outcomes, Goligher classification does not describe the size of the hemorrhoids or whether they are isolated or circumferential or whether they are associated with other symptoms. Yet these factors are important in the selection of treatment. In the same way, three main cushions are classically described in the left lateral (3 o’clock), right posterolateral (7 o’clock), and right anterolateral (11 o’clock) portions of the anal canal (Milligan et al. 1937; Loder et al. 1994). Symptoms of hemorrhoidal disease such as bleeding, prolapse, discomfort, or pruritis are caused by pathologic changes in hemorrhoidal tissue. The estimated prevalence rate of hemorrhoidal disease is between 4% and 39% of the adult population (Bleday et al. 1992; Johanson and Sonnenberg 1990; Kaidar-Person et al. 2007; Riss et al. 2012). Usually, painless bright red bleeding that stains the water in the toilet occurs from dilated hemorrhoids. This bleeding is arterial, coming from presinusoidal arterioles and is mostly associated with bowel movements.

The pathophysiology of hemorrhoids is still poorly understood. There are two current theories that could be associated in the genesis of the pathology (Lohsiriwat 2012). The vascular theory in which arteriovenous shunts with increased blood flow lead to anal cushions enlargement that could in turn cause mucosal edema, thrombosis, and bleeding. The mechanical theory is based on the deterioration of the anal cushions’ supporting tissue leading to a sliding anal mucosa with subsequent mucosal ulceration and bleeding.

Table 1 Classification of internal hemorrhoids (From Salvati 1999)

Grade	Definition
I	Normal appearance externally, bleeding but not prolapsing
II	Anal cushions prolapse on straining but reduces spontaneously
III	Anal cushions prolapse on straining or exertion and require manual reduction
IV	Permanent prolapse, irreducible

Surgery is the treatment of choice for hemorrhoids that have failed to respond to conservative measures. Hemorrhoidectomy by excision of the three main pedicles arranged in the classic 3, 7, and 11 o'clock position is considered the gold standard for the surgical treatment of hemorrhoids (Milligan et al. 1937). Ferguson et al. proposed a variation of the technique, by closing the wound with the aim to decrease the postoperative pain and soiling (Ferguson et al. 1971). Hemorrhoidectomy has been the only surgical treatment for hemorrhoids during nearly 50 years and is still considered as the main option if recurrence is the main consideration for the patient.

However, anal cushions contribute to maintaining anal continence during coughing, straining, and sneezing (Aigner et al. 2009). When engorged with blood, anal cushions protect the underlying anal sphincters during defecation and play a key role in differentiating gas, liquid, and solid and the subsequent decision to evacuate (Sneider and Maykel 2010; Yeo and Tan 2014). Hemorrhoidectomy is associated with significant postoperative pain, perianal discharge, irritation, and late complications such as anal incontinence and stenosis.

In an effort to decrease postoperative complications, several procedures have been proposed since the original description of the Milligan and Morgan procedure. These new techniques have emerged in the end of the twentieth century and can be considered as modern surgical approach to hemorrhoids.

2 Thermofusion Hemorrhoidectomy

In an attempt to decrease postoperative pain and complications new devices have been used to perform hemorrhoidectomy, instead of scissors. Hemorrhoidectomy is nowadays performed either with diathermy (Seow-Chen et al. 1992) or later with energized vessel sealing system (Tan et al. 2008). These techniques have been shown to shorten the operative time and lower the analgesic requirements. The energized vessel sealing system allows sealing of blood vessels up

to 7 mm in diameter with minimal thermal spread. This device uses a very high frequency current and provides hemostasis by denaturing collagen and elastin from the vessel wall (Nienhuijs and de Hingh 2009). The procedure consists in retraction of the hemorrhoidal tissue that is dissected off the internal anal sphincter using the device; the pedicles are secured by thermofusion and the wound left open to heal with adequate skin bridges. Compared with diathermy, thermofusion hemorrhoidectomy while more expensive is associated with a significantly shorter operative time, shorter theater room occupancy, earlier return to normal activity and work, and a similar rate of postoperative complications and recurrence (Gentile et al. 2011).

3 Doppler-Guided Hemorrhoidal Artery Ligation

The principle of Doppler-guided hemorrhoidal artery ligation was originally described by Morinaga et al. and first published in 1995 (Morinaga et al. 1995). This involved a specially designed proctoscope called the Moricorn and a Doppler guidance to localize the arteries and then suture ligate them selectively. The procedure is based on the theory that hemorrhoids occur when there is an imbalance in the blood flow of the hemorrhoidal plexus, either caused by increased inflow or decreased venous outflow (Festen et al. 2009). By arterial ligation the inflow is reduced, causing the plexus to diminish and the hemorrhoids to shrink (Faucheron and Gangner 2008). This procedure alone does not deal with large prolapse (Giordano et al. 2009). In patients with such severe prolapsed piles, a procedure has been proposed in addition to Doppler-guided hemorrhoidal artery ligation: the mucopexy (Forrest et al. 2010; Gupta et al. 2011). More recently, specialized instrumentation has been developed that has simplified the procedure, allowed addition of mucopexies, and rendered it more popular. The cushion plexus is supplied by a complex structure of blood vessels. As the arterial blood flow in the cushion plexus is considered to be associated, at least in part, with the pathogenesis

of hemorrhoids, these new techniques aim to reduce the vascularization of the hemorrhoidal tissue. The two main techniques are the hemorrhoidal artery ligation (HAL) with mucopexy if needed (called RAR for recto anal repair) and the transanal hemorrhoidal dearterialization (THD). Both techniques are based on the same principle of Doppler identification and ligation of the sub-mucosal distal branches of the superior rectal artery 2–3 cm above the dentate line, but the goal is reached by two different proctoscopes and Doppler systems (Sohn et al. 2001; Faucheron et al. 2011; Denoya et al. 2013; Ratto 2014; Scheyer et al. 2015; LaBella et al. 2015).

For the HAL RAR procedure, the special proctoscope lubricated with electro-conductive gel, equipped with a Doppler transducer, and attached to the HAL unit is inserted into the rectum to search for distal branches of the superior rectal arteries. Once located, each artery is ligated through the proctoscope's lateral ligation window positioned just above the Doppler transducer. The window is illuminated by an inbuilt light source, allowing for the easy placement of sutures at a depth of between 3 and 6 mm from the surface under clear vision. The specially designed needle holder and knot pusher are used to place a "figure of 8" stitch and then tie the knot. After each ligation, the proctoscope is rotated slowly to localize further rectal arteries some 3–4 cm above the dentate line. Once a full rotation is made, the procedure is repeated approximately 15 mm below the first series of sutures. The ligations are performed using a slowly absorbable 2/0 stitch. The position of each ligation is reported on the unit's screen by the operative nurse, and a full list of all ligations printed at the end of each procedure by the surgeon. After the ligations have been made and depending on the size of the residual hemorrhoidal prolapses, mucopexy is performed at the positions where a hemorrhoidal prolapse is identified. This transanal mucopexy is carried out using the same, specially designed proctoscope, by making continuous running sutures applied longitudinally from proximal to distal in the lower part of the rectum just above the prolapsed hemorrhoid. Care should be taken to remain

above the dentate line with the last bites of the running suture to avoid postoperative pain. Tying the two ends of the suture together serves to lift the prolapsing mucosal tissue back up into the anal canal. No tissue is excised. No severe complications following HAL-RAR have been published so far (Faucheron et al. 2015). The main drawback might be the recurrence rate: the higher the hemorrhoidal grade, the higher the recurrence rate. It can be as high as 13% at 3 years in patients with grade 2 and 3 hemorrhoids when using HAL without mucopexy (Faucheron and Gangner 2008). One of the advantages of the HAL or THD procedure with or without mucopexy is that the suture ligations are guided by the Doppler depending on the exact location and number of the arterial branches, according to Schuurman findings (Schuurman et al. 2009). The HAL procedure with or without mucopexy thus appears as a surgical treatment well adapted to the anatomy and pathophysiology of hemorrhoidal disease. Moreover, it is a minimally invasive therapy that produces little pain. These two elements might explain why Doppler guidance in hemorrhoidal surgery has become more frequent during the past decade in patients with grade II and III hemorrhoids (Felice et al. 2005; Greenberg et al. 2006; Walega et al. 2008; Wilkerson et al. 2009).

4 Suture Ligation and Mucopexy Without Doppler Guidance

Some authors have argued that placing the stitch adequately to achieve absence of Doppler signal distal to the ligated artery is sometimes difficult to assess. Moreover, as the median number of artery ligations under Doppler guidance may be as high as 8 to 16, the question has even aroused as to the necessity of using Doppler ultrasonography for the identification and ligation of the arteries (Gupta et al. 2011; Avital et al. 2012). For these authors, simple ligation without Doppler guidance, associated with mucopexy if necessary, might be as effective in treating symptoms as Doppler-guided hemorrhoidal artery ligations. Ligation anopexy has been proposed by some

authors who never used the Doppler system (Hussain 2001). Further prospective randomized studies will be necessary to address the question of using the Doppler or not.

5 Stapled Hemorrhoidopexy

Longo was the first to describe the treatment of hemorrhoidal disease by reduction of mucosa and hemorrhoidal prolapse with a circular suturing device as an alternative to hemorrhoidectomy (Longo 1998). He called it stapled hemorrhoidopexy, also known as procedure for prolapsed hemorrhoids (PPH). Instead of removing the hemorrhoidal tissue, the principle of stapled hemorrhoidopexy involves excision of a circular ring of mucosa between 2 and 4 cm above the dentate line, using a circular stapler. This technique aims in interrupting the submucous hemorrhoidal vessels and restore the hemorrhoidal tissue back into their anatomic position. As the excision occurs above the dentate line, it produces less pain than the conventional hemorrhoidectomy, avoiding a wound in the somatically innervated anoderm. This clever procedure targeted towards both the mechanical hypothesis and the vascular hypothesis can be considered as a modern surgical approach to hemorrhoids.

To perform stapled hemorrhoidopexy, a purse string suture of 2/0 polypropylene is placed within the submucosa 3–4 cm above the dentate line. The circular stapler is fully opened and inserted through the anal canal using a specifically designed dilator. The purse string suture is tied on the stapler shaft and the head of the stapler is closed on the anvil, incorporating the mucosal and submucosal rectal tissue in the suture. The stapler is then fired and withdrawn. The suture line is inspected at the end of the procedure and any bleeding is points ligated rather than coagulated.

Complications following stapled hemorrhoidopexy are similar to those of conventional hemorrhoidectomy. In addition, specific and sometimes life-threatening complications have also been described, including severe pelvic

sepsis (Faucheron et al. 2012), rectal obstruction (Vasudevan et al. 2007), rectovaginal fistula (McDonald et al. 2004), pneumomediastinum (Filingeri and Gravante 2005), intra-abdominal bleeding (Blouhos et al. 2007), chronic pain (Cheetham et al. 2000), and Fournier's gangrene (Bönner et al. 2001). While stapled hemorrhoidopexy causes less early postoperative pain than hemorrhoidectomy, some patients complain of chronic pain lasting for months or even years (Khubchandani et al. 2009). Etiology of this "post-PPH syndrome" is unclear and might be related to fibrosis surrounding the staples, trauma to the pudendal nerve branches or anal sphincter stapling (De Nardi et al. 2008).

Stapled hemorrhoidopexy is also associated with a higher long-term recurrence rate of internal hemorrhoids compared with conventional excisional hemorrhoidal surgery (Jayaraman et al. 2007). A very recent multicenter randomized controlled trial comparing transanal Doppler-guided hemorrhoidal artery ligation with mucopexy and circular stapled hemorrhoidopexy involving 393 patients from 22 centers concluded that both options are viable in grade II/III HD with no significant difference in operative-related risk. Although resulting in less postoperative pain and shorter sick leave, Doppler-guided hemorrhoidal artery ligation was more expensive and provided a possible inferior anatomical correction suggesting an increased risk of recurrence (Lehur et al. 2016).

6 Embolization

Very recently, a new technique has been described, responding to the theory of the arterial vascularization of the hemorrhoids. The principle is to embolize the main feeding arteries of the piles, in order to permanently reduce the blood flow in the hemorrhoids (Moussa et al. 2017). The procedure consists in performing super selective microcoil embolization (pushable 2–3 mm fiber coils) of the distal branches of the superior rectal arteries with a microcatheter, via a right femoral approach, under local anesthesia. Main indication seems to be a patient suffering

from disabling chronic bleeding due to hemorrhoidal disease and with a contraindication for surgery or with a failure of instrumental or surgical treatment (Moussa et al. 2017). This procedure, still experimental, appears safe and effective in patients untreatable by surgery and might be proposed in other hemorrhoidal grades in further studies.

7 Which Surgical Options for Which Patients and Which Hemorrhoids. . .

The reader will probably understand that there are various surgical options available for hemorrhoids. He will find some in details answers in the other chapters of this book through randomized controlled trials performed so far (Elmer et al. 2013; De Nardi et al. 2014; Tsang et al. 2014; Lehur et al. 2016). Modern surgical approach to hemorrhoids should not be on the basis of “one size fits all.” Many factors have to be taken into account.

The ideal operation for hemorrhoidal disease should be effective on the symptoms with as low as possible rate of recurrence, minimal postoperative pain and discomfort to allow early return to normal and/or usual activities, and safe with minimal mortality and morbidity.

Excisional surgery is still considered as the gold standard for the operative treatment of hemorrhoids because of its low recurrence rate. During nearly 50 years, this procedure has been the only surgical treatment proposed to patients searching for radical surgery, whatever the grade of the disease and the clinical status of the patient.

However, postoperative pain with its associated disability and complications such as bleeding, sepsis, anal incontinence, and anal stenosis limit the systematic application of hemorrhoidectomy in all instances. In our opinion, the surgical management of hemorrhoidal disease should nowadays be an “à la carte” treatment.

The surgeon must consider the nature and severity of the symptoms; the grade of the disease; the local extension of the pathology

(localized versus circumferential); the associated conditions (anal symptomatic tags, fissures, anal sphincter hypertonia, ulcerative colitis, anal incontinence, and so on); the previous treatments, either medical, instrumental, or surgical; and the general status of the patient including the medications intake (for instance, antiplatelets or anticoagulants).

Once done, beside the conventional open or closed hemorrhoidectomy, the surgeon must clearly explain to the patient the published technical and functional results including recurrence rate of each other applicable options, essentially depending on the Goligher’s grade of the disease. When many procedures are available for the same figure, benefits and drawbacks including cost for all of them should be clearly stated.

Then, the patient himself could ask for a radical surgery at a low recurrence risk but higher short- and long-term complication risk (the Milligan and Morgan procedure) or at the opposite a noninvasive, quasi painless operation that carries a higher recurrence and reoperation rate (the HAL RAR procedure).

Lastly, as many others, we think that proposing a staged management of the hemorrhoidal disease with or without association of procedures in some patients could be an option, when symptomatic, circumferential, grade III or IV piles are present. Delaying excision of a third hemorrhoidal pedicle renders the first two pedicles excision less troublesome, and it can be done as a one day surgery (Vinson Bonnet et al. 2015). Other patients could have a large hemorrhoidal pedicle and tag removed with HAL RAR in the same time: this also could allow management in ambulatory setting (Tempel et al. 2014).

8 Conclusion

Table 2 could represent the modern surgical management of hemorrhoidal disease taking into account all factors depending on the nature and severity of the symptoms, localization and grade of the disease, status and expectation of the patient, and experience of the surgeon.

Table 2 Advices for modern surgical approach to hemorrhoids (personal view)

Grade	Localized hemorrhoids	Circumferential hemorrhoids
I	No surgery	No surgery
II	No surgery / DGHAL/limited CH	DGHAL/CH ^a /SH
III	DGHAL mucopexy/limited CH	DGHAL mucopexy/CH ^a /SH
IV	CH	CH ^a
Thrombosis	Thrombectomy first	Thrombectomy first
Life-threatening bleeding	CH	Embolization

DGHAL Doppler-guided hemorrhoidal artery ligation, *CH* conventional hemorrhoidectomy, *SH* stapled hemorrhoidopexy

^aDiscuss sequential operation (hemorrhoidectomy limited to two pedicles, delayed the third one) and/or association of procedures

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Management of Hemorrhoidal Disease in Special Conditions

9

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Abstract

In this chapter, management of hemorrhoidal disease in special conditions is discussed. These special conditions include acutely thrombosed or strangulated external hemorrhoids and hemorrhoidal disease in pregnancy, in patients with cirrhosis or portal hypertension, in patients having anticoagulant or antiplatelet drugs, and in patients with immune deficiency. Medical and surgical treatments, alternatives of treatment, complications, and outcome are presented.

1 Acutely Thrombosed or Strangulated External Hemorrhoids

Hemorrhoidal disease is mainly painless when not complicated. It is basically because of lack of sensitive nerve endings above the level of dentate line. When the blood within the vessels of the external piles clotted then the thrombosis process starts. When the thrombosis process is completed, patients mostly present with pain and a hard oval mass around the anus. Acutely tender thrombosed hemorrhoids can be surgically removed within the first 72 h, and patients who are admitted later than this period are treated conservatively in most centers (Zuber 2002).

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The evidence for current management of thrombosed hemorrhoids has been reviewed by Chan et al. (Chan and Arthur 2013). Among 800 articles on hemorrhoids, only two prospective studies encompassing 248 patients and two retrospective studies of 571 patients were found. Excision significantly relieves presenting symptoms by postoperative day 4 compared with incision or topical GTN (Level IB evidence). Symptoms last over 3 weeks with conservative treatment (Level III evidence), and this period may be reduced by combining topical nifedipine and lignocaine rather than using lignocaine alone (Level IB evidence).

The data about the treatment modalities and outcome of thrombosed hemorrhoids is not sufficient. One study is composed of 231 patients with thrombosed external hemorrhoids. The cases were managed conservatively in 51.5% and surgically in 48.5%.

Complaints of most patients with thrombosed hemorrhoids resolve eventually; however, at least in this study symptoms resolved within 24 days in conservative group and 3.9 days in the surgical group ($p < 0.0001$). The overall recurrence rate was also significantly high in the conservative group. Eventually, surgical treatment of thrombosed hemorrhoids offers a faster resolution of symptoms with lower rates of recurrence (Greenspon et al. 2004).

A long discussion has been coming along whether to incise or excise the thrombosed pile. Incising and removing the thrombosis should be avoided for several reasons. Reaccumulation of a bigger clot is one and bleeding from the incised vein is another reason for excising the entire pile (Rivadeneira et al. 2011).

For the conservative treatment, phlebotonics (synthetic calcium dobesilate or natural flavonoids), in general, offers benefit for alleviating hemorrhoidal symptoms like itching, bleeding, post-hemorrhoidectomy pain, and discomfort (Perera et al. 2012).

The most important component of the conservative management is high-fiber diet and sufficient water intake. In a double-blind randomized controlled study, patients with third and fourth degree hemorrhoids are randomized to receive

high-fiber diet versus placebo. After 6 weeks, high-fiber group had significant improvement symptoms of bleeding, painful defecation, itching, and wet anus due to prolapsus (Moesgaard et al. 1982). Sitz bath has been historically recommended in almost all treatment algorithms and probably helpful in at least temporarily alleviating the symptoms (Song and Kim 2011).

While the pain is the most prominent symptom, internal sphincter hypertonicity is likely to play a major role in the etiology of the pain. In one study, the efficacy and safety of an intrasphincteric injection of botulinum toxin are used to lower the anal resting pressure for pain relief in patients with thrombosed external hemorrhoids. Thirty patients with thrombosed external hemorrhoids who refused surgical operation were randomized into two groups. Patients received an intrasphincteric injection of either 0.6 ml saline or 0.6 ml of a solution containing 30 units botulinum toxin. Anorectal manometry was performed before treatment and 5 days afterwards. Anal resting pressure fell in both groups but was significantly lower in the botulinum toxin group ($P = 0.004$). Pain intensity was significantly reduced within 24 h of botulinum toxin treatment ($P < 0.001$), but only after 1 week in the placebo group ($P = 0.019$). Eventually, a single injection of botulinum toxin into the anal sphincter seems to be effective in rapidly controlling the pain associated with thrombosed external hemorrhoids and could represent an effective conservative treatment for this condition (Patti et al. 2008). Similarly, nitric oxide has recently been identified as the “novel biologic messenger” that mediates the anorectal inhibitory reflex in humans. Lowering the anal resting tone by means of nitric oxide gives similar results compared to botulinum toxin. In one study, patients with thrombosed external hemorrhoids were treated with topically administered 0.5% nitroglycerin ointment. All patients reported dramatic relief of anal pain following application of nitroglycerin. Pain relief lasted from 2 to 6 h. Side effects were limited to transient headache in one fourth of patients. Topically applied nitroglycerin ointment appears to have a therapeutic role

in the treatment not only in anal fissures but also in thrombosed external hemorrhoids (Gorfine 1995). In another study, topical nifedipine, was used to treat and control the symptoms of acute thrombosed hemorrhoids. Topical 0.3% nifedipine and 1.5% lidocaine ointment was used twice daily for 2 weeks. The control group received topical 1.5% lidocaine ointment only. The headache, side effect of nitroglycerin, was not observed with nifedipine. Complete relief of pain in 43 patients (86%) of the nifedipine-treated group while only 24 patients (50%) of the control group after 7 days of therapy ($P < 0.01$); oral analgesics were used by 4 patients (8%) in the nifedipine-treated group but in 26 patients (54.1%) of the control group after 7 days of therapy ($P < 0.01$). At the end of 14 days of treatment, 46 patients (92%) in nifedipine groups and 22 patients (45.8%) showed complete resolution of thrombosed external hemorrhoids. Nonetheless, topical nifedipine 0.3% is also a reliable option in the conservative treatment of thrombosed external hemorrhoids with less side effects to control the pain and offers a faster resolution of the disease (Perrotti et al. 2001).

Stapled hemorrhoidectomy, a modified technique of stapler hemorrhoidopexy, was compared to conventional hemorrhoidectomy for 41 patients with acute thrombosed hemorrhoids in a prospective randomized study. Thrombosed anal cushions were incised to remove the clots and the hemorrhoidal tissue is largely excised during operation by placing the purse string at 3 cm level above the dentate line in this particular technique. Patients were followed up by independent assessors to evaluate pain, recurrence, continence function, and satisfaction at regular intervals. The follow-up period was more than a year for both groups. There was no significant difference in terms of the hospital stay, complication rate, and continence function; however, the mean pain intensity in the first postoperative week was significantly less in the PPH group (4.1 vs. 5.7, $P = 0.02$). Patients in the PPH group recovered significantly faster in terms of the time to become analgesic-free (4 vs. 8.5 days, $P = 0.01$), resumption of work (7 vs. 12.5 days, $P = 0.01$), and time for complete wound healing (2 vs. 4 weeks, $P < 0.01$) (Patti

et al. 2008). Our experience with this particular way of hemorrhoidectomy is limited, but in selected cases where the disease is circumferential and feasible for no remaining thrombosed residual tissue is left after surgery, the advantages of stapler technique including less pain and faster recovery are obtained (Wong et al. 2008).

2 Hemorrhoids in Pregnancy

Thrombosed external hemorrhoids are one of the frequent problems during pregnancy. Constipation is probably the most important factor in the etiology. In many cases, anal fissure diseases accompany the hemorrhoids. The incidence of thrombosed external hemorrhoids during pregnancy is reported as 12.2–34% (Abramowitz and Batallan 2003). The largest series reporting surgical treatment of thrombosed external hemorrhoids goes back to 1970. In this series, 100 patients were operated immediately or within 4 days after delivery with no serious complications. It was reported that post-operative pain was significantly less and healing time was 20–30% faster in postpartum women compared to other women. As in other cases, simple thrombectomy was not recommended as remaining tissue may cause further problems (Ruiz-Moreno 1970). Another group reported 4–10% of symptomatic hemorrhoidal disease during pregnancy and 85% of them in the second and third trimester. In the third trimester, 7.8% of pregnant females will experience a TEH. Options of treatment historically have included rubber band ligation, sclerotherapy, cryotherapy, anal dilation, sphincterotomy, infrared photocoagulation, etc. Operative hemorrhoidectomy is considered when hemorrhoids have become severely prolapsed, incarcerated, ulcerated, and thrombosed or are persistently bleeding. In their series, 1700 female patients with a clinical diagnosis of thrombosed external hemorrhoids were identified. Of these patients, 333 (19.6%) underwent excision of a thrombosed external hemorrhoid and 1367 (80.4%) received medical management only. Forty (12.2%) of the 333 patients were pregnant. These 40 patients with an average gestational age of 31.7 weeks were diagnosed with a thrombosed

external hemorrhoid and underwent subsequent office-based excisional treatment. The recurrence rate for a thrombosed external hemorrhoid was 32.5% (13 patients) with an average time for recurrence at 76.8 weeks. The most common post-op complication was redevelopment of a thrombosed external hemorrhoid (32.5%), 10% of which occurred during the pregnancy. The second most common complication was a fissure or nonhealed wound (25%) followed by development of a hemorrhoidal tag (17.5%). No spontaneous abortions or admissions for preterm labor occurred. As a consequence, the approach and outcome in thrombosed external hemorrhoids are more or less same in the pregnant and nonpregnant population. The reluctance to perform office thrombosed hemorrhoid excision on the pregnant patient is unfounded. The surgery can be performed easily in the office under local anesthesia without any special monitoring. This data suggests that there is no increased risk of inducing preterm labor or miscarriage. The common complications after surgery, recurrence, anal fissure, and development of hemorrhoidal tags, are amenable to further definitive treatment after the delivery (Mirhaidari et al. 2016). For the conservative treatment, fiber supplement, stool softener, and mild laxatives are generally safe for pregnant women. Topical medications or oral phlebotonics may be used with special caution because the strong evidence of their safety and efficacy in pregnancy is lacking (Lohsiriwat 2015).

3 Hemorrhoids in Patients with Cirrhosis or Portal Hypertension

A clinician must differentiate bleeding hemorrhoids from bleeding anorectal varices because the latter can be managed by suture ligation along the course of varices, transjugular intrahepatic portosystemic shunt, or pharmacological treatment of portal hypertension (Lohsiriwat 2013). In a prospective study of 100 consecutive patients with cirrhosis, 44% had anorectal varices. The prevalence of anorectal varices rose with progression of portal

hypertension; it was 19% in cirrhotic patients without portal hypertension compared with 59% in those who had bled from oesophageal varices. There was no evidence that endoscopic sclerotherapy directly increased the prevalence of anorectal varices. Hemorrhoids occurred independently of anorectal varices and their presence was unrelated to the degree of portal hypertension. These data provide further evidence that hemorrhoids and anorectal varices are separate and distinct entities. However, both can bleed and careful examination is essential to prevent misdiagnosis and inappropriate treatment (Hosking et al. 1989).

Since a majority of bleeding hemorrhoids in such patients is not life threatening, conservative measure with the correction of any coagulopathy is a preferential initial approach. Of note, rubber band ligation is generally contraindicated in patients with advanced cirrhosis due to the risk of profound secondary bleeding following the procedure. Injection sclerotherapy is an effective and safe procedure for treating bleeding hemorrhoids in this situation. In a refractory case, suture ligation at the bleeder is advised. Hemorrhoidectomy is indicated when bleeding hemorrhoids are refractory to other approaches (Lohsiriwat 2013, 2015).

4 Hemorrhoids in Patients Having Anticoagulant or Antiplatelet Drugs

In general, bleeding might be predominant over other symptoms in patients who are on drugs to impair the clotting function. The choice of treatment must also be decided according to the condition of the patient. In patients who can stop anticoagulant medication for a few days, rubber band ligation might be an option. Because of the risk of postoperative hemorrhage, rubber band ligation should not be performed in patients receiving warfarin (Coumadin). Aspirin and other antiplatelet agents should be discontinued 5–7 days before the procedure and restarted 5–7 days after (Mounsey et al. 2011). When the anticoagulant or antiplatelet drugs cannot be stopped for various reasons, any kind of surgery

has the risk of bleeding and should be avoided as much as possible. Sclerotherapy is probably the next and optimum option in such cases (Song and Kim 2011). Conventionally, 5% phenol in almond oil has been used as a sclerosing agent for hemorrhoids. Polydocanol, a polyhydroxy alcohol, is also widely used (Ono et al. 2005). Aluminum potassium sulfate and tannic acid (ALTA) was recently developed in Japan as an injecting sclerosing agent for treating hemorrhoids and has been actively applied to grade 2 and 3 internal hemorrhoids. This method is based on the Xiaozhiling injection introduced by Shi et al. (1981). The mechanism is as follows: The agent injected into the hemorrhoid leads to an inflammatory response, and as the blood flow into the hemorrhoid is interrupted, secondary fibrosis is facilitated, shrinking the hemorrhoid. This method is effective for hemorrhoids with bleeding as a major symptom on a short-term basis, but not for protruding hemorrhoids (Ono et al. 2005; Shi et al. 1981).

5 Hemorrhoids in Patients with Immune Deficiency

Besides, 2.3 million people are contracting HIV infection every year; a total of 35 million people were estimated to be affected in the world (Juusola and Brandeau 2016). Perianal diseases including hemorrhoids usually require surgery in HIV infected patients, who comprise 5.9–34% of this special group (Oh et al. 2014). Heterosexual males had fewer hemorrhoids than homosexual or bisexual males (Wolkomir et al. 1990). HIV-positive patients have as many classic anal diseases (hemorrhoids, fistulas, and fissures) and venereal diseases (condylomas, gonorrhea, syphilis, and chlamydia) as systemic diseases typical for HIV-positive diagnoses (cytomegalovirus (CMV), herpes simplex, candida, and idiopathic ulcers). Some neoplastic lesions are also referred to as being more prevalent than in the HIV-negative population, mainly Kaposi's sarcoma, non-Hodgkin's lymphomas and epidermoid anal cancer, which is

associated with human papillomavirus (HPV) infection. More than one third of patients with hemorrhoidal disease simultaneously have other conditions like condylomas and fistulas (Nadal et al. 1999). One should be aware of all these conditions and be very careful about the differential diagnosis in HIV-positive patients. If the problem is solely hemorrhoids, HIV status should basically not alter indications for hemorrhoidectomy. The treatment should be given in accord with the degree and prominent symptom of the disease (Morandi et al. 1999). However, if hemorrhoidectomy is performed, the rate and severity of postoperative complications differ significantly between the HIV-positive, AIDS, and control group with none of these conditions. In one study, the complication rate was 87.5% in the AIDS, 22% in the HIV-positive, and 5% in the control group. AIDS patients were the most vulnerable for local sepsis compared to HIV-positive and control cases ($P < 0.01$). When healing time was compared, HIV-positive status, AIDS, and wound infection significantly delayed healing time. After 32 weeks, all of the HIV-positive patients had healed, but only 50% of those with AIDS ($P < 0.01$) (Hewitt et al. 1996).

In conclusion, hemorrhoidectomy or other interventions for hemorrhoidal disease can be performed in an otherwise healthy HIV-positive patient with comparable morbidity and mortality as seen in the HIV-negative patient. Presence of AIDS, may increase the rate of complications and healing time after surgery; however, HIV status should eventually not alter the treatment indications of hemorrhoidal disease.

6 Cross-References

- ▶ [Critical Aspects of Modern Surgical Approach to Hemorrhoids](#)
- ▶ [Endoscopic Treatment of Internal Hemorrhoids](#)
- ▶ [Medical Therapy of Hemorrhoidal Disease](#)
- ▶ [Selection of Patients to the Surgical Treatment of Hemorrhoids](#)
- ▶ [The Acute Management of Hemorrhoids](#)

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The Acute Management of Hemorrhoids

10

Alexander Hardy

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Abstract

Chronic hemorrhoids can cause a number of symptoms, but are rarely painful. There is a tendency to attribute any perianal symptoms to “piles” and patients presenting with acute anal pain may have another underlying pathology. However, the acute complications of hemorrhoids may be debilitating and cause severe pain. This is due to either strangulation of prolapsed internal hemorrhoids or a thrombosed perianal varix – two discrete clinical entities requiring differing approaches to

treatment. If symptoms are subsiding, a conservative approach may be adopted with systemic analgesics, stool softeners, and topical treatments. The hemorrhoids can then be reassessed several months later when symptoms have resolved and treated appropriately. Operative intervention may be considered to relieve symptoms if feasible, the expertise is available, and the presentation is early enough. The thrombosed perianal varix can be evacuated or the strangulated hemorrhoids excised. Care must be taken in an emergency hemorrhoidectomy to remove only the affected tissue, avoiding the sphincters and leaving adequate skin bridges. Clinical decisions about treatment should be directed toward the relief of symptoms and not merely the restoration of anatomy.

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1 Introduction

Chronic hemorrhoids may cause discomfort and inconvenience, but are rarely painful. They may bleed or prolapse, and this may lead to other symptoms such as discharge, pruritus, and problems with perianal hygiene. Other causes of pain, such as an anal fissure (or, more rarely, an abscess or tumor) should be sought. Severe pain from hemorrhoids themselves is usually due to their acute complications of thrombosis or strangulation.

Napoleon is purported to have delayed the start of the Battle of Waterloo due to pain from hemorrhoids “which had acutely prolapsed and had strangulated outside the anus.” Unable to ride his horse, the leaches usually used to relieve the Emperor’s pain could not be found, and his doctors had to resort to the use of laudanum (Mason 2010). We can only speculate how this may have affected the course of history. A similar fate befell the men of the city of Ashod in the Bible, who were “smote” with “emerods in their secret parts” as punishment for stealing the Ark of the Covenant (1 Samuel 5:9). They were forced to attempt a rather unusual cure and made an offering to God of images of five golden hemorrhoids and five golden mice. Treatments may have moved on a little in the last few thousand years, but it is perhaps surprising that a condition that has been described for so many centuries remains so poorly understood (Parks 1955).

While attempts have been made to establish a consensus for the treatment of chronic hemorrhoids (The Standards Task Force American Society of Colon and Rectal Surgeons 1993; Corman et al. 2003), there is little consistency in the management of patients presenting as an emergency. This is partly due to confusion as to the nature of hemorrhoids and in the terminology used to describe them. Terms such as “hemorrhoidal crisis,” “strangulated piles,” “acute hemorrhoids,” “thrombosed external hemorrhoids,” and “perianal hematoma” are used interchangeably, with little regard for the underlying pathology. An understanding of the anatomy of the anal sphincter complex and its blood supply is necessary to understand why hemorrhoids may thrombose and become acutely painful. It is also needed to distinguish between the two pathologies causing these acute hemorrhoidal

conditions, the “strangulated internal hemorrhoid” and the “thrombosed perianal varix.” Though there has been a wealth of literature published on the treatment of chronic hemorrhoids over the last 10 years, we often have to go back to work published in 1970s and 1980s for clues as to the nature of their acute complications.

1.1 Prevalence

Data on the prevalence of chronic hemorrhoids in the general population are difficult to obtain. Studies quote between 4.4% and 36.4% of the general population affected (Loder et al. 1994), though this must be tempered by the fact that many of the public (and some clinicians) have a tendency to attribute any perianal symptoms to “hemorrhoids” or “piles.” The prevalence of acute complications and their sequelae is not known.

The largest study comparing emergency with elective hemorrhoidectomy reviewed 704 patients with symptomatic prolapsed hemorrhoids over a 2 year period (Eu et al. 1994). Overall, 204 patients (29%) presented as an emergency with acutely prolapsed hemorrhoids which were thrombosed, ulcerated, or gangrenous. These were operated on within 12 hours of admission. The other 500 (71%) had more chronic symptoms and were operated on electively. These figures only represent patients considered appropriate for emergency or elective hemorrhoidectomy and not those patients with chronic symptoms for whom more conservative measures were considered appropriate. One attempt to reclassify hemorrhoids included a new categorization of “acute events” (i.e., edema or thrombosis) and undertook to compare this new system with the traditional four grades of the Goligher classification (Gaj et al. 2002). One thousand four hundred ninety four patients were examined. Eight percent of those with third degree hemorrhoids (i.e., prolapsing and requiring manual reduction) and 17% of fourth degree (i.e., permanently prolapsed) fell into the new category of “acute events.”

Thrombosis may be present in histological specimens, but not necessarily evident clinically. In a retrospective review of 2,038 consecutive

hemorrhoidectomies, 211 (10.4%) had a clinical diagnosis of thrombosis made preoperatively. Five hundred fifty five patients (27.3%) had the diagnosis established histologically, though only a third of these thromboses were apparent clinically (Ganchrow et al. 1971a). In another retrospective analysis by the same author of 100 patients with histological evidence of thrombosis, only 45 of these patients had a clinical diagnosis made preoperatively (Ganchrow et al. 1971b).

1.2 Anatomy

Hemorrhoids are made up of vascular, muscular, and connective tissue (Haas et al. 1984). An understanding of the anatomy of each of these elements is necessary to understand the causes of hemorrhoids and their acute sequelae. Thomson was the first to describe the anal cushions – discrete masses of tissue above the dentate line found most commonly in the left lateral and right anterior and posterior positions (or classical “3, 7, and 11 o’clock” positions) (Thomson 1975). Anal cushions are normal structures. Hemorrhoids are anal cushions which have prolapsed or become symptomatic.

Thomson’s work of the 1970s helped further explain the blood supply to the anal canal. He made latex casts of the blood vessels of 75 cadaveric anorectal specimens in adults and children by canulating either the superior rectal artery or vein. This showed the terminal vasculature of the hemorrhoidal vessels to be condensed within the anal cushions, forming the internal (or superior) hemorrhoidal plexus. Filling of these vessels is thought to contribute between 15% and 20% of anal pressure (Lestar et al. 1989) and fine-tune liquid continence by forming a “watertight” seal (Gibbons et al. 1986). An analogy has been made with the washer on a tap. Below the dentate line is found the external (or inferior) hemorrhoidal plexus, a discrete collection of vessels at the anal margin, continuous with those above. Vascular engorgement at this level can give an external component to the hemorrhoids. With more severe degrees of prolapse the internal and external components become continuous and “intero-external” hemorrhoidal masses are seen prolapsing.

Thomson’s studies also demonstrated tiny direct arteriovenous communications between vessels. This explains the bright red color of hemorrhoidal bleeding, which has the same pH as arterial blood (Thulesius and Gjores 1973). Within the veins of the submucosal venous plexus he found discrete dilatations. These could be fusiform, saccular, or serpiginous. He drew a distinction between those found above the dentate line (i.e., within the superior hemorrhoidal plexus), occurring “in greatest profusion and complexity” and those below, “fewer in number and with a tendency to be larger in size” (within the inferior hemorrhoidal plexus). This anatomical distinction is important as it helps explain the two separate (but often confused) clinical entities described by the term “acutely thrombosed hemorrhoids.” A thrombosis within the inferior hemorrhoidal plexus may best be termed a “thrombosed perianal varix.” A hemorrhoidal mass containing the superior hemorrhoidal plexus which has prolapsed and become trapped outside the sphincter complex should be termed a “strangulated internal hemorrhoid.” Using any of the various other terms for acute hemorrhoid complications may cause ambiguity. A failure to draw this distinction is seen throughout the literature.

The blood vessels of the superior hemorrhoidal plexus are surrounded by a web of connective tissue and smooth muscle. This is derived from the conjoined longitudinal coat, a continuation of the outer muscular coat of the rectum and the levator plate (Lunniss and Phillips 1992). This muscle sends out a plexiform arrangement of fibers medially, which cross the internal and external sphincters into the submucosa, anchoring the anal cushions to the intersphincteric layer (Haas and Fox 1980). Parks described a condensation of these fibers inserted into the mucosa at the level of the dentate line, the “mucosal suspensory ligament,” dividing the superior and inferior hemorrhoidal plexuses. This he considered to be derived from the sheath surrounding the internal sphincter (Parks 1954). Smooth muscle elements within the submucosa are associated with the anchoring slips of longitudinal muscle, termed “Trietz’s muscle.” Degeneration of these muscular and fibrous elements leads to hypertrophy and fragmentation of the fibers, and loss of the normal support to the

submucosa and its vasculature (Haas et al. 1984). The muscle to collagen ratio decreases within the hemorrhoidal cushions, leading to similar histological appearances to aging anal cushions. This can result in prolapse of the hemorrhoidal mass. A loss of support to the blood vessels and local trauma to the more superficial vessels of the dilated venous plexus may lead to hemorrhoidal bleeding.

2 The Thrombosed Perianal Varix

Thomson found thrombosis within the venous dilations of the inferior hemorrhoidal plexus in 3 out of 50 specimens examined (6%). This pathology had previously been described as a “perianal hematoma.” In a later article he qualified this term, having had the opportunity to examine a specimen removed from the anal margin at hemorrhoidectomy along with a prolapsed hemorrhoid (Thomson 1982). He now favored the term “clotted venous saccul,” since it was strictly subanodermal (rather than perianal) and not a true hematoma (as there was no evidence of hemorrhage). Ganchrow et al. drew a similar distinction between external and internal thromboses (Ganchrow et al. 1971b). In 127 specimens of thrombosed hemorrhoids, 110 had what they termed “external thrombosis” (presumably involving the inferior hemorrhoidal plexus), 9 patients had internal thrombosis only, and 8 had combined internal and external thromboses. All thrombi were intravascular, with no evidence of extravasation or “hematoma.” Of the 31 patients where the time of symptom onset was known, the histological extent and degree of thrombosis was consistent with this. No evidence of systemic consumption coagulopathy was seen in these patients to account for their thromboses. In keeping with Thomson’s observations, “red thrombi” were seen in the vessels of the hemorrhoidal plexus, caused by a combination of hypercoagulability, stasis, and trauma. More than half of the patients were able to associate the onset of their symptoms with acts such as lifting heavy objects or straining. The combination of venous stasis and local trauma was proposed as the cause of thrombosis. Oh described 159 patients with thrombosis within the inferior hemorrhoidal plexus (Oh 1989). It was found twice as

commonly in male patients and in a younger age group (mean age 36 years). An episode of constipation was often the precipitating event.

The term “perianal hematoma” is therefore a misnomer. The term “thrombosed external hemorrhoid” is also confusing in this situation. Although the external (or inferior) hemorrhoidal plexus is involved, it can lead to confusion with a strangulated internal hemorrhoid which has prolapsed externally from within the anal canal. The term “thrombosed perianal varix” is sometimes used (Nicholls and Glass 1985), which describes this condition more accurately and without ambiguity.

A thrombosed perianal varix usually presents as a single, tense, painful, bluish lump at the anal margin, with a clear line of demarcation between the swelling and the mucosa of the anal canal (Mann 2002). This distance from the anal margin is the key to distinguishing this from a strangulated prolapsed hemorrhoid. Sometimes a large proportion of the inferior hemorrhoidal plexus is thrombosed, and a firm, tender, homogenous mass is present at the anal verge. If left, spontaneous resolution occurs over 7–10 days. Symptoms can last for up to 4 weeks. On rare occasions the clot may erode through the skin and discharge itself. If the pain is resolving on presentation, the thrombosed varix can be treated conservatively with analgesics, stool softeners, and reassurance.

2.1 Conservative Treatments

Nifedipine (a calcium channel antagonist) has been shown both in vitro and in vivo to relax the internal sphincter and modulate resting anal tone (Cook et al. 1999). A randomized trial of 98 patients compared 0.3% topical Nifedipine with placebo for “acute thrombosed external hemorrhoids” (Perrotti et al. 2001). Both groups were given standard conservative measures (high fiber diet, bulk laxatives, sitz baths, and 1.5% lidocaine ointment). Pain was absent or modest in 86% of the Nifedipine group compared with 14% of the control group at 1 week. At 2 weeks, total remission of pain and swelling was present in 92% of the Nifedipine users and 46% of controls. It is thought that internal anal sphincter hypertonicity may be a cause of pain.

Botulinum toxin has been used in a similar context (Patti et al. 2008). In a randomized trial of 30 patients receiving either an intrasphincteric injection of 0.6 ml (30 units) of botulinum toxin or an identical volume of saline, pain intensity was significantly reduced in 24 hours in the botulinum toxin group, but only after a week in the placebo group.

2.2 Operative Treatment

If seen within the first 24–48 hours, evacuation of the clot under local anesthetic is recommended (Nicholls and Glass 1985; Mann 2002). The clot may be single or multiloculated. A circumferential rather than a radial incision may help ensure all the clots are removed from the venous plexus without a skin tag forming after healing (Grosz 1990). Care should be taken to remove all visible clot, and it is not necessary to pack the cavity. This is a procedure that can usually be safely carried out without admission to hospital. It also avoids the morbidity associated with formal excision. If the thrombosed external hemorrhoid mass is large, there may be concerns about ongoing bleeding after the procedure. In this situation, formal excision may be considered. The choice of excision or incision must be a clinical judgment.

A comparison of the outcomes of conservative treatment or surgical excision reviewed 231 cases of “thrombosed external hemorrhoids” over a 12 year period in a retrospective study (Greenspon et al. 2004). A prior history of hemorrhoid thrombosis was found in 44.5% of patients. Pain was found as the primary presenting symptom in over 90% of patients. Conservative measures included stool softeners, sitz baths, and oral and topical analgesics. One hundred nineteen patients were treated in this way, and 112 patients had a surgical excision (or in a few cases, incision). Follow-up ranged from 7 months to 7 years. There was a fourfold higher rate of recurrence of symptoms in the conservative group (25.4%) compared with those who had surgical excision (6.3%).

A large retrospective study described the results of an “excision of thrombosed external haemorrhoid under local anaesthesia” in 340 patients (Jongen et al. 2003). Operative indications

were severe pain, necrosis, or perforation of the underlying skin. One percent Mepivacaine with adrenaline (later with 8.4% Bicarbonate) was infiltrated, and the lesion excised starting perianally and continuing to the dentate line. Seventy nine percent of patients would have accepted local anesthesia again for the procedure. Bleeding occurred in 1 patient (0.3%), and 7 patients (2.1%) developed a fistula or abscess. No patients developed urinary retention or an anal stenosis. Twenty two patients (6.5%) suffered a recurrence within the 28 months follow-up period which required further treatment under local anesthetic.

3 Strangulated Hemorrhoids

Prolapse of hemorrhoids is usually a chronic phenomenon. Symptoms may vary over time, and there is not always a good correlation between the appearance of the hemorrhoids and the severity of symptoms experienced. Acute prolapse (where the hemorrhoidal mass becomes trapped outside the anus by the sphincter) can lead to obstruction of venous return, edema, and strangulation. Patients may present with severe pain, which if left untreated can be severely incapacitating for several weeks. Treatment in such cases has often traditionally been conservative, including bed rest, analgesia, hot baths, ice packs, soothing topical applications, and stool softeners. Resolution does eventually occur, but there is a high incidence of continuing symptoms and the need for subsequent hemorrhoidectomy.

3.1 Conservative Treatments

There are very few studies of the long-term consequences of initial conservative management of acute hemorrhoidal prolapse. One such study followed 92 patients presenting to St. Mark's Hospital over a 5 year period and treated conservatively for “prolapsing thrombosed hemorrhoids” (Grace and Creed 1975). Nineteen patients (21%) denied previous symptoms, and 6 patients (7%) had had previous episodes of thrombosis. Only 12 patients (13%) had no further trouble from their hemorrhoids after

conservative treatment. Ten patients (11%) subsequently had a further episode of thrombosis. Sixty four patients (55%) were advised to undergo a hemorrhoidectomy for continuing symptoms. The study suggests that thrombosis is “merely an episode in the natural history of the disease and does not influence subsequent symptoms.”

Injection sclerotherapy in conjunction with oral Daflon has been described, but only with a small nonrandomized study (Deen 1996). Daflon, a flavonoid phlebotropic agent, is thought to relieve hemorrhoidal symptoms (Meshikhes 2002) but is not licensed for use in all countries. Other flavonoid agents have also been shown to reduce pain, bleeding, and edema in the acute hemorrhoids (Giannini et al. 2015).

3.2 Operative Treatment

Historically, a fear of surgical complications has led older textbooks to advocate a nonoperative approach to strangulated hemorrhoids. These complications have included portal pyemia, secondary hemorrhage, anal stenosis, and incontinence. The evidence seems to suggest otherwise, and a number of studies since have suggested acute excision is safe (Ganchrow et al. 1971a; Eu et al. 1994; Tinckler and Baratham 1964; Howard and Pingree 1968; Ceulemans et al. 2000) and fears of systemic infection are unfounded (Guy and Seow-Choen 2003). Ackland describes a case of systemic infection, but this was after elective hemorrhoidectomy. He also noted that the resected pile pedicle was free from thrombosis or inflammation (Ackland 1961). Smith confirmed that of 15 acute hemorrhoidectomy specimens examined, most were free of thrombosis and all were free of ulceration and inflammatory cells at the pedicle. The apex of the pile, however, showed dilated vessels, thrombosis and hemorrhage, and an inflammatory infiltration of extravascular tissues (Smith 1967). Others have found inflammatory changes only where ulceration of the mucosa had occurred, and not necessarily associated with thrombosis (Laurence and Murray 1962).

Identifying the anatomy and leaving adequate mucocutaneous bridges can cause technical difficulties in operating on acutely strangulated hemorrhoids. Hansen and Jorgensen observed

clinically what the above studies had noted histologically. The pedicles are usually unaffected and well defined, making an emergency operation no more technically demanding (Hansen and Jorgensen 1975). Smith believed that the presence of gangrenous changes was a contraindication to surgery, although failed to explain his reasoning (Smith 1967). In fact, the opposite argument for the removal of gangrenous hemorrhoid tissue has been made, which “leaves a wound draining freely and fulfils the basic tenet of surgery for septic lesions” (Tinckler and Baratham 1964).

A Danish study randomized 30 patients with acute strangulated hemorrhoids to either emergency Milligan-Morgan hemorrhoidectomy or “incision of the most prominent part of each strangulated haemorrhoid with evacuation of . . . the blood clots” and banding of the pedicle (Rasmussen et al. 1991). Postoperative pain was assessed by requirement for opioid analgesics. Those patients treated with incision, evacuation, and banding had lower pain scores and were discharged earlier than the hemorrhoidectomy group. Two patients in the banding group required hemorrhoidectomy for recurrence one or 2 days after the primary operation.

3.3 Hemorrhoidectomy

A number of case series in the 1960s and 1970s mentioned above advocate emergency hemorrhoidectomy for acute hemorrhoids. None of these studies describe the septic complications traditionally feared. Mazier describes 400 patients who underwent “emergency hemorrhoidectomy” procedures, though only 137 were known to have symptoms of less than 4 days duration, and only half had pain – calling into question his definition of acute hemorrhoidal disease (Mazier 1973). Nine patients (2%) suffered postoperative bleeding that necessitated a return to theater. Two patients (0.5%) had recurrences involving single quadrants that were treated conservatively. Of the five patients (1%) who developed anal stenosis postoperatively, all had had four quadrant hemorrhoidectomies.

Those studies comparing emergency with elective hemorrhoidectomies show similar complication rates. Eu et al. describe a total of 704 patients who underwent hemorrhoidectomy over a 24-

month period (Eu et al. 1994). Of these, 500 were operated on electively for symptomatic prolapsed hemorrhoids, and 204 emergency hemorrhoidectomies were performed (within 12 hours of admission) for acutely prolapsed, thrombosed, or gangrenous hemorrhoids. Twenty seven of the elective (5%) and 10 emergency patients (2%) had secondary hemorrhage (more than 24 hours after surgery). Of these, only 1% of patients in either group required surgical hemostasis. Three percent of elective and 5.9% of emergency patients developed a symptomatic stricture. There was no significant difference in recurrence between the two groups. No patients developed portal pyemia or septicemia following surgery. The authors conclude that emergency hemorrhoidectomy is a safe and suitable treatment in the acute setting.

A more recent retrospective study by Ceulemans et al. confirms these results (Ceulemans et al. 2000). Of 649 patients operated on for hemorrhoids, 104 were classified as emergencies (being operated on within 24 hours of admission). Rates of urinary retention and postoperative bleeding were not significantly different between groups. Anal stenosis was seen in 1 patient (0.2%) in the elective group, and 7 (7%) in the emergency group. These responded to dilators and did not require operative correction. One patient in the elective group (0.2%) had a recurrence and required further hemorrhoidectomy 3 years after the original surgery. No patients in the emergency group developed a recurrence.

Treatment of strangulated hemorrhoids under local anesthetic has been described. Saleeby et al. report a series of 25 pregnant women who underwent closed hemorrhoidectomy acutely for strangulation (Saleeby et al. 1991). Eighty eight percent of patients had a previous history of hemorrhoidal disease. Local anesthetic with adrenaline and hyaluronidase was used, with intravenous sedation. One patient required packing for postoperative bleeding. At longer term follow-up (between 6 months and 6 years) 6 women (24%) required additional treatment (2 being banded, and 4 requiring further hemorrhoidectomy). This series suggests that surgery under local anesthetic is feasible in these circumstances, though general anesthetic is more commonly employed. Conservative management of strangulated hemorrhoids is usually favored

in pregnant women due to the operative risks of a general anesthetic to the mother and fetus.

In an attempt to circumvent the potential technical difficulties of radical hemorrhoidectomy in the acute situation, Heald performed a limited hemorrhoidectomy on 21 patients presenting with strangulated hemorrhoids (Heald and Gudgeon 1986). The largest hemorrhoid was removed (or that in the left lateral position if all were considered equally large) and a four finger anal stretch was performed. This, it was proposed, “decompressed” the remaining hemorrhoids. Five patients required subsequent injection for bleeding, but after 2 years no patients reported a major recurrence of symptoms. This study was published in the 1980s, and since the advent of endoanal ultrasound the anal stretch has now been confined to history, for good reason.

3.4 Stapled Hemorrhoidopexy

The stapled hemorrhoidopexy (Procedure for Prolapse and Hemorrhoids (PPH)) treats hemorrhoids without recourse to excision by removing a cuff of mucosa above the hemorrhoids and thus reducing the prolapse. Its use in the acute setting is not widespread and indeed its popularity has waned over the last few years even in an elective setting. Brown et al. randomized patients with painful, edematous, circumferential prolapsed hemorrhoids to either stapled hemorrhoidopexy or a Milligan-Morgan hemorrhoidectomy (Brown et al. 2001). Patients with evidence of infection or necrosis were excluded. Eighteen patients had the Milligan-Morgan procedure and 17 patients the stapled procedure. Patients who had the stapled procedure performed had higher pain scores (average 5 out of 10) than the conventional hemorrhoidectomy group (average pain score 1) immediately postoperatively. Analgesic requirements were similar between the groups. At 2 weeks, however, perceived pain (particularly on passing motion) was significantly less in the stapled group. Ten patients in the conventional group (67%) complained of minor bleeding in the first 2 weeks. Three patients (20%) in the stapled group had bleeding in this period. One patient in each group had a stenosis at 6 weeks. The authors speculate that the greater

pain experienced immediately postoperatively in the stapled group reflects the fact that the thrombosed area is not removed in this group, merely drawn up inside the anal canal. The majority of complications in the conventional hemorrhoidectomy group were due to an exposed cutaneous wound, not present in the stapled group.

A study from Hong Kong randomized 41 patients with acute thrombosed hemorrhoids (with symptoms of less than 5 days) to either stapled or open hemorrhoidectomy (Wong et al. 2008). The PPH technique was modified in the acute setting to include stab incisions to extrude any thrombus, and an anal stretch to reduce edema. The purse-string was placed 3 cm above the dentate line (1–2 cm lower than usual), so the excision included hemorrhoid tissue – a true “stapled hemorrhoidectomy.” Microscopic muscle incorporation in the resection specimens occurred in 43% of the PPH group, though only transient flatus incontinence was reported, and no urgency. Patients in the PPH group had a significantly lower average pain score and a significantly shorter time to become pain free. One patient in the open group required readmission for hemorrhage. Five patients in the open group developed recurrent symptoms at follow-up of a year. No patients had recurrence in the stapled group.

Sphincter damage has also been identified after emergency open hemorrhoidectomy (Allan et al. 2006). Of 9 patients (in a series of 25 patients) who underwent endoanal ultrasonography after this procedure, 6 (66%) were found to have evidence of internal anal sphincter damage. All but one of these patients had been operated on by a trainee. Three of these patients described minor degrees of incontinence to flatus, but a similar number of patients treated conservatively (with normal ultrasound) also described this. This potential for sphincter injury must be borne in mind when operating in the acute setting.

Doppler guided hemorrhoidal artery ligation is becoming increasingly popular in the elective setting, particularly when combined with a suture anopexy. It is hard to see a place for it in the acute setting.

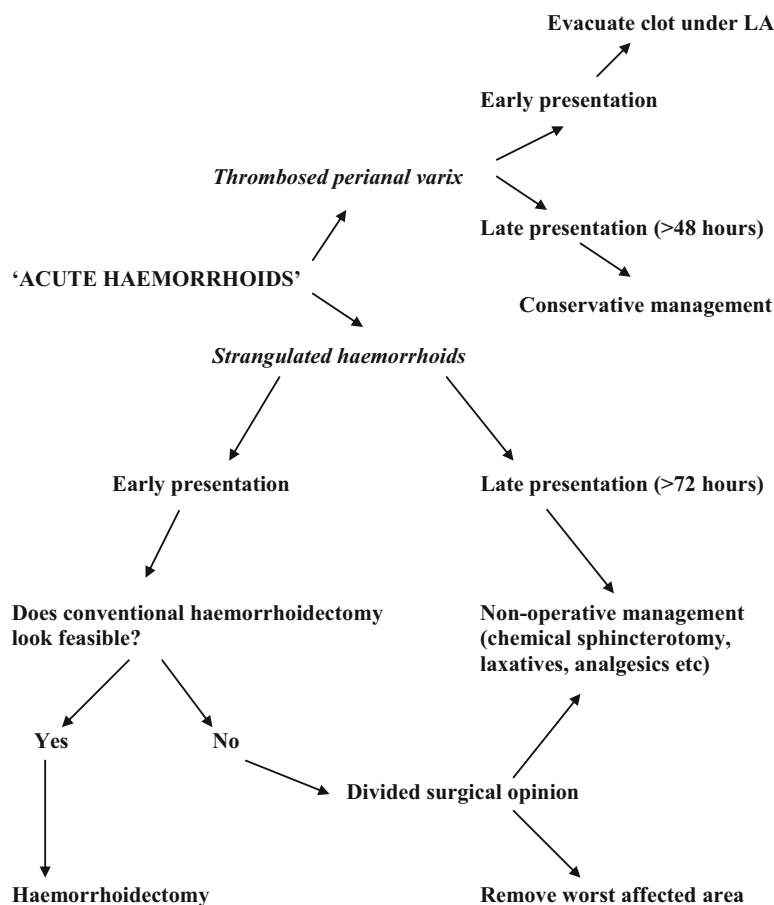
4 Conclusion

Management options for the acute presentation of hemorrhoids depend on the distinction between two discrete diagnoses: the thrombosed perianal varix and strangulated internal hemorrhoids. The timing of presentation is also important, as both conditions will tend to resolve spontaneously after a few days. A proposed algorithm for such treatment is given in Fig. 1. The thrombosed perianal varix can be treated with incision of the clot under local anesthetic or conservative treatment, depending on the duration and severity of symptoms. Evidence for various conservative therapies is limited, but topical Nifedipine in addition to traditional measures appears to offer significant symptomatic benefit.

Strangulated hemorrhoids have traditionally been treated conservatively. If surgical facilities or expertise are not available, overt gangrene and sepsis is absent, and the symptoms are resolving, this may be a reasonable strategy. The literature contains a number of series of acute surgical excision by Milligan Morgan or Ferguson hemorrhoidectomy. These show that fear of infection in the acute situation is unfounded, and complication rates are similar to those found in the elective setting. Immediate surgical treatment also prevents the social and economic consequences of a prolonged recovery during conservative treatment, and avoids the need for surgery at a later date. Once again, the timing of this surgery is important. The natural history of the condition is spontaneous resolution over days and weeks, and therefore the benefits of surgery lessen with the improvement of symptoms.

If a surgical excision is undertaken, a balance must be struck between removing too much tissue and risking a stenosis, and removing too little and risking recurrence. Those studies with a low recurrence rate had a higher incidence of anal stenosis. Heald's work may suggest that a more conservative approach to removing tissue is to be advocated (Heald and Gudgeon 1986). Stapled hemorrhoidopexy (PPH) may offer another surgical option, though the principles behind it fit more comfortably in an elective setting. Its use in the emergency situation is not common. In all surgical approaches, special care must be taken to avoid damaging the internal anal sphincter, which lies

Fig. 1 Suggested treatment algorithm for the acute management of hemorrhoids



just below the submucosa of the hemorrhoid pedicle.

Careful choices must be made in the management of any patient presenting with hemorrhoids in an outpatient setting. A classification system based solely on appearance may discourage a proper assessment of the resulting symptoms. Impressive looking hemorrhoids may give very few symptoms. Conversely, fairly trivial looking hemorrhoids may cause significant distress. It is the relief of symptoms which must guide the choice of treatment, rather than an attempt to correct the anatomy. Similarly, in the acute setting the clinical appearances are important, and a distinction must be made between the strangulated hemorrhoid and the thrombosed perianal varix. But it is the patient's symptoms, their severity and duration, and the resources available that should dictate whether a conservative or operative approach is adopted.

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Part III

Outpatient Treatments

Rubber Band Ligation, Sclerotherapy, Infrared Coagulation, and Other Techniques in the Treatment of Hemorrhoids

11

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Abstract

The treatment of hemorrhoids should focus on eliminating the patient's symptoms. If possible, hemorrhoidectomy should be avoided, to

prevent postoperative complications and fecal incontinence. In this sense, the noninvasive surgical treatment of hemorrhoids is becoming more important. Considering the high incidence of hemorrhoids (almost 5% of the world population), and that most of these non-invasive treatments can be performed in an outpatient setting, these treatments are becoming more common. The mechanism of action is the same in all of them: producing a scar at the

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base of the hemorrhoid, reducing the vascular supply, and fixing the hemorrhoid cushion to the upper part of the anal canal in order to reduce bleeding and prolapse. Multiple techniques are available: rubber band ligation, sclerotherapy, infrared coagulation, bipolar diathermy, laser coagulation, the Ultroid (Ultior Technologies, Tampa, FL, USA) approach, cryosurgery, and anal dilatation. These techniques are detailed in this chapter.

1 Introduction

In the healthy body, hemorrhoids contribute to continence by enhancing anal closure, and therefore treatment that includes the excision of hemorrhoidal tissue should be avoided or should be the treatment of last resort, because of the risk of secondary fecal incontinence. In addition, complications such as secondary bleeding, anal sphincter injury, and stenosis may occur after invasive surgery (Trompetto et al. 2015; Lohsiriwat 2015; Ganz 2013).

The treatment of hemorrhoids should focus on eliminating the symptoms and minimizing post-operative pain, complications, and recurrences. Against this background, noninvasive surgical treatments of hemorrhoids have shown great advances in recent years. Multiple techniques are now available. Rubber band ligation (RBL), sclerotherapy, and infrared coagulation are the most common, but other techniques are also employed: cryosurgery, bipolar diathermy, laser coagulation, the Ultroid (Ultior Technologies, Tampa, FL, USA) approach, and anal dilatation. As noted in recent reviews, each of the above

methodologies has its advocates, and there is no perfect technique. Randomized controlled trials have compared each method with some others, but there is no overarching study that has compared all the techniques with each other (MacRae and McLeod 1997; Seok-Gyu and Soung-Ho 2011; Serventi et al. 2011).

The mechanism of action is the same in all the techniques: producing a scar at the base of the hemorrhoid, reducing the vascular supply, and fixing the hemorrhoid cushion to the upper part of the anal canal.

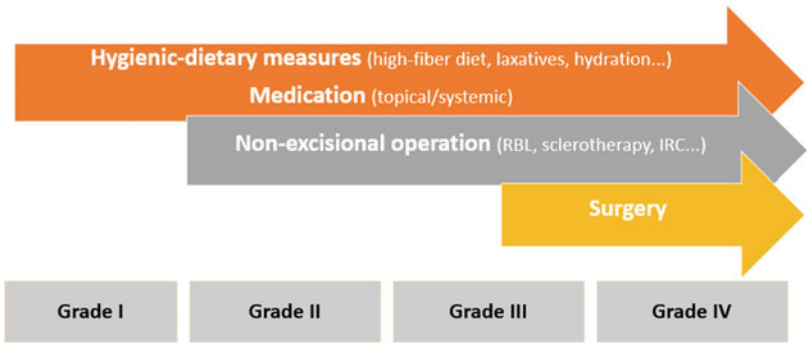
About 5% of the total population worldwide experience hemorrhoids at least once in their lifetime (Ganz 2013); accordingly, the noninvasive surgical treatment of hemorrhoids performed in an outpatient setting is becoming more common.

It has been widely demonstrated that grade I and II hemorrhoids respond to conservative management, with hygienic-dietary measures and medical treatment, but in some cases symptoms persist and noninvasive surgical treatments are required. A high percentage of grade III hemorrhoids also respond to these treatments, with only the most serious cases of grade III hemorrhoids, as well as those of grade IV, requiring surgical excision (Ganz 2013; MacRae and McLeod 1997; Cocorullo et al. 2017; Fig. 1).

2 Rubber Band Ligation

Blaisdel first described the rubber band ligation (RBL) of internal hemorrhoids in 1954. This technique was subsequently popularized by Barron in 1963 and is now among the most frequently

Fig. 1 Treatment recommended for each grade of hemorrhoidal disease



employed treatments for symptomatic internal hemorrhoids (Iyer et al. 2004).

RBL is a safe, effective, low-cost, and easy-to-use method that can be performed without anesthesia in the outpatient clinic. It has been recommended above other forms of therapy for the treatment of symptomatic internal hemorrhoids that are unresponsive to diet modifications and bulk-forming agents (Iyer et al. 2004).

The RBL procedure consists of positioning an elastic band above the dentate line to strangulate the hemorrhoids, leaving an area where an inflammatory process fixes the mucosa to the submucosal tissue, preventing the subsequent development of new hemorrhoidal tissue and alleviating the symptoms of bleeding and prolapse. Accordingly, this technique is more effective in patients with a mucosal prolapse component (Cocorullo et al. 2017; Iyer et al. 2004).

2.1 Indications and Contraindications of Rubber Band Ligation

The main indications for RBL are symptomatic and Grade II and III hemorrhoids. However, RBL can be used in selected Grade IV cases (such as in patients with high surgical risk because of comorbidity).

The RBL technique is also useful to treat non-excised internal hemorrhoids during hemorrhoidectomy, and it has also been employed to remove rectal polyps (Cocorullo et al. 2017).

The most frequent exclusion criteria for RBL (Iyer et al. 2004; Jacobs 2014) are:

1. First- and fourth-degree hemorrhoids (but this must be individualized in each patient).
2. Thrombosed hemorrhoids.
3. Anorectal pathologies (fissures, fistulas, and abscess).
4. Colitis.
5. Colorectal malignancies.
6. Pregnancy.
7. Coagulation disorders: unless it appears to be safe to stop antiplatelet and anticoagulant therapy before the procedure.

Before RBL is performed, it is important to inform all patients with external components, such as residual skin or skin tags, that these components will not be excised with this procedure. So when these are present and the patient wishes them to be dealt with, surgery is the only option (Jacobs 2014).

2.2 Rubber Band Ligation Application Technique

This procedure is performed with the patient in the Sims or modified knee chest position (Fig. 2), using a device that applies a rubber band to each hemorrhoid via a proctoscope. The procedure is easier if the proctoscope is slotted (Fig. 3).

The rubber band must be placed cranially from the dentate line to minimize the risk of severe pain. The ligation constricts the blood supply, causing ischemia 1–2 weeks later, and the scar is fixed to the rectal wall (Chaundhry and Abscarian 2016; Figs. 4 and 5).

In the original technique, Barron proposed treating only one cushion per session; however, many groups report different types of management, inserting two, three, or up to six bands per session, in order to reduce the number of patient visits (Trompetto et al. 2015; Cocorullo et al. 2017).

If multiple sessions are required, there is typically an interval of at least 4–6 weeks between sessions to allow sufficient healing to occur (Jacobs 2014).

No bowel preparation, other than simple enemas, is recommended, and the procedure is most often performed without sedation (Jacobs 2014).

Severe pain immediately after the procedure usually indicates placement of the rubber band too close to the dentate line, and if this occurs the rubber band is cut. To prevent vasovagal syncopal symptoms, patients are instructed to rest for a few minutes after the procedure before assuming the upright posture (Chaundhry and Abscarian 2016).

2.3 Complications

The reported overall complication rate ranges from 3% to 8% (Jacobs 2014).

Fig. 2 Patient positions for performing rubber band ligation. (a) Sims position. (b) Modified knee chest position

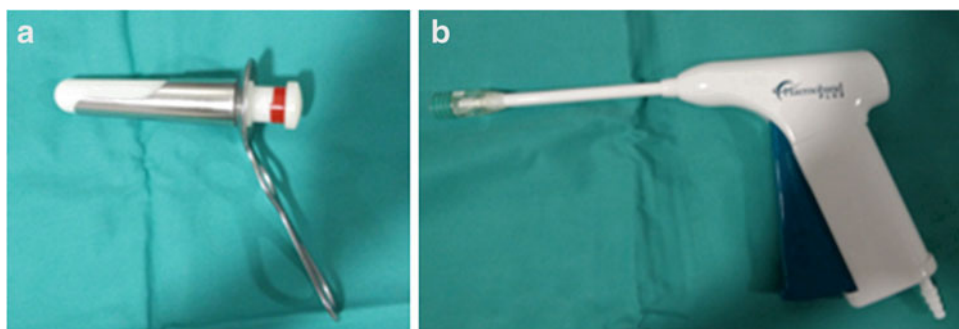
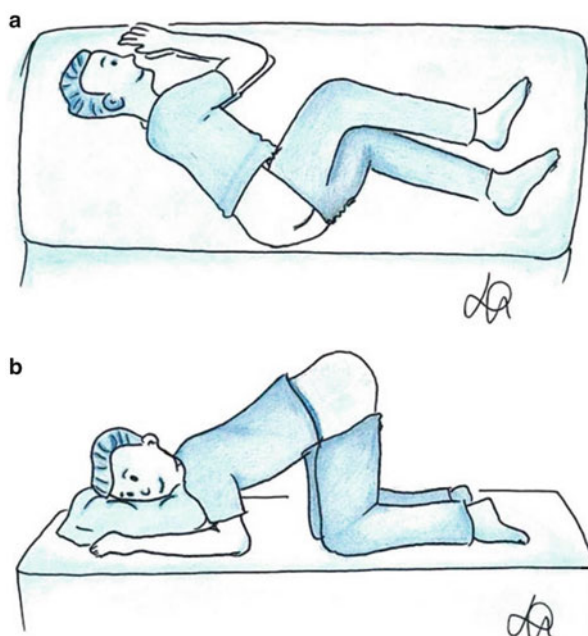


Fig. 3 Materials required for rubber band ligation. (a) Slotted proctoscope. (b) Hemorrhoid ligator or vacuum-assisted device

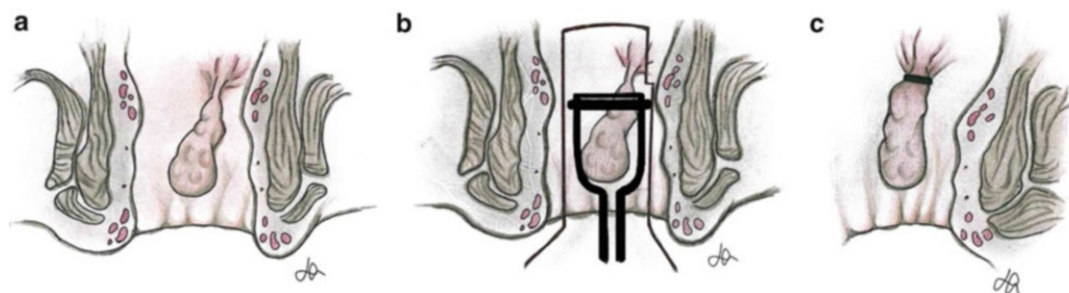


Fig. 4 Rubber band ligation procedure. (a) Internal hemorrhoid in the anorectal canal. (b) The ligating device is positioned over the base of the hemorrhoid and the rubber bands are released. (c) Band in place

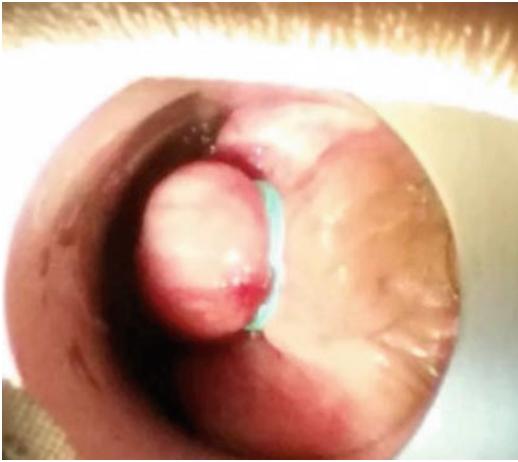


Fig. 5 Picture of ligated hemorrhoid. The constricting band remains in place until it eventually falls off

Complications of RBL reported in the literature (Trompetto et al. 2015; Seok-Gyu and Soung-Ho 2011; Iyer et al. 2004; Chaundhry and Abscarian 2016; Russell and Donohue 1985) are:

- Thrombosis of external hemorrhoids.
- Postband bleeding: this occurs in fewer than 1% of patients and appears 3–7 days after the banding. Very few patients require hospital admission. In many patients with bleeding hemostasis can be achieved with topical silver nitrate cautery. If the extent of the bleeding is more than a few drops and if it persists for a few hours, the patient must be examined and the source controlled with topical epinephrine, followed by cauterization or suture. There are few reported cases of life-threatening hemorrhage following RBL of hemorrhoids. Higher bleeding rates were encountered in patients on antiplatelet and anticoagulant treatments.
- Pain that develops within 24 h of the procedure is the most common complication and can be controlled by administering pain relievers.
- Urinary retention is very uncommon.
- Pelvic sepsis is a very rare (1: 15,000) but life-threatening complication. In the presence of pain plus urinary dysfunction, with or without toxic symptoms, expeditious evaluation and treatment of the patient must be performed to avoid a possibly fatal outcome. It is important

to perform an early examination under anesthesia, remove the band, and debride necrotic tissue; hospitalization must be instituted for the administration of intravenous antibiotics.

- Endocarditis.
- Liver abscesses.

2.4 Outcomes

The reported long-term success rate of RBL (with long-term defined as 6 months minimum) is approximately 90% in patients with grade II–III hemorrhoidal disease (Marques et al. 2006).

If more than four banding sessions are required for symptom control a conventional hemorrhoidectomy may be required (Cocorullo et al. 2017; Chaundhry and Abscarian 2016).

The incidence of postoperative pain ranges from 8% to 80% in different studies and the incidence of postoperative bleeding ranges from 3.5% to 50%. Overall, recurrence of bleeding and prolapse at follow-up occur in 10%–18% and 2.2% of patients, respectively. However, some series report higher percentages of recurrence (46% for bleeding and 34% for prolapse) (Cocorullo et al. 2017; Marques et al. 2006).

The results of many studies have confirmed the superiority of RBL over sclerotherapy, cryotherapy, and anal dilatation, and similar efficacy to infrared coagulation, with lower recurrence rates than either sclerotherapy or infrared coagulation (MacRae and McLeod 1997; Table 1).

Rubber band ligation has also compared favorably with hemorrhoidectomy in second- and third-degree hemorrhoids. Although RBL is less effective than surgery it has low rates of postoperative pain and complications and higher patient acceptability. That is why hemorrhoidectomy is now a treatment reserved for grade IV and refractory hemorrhoids (MacRae and McLeod 1997; Jacobs 2014; Hood and Alexander-Williams 1971; Templeton et al. 1983; Sim et al. 1981; Keighley et al. 1979; Murie et al. 1980; Kanellos et al. 2003).

A meta-analysis that included 18 randomized studies concluded that RBL should be recommended as first-line treatment for grade I

Table 1 Comparison of rubber band ligation (RBL), sclerotherapy, and infrared coagulation

Technique	Indications	Contraindications	Outcomes	Adverse events
Rubber band ligation	Grade III hemorrhoids if conservative treatment has failed	Hemorrhoidal thrombosis Other anorectal disorders Colitis Coagulopathy Pregnancy	Success rate: Bleeding: 90% Prolapse: Second-degree 93%–100% Third-degree 78%–83.8% Recurrence rates: Bleeding: 10%–18% Prolapse: 2.2%	Pain Bleeding Thrombosis Urinary retention Pelvic sepsis
Sclerotherapy	Grade I and II Hemorrhoids if conservative treatment has failed Hemorrhoids third-degree with new sclerosing agents (e.g., ALTA)	Hemorrhoidal thrombosis Other anorectal disorders Coagulopathy Pregnancy and lactation Inflammatory bowel disease Allergic asthma	Success rate: Bleeding: 69%–88% Prolapse: Second-degree 90%–100% Recurrence rate: Bleeding: 1.5%–29% Prolapse: 16%	Pain Bleeding Thrombosis Urinary retention Impotence Hematuria Hemospermia Epididymitis Urethral stricture
Infrared coagulation	Grade I and II Hemorrhoids if conservative treatment has failed	Hemorrhoidal thrombosis Other anorectal disorders Colitis Coagulopathy Pregnancy Renal, cardiac, and pulmonary diseases	Success rate: 62%–93% Recurrence rate: Bleeding: 13%	Pain Bleeding Thrombosis Urinary retention

and II hemorrhoids and grade III hemorrhoids that do not respond to diet or local preparations (MacRae and McLeod 1997).

3 Sclerotherapy

Sclerotherapy in the treatment of hemorrhoids began more than 200 years ago. In 1869, Molgan, in Dublin, reported the injection of iron persulfate as a painless method of treating hemorrhoids. In 1871, this injection technique was popularized in the United States, using a high concentration of phenol in olive oil, but

because this technique was used by non-expert personnel and because of the use of toxic agents, multiple complications were described, including death (Chaundhry and Abscarian 2016; Yang 2014).

In 1923, Morley, in England, described the technique of submucosal injection, using 5% phenol in almond oil, which is still in use today and is marketed by different pharmaceutical companies. Morley recommended reinjection at 2 or 3 weeks and using 2.5 ml of sclerosing agent for each hemorrhoidal cushion (Yang 2014; Akindiose et al. 2016).

Over the years, different sclerosing agents have been used: ethanalamine oleate, quinine

and urea hydrochlorides, sodium phosphate and sodium tetradecyl sulfate, and 50% dextrose solution, and all have proven efficacy. The use of aluminum potassium sulfate and tannic acid (ALTA), developed in Japan, has been widespread in recent years. The main advantage of this sclerosing agent is that it is effective in grade III hemorrhoids, as opposed to the injection of 5% phenol in almond oil (Miyamoto et al. 2016; Tomiki et al. 2015).

The principle of sclerotherapy is that the sclerosing agents lead to necrosis of the hemorrhoidal tissue, causing a scar that fixes the mucosa and submucosal layers to the muscular layer, avoiding prolapse.

3.1 Indications and Contraindications of Sclerotherapy

Sclerotherapy is indicated in grade I and II hemorrhoids with rectal bleeding that have not responded to conservative measures (Trompetto et al. 2015; Lohsiriwat 2015; Cocorullo et al. 2017). With the introduction of ALTA, the indication has been extended to grade III hemorrhoids and, in selected cases, to grade IV hemorrhoids (Yang 2014; Tomiki et al. 2015).

The contraindications for the use of sclerotherapy (Cocorullo et al. 2017; Yang 2014; Akindiose et al. 2016; Miyamoto et al. 2016; Tomiki et al. 2015) are:

- Inflammation in the perianal region, abscess, fissures, fistulas, external hemorrhoids, and other proctological conditions
- Hemorrhoidal thrombosis and acute hemorrhoidal prolapse
- Previous anal surgery and previous sclerotherapy are relative contraindications
- Cardiac, hepatic, renal, or hematologic diseases
- Pregnancy and lactation
- Allergic asthma
- Inflammatory bowel disease
- Coagulopathy

3.2 The Injection Method

Sclerotherapy is an easy and fast method that can be performed in the operating room or in the outpatient clinic, depending on the sclerosing agent used and the surgeon's experience. The injection can be performed under spinal or local anesthesia.

Usually the patient is placed in the Sims position, but other positions, such as the jackknife, left lateral, or lithotomy are also possible.

A lubricated anoscope is inserted. When the anoscope is gently removed, the hemorrhoidal cushion is located. The sclerosing agent is then injected into the submucosal layer, 2–3 mm proximal to the dentate line. Before injecting the agent, you should check you are not into a vessel, performing a little suction with the needle, to avoid introducing the drug into a vessel lumen. Next, the injection area must be massaged to disperse the drug. Injection distal to the dentate line must be avoided, to prevent pain and stenosis. In men, it is preferable to avoid injection on the anterior side, to avoid prostate problems (Yang 2014; Akindiose et al. 2016; Miyamoto et al. 2016) (Fig. 6).

The dose of the sclerosing agent depends on the agent used. In each session, not more than three cushions should be sclerosed, and the recommendation is to repeat the procedure every 2 or 3 weeks according to the patient's evolution (Yang 2014; Lim et al. 1995).

3.3 Complications

Complications are related to incorrect application. They are uncommon but can be very serious (Cocorullo et al. 2017; Akindiose et al. 2016; Miyamoto et al. 2016; Tomiki et al. 2015).

- Pain is the most frequent complication (12%–70%).
- Urinary retention.
- Abscess.
- Impotence, which is caused if the sclerosant is injected too deeply, affecting the parasympathetic nerves.

Fig. 6 Sclerotherapy technique

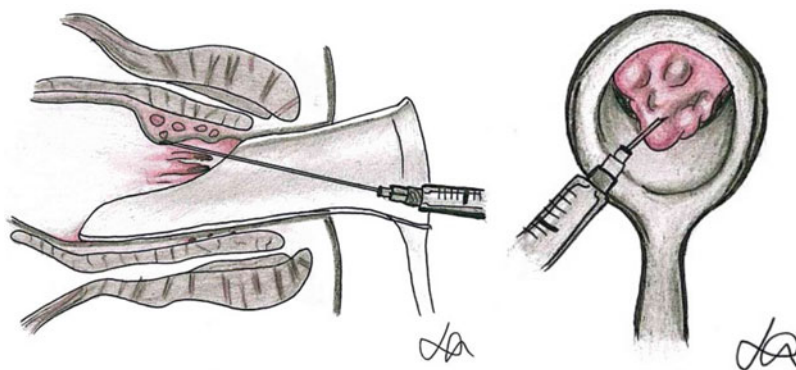
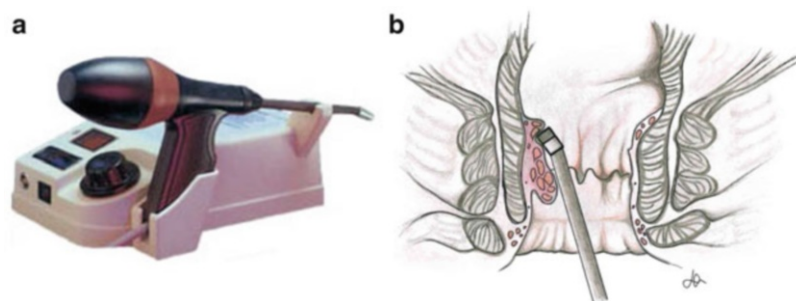


Fig. 7 Infrared coagulation of hemorrhoids. (a) Infrared coagulation device. (b) Transanaloscopic approach to hemorrhoid treatment using infrared coagulation



- Hematuria.
- Hematospermia.
- Epididymitis.
- Urethral stricture.
- Urinary perineal fistula.

3.4 Outcomes

Published series have shown good results. Reduction of bleeding has been reported in 100% of patients with grade I-III hemorrhoids, but complete resolution was achieved in only 69% (88% with grade I and 52% with grade III hemorrhoids). Prolapse resolution was also present in 90%–100% of cases. The rate of bleeding recurrence was around 29% and the prolapse recurrence rate was 16% (Cocorullo et al. 2017; Yang 2014; Miyamoto et al. 2016; Lim et al. 1995). Some groups, as Tomiki et al., recently reported the greater efficacy of ALTA compared with other sclerosing agents, especially in grade III hemorrhoids; however,

more clinical trials with longer follow-up are needed (Yang 2014; Tomiki et al. 2015).

4 Infrared Coagulation

Infrared coagulation (IRC), described by Neiger in 1979, is based on the controlled application of infrared energy (converted to heat) to hemorrhoidal tissue, causing tissue destruction, protein coagulation, and inflammation, events which lead to scarring and tissue fixation (Seok-Gyu and Soung-Ho 2011; Ahmad et al. 2013; Gupta 2007).

Three to four pulses of infrared energy are applied to the mucosa proximal to the hemorrhoidal tissue, not to the hemorrhoid itself. A tungsten-halogen lamp is used through an anoscope (Fig. 7).

One or two hemorrhoids are treated per session, with repeated sessions as needed every 2–4 weeks.

Infrared coagulation is indicated in grade I-II hemorrhoids when conservative treatment has

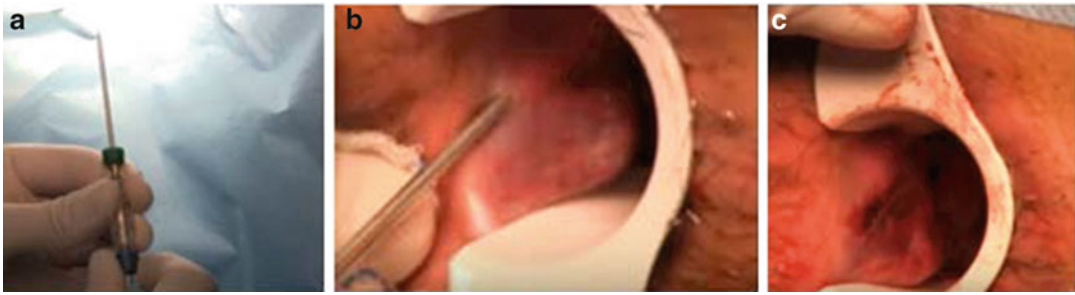


Fig. 8 Laser coagulation of hemorrhoids. (a) Laser probe. (b) Laser sclerotherapy of hemorrhoids. (c) Final result of laser hemorrhoid coagulation

failed, and in selected cases of grade III hemorrhoids.

The results, in terms of resolution of bleeding and prolapse, are similar to those for RBL (improvement in 81–93% of patients) (Marques et al. 2006; Templeton et al. 1983). However, several studies have demonstrated a higher recurrence rate, especially in grade III hemorrhoids, and the need for more retreatments than for RBL. In addition, the cost of the equipment is higher than that for RBL, so this method is used less often (Trompetto et al. 2015; Lohsiriwat 2015; Serventi et al. 2011; Cocorullo et al. 2017).

5 Bipolar Diathermy and Heater Probe Coagulation

Heater probe and bipolar diathermy devices generate heat, causing coagulation of the hemorrhoidal tissue, resulting in a fibrotic reaction at the treatment site, with fixation of the treated tissue. These methods are indicated for grade I–III hemorrhoids after failure of conservative measures (Trompetto et al. 2015; Lohsiriwat 2015; Hinton and Morris 1990).

Success rates range from 88% to 100%. The two technologies provided similar efficacy for the treatment of bleeding, with a recurrence rate of 6.2% per year, but the heater probe controlled bleeding more quickly (76.5 vs. 120.5 days), although it caused more pain. However, the results regarding the alleviation of prolapse are poor for these two technologies

(Hinton and Morris 1990; Dennison et al. 1990; Zinberg et al. 1989).

Complications include pain, bleeding, fissure, or spasm of the internal sphincter. Compared with RBL, these technologies require more treatment sessions and have more treatment failures (Trompetto et al. 2015; MacRae and McLeod 1997; Serventi et al. 2011).

6 Laser Coagulation

CO₂ or Nd-YAG and diode lasers have been used to treat hemorrhoids. The laser beam is applied to the submucosal layer and causes shrinkage and degeneration of hemorrhoidal tissue at different depths, depending on the laser power (irradiance) and the duration of laser light application (Fig. 8).

The Nd-YAG laser has an output of 10–20 W. It uses a 0.2- to 0.4-mm probe for excision and a 0.4- to 0.6-mm probe for coagulation. The advantages of this method are minimal bleeding during the procedure, less pain after the procedure, and short treatment time (Yang 2014; Akindiose et al. 2016; Crea et al. 2014).

The use of the diode laser in the treatment of hemorrhoids was first described in 2007. It has a low penetration depth (up to 2 mm); therefore it can be applied in submucosal tissue without causing anal sphincter injury. However, reports in the literature are limited and the role of the diode laser is not well established (Crea et al. 2014; Naderan et al. 2016; Jahanshahi et al. 2012; Giamundo et al. 2011).

7 Ultroid (Direct Current Probe)

The direct current probe (Ultroid; Ulterior Technologies, Tampa, FL, USA) is a disposable device that uses low-voltage monopolar current and generates sodium hydroxide on its negative electrode, producing coagulation of hemorrhoidal tissue. Unlike other techniques, it does not produce tissue destruction by heat.

Treatment of hemorrhoids using Ultroid technology is limited by the long time required to treat the involved tissue (up to 14 min per site), post-procedural pain (in up to 20% of patients), and poor results in correcting prolapse (Zinberg et al. 1989; Azizi et al. 2010; Randall et al. 1994).

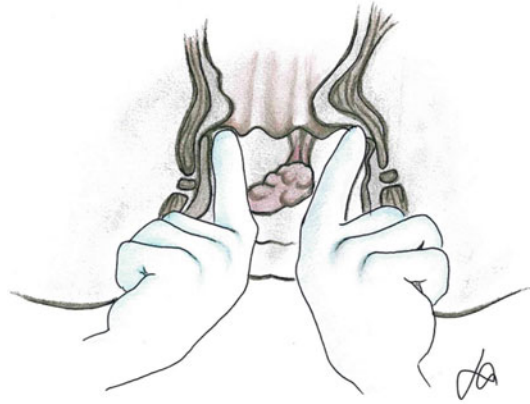


Fig. 9 Lord's procedure for the treatment of hemorrhoids

8 Cryosurgery

Cryosurgery was popularized in the 1970s to 1980s, although currently it is in disuse. Liquid nitrogen is applied into the hemorrhoidal tissue, causing a necrotizing effect, with a permanent result. The main disadvantage is the long time required for each session; also, the technique can cause secondary bleeding (Trompetto et al. 2015; Tanaka 1989; Tajana et al. 1995).

9 Anal Dilatation (Lord's Procedure)

Anal dilatation, which is the digital stretching of the anus to decrease sphincteric pressure, is performed after spinal or general anesthesia. The surgeon gently and softly dilates the fibrotic band of the internal sphincter by using both index fingers. It is essential to dilate the sphincter gently and not excessively. The technique is especially useful for acute incarcerated hemorrhoids (Lord 1989; Fig. 9).

Lord's procedure initially showed some promise for hemorrhoids and anal fissures; however, some patients had postoperative incontinence, and response rates were lower than those with other techniques (Anscombe et al. 1974). The American Society of Colon and Rectal Surgeons recommends that this procedure be abandoned.

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Why and When I Do Prefer the Outpatient Treatments for Hemorrhoids

12

Steven R. Brown

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Abstract

The perfect outpatient treatment must meet several criteria including appropriateness, broad tolerance, minimal side effects and inconvenience, and a high and long-lasting efficacy. Of the various outpatient therapies, rubber band ligation and injection

sclerotherapy are the two most commonly utilized. However, selection and individualization according to patient choice and degree of hemorrhoidal disease along with simple refinement of technique is essential if optimal results are to be obtained. Outpatient therapy should also be a package of care that includes careful counseling as to risks and benefits and alternative options as well as lifestyle advice. In addition, there are some patients such as the immunocompromised, the pregnant, and the cirrhotic, where some therapies may be inappropriate.

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1 Introduction

When considering “outpatient” therapies, it is important to define exactly what “outpatient” therapy is. The literature is strewn with descriptions of procedures that are classified as outpatient procedures when they are essentially day case or ambulatory operations. Indeed, it appears possible to carry out almost any hemorrhoidal intervention (including invasive procedures) in an “outpatient” setting (Zafar et al. 2009; Lohsiriwat and Lohsiriwat 2003; Johnson et al. 2003). This chapter concentrates only on interventions that can be carried out without the necessary need for an operating theater setup or any general or regional anesthesia.

The optimum “outpatient” therapy would have the following criteria. It should be appropriate for a significant proportion of patients. There is no point in a procedure that can only be used in exceptional circumstances. As anesthesia is not routinely required, the procedure should be easily tolerated. Side effects should be low. There should be minimal inconvenience, meaning a quick procedure, rapid recovery, reduced need for repeat procedures, as well as a high and long-lasting efficacy.

The main procedures that are true outpatient procedures include rubber band ligation, injection sclerotherapy, infrared coagulation therapy, and bipolar and direct current therapy. Each of these treatments has its proponents. Although it is appropriate to discuss the evidence base for each, such an approach is difficult as the literature is often of very low quality. Many papers are full of bold statements such as “painless,” “easy,” “well tolerated,” “remarkably effective,” and “complication free” with clear bias and little robust evidence to support these claims. Even the higher quality literature has significant drawbacks, not least the definition of recurrence (Tiernan et al. 2013). In addition, many “higher quality trials” have compared one treatment with another and never all options together.

2 Rubber Band Ligation

Conventional RBL uses a device that allows a rubber band to be applied to each hemorrhoid via a proctoscope utilizing usually a suction device or a

forceps ligator. This rubber band constricts the blood supply causing it to become ischemic before being sloughed approximately 1–2 weeks later. The resultant fibrosis reduces any element of hemorrhoidal prolapse that may have been present. It is a very commonly performed procedure in the UK and throughout the world (Hospital Episode Statistics – Hospital Outpatient Activity 2013). Extrapolation from our own hospital data suggests over 1000 procedures are carried out per 500,000 population per year. Although easy to perform and there is a short learning curve, care has to be taken to place the bands correctly to reduce the potential for severe pain.

There are substantial data in the literature concerning efficacy and safety of RBL, including comparisons with other interventions (Brown et al. 2016a). Recurrence is estimated from 11% to over 50%. The broad range probably reflects the definition of recurrence (patient symptoms or clinical appearance), the grade of hemorrhoids treated (grade I no prolapse; grade II spontaneously reducible prolapse; grade III prolapse requiring manual reduction; and grade IV unreducible prolapse), the number of treatments and/or the intensity, and length of follow-up. However, most series indicate a recurrence rate of greater than 30% with recurrence most likely for grade III hemorrhoids. Short-lived pain (a few hours) is common following RBL. Occasionally (less than 1%), severe pain necessitates admission to hospital. Other complications include bleeding (3–4%, sometimes necessitating further treatment) and vaso-vagal symptoms (3%). There have also been rare incidences of the need for blood transfusion and severe pelvic sepsis with a few instances leading to death (Brown et al. 2016a). Recurrences can be treated by rebanding or by surgical intervention.

The procedure meets several criteria for the optimum outpatient therapy. It is certainly cheap, quick, and easy to carry out. The procedure appears very safe. Efficacy may not be as high as some operative interventions but improves with repeat procedures (Watson et al. 2006). Pain is common but often short lived. Local anesthetic injection can reduce this discomfort (Kwok et al. 2013). If used it makes sense to inject the

anesthetic into the rectal side of the band rather than the ischemic tissue distal to the band.

3 Injection Sclerotherapy

Various sclerosant solutions have been used for injecting piles. There is no evidence as to which is more effective, but less potent solutions (such as 5% phenol in almond oil) have a lesser risk of mucosal necrosis. Injection treatment is simple, safe, and rapid, but not as effective as RBL in treating prolapse (Mann 2002). It should probably be reserved for patients where bleeding is the main symptom and conservative therapy (diet etc.) has not improved the symptoms (other causes having been excluded). For optimal effect, each hemorrhoid should be visualized and isolated in the end of the proctoscope and the needle introduced close to the origin of the hemorrhoid well above the dentate line. It is useful to advance the needle in the submucosal plane for a short distance and then carefully inject. Blanching of the mucosa probably indicates too superficial an injection. Any pain should result in immediate cessation of the procedure as the injection may be too deep.

Complications include bleeding (either immediate or secondary), pain (this can be localized or rarely liver pain due to porto-systemic injection), or prostatic symptoms if the injection is placed too deeply. Injection of the prostate can result in urinary retention (often resolving spontaneously), epididymitis, prostatitis (presenting as pain in ejaculation and hemospermia), and even prostatic abscess (Mann 2002).

4 Infrared Coagulation

Infrared coagulation consists of a direct application of infrared waves resulting in necrosis of the protein within the hemorrhoids. The procedure is certainly quick. Although several applications are required per hemorrhoidal column, each takes only a matter of seconds. Complications and efficacy are similar to RBL with some suggesting less pain presumably related to a lesser degree of tissue necrosis (Poeh et al. 2000; Ambrose et al. 1983;

Templeton et al. 1983; Marques et al. 2006). As such it is a viable alternative to RBL. However, the apparatus is expensive and there is a learning curve, particularly as poor technique may lead to burn out of the detachable tips of the instrument.

5 Other Therapies

5.1 Bipolar, Direct Current, and Radiofrequency Ablation Therapy

Bipolar diathermy is applied in 1-s pulses of 20 W until the underlying tissue coagulates (often <30 s) (Madoff et al. 2004). Multiple applications to the same site are often required. Complications including pain, bleeding, and fissuring occur in around 10% of patients.

Direct current therapy has gained favor recently, particularly in the USA (Ultroid therapy). Other than aggressive marketing, it is difficult to understand why. The procedure involves application of a probe onto the hemorrhoidal cushion and application of a low direct current for around 10 min per hemorrhoidal column. Results are at best equivalent to injection sclerotherapy (Varma et al. 1991) and RBL but with the procedure taking up to 15 times longer.

Radiofrequency ablation has been described which cuts and coagulates hemorrhoidal tissue using less power (and hence less temperature) than other electrical equipment. A comparison with RBL suggested similar efficacy to RBL with less pain (Gupta 2005). Again equipment is expensive and the procedure has not gained universal favor.

5.2 Combination Therapy

Numerous combinations of therapies have been described and include rubber band ligation with injection sclerotherapy (Chew et al. 2003) or infrared coagulation (Accarpio et al. 2002).

Again the literature is of poor quality. Indeed the combination of rubber band ligation with coagulation involved the patient initially undergoing

injection sclerotherapy followed by the combined treatment 15 days later and every 15 days until relief of symptoms. Definition of success was not described. Such an intense therapy negates the underlying principles of an optimal outpatient procedure particularly as the efficacy remains questionable. Nevertheless, the combination of RBL with injection sclerotherapy does make practical sense. Not only is the double therapy a “belt and braces” approach but the bolus of sclerosant below the band ligation may act to secure the band, reducing failure due to early slippage of the band.

6 Drug Therapy

The main goal of medical treatment is to control acute symptoms rather than treat the underlying cause. Several formats exist, including both oral and locally applied medications. However, the published literature lacks any evidence in efficacy for most. Flavonoids, in the new formulation of micronized purified flavonoid fraction (MPFF), are an exception and have been recommended for control of acute bleeding (Misra and Imlitemsu 2005). MPFF increases vascular tone, reduce venous capacity, decrease capillary permeability, facilitate lymphatic drainage, and have anti-inflammatory effects. A large meta-analysis showed that phlebotonics had significant beneficial effects on bleeding, pruritus, discharge, and overall symptom improvement (Cerera et al. 2012).

7 Lifestyle

A meta-analysis of seven clinical trials comprising of 378 patients with hemorrhoids showed that fiber supplement had a consistent benefit of relieving symptom and minimizing risk of bleeding by approximately 50% (Alonso-Coello et al. 2005). Although there is relatively little information of the efficacy of dietary and lifestyle modification on the treatment of hemorrhoids, many physicians include advice on dietary and lifestyle modification as a part of conservative treatment of hemorrhoids and as a preventive measure. The advice usually includes increasing the intake of dietary fiber and

oral fluid, having regular exercise, refraining from straining and reading on the toilet, and avoiding drug causing constipation or diarrhea.

8 Systematic Reviews of the Literature

There are two meta-analyses, both written in the 1990s (Johanson and Rimm 1992; MacRae and McLeod 1997). One suggests infrared coagulation is the outpatient treatment of choice while the other more extensive article concludes that RBL is the most efficacious although notes the association with more pain. As previously mentioned, both contain evidence which is of poor quality.

9 When Do I Prefer Outpatient Treatment and What Treatment?

The title of this article allows an element of licence to give my own personal opinion. As already indicated the evidence base is weak but, nevertheless some conclusions can be drawn. Informed patient choice is key. Options should be given to the patient based on the quality evidence available as well as the facilities and expertise available locally.

There is little doubt that advanced disease will not respond to outpatient therapy as well as early disease. Hence outpatient therapy should be reserved for the patient who presents with less severe symptoms. Simple and intermittent bleeding or minimal symptoms only (grade I or early grade II piles) require exclusion of alternative and more sinister causes along with reassurance and advice on lifestyle. A high fiber diet and avoidance of straining are essential components to this advice (Alonso-Coello et al. 2005). The prescription of microionized flavinoids should be considered.

More symptomatic disease (grade II or mild grade III hemorrhoids) may be appropriate for outpatient treatment. Of course, more aggressive intervention is probably more effective in treating

such a level of disease but at the price of more patient inconvenience (wait for surgery, need for anesthetic, potential increased harm). Conversely, outpatient therapy may require more than one visit to achieve a satisfactory outcome.

Of the outpatient therapies that are available, RBL seems to meet most of the criteria for optimal outpatient treatment and is my preferred therapy. The available evidence also suggests that RBL is the most effective of the outpatient therapies (although infra-red coagulation has a similar efficacy profile). I would not personally combine RBL with local anesthetic or injection sclerotherapy, but there is some evidence to suggest these are acceptable additions.

Banding would be preceded by informed consent, explaining the potential for pain, vasovagal episodes, and a risk of bleeding after the band falls off as well as an explanation that further banding may be required. Preferably, this consent is done before the patient comes to clinic and often helps to reduce the impact of any complication if it should occur (Hardwick and Durdey 1994). Any consent process should include mention of alternative therapies including those requiring operative intervention. The most obvious minimally invasive operative option is hemorrhoidal artery ligation (HAL). There is good evidence to suggest that this technique is more effective than a single RBL but just as effective as a “course” of RBL (two banding episodes) (Brown et al. 2016b). It should be made clear to the patient that they could have a single HAL which requires an anesthetic and is initially more painful, or two RBL sessions as an outpatient, with the same outcome.

If RBL is carried out, each band is carefully placed well above the dentate line with the procedure abandoned after one band if there was any significant discomfort. Although Barron originally advocated ligation of a single hemorrhoidal column at a time, inviting the patient back for further banding at 3 weekly intervals, it is more convenient and economically prudent to band up to three columns at one time. Khubchandani has shown that there is no significant increase in discomfort with up to three separate hemorrhoids (Khubchandani 1983).

Some advocate the application of two bands for each hemorrhoid to avoid slippage. With the current suction banding device, I have not found this necessary.

An optional follow-up appointment would be offered 6 weeks later for rebanding if there has been a partial improvement, or alternative procedures (such as HAL) if no effect.

There are some exceptions to this management approach.

- If the patient is on an anticoagulant, the risk of bleeding is substantially increased as the pile sloughs off and an ulcer ensues 7–10 days later. There seems little point in stopping the anticoagulant, banding, and then reintroducing anticoagulation unless the medication is stopped for 7–10 days before and after the intervention. The risky period is at this 7–10 day point. Instead, I favor injection sclerotherapy as a procedure less likely to cause ulceration and potential for bleeding.
- A patient who is clearly symptomatic from anal skin tags will not improve after outpatient therapy but RBL could be combined with local anaesthetic removal of the tags.
- In an immunocompromised patient, the risks may be too high. Antibiotic prophylaxis may be required and, given the risks, I prefer to do any intervention (if truly required) in an inpatient environment. Injection sclerotherapy may be safer than RBL (Scaglia et al. 2001; Buchmann and Seefeld 1989).
- Hemorrhoids in pregnancy should be treated with lifestyle advice and avoidance of any intervention unless very severe. Often the problem resolves after childbirth. There is some evidence for Rutosides as an effective therapy (Quijano and Abalos 2005), but further research is required into their safety profile.
- Hemorrhoids in advanced cirrhosis should be distinguished from rectal varices. In either case, I would avoid RBL due to the risk of profound secondary bleeding following the procedure. Injection sclerotherapy is an effective and safe procedure for treating bleeding hemorrhoids in this situation. In a refractory case, suture ligation is appropriate.

10 Conclusion

Outpatient treatment should form a significant part of the armamentarium for the treatment of hemorrhoidal disease. Exactly what intervention should be used and on what type of patient is not absolutely clear although a personal view based on the current evidence is presented. Even with the current literature, it is clear that tailoring of treatment to both patient requirements and the degree of clinical findings is essential for optimal outcome. Evidence of this is available for more severe hemorrhoidal disease (Simillis et al. 2015) and should become available in the near future for all grades of hemorrhoids with the development of a network meta-analysis approach.

11 Cross-References

- Literature Review on Outpatient Treatments for Hemorrhoids
- Main Disadvantages of Outpatient Treatments for Hemorrhoids
- Pros and Contras of Outpatient Treatments for Hemorrhoids
- Rubber Band Ligation, Sclerotherapy, Infrared Coagulation, and Other Techniques in the Treatment of Hemorrhoids
- Technical Tips and Tricks of Outpatient Treatments for Hemorrhoids

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Technical Tips and Tricks of Outpatient Treatments for Hemorrhoids

13

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Abstract

Hemorrhoids are a common condition affecting the anorectum. The clinician must accurately diagnose the condition and exclude more sinister causes responsible for the same symptoms. A focused history and thorough examination help in establishing a differential diagnosis. The treatment modality is guided by the degree of the hemorrhoids. Conservative measures should be employed, including dietary advice and toileting techniques, to treat acute inflammation and as a long-term method of reducing symptom recurrence and worsening disease. A wide range of out-patient therapies are available and all have been shown to be effective in experienced hands and when used in the correct clinical context. Here we present an approach to out-patient treatment

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methods including conservative treatments, medical therapies, and simple interventions.

1 Introduction

Hemorrhoids, or “pathological anal cushions,” are a condition of historical significance (Parks 1955; Loder et al. 1994; Warusavitarne and Phillips 2007). They are not only one of the commonest pathologies of the anorectum, but also a blanket layman’s term used to generalize an array of symptoms including rectal bleeding, pain, and a lump at the anus (Mounsey et al. 2011). The clinician must accurately diagnose the condition while being able to confidently exclude more sinister causes responsible for the same symptoms. A focused history and thorough examination help in differentiating hemorrhoids from other anal conditions with similar symptoms and in grading the severity, which will guide the treatment modality (Mounsey et al. 2011; Lohsiriwat 2015). The decision as to which patients require further evaluation to exclude a left sided colorectal cancer or inflammatory bowel disease is an essential part of managing hemorrhoids (Robertson et al. 2006). Treatment of hemorrhoids has evolved from open surgery to noninvasive techniques although the principle of treatment has remained relatively constant since its description in ancient times. The treatment modality is guided by the degree of the hemorrhoids as first described by Goligher (1980) that is mainly based on their anatomical displacement. The armamentarium ranges from techniques that can be performed at the outpatient clinic without anesthesia to procedures done in an operating theater under general anesthesia. This chapter will focus on the technical details of accurate assessment and treatment options available for hemorrhoids in the outpatient setting.

2 Outpatient Setting

2.1 History

The commonest presentation of hemorrhoids is rectal bleeding (Lohsiriwat 2012). Characteristic hemorroidal bleeding is painless, fresh, and

drips in the pan. It is prudent to assume that rectal bleeding is due to an underlying malignancy until proven otherwise, especially in elderly patients. Although the classical history describes dripping of blood, patients may describe blood streaks in the stool or blood seen on the paper on wiping. There can be associated pain with prolapsed hemorrhoids or with coexisting fissures, which are a common occurrence. At more advanced stages, hemorrhoids can present as a lump appearing at the anus. The lump may return without effort or may remain outside until the patient manually reduces it with a finger. In the most severe form, the hemorrhoidal mass may remain outside of the anus as a result of swelling or thrombosis. This is a painful condition which can warrant in-patient treatment. For practical purposes, the hemorrhoids can be classified according to the Goligher’s classification (Clinical Practice Committee, American Gastroenterological Association 2004) based on their degree of prolapse (Table 1).

It is important to inquire about “red flag” symptoms such as altered bowel habits, loss of weight, or associated abdominal pain in order to exclude an underlying neoplasm or an inflammatory cause. Recent onset erratic bowel movements should raise the possibility of a rectal polyp or a

Table 1 Hemorrhoids classification according to Goligher (1980)

Grade of hemorrhoids	Description
1. First-degree hemorrhoids (grade I)	Hemorrhoids bleed but do not prolapse
2. Second-degree hemorrhoids (grade II)	Hemorrhoids prolapse through the anus on straining but reduce spontaneously
3. Third-degree hemorrhoids (grade III)	Hemorrhoids prolapse through the anus on straining or exertion and require manual replacement into the anal canal
4. Fourth-degree hemorrhoids (grade IV)	Prolapsed hemorrhoids which are irreducible. Acutely thrombosed, incarcerated internal hemorrhoids; or incarcerated, thrombosed hemorrhoids involving circumferential rectal mucosal prolapse

malignancy. Long standing episodic, repetitive periods of alterations in stool frequency and consistency may indicate an inflammatory bowel disease such as ulcerative colitis or colonic Crohn's disease. These symptoms should prompt an urgent referral for luminal assessment of the right colon via colonoscopy. Further assessment may also be required if a strong family history of colorectal malignancy is present (Cairns et al. 2010).

Details of patient's regular bowel movements and continence status are also important in making the diagnosis as well as the treatment plan. Episodes of constipation may precipitate acute hemorrhoidal bleeding although it is not a prerequisite (Walker et al. 1969; Johanson and Sonnenberg 1994; Cairns et al. 2010). Excessive straining and spending a long time sitting on the toilet could also precipitate prolapse of hemorrhoids. It is important to inquire about dietary habits in order to assess for adequate intake of fiber. This could precipitate less bulky stools resulting in straining and longer stays in the toilet. Similarly, an acute episode of diarrhea can also precipitate hemorrhoids. Preexisting incontinence should be evaluated fully as symptoms could be worsened by hemorrhoidectomy, due to loss of the anal cushions (Lindsey et al. 2004; Li et al. 2012). Medical conditions such as congestive cardiac failure and decompensated cirrhosis may result in rectal varices which present with similar symptoms. The high pressure in the venous circulation not only predispose to the development of hemorrhoids it can also make the bleeding more profuse. Deranged clotting function can add to the severity of bleeding in patients with decompensated cirrhosis. History of anticoagulation medication such as warfarin should also be evaluated as hemorrhoidal bleeding under these circumstances can cause significant blood loss within a short time period. It is important to assess symptoms of anemia in those with a history of long standing hemorrhoidal bleeding or acute severe bleeds. Dyspnea on exertion and ischemic type chest pain can occur due to anemia. Preexisting ischemic cardiac disease may be worsened by anemia (Johanson and Sonnenberg 1994; Loder et al. 1994; Clinical Practice Committee, American

Gastroenterological Association 2004; Pigot et al. 2005; Lohsiriwat 2012).

2.2 Examination

In January 1828, Mr Frederick Salmon, founder of St Mark's Hospital, highlighted that many anorectal pathologies can be simply diagnosed and treated as a result of careful and accurate rectal examination (Dukes 1959).

Examination should begin by assessing the patient's general condition. Patients with anemia may be dyspneic and have pallor in the sclera, tongue, and palms. A standard abdominal examination should be performed in order to assess for tenderness and palpable masses that could indicate additional or alternative disease processes.

Perineal examination should be performed on the examination couch. Care must be taken to explain all aspects of the examination to the patient and receive the appropriate consent. Although a rectal examination is routine practice for a physician, it is definitely not routine for most patients. A chaperone should always be used to provide legal protection, reassure the patient, and assist procedures for the physician (Jadoon et al. 2009). The choice of appropriate examination position depends on the physician's preference and training, the available equipment, and the general health of the patient and of the patient (Walker et al. 1969).

Most commonly, rectal examination is performed in the left lateral (Sim's) position in the out-patient setting. Patients should be instructed to remove the minimal clothing to allow this and lie on their left side with the lower back and buttocks at the edge of the couch. A modesty blanket should cover all but the perianal area. Hips should be flexed to form a 90° angle with the trunk; knees should also be flexed together to 90° to maintain the lower legs in parallel with the trunk. Examination can then be performed with the clinician in a standing or seated position. This position is usually adequate for patients in any state of health and allows for minimal discomfort or embarrassment to the patient.

Alternatively the gynecubital position can be used. In this case the patient kneels on the couch giving to clinician good visibility for external inspection and a reasonable position for examination and treatment with proctoscopy and/or rigid sigmoidoscopy. This position can be more uncomfortable for the patient, may be quite embarrassing, and is not ideal for elderly patients or those with lower limb joint abnormality/disease.

Rarely a similar position to this is recreated without leg support by simply asking the patient to lie on the couch, with the legs widened allowing the physician to examine the anal area from the above. This has many limitations including poor ability to inspect the area and a difficult angle for the introduction of proctologic instruments meaning most therapeutic interventions cannot be offered.

The ideal positions for rectal examination are the lithotomy (gynecological) or genupectoral positions. These however require a specialist examination couch which is not available in all out-patient departments. The lithotomy position requires the patient to lie on their back with legs supported by stirrups, while the genupectoral position has the patient lying on their front with the knees supported at a lower level. Both positions provide a 90° angle to examine the rectum while maintaining patient comfort via the specifically designed supports. Again both positions can be embarrassing for the patient.

Once the patient is in position a careful inspection of the perineal area must be performed in order to exclude other external abnormalities and to give an accurate diagnosis. The perineal region should be brightly illuminated. Sometimes a Clar mirror (headlight) is preferred to other more common external light sources. Following this, a digital rectal examination (DRE) is performed (Shirley and Brewster 2011) to palpate for any rectal mass, internal hemorrhoids, or other abnormality. A large dose of Lidocaine gel or similar is recommended to avoid patient discomfort and to reduce pain during the examination or treatment. This should be applied all around the anal canal with a smooth well fitted disposable glove. A poorly fitting or loose glove can reduce the

accuracy of examination. The DRE should be long enough to allow the physician to complete an optimal examination as anal tone will relax slightly over time to facilitate the procedure.

Following this, rigid sigmoidoscopy should be performed (Nyberg 2007), as it is important to exclude other sources of rectal bleeding. Proctoscopy will then allow for identification and grading of hemorrhoids. The proctoscope should be easy to maneuver and sized appropriately for the patient. It should be wide enough to allow for adequate visualization but small enough to avoid patient discomfort. Nonilluminated proctoscopes require an external light source particularly in certain positions, for example, the Sim's (left lateral) position. This can be difficult as the light lead can prevent rotation of the scope and appropriated angling of the lead should be considered prior to performing intervention. Self-illuminated proctoscopes avoid this issue and provide an optimal examination at a similar cost (THD Light-Scope Ano, THD UK Ltd, Worcester, UK). Depending on the intervention required, an open-ended or closed-ended proctoscope could be used. The closed-ended device is ideal for visualization of the anal canal and total hemorrhoidal disease load however may not provide a good angle to provide therapeutic intervention. An open-ended proctoscopy can better visualize a single pedicle and allow for accurate intervention such as banding or injection.

3 Outpatient Management of Hemorrhoids

3.1 Conservative Management

Although conservative measures are the most common type of treatment employed for hemorrhoids, they are still not well evaluated in the scientific literature and there has been minimal recent innovation from older well established techniques (Clinical Practice Committee, American Gastroenterological Association 2004; Lohsiriwat 2015). There is a wide range of expert opinion; however, it is commonly thought that correctly applied conservative management can,

in most of the cases, prevent long-term symptoms, especially when treating lower grade hemorrhoids (I° and II°). Common and recognized conservative treatments are local hygiene, physical activity and lifestyle, diet, and regulation of bowel habit.

Other methods of cleansing, particularly in the setting of acutely inflamed hemorrhoids, include salt baths. Baths should be recommended two or three times per daily, with warm water in order to reduce swelling, itchiness, and minor pain. The exact mechanism of action is unknown; however, it is probably related to sphincter muscle relaxation. After a salt bath patients should dry properly with a soft cotton towel without scrubbing that could cause pain and discomfort. An alternative to salt baths are soothing wipes although care should be taken as some wipes contain soap and chemicals that can irritate the skin particularly if used regularly. Ice packs can also be used to reduce pain in an acute thrombotic event.

Dietary advice is important to consider in order to achieve the correct consistency of stool. A lack of fiber is the most common cause of poor diet leading to problems with hemorrhoids (Alonso-Coello et al. 2006). More fiber, green vegetable, fruit, avoiding spicy, and caloric foods are simple tips that can easily be taught to patients in clinic. An intake of at least 25 g of fiber per day is strongly advised. Reducing alcohol consumption can also be recommended in managing hemorrhoids. This is because consumption can cause dehydration that leads to constipation and therefore worsening of hemorrhoids.

As part of the dietary advice, weight reduction can help improve hemorrhoidal symptoms. Being overweight can reduce the chance of good conservative measures working; therefore, patients with a high Body Mass index (BMI) should be advised on weight loss strategies. Weight loss and exercise have been shown to reduce stress and pressure in the veins at the anal level as well as improve gut transit and help in avoiding constipation (Riss et al. 2011). Aerobic exercise such as cycling, walking, running, and yoga are all recommended exercises in these patients for weight loss. While it is true that exercising regularly helps to manage and prevent hemorrhoids, it also true that heavy lifting can worsen the condition increasing the

pressure in the anal veins, so this should be avoided.

Advice on toileting habit is also extremely important. Instructing patients to avoid sitting for long periods of time on the toilet can increase pressure and stress on the anal blood vessels and worsen preexisting hemorrhoids. Ensuring patients attempt to evacuate only when they get the urge to, avoiding straining, and correct toilet positioning (feet shoulder width apart, knees slightly elevated, and trunk forward with elbows on knees) are also important recommendations. A gentle reminder that “the lavatory is not a library” can prove helpful for a number of patients.

A combination of these treatments along with biofeedback therapy focused on proper emptying techniques can be an important addition to a patients’ treatment (Prichard and Bharucha 2014; Rao et al. 2016). For most patients, these simple measures can be enough to manage acute symptoms and prevent long-term recurrence of hemorrhoids (Table 2).

3.2 Medications

Medications should be considered in all patients with mild symptomatic hemorrhoids. Although there is little robust evidence for good therapeutic outcome, medications are still a valid noninvasive and low risk in most cases (Lohsiriwat 2012).

Fiber supplements maybe useful for patients who have a low fiber diet and are struggling to balance their diet. The most common supplements are Methylcellulose and Psyllium seeds, and these together with a balanced diet should help to achieve 25 g of fiber per day as is commonly advised (McRorie 2015a, b).

Stool softeners (laxatives) should also be considered especially in patients with history of severe constipation (Riss et al. 2011; Hollingshead and Phillips 2016). Medications, such as Docusate Sodium, help patients to avoid straining incorporating water and fat into stools resulting in softer stools.

As mentioned above, soaps with a slightly acidic pH are recommended for daily hygiene and during the use of salt baths. These should

Table 2 Conservative measures for outpatient assessment and treatment of hemorrhoids

Conservative treatment	
Local hygiene	Soft paper roll, sitz baths, neutral pH soap, soothing wipes
Diet	High fiber diet, avoid spicy food, and moderate alcohol
Physical exercise	Aerobic exercises, avoid heavy lifting
Regular bowel habit	Go to the toilet as soon as there is urge, avoid straining
Biofeedback	Emptying techniques

also be emollient, moisturizing, and delicate and should contain antibacterial solutions. Most of these soaps are a mix of chemical agents such as chlorhexidine digluconate and natural substances such as chamomile, hyppocastanum, and sage. Similar components and similar products are available as soothing wipes.

Nonsteroidal Anti-Inflammatory Drugs (NSAIDs) including Ibuprofen, Aspirin, and Naproxen should be restricted to patients with acute thrombosis only and for a limited time period. In all other scenarios NSAIDs should be avoided as they can be associated hemorrhoidal bleeding and gastritis (Laine 1996). It is advisable that if NSAIDs are prescribed orally they should be given in association with a Proton Pump Inhibitor (PPI), particularly in the elderly and those with risk factors for gastroduodenal ulceration. Safer pain-relieving alternatives, such as Paracetamol, can also be used.

Topical analgesia should also be considered to alleviate acute pain symptoms. The most common form of topical anesthetic agents is Lidocaine ointment which acts by blocking voltage-gated sodium channels, thus preventing nerve impulse transmission in pain receptors.

The use of steroids is still controversial; however, they are prescribed by many physicians especially in cases of acute inflammation. Steroids can be used as ointment or suppositories and aims to decrease local inflammation and reduce swelling (Lohsiriwat 2015). Vascular protective agents are often used and prescribed as first line medications after the first clinic assessment (Misra and Imlitemsu 2005). These include flavonoids

agents. Flavonoids agents aside from antioxidant activity have also anti-inflammatory properties. Diosmin and Hesperidin are part of flavonoid family and can be effective in stopping hemorrhoidal bleeding (Cospite 1995; Misra and Parshad 2000). This acts by increasing venous tone (they strengthen the wall of veins), making the vein less susceptible to stasis. The anti-inflammatory property also acts by suppressing the tendency of varicose veins, including hemorrhoids to become extremely permeable and fragile. Osmotic agents such as a mixture of honey, olive oil, and beeswax applied to swollen hemorrhoids can reduce the swelling and pain in the acute setting (Cospite 1995).

3.3 Interventional Treatment

3.3.1 Rubber Banding Ligation

The principle underlying the procedure of rubber band ligation (RBL) is to cause fibrosis, retraction, and fixation of the bleeding anal cushions (Siddiqui et al. 2014). This technique evolved following the initial description by Blaisdell PC (1958) in the late 1950s, when he described the ligation of bleeding internal hemorrhoids as an office procedure. The procedure is tolerated as internal hemorrhoids are situated above the dentate line, making them insensitive but easily accessible through an anoscope. Barron et al. (Barron 1963) later described a modified version of this technique using rubber bands which has superseded other office procedures as the most popular technique for grade I and II hemorrhoids while being used to control some grade III disease as well (MacRae and McLeod 1995; Shanmugam et al. 2005; Siddiqui et al. 2014).

The mechanism of action of rubber band ligation is largely unknown. Although the conventional description of RBL was to strangulate the hemorrhoid at its base, Nivatvongs and Goldberg (1982) described an improved technique where the rubber band also causes “pulling up” (retraction) of the hemorrhoids in grade II and III hemorrhoids. This is based on the understanding that the underlying cause for symptomatic hemorrhoids is also related to downward displacement

of the cushions, which can be improved by the retraction and replacement of the hemorrhoid internally. In this technique, rubber bands are applied to the redundant rectal mucosa just above the hemorrhoidal mass. This also preserves the anal cushion itself which is believed to be an essential component for full anal continence. It further ensures the application of the band above the dentate line to avoid any discomfort.

RBL can be offered as first line treatment to all symptomatic patients with grade I and II hemorrhoids. In those with grade III hemorrhoids, a clinical decision has to be made following examination. Painless, moderate sized, prolapsing hemorrhoids can be effectively managed with banding on multiple occasions; however, it is important to effectively counsel patients for that this procedure will take time to control symptoms and may require surgical intervention if not successful. If the masses are circumferential and large or if there is a large external component to the hemorrhoids, they will require surgical intervention. If the patient has an associated anal fissure causing pain, they will be unsuitable for banding as the insertion of the anoscope will be unbearable.

The procedure should be explained to the patient preferably with a patient information leaflet including the complications of pain and bleeding and early failure of the bands. The possibility of tenesmus and urine retention should also be explained prior to the procedure stressing their low rates. Patients should be informed that minor bleeding is expected within 7–14 days due to the ulceration and sloughing of the fibrosed hemorrhoid to prevent undue alarm. On rare occasions this bleeding could also be excessive, where the fibrotic process has not completely taken place, and it is important to highlight if bleeding does not stop or is excessive patients should seek medical advice. Patients should be well aware of the risk of recurrent disease, the likelihood of which is comparable to all other available techniques. Contrary to previously held beliefs, current evidence supports multiple hemorrhoidal banding without an increase in complication rates (Khubchandani 1983; Poon et al. 1986). However, if a clinical decision is made to ligate fewer masses or an excess of three masses exist,

the patient should be warned of bleeding from the unligated masses and booked in for a repeat session in two or more weeks' time. Those on antiplatelet treatments can bleed more frequently, and one should proceed with caution, but it is preferable to avoid the procedure until the antiplatelet agents have been stopped for an appropriate period of time (Albuquerque 2016). Special bowel preparation is not required for this procedure; however, patients with constipation may benefit from a fecal softener for the first 5 days postprocedure. An evaluation endoscopy should be performed before the procedure in those who require luminal assessment due to exclude underlying cancer or other cause for bleeding.

The patient should be lying in the lateral position with knees and hips flexed towards the chest. This position gives the maximum exposure of the lower rectum and the anal canal. There are two techniques of RBL that can be performed in the outpatient setting. The more popular less costly hand held disposable band dispenser (Fig. 1) used through a self-illuminated proctoscope (Fig. 2) and the endoscopic banding are the two most commonly used methods.

RBL Without an Endoscope

Following digital rectal examination, the anal canal and the lower rectum is visualized through a proctoscope. An assessment of the number and position of the hemorrhoidal cushions can be made at this juncture and the decision regarding which masses need to be attended to and in which order should be made. A single-use, beveled, clear self-illuminated proctoscope is ideal for this procedure (Fig. 2). A beveled proctoscope provides the best visualization and the access to the hemorrhoids. There are also disposable rubber band applicators where multiple bands can be applied at once without the need to reload (Multi-Band Ligator, Cook Medical, Winston-Salem, NC) (Fig. 3). The modern low cost disposable plastic equipment provides several advantages such as the low risk of infection and ease of handling to the operator due to its low weight and low complexity of a single instrument (Cospite 1995).

The proctoscope, with the obturator, is inserted with a generous amount of lubrication gel and the

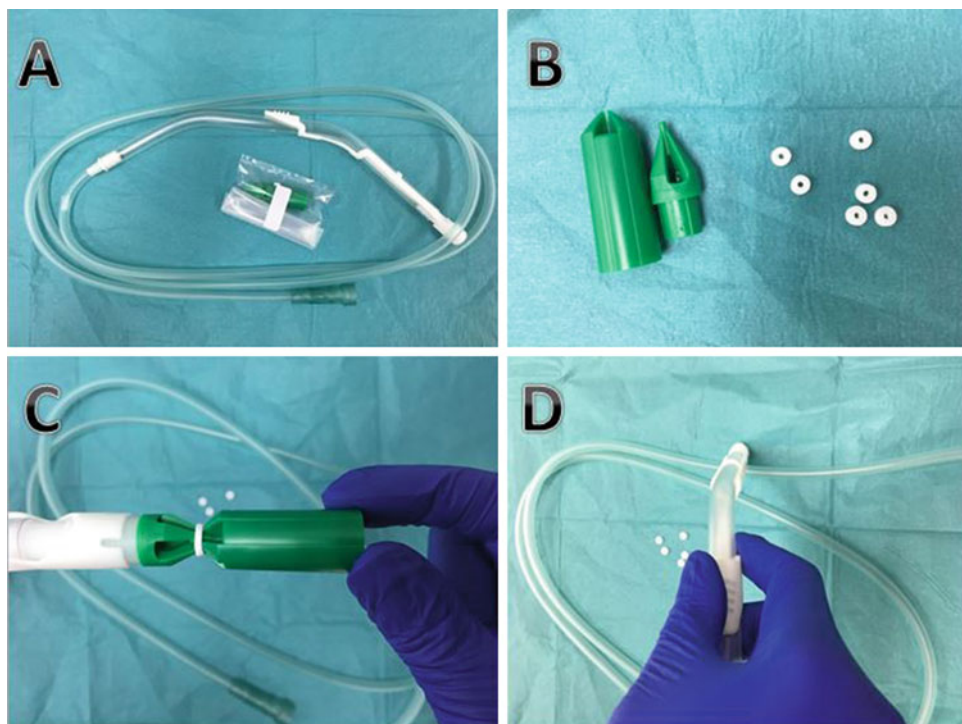


Fig. 1 A disposable band dispenser used at St Mark's Hospital. (A) The band dispenser with rubber banding provided. (B) Common rubber banding. (C) Rubber band

are installed at the tip of the dispenser. (D) Covering the hole in the handle activates suction

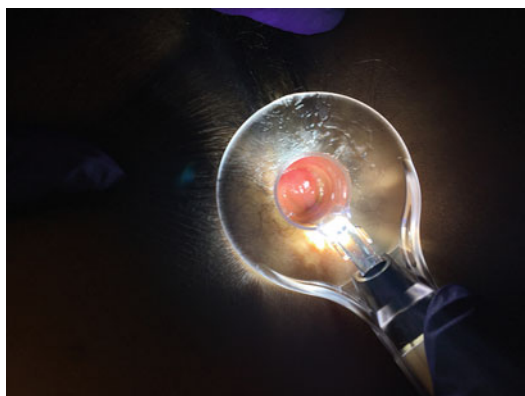


Fig. 2 A self-illuminated proctoscope is carefully inserted in the anus and internal hemorrhoidal are visualised

obturator is withdrawn. While withdrawing the proctoscope under direct vision, the internal hemorrhoid (part above the dentate line) should be clearly visualized. The objective is to apply the rubber band at the base of the hemorrhoidal mass

that will obstruct the artery and pull it up into the lower rectum (Fig. 4). The operator might need to move the proctoscope in and out several times in order to clearly visualize the transition of purplish squamous mucosa of the anal canal into the pink rectal mucosa at the dentate line. After confirmation while withdrawing the proctoscope where the base of the hemorrhoid is bulging into the lumen the applicator should be placed at the base. Covering the hole in the handle activates suction and the hemorrhoid is pulled into the tube. After ensuring the patient is not in pain, the band can be deployed by either pushing a handle forwards or rolling a wheel with the thumb. The band should be then being seen tightly around the base of the hemorrhoidal tissue.

Before starting the procedure load the first band onto the suction and a second onto the loading device, prior to putting on gloves, while the patient is getting into position. It is advisable to start with the largest hemorrhoidal pedicle as

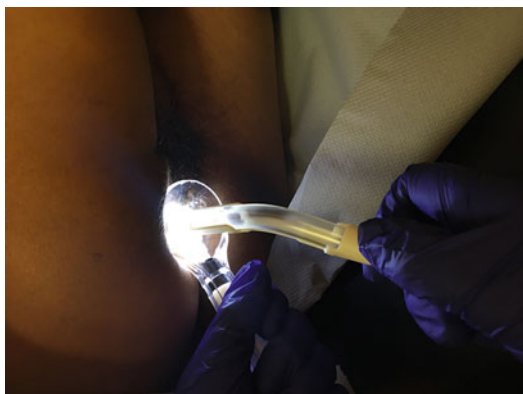


Fig. 3 A rubber band dispenser is inserted through the proctoscope

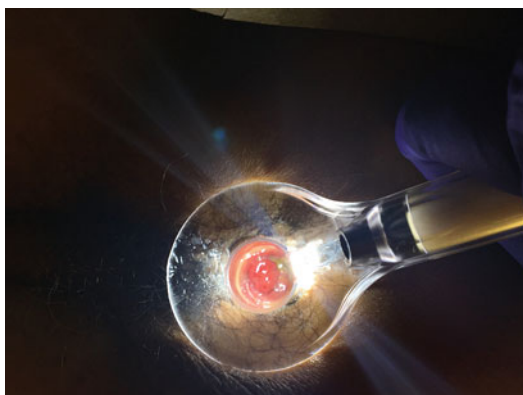


Fig. 4 Internal hemorrhoid at 7 o'clock after rubber band ligation

successfully treatment of this is most likely to improve symptoms and ensure the patient re-attends for further treatment if required. Check the suction device has adequate pressure and allow sufficient time when the suction has been applied for the hemorrhoid to be pulled into the device before deploying the band. While waiting for this ensure the patient is not experiencing any pain or discomfort as this is an indication the band may be placed too close to the dentate line. If multiple bands are being used ensure they are all placed at the same level. Local trauma from the action of the examination can lead to bleeding from the hemorrhoid; however, this should be controlled when the band is deployed as it causes occlusion of the hemorrhoidal artery.

RBL with an Endoscope

The principles of the technique are same although the banding is performed using a flexible endoscope. Although less popular this method has a few advantages over the nonendoscopic techniques. The operator can perform the evaluation of the left side of the large bowel and perform the banding at the same setting. Also the visualization of the dentate line through a retroflexed flexible sigmoidoscope is much easier than under direct vision. The rubber band ligation is performed in a way similar to the esophageal banding. A transparent plastic cup is fixed to the tip of the scope with preloaded bands. The mechanism has a trip wire mechanism to release the bands when needed. Suction is used to capture the hemorrhoid at the base while the endoscope is retroflexed. Stiegmann-Goff Bandito Endoscopic Hemorrhoidal Ligator (ConMed Corp, Utica, NY) is the only system specifically designed for hemorrhoidal banding although standard esophageal variceal banding systems can be used. Retroflexion and air insufflation in the rectum might cause an added discomfort to the patient when compared to using a proctoscope. However, endoscopic RBL allows more bands to be applied in a single setting therefore reducing the number of treatment sessions (Berkelhammer and Moosvi 2002; Wehrmann et al. 2004).

Complications of RBL

Several authors have reported complications ranging from 3% to 18% while the commonest complication of the procedure are pain and hemorrhage (Wechter and Luna 1987; Komborozos et al. 2000; Longman and Thomson 2006). Minor bleeding could be secondary to the procedure, but more severe bleeding could result from slippage of the rubber band or when the hemorrhoid sloughs off in 7–14 days following treatment. Abnormal bleeding is more likely in those patients on antiplatelet therapy and should be treated with caution (Beattie et al. 2004). Usually the patients will experience a mild discomfort in the anal canal or tenesmus following this procedure. However, severe pain indicates incorrect placement of the bands below the dentate line. If severe pain is noted during the treatment process, the band can be removed and reapplied at the correct site (Khubchandani 1983).

If pain occurs later, the tissue edema around the band will prevent simple removal in which case pain should be managed either with analgesia or by band removal in theater in severe cases. In a large prospective study, around 90% of patients experienced some degree of pain and 65% required oral analgesia (Watson et al. 2006). In some patients, severe pain may be associated with vaso-vagal symptoms and patients should be made aware of this possibility. Pain may be associated with difficulty in passing urine or urine retention requiring catheterization (Bat et al. 1993). Other minor complications are thrombosed hemorrhoids, development of an anal fissure, chronic longitudinal ulcer, and priapism, which have been reported in literature (Albuquerque 2016). Septic complications, although less than in sclerotherapy, have been reported following RBL. Localized sepsis such as peri-anal abscess and anal fistula can be rarely (<0.5%) seen following the procedure (Wechter and Luna 1987). Severe pelvic sepsis, Fournier's gangrene, and systemic septic complications including liver abscess have been reported in isolated cases in immune compromised patients (Clay et al. 1986; Subramaniam et al. 2013; Albuquerque 2016).

Success rates between 70% and 50% have been reported in various studies although the common consensus is that the success rate improves with repeated procedures (Iyer et al. 2004; Brown et al. 2016; Hollingshead and Phillips 2016). Advantages and disadvantages of this technique are resumed in Table 3.

3.3.2 Sclerotherapy

This previously popular treatment for small but vascular hemorrhoids is now rarely employed and

aims to cause fibrosis. RBL has largely replaced sclerotherapy due to its comparatively lower side effect profile. The technique involves injection of a sclerosant agent into the submucosa of the hemorrhoid causing an inflammatory reaction leading to fibrosis and sclerosis of the vessels. The classical description of the procedure involves a Gabriel's syringe which is a metal syringe with a beveled needle that was used to inject the sclerosant, 5% phenol in almond oil. Hemorrhoids with only an internal component, grade I and early grade II, are best suited to this treatment modality. The injection is carried out in the submucosal plane and should be placed above the dentate line. Similar to RBL, sclerotherapy can be performed with or without an endoscope.

Sclerotherapy Without an Endoscope

The patient is positioned in the lateral position with knees and hips flexed and drawn towards the chest. A beveled proctoscope is useful during this procedure for better visualization and access. The Gabriel's syringe with an angulated needle has the advantage of being able to guide the needle into the submucosal plane with ease, although a straight FG 23 needle can be used with a proper understanding of the tissue planes. It is advisable to inject 2.5 ml of sclerosant into a single mass at any one time and a maximum of three injections per session. The internal component of the hemorrhoid is identified while withdrawing the anoscope and the needle is placed in the submucosal plane. Following needle placement, withdrawal of the plunger should be done to ensure that the sclerosant is not injected intravascularly. If blood is aspirated into the syringe, the needle should be withdrawn and replaced in the submucosal plane. Sclerosant is injected to raise a pale bleb in the mucosa. Patient should not experience pain during injection. The procedure should be abandoned immediately if the patient complains of pain. Although 5% phenol is the most popular sclerosant other agents such as hypertonic saline, absolute alcohol, and newer commercial compounds such as ALTA (Zione, Mitsubishi Pharma Corporation, Osaka, Japan), which contain aluminum potassium sulfate and tannic acid, have been used with success. When using phenol it is

Table 3 Advantages and disadvantages of hemorrhoids' treatment with RBL

Advantages	Disadvantages
Simple, cost-effective	High rate of postprocedure pain
Can be done in clinic	Risk of bleeding
Relatively safe	May require multiple sessions
Can be used endoscopically	

important to check the correct strength solution (5%) is used, as stronger concentrations, used for nerve blocks/destruction, will cause severe side effects and destruction of the anus. Only operators with sufficient experience and a good understanding of the anal canal anatomy should administer Sclerotherapy in order to prevent complications. Novices must be closely supervised and well trained as complications can be severe.

Sclerotherapy With an Endoscope

Similar to RBL a retroflexed flexible endoscope can be used to inject the hemorrhoids under magnified vision. The endoscopic blunt needle used in the procedure is believed to provide additional security against deep injection. This compensates for the loss of tactile sensation. Use of an endoscope has not proven to be beneficial over the conventional technique (Tomiki et al. 2015).

Complications of Sclerotherapy

The complication profile of sclerotherapy is more severe compared to other techniques. Common complications of anal pain and tenesmus can follow due to the inflammatory process that takes place causing mild swelling of the anal cushions. These symptoms can generally be managed with oral analgesia and fecal softeners. Injection of the sclerosant into deeper plane could result in destruction of deeper tissue causing irreversible damage resulting in poor quality of life. Deep injection into the muscle layer could cause sepsis leading to a high anal fistula. Injecting into the deeper planes of the anal canal could result in the destruction of the sphincter complex and anal stenosis. The sclerosis of the tissue planes following deep injection leaves them poorly suited for surgical correction. A serious complication in injecting the sclerosant into deeper planes anteriorly is chemical prostatitis. Patient may experience urinary symptoms, including urinary retention, hematuria, and urinary tract infection, following injection which worsens with time. The end result may sometimes be an ano urethral fistula (Al-Ghnam et al. 2001). Intravenous injection of the sclerosant can lead to portal pyemia rarely which present as fever, abdominal pain, and deranged liver function tests.

Sclerotherapy has been shown to reduce symptoms in around 50–80% of patients when employed in the correct patient group (Takano et al. 2006, 2010; Tomiki et al. 2015).

Advantages and disadvantages of this technique are resumed in Table 4.

3.3.3 Radiofrequency

Radiofrequency is a newer approach to treat hemorrhoids of grade I and II in the outpatient setting (Gupta 2005; NICE 2017). This technique is easy to perform with the patient in the usual left lateral position. A proctoscope is inserted and a metallic probe is applied to the base which delivers a very high frequency current (4 MHz). The advantage of this technique is the probe remains cold, unlike electrotherapy, and therefore minimizes surrounding tissue damage. The high intensity current dehydrates the cells and coagulates their organic contents desiccating and shrinking the hemorrhoid. There are different radiotherapy units available and all of them work in a very similar ways and normally provide both cut and coagulation settings. It is recommended that using the setting where both cut and coagulation are simultaneously used and that the electrode should be applied directly on to the hemorrhoidal cushion to achieve the required level of shrinking. This is usually attained in 10–20 s. More than one hemorrhoid can be easily treated using this technique and it is usually well tolerated by patients. It is strongly recommended to leave a mucocutaneous bridge between sites of treatment, as with open hemorrhoidectomy, to avoid the risk of anal stenosis. Radiotherapy is cheap, quick, and a valid alternative technique for low grade hemorrhoids

Table 4 Advantages and disadvantages of sclerotherapy for treatment of hemorrhoids

Advantages	Disadvantages
Simple, cost-effective	Only used in grade I and II hemorrhoids
Can be done in clinic	May require multiple sessions
Relatively safe	Deep injection can cause irreversible sphincter damage
Can be used endoscopically	

which has a low rate of intra- and postprocedural complications (bleeding, pain, urinary retention) (Lin et al. 2010). Salt baths and over the counter painkillers are suggested to relief discomfort and pain in the first 48 h.

3.3.4 Cryotherapy

Cryotherapy is a well-known technique used for many conditions and many diseases, and its approach for hemorrhoidal disease consists of applying extreme cold to the abnormal tissue with the aim of creating submucosal fibrosis (MacLeod 1982). It has been used for many years and its use remains controversial. Several studies show great results for low grade uncomplicated hemorrhoids (MacLeod 1982; MacKay 2001; Guindic and Frank 2014). There are different devices made by different companies, all anatomically designed for the direct application of cold on both external and internal hemorrhoids components. The technique aims to give immediate relief of pain, inflammation, and itching due to vasoconstriction and it is also a muscle relaxant. Most of these devices have been designed to be easily used in one office and can also be prescribed and used by the patients themselves. It is preferable use devices with a curved tip in order to facilitate easy and pain-free introduction together with plenty of lubricant gel. The device should be stored in a freezer for at least 3 h prior to use. The application should be for a maximum of 1 min. Different devices have different techniques of use so it is strongly advised to refer to the manufacturer's instructions prior to using any particular device.

3.3.5 Photocoagulation

Infrared Photocoagulation, also simply known as coagulation therapy (McLemore et al. 2012; Singal et al. 2013), is strictly reserved for uncomplicated low grade internal hemorrhoids (I° and II°). The device creates an intense ray of infrared light that leads to heating and tissue damage and consequently scar tissue that cuts off the blood supply to the hemorrhoid. It is normally performed with an infrared light but a laser can be utilized as well. The procedure is relatively safe and easy to perform. It can be done in an

outpatient clinic with the patient in the usual left lateral position. Only one hemorrhoidal pedicle should be treated at any one time and in cases where further treatment is required this can be done at 2-week intervals. However, this technique is expensive and is not without risk, especially related to the use of laser. Common postprocedural complications are bleeding, pain, local infections, and urinary retention. It is strongly recommended to have some experience or training in this technique prior to use and to ask patients to stop anticoagulants. In case of significant postprocedural pain, patients may find pain killers and salt baths with warm water useful to relieve symptoms. Stools softeners are also recommended postprocedure. It is also suggested that multiple repeat procedures be avoided in case of recurrence or failure as it may be better to trying a different approach and/or consider surgery (McLemore et al. 2012; Singal et al. 2013).

Laser photocoagulation therapy is similar to the technique described above and can also be performed at the same time as excision. This technique vaporizes and completely removes the hemorrhoidal tissue. It is slightly more invasive than the technique described above, but it is still a valid and safe technique that can be performed in the clinic setting. Also this may be considered for the treatment of larger grade 3 hemorrhoids. Despite its higher costs it has been shown to be more effective than rubber banding and has a lower rate of complications and recurrence (Giamundo et al. 2011; Maloku et al. 2014).

Advantages and disadvantages of these techniques are resumed in Table 5.

3.3.6 Electrotherapy

Electrotherapy, also known as electrocoagulation, is alternative treatment method (Olatoke et al. 2014) that involves using an electric current to shrink grade I°-II°-III° hemorrhoids. It can easily be used in outpatient setting (if using low amplitude current (10–16 mA)) but is also a validated surgical option under general anesthesia, where it is possible to use higher amplitude (up to 30 mA). The technique is usually performed in the left lateral position, and after insertion of a proctoscope, piles are cauterized at the base applying

Table 5 Advantages and disadvantages using photocoagulation therapy and laser therapy for low grade hemorrhoids

Advantages	Disadvantages
Easy	Expensive (especially if laser is used)
Can be done in clinic	Treats only low grade hemorrhoids
Relatively safe	Needs experience
Low recurrence	Only one hemorrhoid at a time

direct current through a single metallic probe. The interventional time may vary due to grade of hemorrhoid, number of hemorrhoids to treat, clinician experience, patient tolerance, and amplitude dose. The electrotherapy is controlled by an ergonomic hand piece, and an earthing lead must be applied to the patient prior to start the procedure as with all electrotherapy. The current is directly applied to the base and shrinks the hemorrhoid causing thrombosis of the tributary vessels. It is recommended that patients are given a low dose pain killer 20–30 min before the procedure to help relieve intraprocedural discomfort. All hemorrhoids treated must be above the dentate line to avoid significant patient pain. Although more than one pedicle can be treated in the same session, it is preferable to limit the procedure to a single hemorrhoid to minimize patient discomfort. Pain is by far the most common complication of this technique, and evidence suggests it is experienced by a significant number of patients during the procedure (Izadpanah et al. 2010; Nikooiyan et al. 2016). A few patients have also been shown to describe on going pain for few days after the procedure. Other complications that might be seen are bleeding, urinary retention, vasovagal syncope, electrocution, burning, and infection. Advantages and disadvantages of this technique are resumed in Table 6.

3.3.7 Thrombosed External Hemorrhoid Excision

In the case of an acutely thrombosed external hemorrhoid controversy exists about the best treatment. Excision is a valid and simple procedure which has been shown to have good outcomes but is associated with significant pain

Table 6 Advantages and disadvantages using electrotherapy for treatment of hemorrhoids

Advantages	Disadvantages
Easy	I°-II°-III° hemorrhoids
Can be performed in clinic	Poor patient tolerance
Relatively safe	Episodes of ongoing pain
Cheap	Only one hemorrhoid can be treated at a time

(Jongen et al. 2003; Greenspon et al. 2004). It is best performed when the patients present to clinic within 48–72 h from the onset of symptoms. This technique is indicated when the symptoms are acute, there is no response to ice or osmotic agents and when there is evidence on examination of thrombus. This procedure can be done on the couch and with an injection of local anesthesia containing Epinephrine. An elliptical excision with the aim of removing the thrombus, its vein, and overlying skin is performed. The procedure is also relatively easy and safe. A pressure dressing should be applied for a few hours and the wound is left to heal by secondary intention.

4 Referral

A surgeon or a physician managing hemorrhoidal disease in the outpatient department should be clear on the indications for onward referral (Royal College of General Practitioners 1992). Referral may be required pretreatment, during treatment or posttreatment (Table 7).

A patient may present to the OPD with a longstanding history of rectal bleeding causing physiological effects of anemia such as cardiovascular compromise. These patients need to be simultaneously treated for the disease while replenishing their blood hemoglobin levels. They are best managed by a surgeon in combination with a transfusion specialist as they might sometimes require intravenous iron infusion for severe depletion of iron stores.

A patient with “red flag symptoms” suspicious of a large bowel malignancy requires an urgent referral to an endoscopist. The treatment for the

Table 7 Indications for referral pre-, during, and posttreatment

Pretreatment	During treatment	Posttreatment
Severe anemia (Hb < 7 g/dL)	Wrong application	Sepsis
Red flag symptoms – Suspicious of malignancy	Severe hemorrhage	Prostitits
Anticoagulation therapy	Anticoagulation therapy	Continued symptoms/poor response
Liver or congested cardiac failure	Pain	Anemia
Prolapsed thrombosed hemorrhoids	Sepsis	High/increased risk of bowel cancer
	Urinary retention	Obstructed defecation/ pelvic floor dysfunction
		Incontinence

hemorrhoids may sometimes become secondary if they are proven to be first degree and unlikely to cause further significant symptoms. These patients should be referred to an out-patient colorectal clinic via an expedite cancer screening pathway. Even if the hemorrhoids are treated in the first instance, the referral for further tests should be made and the patient must be aware of the importance of attending the appointment to exclude other more serious causes of bleeding. It is good practice to evaluate the left side of the colon for a malignancy in all those above 50 years of age even if the hemorrhoids are obvious as these two conditions co-exist in around 15% of the western population (Robertson et al. 2006). Individual risk factors including the family history should be considered when deciding on a referral.

Prolapsed and thrombosed hemorrhoids that are likely to require surgical management can be treated conservatively and medically in the out-patient setting; however, intervention is not recommended. Most will require surgical intervention in the form of open or closed hemorrhoidectomy, and these patients should be

referred to a colorectal surgeon with expertise in these procedures.

Patients may present with hemorrhoids caused by underlying disease such as liver failure with portal hypertension or congestive cardiac failure. These patients will need the care of a physician in the respective field, and management of the hemorrhoids is likely to be limited to conservative measures.

Those who develop excruciating pain following RBL may present to primary care services and may need onwards referral for a specialist opinion. They are unlikely to require surgical intervention, particularly if they present late, but will require adequate pain management. Septic complications following either RBL or sclerotherapy in the form of perianal abscess or pelvic sepsis requires inpatient treatment under a colorectal surgeon for intravenous antibiotics and possible incision and drainage. More advanced complications such as prostatitis is best managed early in the process in collaboration with an urologist.

Patients who complain of symptoms suggestive of pelvic floor dysfunction (e.g., straining) which precipitate hemorrhoidal bleeding need to be referred to a specialized pelvic floor service for assessment and therapy if symptoms persist following management of hemorrhoids. Also those who develop poor continence following treatment will require similar referral for the Anorectal Physiology and Endo Anal Ultrasound Scan assessment and biofeedback.

5 Conclusions

Hemorrhoids are challenging conditions to treat. Clinicians must accurately diagnose the condition and exclude other causes responsible for the symptoms. A thorough examination has a key role in the management of this condition, and the treatment modality may vary due to the degree of the hemorrhoids. Conservative measures should be used in the first instance and when they fail, a wide range of out-patient minimally invasive treatments can be employed.

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Pros and Contrasts of Outpatient Treatments for Hemorrhoids

14

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Abstract

In this chapter, we consider the literature regarding different modalities of lifestyle modifications, oral medications, and topical

applications in the treatment of early-stage hemorrhoids. We also examine the advantages and disadvantages of available outpatient office procedures, including rubber band ligation, injection sclerotherapy, electrotherapy, infrared coagulation, and other therapies.

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1 Introduction

Treatment of hemorrhoids is broadly classified as non-operative management, office-based procedures, and surgical management. In the outpatient setting, emphasis is placed on non-operative management and office-based procedures. The majority of hemorrhoidal symptoms are adequately controlled with these measures, leaving a smaller subset of patients requiring surgery for hemorrhoids.

2 Lifestyle Modification

Hemorrhoids are common and can lead to significant quality-of-life disturbances when symptomatic. The current opinion on optimal non-operative management remains unclear. Much of the evidence for this remains anecdotal or from retrospective cohort studies. The importance of optimizing bowel habits, diet, and exercise cannot be discounted.

The etiology and predisposing factors leading to hemorrhoids have been discussed in other chapters. Lifestyle modification aims to correct constipation, prolonged straining, and incorrect toileting habits that are known to exacerbate the anal symptoms of hemorrhoidal disease.

2.1 Fiber

We advocate that not all fiber is good and that moderation is key in fiber consumption. Several systematic reviews and meta-analysis have attempted to address the divergent views regarding fiber in constipation. Alonso-Coello et al. (2006) analyzed 378 patients in 7 trials to fiber or non-fiber control groups. They found that the risk of experiencing hemorrhoidal symptoms decreased by 47% (RR 0.53, 95% CI 0.38–0.73) and the risk of bleeding by 50% (RR 0.50, 95% CI 0.28–0.89) in the fiber group. There was no effect of fiber on prolapse, pain, or itching. The type of fiber used in the studies included ispaghula husk, psyllium seeds, and bran. However, ordinary dietary fiber already in the patients' diet was not controlled for, leading to potential bias.

The American Dietetic Association (Slavin 2008) recommends a high-fiber diet of 25 g for adult women and 38 g for adult men per day. However, this position resulted from data on protection against cardiovascular disease. The authors concluded that data examining the impact of fiber on outcomes in gastrointestinal function and disease was lacking.

In the practice at this institution in Singapore, we find that those with mild constipation have had their symptoms largely resolved, having already self-treated with fiber. The patients who do present themselves to the specialist colorectal clinics are those in whom constipation has not improved or has indeed worsened with fiber. This is in line with the experience of Müller-Lissner et al. (2005) and Tan KY and Seow-Choen F (2007), who argued against the role of fiber in chronic constipation. Of note, Voderholzer et al. (1997) performed a non-randomized study, showing that 85% of those without pathological findings had improved with high fiber (more than 30 g/day). However, 88% of slow-transit patients and 63% of patients with defecation disorder did not respond to high-fiber treatment. In these groups of patients, fiber may indeed aggravate constipation and symptoms of flatulence, bloatedness, and abdominal discomfort. Patients with suspected slow-transit constipation and obstructive defecation syndrome will benefit from anorectal physiological tests and biofeedback and should consider decreasing, and even stopping, fiber completely.

McRorie JW and McKeown NM (2017) summarized the effects of differing types of fibers. They concluded that just two main types of fibers drive a regularity/laxative benefit in the colon. The first is insoluble large particle fiber, like wheat bran, which mechanically irritates colonic mucosa to increase mucous and water secretion. The second is soluble gel-forming fiber, like psyllium, that resists fermentation and retains a high water-holding capacity. On the contrary, fine small insoluble fiber, like fine wheat bran, and fermentable soluble gel-forming fiber, like wheat dextrin, should be avoided as they cause harder stools and have a

detrimental effect to patients who suffer from constipation.

2.2 Probiotics

Dimidi et al. (2014) concluded in a meta-analysis of 1182 patients that probiotics significantly reduced gut transit time by 12.4 hours (95% CI -22.3 to -2.5), increased weekly stool frequency by 1.3 bowel movements per week (95% CI 0.7 – 1.9), and improved stool consistency (SMD 0.55 , 95% CI 0.27 – 0.82). Further randomized trials are necessary to better elucidate the most effective strain of probiotics and its optimal dosage and treatment duration.

2.3 Overstraining and Posture During Defecation

Toileting habits should be optimized. Prolonged and repeated straining predisposes to hemorrhoid formation, as does constipation and diarrhea. A simple change in posture during defecation can assist defecation even in healthy people. Fluoroscopic imaging confirmed that the greater the hip flexion, the lower the abdominal pressure, the straighter the rectoanal canal (Sakakibara et al. 2010). The “Thinker position” is also advocated by Takano and Sands (2016), resulting in significantly wider anorectal angle than the sitting position, and larger perineal plane distance and longer puborectalis length. Of the 22 patients who were unable to evacuate barium paste on cinerdefecography in the sitting position, 50% were able to do so after shifting into the “Thinker” position.

2.4 Others

Patients above the age of 50, or with any red flag signs or symptoms of colorectal malignancy, should undergo the appropriate colonic evaluation. Medications and medical conditions that predispose to constipation (like hypothyroidism and hypercalcemia) should be identified and treated.

3 Medical Therapy

3.1 Venotonics

Oral flavonoids belong to a group of phlebotonics that is widely used to address hemorrhoidal symptoms. These venotonics act by stabilizing capillary permeability, decreasing inflammatory agents, and improving lymphatic drainage (Labrid 1989).

A Cochrane review (Perera et al. 2012) analyzed outcomes of 2344 participants from 20 randomized controlled trials. The meta-analysis concluded that phlebotonics had a statistically significant beneficial outcome for pruritus (OR 0.23 , 95% CI 0.07 – 0.79), bleeding (OR 0.12 , 95% CI 0.04 – 0.37), discharge and leakage (OR 0.12 , 95% CI 0.04 – 0.42), and overall symptom improvement (OR 15.99 , CI 5.97 – 42.84). They also reported improved symptoms post-hemorrhoidectomy. However, they cautioned about moderate methodological quality and bias. An earlier meta-analysis by Alonso-Coello et al. (2006) that met with similar limitations in methodological quality, heterogeneity, and publication bias nonetheless showed that flavonoids were useful in hemorrhoids. They reported that flavonoids decreased the risk of no improvement or persisting hemorrhoidal symptoms by 58% (RR 0.42 , 95% CI 0.28 – 0.61), decreased risk of bleeding (RR 0.33 , 95% CI 0.19 – 0.57), pain (RR 0.35 , 95% CI 0.18 – 0.69), itch (RR 0.65 , 95% CI 0.44 – 0.97), and recurrence (RR 0.53 , 95% CI 0.41 – 0.69).

Among the phlebotonics, micronized purified flavonoid fraction (for instance, Daflon[®] 50 which contains 90% diosmin and 10% hesperidin) is the most common type used in clinical practice, especially in Asia and Europe. The micronized particles promote absorption and speed of action, compared to non-micronized versions (Garner et al. 2002). There are also no major adverse effects reported. In our practice, Daflon[®] is commonly used as a first-line primary or adjunct treatment for all grades of hemorrhoids and during post-hemorrhoidectomy recovery.

Synthetic venotonics like calcium dobesilate has also been found to be useful. However, it is

avoided in our practice due to its association with agranulocytosis (Ibanez et al. 2000).

3.2 Topical Medications

Numerous topical medications seek to temporarily alleviate hemorrhoidal symptoms. Over-the-counter preparations come in the form of ointments, suppositories, and wipes. They contain various ingredients, including corticosteroids, local anesthesia, astringents, and antibiotics. Robust evidence for their efficacy is lacking for many of these formulations. The most common ones are Preparation-H® (Pfizer, United States) and Proctosedyl® (Sanofi, France). While ingredients differ from country to country, Preparation-H® usually contains phenylephrine (vasoconstrictor), hydrocortisone, pramoxine (local anesthetic), and witch hazel (astringent). Proctosedyl® contains neomycin B (antibiotics), hydrocortisone, dibucaine (local anesthetic), and esculoside (vasoactive substance obtained from the bark of horse chestnut branches). Long-term use of steroidal-based applications should be avoided due to potential thinning of perianal/anal skin and mucosa and contact dermatitis.

4 Outpatient Procedures

There are several outpatient treatments for hemorrhoids that are suitable for office-based practice. They are mostly suitable for the symptomatic lower-grade internal hemorrhoids, namely, grade I and II, and selected grade III hemorrhoids that are refractory to conservative medical treatments. All of them have the common goal of inducing fibrosis and hence contraction and elevation of hemorrhoidal pedicles. An ideal office-based procedure is one that is safe and efficacious, causing minimal discomfort and allowing return to normal activity after the procedure. It is preferably quick and not costly. Larger grade IV hemorrhoids, lower-grade hemorrhoids that are refractory to these office-based treatments, or those with bothersome external anorectal issues like large skin tags will require surgical therapy that entail regional or general anesthesia in the operating theater.

4.1 Rubber Band Ligation

Rubber band ligation (RBL) is the most common and widely accepted technique in addressing grade I to III hemorrhoids. There are three main methods of performing RBL, namely, using an atraumatic grasping forceps with hemorrhoidal ligator, using a wall suction band ligator, and using endoscopic ligator with preloaded bands on the tip of a retroflexed endoscope, very similar to that used for esophageal varices.

RBL is effective, quick, and easy to perform and has a short learning curve, even for junior doctors. The equipment required is inexpensive and widely available. The success rate of RBL ranges from 69% to 97% and has proven superiority in terms of efficacy and safety when compared to other modalities.

The recurrence rate following RBL is about 30%, ranging from 11 to 50% in the literature (Brown 2017). Recurrences are often treated by repeated RBL or other surgical procedures. In one of the largest series, Iyer et al. (2004) retrospectively reviewed 805 patients who underwent 2114 RBLs. They found that the success rate after the initial RBL was 70.5%, regardless of degree of hemorrhoids. With subsequent repeated RBL treatments, the time to recurrence decreased accordingly, resulting in success rate of 73.6%, 61.4%, and 65% for the first to third recurrences, respectively. The overall cumulative success rate was 80.2%, taking into account patients who had repeated RBLs for recurrence. A higher failure rate was not unexpectedly noted in patients who required placement of four or more bands.

Another concern about RBL is post-procedural pain. Wechter and Luna (1987) examined 8060 patients from 39 studies who underwent RBL. Post-procedural pain occurred most commonly (5.8%), which is due to incorrect placement of bands too closely to the dentate line. This can usually be relieved by simple oral analgesia or local anesthetic injection given prior to RBL or by removal of the offending band. Other complications include recurrence in 2.8%, bleeding following mucosal ulceration in 1.7%, thrombosis in 0.6%, fissure or fistula in 0.4%, sepsis in 0.05%, and urinary retention in 0.04% (Albuquerque

2016). RBL should be avoided in high-risk individuals on anticoagulation and antiplatelets to avoid uncontrolled primary and secondary hemorrhage (Nelson et al. 2008).

4.2 Injection Sclerotherapy

Several types of sclerosants have been used: 5% phenol in almond oil, sodium tetradecyl sulfate, hypertonic saline, quinine, and, more recently in East Asia, aluminum potassium sulfate and tannic acid (ALTA).

It is critical that sclerosants are injected in the submucosal plane at the base of the hemorrhoidal pedicle, as incorrect injection into the hemorrhoidal plexus can lead to transient precordial and upper abdominal discomfort (Mann et al. 1988). When applied too superficially to the mucosa or too deeply into the intramuscular space, it can cause several complications, including bleeding, pain, and rectal ulcers. Urinary complications like prostatitis, urinary retention, and epididymitis have been reported as a result of inadvertent injection into the prostate or periprostatic venous plexus in anterior-based hemorrhoids. Rare but major complications have been described, including local wall necrosis resulting in retroperitoneal abscess and fatal necrotizing fasciitis (Wechter and Luna 1987).

Sclerotherapy can be used to treat symptomatic grade I to II hemorrhoids, with a success rate of 75–89% (Khoury et al. 1985). Sclerotherapy has a higher reported rate of recurrences than RBL, requiring more repeated therapy (MacRae and McLeod 1995). Literature suggests that injection sclerotherapy may be safely performed in individuals in whom there may be relative contraindications for RBL. These include patients on anticoagulants and antiplatelets, advanced cirrhosis, and immunosuppressed individuals. Antibiotic prophylaxis is indicated for patients with valvular heart disease or immunosuppression as there is 8% risk of bacteremia (Adami et al. 1981).

The use of ALTA in East Asia has shown promising data. Miyamoto (2014) reported that ALTA sclerotherapy has been performed in over 300,000 cases for grade I to III internal

hemorrhoids in Japan since 2000. The aluminum component causes a strong local inflammatory action, inducing fibrosis and fixation. The tannic acid component has an astringent effect, inducing protein coagulation and vasoconstriction, thereby promoting hemostasis and treatment of prolapse. A four-step injection is performed per hemorrhoid – at the submucosa of the superior pole, central part, and inferior pole, as well as the mucous lamina propria in the central part.

A retrospective study analyzed the 5-year outcomes of 604 patients with symptomatic grade II and III hemorrhoids who underwent ALTA sclerotherapy in several centers (Miyamoto et al. 2016). Success rates at 1, 3, and 5 years for grade II hemorrhoids were 95.9%, 89.3%, and 89.3%, while that for grade III hemorrhoids was 93.1%, 83.7%, and 78.2%. No serious adverse events were noted, although a 7.8% incidence of minor complications such as low-grade pyrexia, pain, and urinary retention was reported.

Further randomized controlled studies are required to compare the efficacy of ALTA with other methods. In addition, ALTA is not available outside of East Asia, and there is a learning curve for the four-step technique to ensure safety and efficacy.

4.3 Direct Current Therapy, Bipolar Therapy, Infrared Coagulation, and Radio-Frequency Ablation

A myriad of techniques used to ablate hemorrhoids have been marketed as a less painful alternative to RBL for early-stage grade I and II hemorrhoids. Another advantage compared to RBL is the ability to treat hemorrhoids that are closer to the dentate line which may otherwise cause post-RBL pain.

In the case of direct current therapy (DCT), low amplitude electrical current is administered to cause thrombosis of hemorrhoidal vessels, resulting in shrinkage and reduction in symptoms. In the outpatient setting without the benefit of sedation or anesthesia, low amplitude in the magnitude of 8–16 mA (NICE guidance 2015) is used. Higher amplitudes of up to 30 mA are used with

regional or general anesthesia. Other than the expense of the equipment, another disadvantage is the comparatively longer time needed to administer the current, with each application lasting about 10 minutes.

The concept for bipolar therapy is similar. Three randomized clinical trials included 200 patients who underwent either DCT or bipolar electrocoagulation. They reported treatment success of between 76 and 88% for DCT and 83 and 92% for bipolar, with no statistical difference (Randall et al. 1994; Hinton and Morris 1990; Yang et al. 1993).

Patients also reported less pain for bipolar therapy than DCT. In a randomized trial (Yang et al. 1993), 20% (5/25) of patients undergoing 16 mA DCT had to stop due to procedural pain, while none encountered pain (0/25) in the bipolar group ($p = 0.05$). Twenty-four percent of patients treated by bipolar therapy (6/25) also experienced rectal ulceration that was managed conservatively, compared to 1 out of 25 in the DCT group ($p = 0.10$).

Infrared coagulation (IRC) uses short pulses of infrared radiation to cause heat-induced coagulation and fibrosis. Each pulse may last between 1.0 and 1.5 s, with a limit of 3 mm depth penetration. Each hemorrhoidal pedicle usually requires three to four applications. Several randomized controlled trials have reported that IRC can control grade I to II hemorrhoids. This technique has been FDA-approved and is safe and fast. Compared to other forms of electrotherapy, it is safe for use in patients with pacemakers. However, its widespread use is limited by equipment cost (Linares et al. 2001).

Radio-frequency ablation is relatively new on the market. Touted to be painless, its use is again limited by equipment cost and is associated with higher rate of recurrent bleeding and prolapse compared to RBL, particularly in larger hemorrhoids (Gupta 2004).

4.4 Cryotherapy

Nitrogen oxide ($-70\text{ }^{\circ}\text{C}$) or liquid nitrogen ($-196\text{ }^{\circ}\text{C}$) is used as the cryogenic agent to freeze

ablate hemorrhoidal tissue. Touted to cause less pain as nerve endings are destroyed by freezing instead of cautery, it has lost its popularity and largely been abandoned due to its association with profuse post-procedural per-anal discharge in up to 70% of patients and its inability to deal with perianal skin tags after 2 years (Traynor and Carter 1984). It has also been associated with anal stenosis, sphincter damage, and fecal incontinence when applied incorrectly.

5 Comparison Between Outpatient Procedures

5.1 RBL versus IRC versus Sclerotherapy

Cocorullo et al. (2017) recently summarized the results of 21 current randomized clinical trials from 2000 to 2014 that compared the outcomes of RBL, IRC, and sclerotherapy. In the RBL group, grade I to III hemorrhoids were treated, with improvement of bleeding and symptoms in 78–83% of patients. Post-op pain was reported in 7.4–80% and bleeding in 1.2–50%. Recurrence of bleeding occurred in 10–18% and prolapse in 2%. In the IRC group, most of the patients treated had grade I and II hemorrhoids. Improvement in bleeding was demonstrated in 22% of patients with grade III, 51% with grade II, and 78% with grade I hemorrhoids, respectively. Post-op pain was documented in 16–100% of patients, while post-op bleeding was found in 15–44%. Recurrences in bleeding were found in 13% of patients after 3-month follow-up in one paper.

Sclerotherapy was also mainly used for grade I to II hemorrhoids, with improvement of bleeding in 69%. There was post-op pain in 24–49% and bleeding in 0.9–6% of patients. Recurrences in bleeding were found in 1.5–29% of sclerotherapy patients and prolapse in 16% of patients. Major limitations included the lack of studies with good methodological quality, no studies directly comparing all three modalities, and studies with high heterogeneity that precluded a meta-analysis. All three methods are useful in early-stage hemorrhoids, result in moderate to high success rate

(albeit lower than surgical techniques), and can be repeated in the event of recurrences. In conclusion, it appears that RBL provided the highest resolution of pain and bleeding among the three modalities, despite a higher post-op pain experienced in RBL and IRC.

Another randomized controlled trial (Poen et al. 2000) directly comparing RBL and IRC showed that among 124 patients, both were effective for grade I and II hemorrhoids (improvement or resolution of symptoms in 97% vs 92% for RBL and IRC). Pain was significantly more common and severe in RBL than IRC (visual analogue score 5.5 ± 3.7 in RBL vs 3.3 ± 3.3 in IRC). There were no differences in recurrence rate in this trial, although this was identified via telephone questionnaire rather than clinical follow-up.

Another meta-analysis (MacRae and McLeod 1995) consisting of data from 18 trials published two decades ago demonstrated that RBL was superior to either sclerotherapy or IRC in terms of efficacy for all grades of hemorrhoids. Compared to sclerotherapy and IRC, RBL required fewer further treatment sessions, with no difference in complication rate except initial post-procedural pain. Compared with traditional surgical hemorrhoidectomy, RBL had more recurrence but fewer complications and lesser pain.

6 Surgical versus Office-Based Treatment

Surgical treatment is indicated in grade IV hemorrhoids, in those with large troublesome external component, and in whom whose hemorrhoids have failed office therapy. A Cochrane review (Shanmugam et al. 2005) showed that hemorrhoidectomy achieved an improved overall cure rate for grade III piles (RR 1.23, 95% CI 1.04–1.45, $p = 0.01$) but no difference for grade II hemorrhoids.

The HubBLE trial (Brown et al. 2016) was a large multicenter randomized controlled trial with a 12-month follow-up period that compared RBL and hemorrhoidal artery ligation (HAL) in grade II and III hemorrhoids. They randomized 372

patients to either arm. Recurrence in 12 months was significantly higher in RBL arm (49%) than HAL (30%) and required further procedures for hemorrhoids (32% vs 14%). However, given that many clinicians deem RBL as a course of treatment rather than a single application, when analyzing RBL patients who succeeded on repeat RBL, there was no difference in recurrence between those groups. Secondary outcomes, like symptom severity score, complications, quality of life, and continence scores, were similar in both arms. Patients reported more pain in HAL than RBL – mean pain on the first post-procedural day was 3.4 (SD 2.8) in RBL group compared to 4.6 (SD 2.8) in the HAL group, $p < 0.05$, although there were no differences by 21 days. This trial supported the use of RBL, which may be repeated as required, over HAL with its improved cost-efficacy for grade II and III hemorrhoidectomy.

7 Conclusion

In conclusion, medical therapies and lifestyle modification should be encouraged. We propose that moderation is key in fiber intake, and probiotics can also be considered. Oral flavonoids may be efficacious, particularly post-hemorrhoidectomy, and have no reported side effect profile. Topical medications may alleviate symptoms, though there is a lack of high-quality scientific evidence to support one over the other.

Office-based therapies should be attempted especially for symptomatic grade I to II and selected grade III hemorrhoids. In our practice, we prefer rubber band ligation, which has been shown to be more efficacious, faster to administer, low equipment costs, and with fewer reported recurrences. The slightly higher post-procedural pain and discomfort can be avoided by ensuring band ligation above the dentate line and/or local anesthesia administration.

For patients who are on anticoagulation or antiplatelets where upfront RBL is contraindicated due to the propensity for delayed hemorrhage, we prefer to stop these medications prior to and after RBL and, if that is not possible, to perform surgical hemorrhoidectomy where the

pedicle can be securely controlled. For patients on immunosuppressants, our preference is for surgical hemorrhoidectomy with prophylactic antibiotics. Although limited evidence has shown that sclerotherapy can be performed safely in this group of patients, its association with severe complications during incorrect administration makes this an uncommon procedure in our practice.

The lesser pain experienced after electrotherapy is encouraging, particularly for grade I and II hemorrhoids. Many of the studies for electrotherapy, RFA, and laser treatment have not shown superiority over RBL or injection sclerotherapy and were performed many years ago. Their uptake has subsequently fallen, with the widespread availability, technical ease of use, and safety of RBL helping it to remain a go-to procedure in non-operative management of hemorrhoidal symptoms.

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Main Disadvantages of Outpatient Treatments for Hemorrhoids

15

Lilli Lundby

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Abstract

Outpatient surgery offers many advantages compared with inpatient procedures and has a high degree of patient satisfaction. Ambulatory surgery for hemorrhoidal disease is now common practice for healthy patients due to high efficiency, faster recovery, and decreased surgical costs. A successful outcome of ambulatory surgery requires a proper patient selection, effective postoperative pain control, patient education, and standardized follow-up; this

chapter will focus on considerations about outpatient hemorrhoidal surgery and include the disadvantages that may be associated with the ambulatory organization.

1 Introduction

Outpatient surgical treatment is intended to optimize the patient's experience in relation to a surgical procedure and to save healthcare costs from an economical point of view. Over the last decades, improvements in surgical and in anesthetic techniques have led to an increase in procedures that can be performed in a day surgery setup and have caused a shift from inpatient to

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outpatient treatment. The introduction of minimal invasive surgical methods has reduced the surgical trauma, and improvements in anesthesia concepts and pain management have significantly expanded the types and complexities of surgical procedures and number of higher-risk patients that can be handled in the outpatient setup. Management of the postoperative period is essential for successful ambulatory surgery. Carefully designed perioperative analgesic and laxative regimens are required. The responsibility of the patient himself, the family members, and other healthcare professionals to handle symptoms and common complications during the postoperative period such as nausea, vomiting, bleeding, and pain after ambulatory surgery must be taken into account. Quality and patient safety remain the primary objective in the delivery of healthcare and should never be compromised; therefore, careful quality control and scientific evidence for the safety of the higher-risk patients and the use of the increasingly complex surgical procedures on an outpatient basis are crucial.

2 Ambulatory Anorectal Surgery

More and more surgical and therapeutic procedures can be performed on an outpatient basis. The Standards Task Force, the American Society of Colon and Rectal Surgeons, has developed clinical practice guidelines for ambulatory anorectal surgery (The Standards Task Force 2003). It is estimated that 90% of anorectal cases may be eligible for ambulatory surgery (Smith 1986) and that the admission rate is 2% (Mezei and Chung 1999; Medwell and Friend 1979). Several factors must be considered before it is decided if the specific anorectal surgical procedure can be performed in the ambulatory setting. The risk of anesthesia can be determined by the ASA physical status classification. ASA classification I and II are generally considered suitable candidates for outpatient surgery. A selected ASA III may also be an appropriate candidate. The type of anesthesia and the extent of the planned surgery, availability of appropriate equipment, ability of the patient to follow instructions, distance of

the patient's home from the surgical center, and home support arrangement all need to be considered.

3 Surgical Treatment of Hemorrhoids

3.1 Feasibility of the Various Surgical Techniques

In many hospitals surgical treatment for hemorrhoids will only be performed as ambulatory operations as the procedures do not require a lengthy hospital stay and the patient can recover and go back to work after a short sick leave. The choice of treatment option mainly depends on the type and severity of the hemorrhoid; however, some surgical procedures are better adapted than others to ambulatory management. Minimal invasive surgical procedures for hemorrhoids such as rubber band ligation, injection sclerotherapy, infrared coagulation, and radio-frequency ablation are obvious procedures that can be done in the doctor's office without anesthesia because they are simple and have a low complication rate (Komborozos et al. 2000).

Conventional hemorrhoidectomy has been described to be feasible in a day-case setup. The failure rate defined as the inability to return to home on the day of surgery had a high variability and ranged from 0% to 61% in a review of 21 studies from 2015 by Vinson-Bonnet (Vinson-Bonnet et al. 2015). The causes of hospitalization were acute urinary retention, insufficient pain control, and postoperative nausea and vomiting, and the main reason for unplanned admissions was acute urinary retention related to spinal anesthesia. The readmission rate within 30 days after the operation varied between 0% and 7%. Open and closed procedures have been compared in two studies, and there were no differences in the failure rate between the two techniques (Carapeti et al. 1999; Arroyo et al. 2004).

Stapled, circular hemorrhoidectomy is even more applicable to day-case surgery because it is a significantly less painful operation (Kam et al. 2011; Cheetham et al. 2003). The unplanned

admission rate was reported to be between 1.6% and 20% and the readmission rate between 0% and 5% (Komborozos et al. 2000). However, stapled hemorrhoidectomy seems to have no advantages over diathermy hemorrhoidectomy as a day-case procedure. A randomized study of diathermy hemorrhoidectomy versus stapled anopexy showed that 97% and 80%, respectively, were discharged on the day of surgery. The failures were mainly due to anesthetic adverse events such as dizziness and nausea or urinary retention (Karialuoma et al. 2003).

The techniques of Doppler-guided hemorrhoidal artery ligation (DGHAL) with or without mucopexy should be particularly suitable for outpatient practice as DGHAL is associated with significant less postoperative pain compared to stapled hemorrhoidopexy (Sajid et al. 2012).

The failure rate ranged between 0% and 15%, and the readmission rate was reported to be between 0% and 5% (Komborozos et al. 2000).

3.2 Complications to Hemorrhoid Surgery

Postoperative complications after hemorrhoid surgery are mainly minor and can usually be solved by symptomatic treatment. Postoperative bleeding is a cause of failure especially after stapled hemorrhoidopexy and hemorrhoidectomy. Careful surgical hemostasis with suturing and special attention to the stapler line in the case of stapled hemorrhoidopexy can prevent unplanned admission or readmission. The main cause for failure of ambulatory hemorrhoid surgery is micturition difficulties, and it has been documented that spinal anesthesia is the principal risk factor for inducing acute urinary retention (Vindson-Bonnet et al. 2015). Spinal anesthesia needs to be adjusted to the constrictions of ambulatory surgery. The use of long-lasting local anesthetics in combination with opioids to induce sacral block may inhibit normal micturition for many hours, and the postoperative bladder function must be monitored with bladder scans and if necessary catheterization before the patient can be discharged. General anesthesia in combination with perineal or

puddendal block should be promoted for ambulatory hemorrhoidal surgery to avoid the high incidence of urinary retention (Jaehwang et al. 2005).

Postprocedural pain is a factor that may compromise outpatient management; however, with careful planning, appropriate surgical procedure, and pain management during and after surgery, this factor for failure can be reduced. The severity of postoperative pain is related to the type of surgical procedure. Conventional hemorrhoidectomy produces an open wound in a sensitive area with a higher incidence of immediate postoperative pain compared to stapled hemorrhoidopexy (Laughlan et al. 2009). For stapled hemorrhoidectomy the extent of pain depends on the height of the stapler line above the anal verge. Removal of squamous epithelium results in greater intensity of postoperative pain and should be avoided (Cheetham et al. 2003).

Postoperative pain and pain after the first stool motion are two different situations. Patients who had hemorrhoidectomy reported more severe pain induced by the first stool motion than patients undergoing stapled hemorrhoidopexy (Senagore et al. 2004). This is not specific for outpatient management, but patients must be informed of the discomfort related to the first bowel movement and the use of laxatives should be recommended.

Major postoperative complications after surgery for hemorrhoids such as excessive bleeding and pelvic sepsis are rare and often associated with compromised immunological competence of the patient.

4 Preoperative, Intraoperative, and Postoperative Concerns

Successful ambulatory hemorrhoidal surgery depends on proper patient selection, careful perioperative care, effective postoperative pain control, patient education, and a well-planned follow-up.

A thorough patient history and physical examination are the basis of proper preoperative evaluation and selection before ambulatory surgery. The functional limitations and comorbidities of the patient should be assessed and the choice of surgery adapted to these conditions. The use of

local anesthetics such as perianal infiltration or anal block is safe and has few complications, and the operation can be started within a short period of time.

Recovery from anesthesia is observed in the postanesthesia care unit until the patient can be safely discharged and in the care of a responsible adult return to home. It is important to achieve adequate postoperative pain control with the use of local anesthetics, nonsteroidal anti-inflammatory drugs, and in certain cases oral narcotics. The incidence of urinary retention after hemorrhoidectomy and other anorectal procedures is relatively high. Restricted intravenous perioperative infusion is recommended to lower the risk especially after spinal anesthesia (The Standards Task Force 2003; Vindson-Bonnet et al. 2015). Follow-up is an important part of outpatient surgery. The use of standardized postoperative follow-up instructions will help the patient being discharged directly from recovery to home. The outcome of the surgery and the patient satisfaction can be evaluated with postoperative telephone questionnaires.

5 Main Disadvantages of Outpatient Treatment for Hemorrhoids

In general, the benefit of outpatient surgery for hemorrhoids highly exceeds the disadvantages. However, there are some drawbacks on the outpatient setup.

Patients with prior health problems or more complicated medical issues do not qualify for ambulatory treatment of their hemorrhoids due to an increased risk of complications. The ambulatory structure is not prepared for all type of emergencies. In the rare event of surgical complications or emergencies during anesthesia or after the operation, transfer to a nearby hospital may be necessary; therefore, high-risk patients must preoperatively be carefully evaluated and should have their surgery done in a hospital except for selected cases.

Most outpatient clinics do not have overnight facilities, and some patients may have a special need to spend the first night in a supervised

place. The disadvantage for these patients is that they must be transported to a nearby hospital for overnight observation. When patients undergo ambulatory surgical treatment, there is a need for an accompanying person on the day of surgery and also on the following day. Family members or friends providing this care for the patient may not know the important signs of complications, so specific instruction about symptoms should be given and counseling by telephone should be available if questions or problems arise. Another disadvantage of outpatient surgery is that secondary hemorrhage and severe pain may occur shortly after the patient is discharged from recovery. Unplanned admission and anesthesia may then be necessary to get control of the bleeding or the pain. General anesthesia may impair psychomotor function and skills related to driving; therefore, ambulatory surgical patients are instructed to refrain from driving for 24 h postoperatively. Chung has investigated this in a study, and he concluded that patients are safe to drive 24 h after general anesthesia (Chung et al. 2005).

6 Conclusion

Day-case hemorrhoidal surgery can be performed whatever the surgical procedure. However, the management of outpatients must be adapted to the surgical technique as the postoperative course is different accordingly. Due to lack of prospective, randomized comparative studies, it is not possible to state that ambulatory surgery decreases morbidity after hemorrhoidal surgery compared to conventional in-hospital surgery.

The main disadvantages of the ambulatory management of patients planned for hemorrhoidal surgery are that some patients do not qualify for the outpatient setup. Most outpatient clinics do not have overnight facilities and in case of unexpected emergencies patients have to be transferred to a nearby hospital. Patients undergoing ambulatory surgery need a family or social network that may be available to help if complications occur after the patient has been discharged from recovery.

7 Cross-References

- Literature Review on Outpatient Treatments for Hemorrhoids
- Pros and Contras of Outpatient Treatments for Hemorrhoids
- Technical Tips and Tricks of Outpatient Treatments for Hemorrhoids
- Why and When I Do Prefer the Outpatient Treatments for Hemorrhoids

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Literature Review on Outpatient Treatments for Hemorrhoids

16

Fabio Gaj, Jacopo Andreuccetti, and Ivano Biviano

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Abstract

The chapter focuses on literature review on outpatient treatments for hemorrhoids, involving medical management, and above all office-based procedures, for symptomatic low-grade

internal hemorrhoids according to the Goligher's classification.

A wide range of options are available, and the choice is based on several aspects that may depend on surgeon preference and experience, equipment availability, patient medical comorbidities, and patient preference. Correction of lifestyle and dietary habits are the initial preventive measures. Conservative approaches are recommended initially for patients with low-grade disease and in particular for pregnant, immunocompromised, in coagulation disorders, cirrhosis, and Crohn's disease. Medical management for symptomatic hemorrhoids can be distinguished in oral and topical treatment; however, there are no evidence showing their benefit for prevention or long-term treatment of hemorrhoid disease.

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Nonoperative treatments are generally done in the office or endoscopy suite, without the need for anesthesia or preparation of the patient and they have the advantage that patients resume normal activities after treatment. These techniques do not have effect on any external hemorrhoid, and rubber band ligation (RBL) is currently the most widespread outpatient treatment. Complications are usually minor with range from 3% to 8%, and banding has the best outcome with first- and second-degree hemorrhoids, with 70–90% success after one treatment.

Other office-based procedures include injection sclerotherapy with a high degree of initial success in decreasing bleeding and pain and infrared photocoagulation, bipolar diathermy, and direct current electrotherapy. All these techniques have success rates inferior to RBL in randomized studies.

Abbreviations	
HAL	Hemorrhoidal artery ligation
HeLP	Hemorrhoid laser procedure
IRC	Infrared coagulation
RBL	Rubber band ligation

1 Introduction

The number of patients who have symptomatic hemorrhoids is increasing in Western societies. The cause of symptom development is multifactorial, including behavioral habits, such as diet, bowel features, as well as genetic influences (Crosland and Jones 1995). Patients with symptomatic hemorrhoids have decreased quality of life compared to the general population (Riss et al. 2011).

A wide range of options are available for those who want treatment. However, the distinction between internal and prolapsing hemorrhoids will affect the optional strategies. So, it is still relevant the standard grading system to evaluate the classification of hemorrhoids (grades I–IV), although in clinical practice other findings may involve clinical decision such as size, severity of bleeding, impact on quality of life, and not least the patient’s wishes (Cataldo et al. 2005).

In this chapter, we will focus on literature review on outpatient treatments for hemorrhoids, involving low-grade internal hemorrhoids according to the Goligher’s classification, that are easily treated with conservative treatment, medical intervention, and/or office-based procedures, e.g., rubber band ligation and sclerotherapy (Lohsiriwat 2013).

2 Dietary and Lifestyle Modification

Correction of lifestyle and dietary habits are the initial therapy above all preventive measure, in patients with difficult evacuation, trying to increase the consistency of the stools to prevent damage to the anal cushions and to avoid symptomatic hemorrhoids. Fiber supplements and fluid intake remain an integral part of initial treatment. Guidelines recommend daily fiber intake (25 g/d fiber for women and 38 g/d for men) which can be hard to get, so the use of bulking agents such as psyllium fiber can be a viable alternative (Rakinic and Poola 2014). There are few studies in this regard; however, a review of seven trials using fiber revealed a consistent benefit in reducing bleeding and other hemorrhoid-related symptoms (Alonso-Coello et al. 2006a). The efficacy of such treatments remains to be proven because diarrhea can occasionally induce the onset of hemorrhoids.

The correction of lifestyle, including regular exercise, sleep hygiene, noncaffeinated fluids, toileting behavior, and laxative uses, can be useful measures, but the evidence is poor (Bryant-Waugh et al. 2006).

3 Conservative Therapy

Conservative approaches are recommended initially for patients with low-grade disease and in particular for pregnant, immunocompromised, in coagulation disorders, cirrhosis or portal hypertension, and Crohn’s disease.

Medical management for symptomatic hemorrhoids can be distinguished in oral and topical treatment. Oral vasotopic drugs are used for treating

Table 1 Some recent studies on the topical treatment of hemorrhoid disease

Authors	Topical treatment		Study
Hernández-Bernal et al. 2014	Vasoconstrictive	Phenylephrine + recombinant streptokinase	Randomized controlled trial
Hernández-Bernal et al. 2015	Anti-inflammatory	Hydrocortisone acetate + recombinant streptokinase	Randomized controlled trial
Ratnasingham et al. 2010	Barrier or emollient	Glyceryl Trinitrate	Meta-analysis
Kolbe and Hain 2015	Anesthetic	Hyaluronidase + local anesthetic	Clinical trial

hemorrhoids, comprising flavonoids (plant extracts) and synthetic compounds. These drugs include oxerutin, diosmin, hesperidin, cumarin, and quercetin, all of which act as pronounced scavengers of hydroxyl radicals. These drugs initially used to treat chronic venous insufficiency were used secondarily for hemorrhoids with the function of increasing vascular tone, promoting capillary resistance and lymphatic drainage, and for anti-inflammatory effects (Thanapongsathorn and Vajrabukka 1992).

In a not very recent study, it had been compared micronized purified flavonoidic fraction plus ispaghula husk with rubber band ligation plus ispaghula husk in the management of bleeding nonprolapsed hemorrhoids and there were no significant differences in the recurrences at 6 months of follow-up, but micronized purified flavonoidic fraction plus ispaghula husk relieved most expediently the bleeding from nonprolapsed hemorrhoids (Ho et al. 2000). Hesperidin in combination with diosmin was particularly favored and they are marketed in more than 50 countries, but their mechanism remains unclear. A 2006 meta-analysis with 14 studies (1514 patients), all parallel-group randomized trials comparing a flavonoid versus placebo, revealed 60% decrease of persisting symptoms and the risks of bleeding, pain, and itching seemed significantly lower. However, quality of the evidence was moderate and for the heterogeneity of the studies was not possible to draw a conclusive effect (Alonso-Coello et al. 2006b). A 2012 Cochrane review on the use of phlebotonics for hemorrhoids showed a statistically significant benefit in itching and bleeding (Perera et al. 2012).

Currently, the Food and Drug Administration (FDA) does not approve the use of micronized purified flavonoid fraction in the United States.

Topical medications provide short-term local relief from discomfort, pain, and bleeding in acute setting. They were more studied than oral, but evidence for any beneficial effect is limited. There are several formulations: creams, gels, foams, wipes, and suppositories. The most studies with corticosteroids were carried out in pregnancy for limited systemic absorption and treatment is mainly symptomatic, over which encumbered by some side effects such as thinning of the perianal skin and maceration. There are no prospective randomized trials that suggest topical preparations reduce bleeding or prolapse in not pregnancy patients, and there is no evidence showing their benefit for prevention or long-term treatment of hemorrhoid disease (Table 1 shows some recent studies on the topical treatment).

3.1 Alternative Conservative Treatment

We report an alternative treatment with Sofora Japonica (*Sophora* flower formula with water soluble herbal ingredients) has long been used in traditional Chinese medicine and currently recorded in European Pharmacopoeia. However, its effects on hemorrhoids need to be studied in a larger sample size and with different dosages (He et al. 2016).

4 Office-Based Procedures

Several techniques are available for nonsurgical treatment of hemorrhoids, all with the goal of causing fibrosis, retraction, and fixation of the hemorrhoidal cushions. Nonoperative treatments

are generally carried out in the office or endoscopy suite, without the need for anesthesia or preparation of the patient and with the advantage that patients resume normal activities after treatment. The lack of somatic innervation makes office treatment of internal hemorrhoids of interest to proctologists. External hemorrhoids, which are somatically innervated, cannot be treated by these methods. For the surgeon does not resort to the patient's sedation allows you to notice inadvertent treatment below the dentate line for the onset of pain. These techniques include rubber band ligation (RBL), infrared coagulation (IRC), bipolar diathermy, laser photocoagulation, injection sclerotherapy, and cryotherapy.

The choice of therapy may depend on surgeon preference and experience, equipment availability, patient medical comorbidities, and patient preference (Jacobs 2014).

4.1 Rubber Band Ligation

Rubber band ligation is the method of choice for the treatment of internal hemorrhoids (first- and second-degree) and some otherwise healthy patients with grade III disease, if not coexists a mucosal prolapse of the rectum (Gaj et al. 2015). This technique is simple and easy to carry out, requiring no anesthetic and with rapid recovery (Forlini et al. 2009).

Complications are usually minor with range from 3% to 8% (El Nakeeb et al. 2008). The most common complications are pain, bleeding, external hemorrhoidal thrombosis, urinary difficulty, and vasovagal attack. Systemic infection is a rare but serious complication. Banding has the best outcome with first- and second-degree hemorrhoids, with 70–90% success after one treatment (Iyer et al. 2004).

A 2005 Cochrane review comparing RBL to excisional hemorrhoidectomy concluded that RBL was the treatment of choice for grade II hemorrhoids, providing results similar to those of excisional hemorrhoidectomy (Shanmugam et al. 2005).

A long term study with RBL showed a recurrence rate at 1 year of 3%, at 2 years of 9.6%, and at 5 years was 16.9% (Su et al. 2011).

An Italian randomized controlled trial study of 60 patients with a follow-up of 1 year compared the hemorrhoid laser procedure (HeLP) with rubber band ligation for outpatient treatment of symptomatic hemorrhoids. The study showed no significant difference between the two techniques regarding duration of operation, intraoperative morbidity, and patient satisfaction. In this study, despite its higher cost and short follow-up, HeLP procedure was superior to RBL in resolving symptoms and reducing hemorrhoid grade (Giamundo et al. 2011).

Recently has been published a well-designed multicentre, parallel-group, randomized controlled trial of 370 patients comparing therapeutic outcomes between RBL and Hemorrhoidal artery ligation (HAL) for grade II–III hemorrhoids. The recurrence rate for HAL was significantly lower than for RBL (30% vs. 49%, $p = 0.001$) at 12 months. Further treatment was required in 31% of the RBL group and 15% of the HAL group. Authors conclude that HAL is more effective than single RBL, if however, RBL is considered a course of treatment involving repeat banding, the procedures are equally effective. HAL is significantly more expensive and requires anesthesia (Brown et al. 2016).

Currently, there is no meta-analysis for hemorrhoids outpatient treatment. The last was in 1997 in which for grades I and II hemorrhoids, RBL appeared to be the treatment of choice. RBL was considered as a first-line treatment for grade III prolapsing hemorrhoids, recognizing that surgical hemorrhoidectomy should be necessary for some patients whose symptoms are not relieved. RBL was shown to be superior to sclerotherapy for grade III hemorrhoids with respect to response to therapy (MacRae and McLeod 1997).

4.2 Sclerotherapy

Sclerotherapy is an outpatient treatment for patients unresponsive to medical therapy. It can be proposed for grade I and II hemorrhoids.

Like RBL, this technique does not require local anesthesia, through an anoscope the sclerosing agents are injected into hemorrhoids. Some

authors propose an endoscopic sclerotherapy during colonoscopy (Zhang et al. 2015). A lot of sclerosing agents, including ethanolamine, quinine, hypertonic saline solution, 5% phenol in oil, aluminum potassium sulfate and tannic acid, have been used. All the sclerosant cause tissue necrosis of hemorrhoids and consequential fibrosis and fixation to the anal canal. It is important that the injection be made into submucosa at the base of the hemorrhoidal tissue and not into the hemorrhoids themselves.

Sclerotherapy is to be avoided in case of acute inflammation in the perianal region, hemorrhoidal thrombosis, acute irreducible hemorrhoids, previous anal surgery, previous sclerotherapy, fourth-degree proctocoele, fissures, fistulas, prolapse, and other proctological conditions, colorectal neoplasia, fecal incontinence, proctitis, abscess, Crohn's disease, or ulcerative colitis.

The success of this technique depends only on the correct indication. There are no reviews and meta-analyses that analyze the effectiveness of sclerotherapy compared to other therapy.

RCT and retrospective studies exist but they evaluate a small numbers of patients.

An improvement in bleeding was reported in 100% of patients with second- and third-degree hemorrhoids. In several series prolapse disappearance rate was 93–100% in patients with second- and third-degree hemorrhoids but decreased to 53% in the fourth-degree hemorrhoids at 4 years follow-up (Yano et al. 2014).

When sclerotherapy was compared to hemorrhoidectomy by Kunimoto, his group did not report statistical difference in recurrence of symptoms at 1 month of follow-up (Hachiro et al. 2007). Yano comes instead to different results comparing sclerotherapy and hemorrhoidectomy in the treatment of third- and fourth-degree hemorrhoids. His results indicate that hemorrhoidectomy is superior to sclerotherapy. In fact, the symptoms-free rates were 53% in the sclerotherapy group and 80% in the hemorrhoidectomy group, and the satisfaction rates were 70% in the sclerotherapy group and 88% in the hemorrhoidectomy group.

Complications are rare and usually due to the misplacement of the sclerosing injection.

Discomfort, bleeding, pain, mucosal ulceration, tenesmus, dysuria, impotence are the most common complications. In some cases were reported life threatening complications like rectal perforation (Barwell et al. 1999), necrotizing fascitis (Schulte et al. 2008), and abdominal compartment syndrome (Miyamoto et al. 2016).

4.3 Infrared Photocoagulation and Bipolar Diathermy

Infrared photocoagulation and bipolar diathermy are similar to RBL. Mechanism of action provides fixation of the prolapsing hemorrhoid with energy. The energy used coagulates tissue and evaporates water in the cell, causing shrinkage of the hemorrhoid mass which fixes the tissue at the apex of the hemorrhoid. Like sclerotherapy, the techniques can also be used through an endoscope with the same advantage.

Infrared photocoagulation and bipolar diathermy should be used in the treatment of first- and second-degree hemorrhoids. In this case, both techniques demonstrate the same feasibility and effectiveness when compared to RBL. IRC was associated with less pain than RBL in the 24 h post-operative period (Marques et al. 2006). Doesn't exist studies that evaluate long-term outcomes. A not recent meta-analysis conducted by Kaidar-Person of five prospective trials, evaluated 862 patients with grades I to II hemorrhoidal disease who received treatment with IRC, RBL, or sclerotherapy. Although rubber-band ligation demonstrated a greater long term efficacy than sclerotherapy or infrared coagulation, it was associated with significantly higher incidence of postprocedure pain. The authors concluded that infrared coagulation is the most favorable nonsurgical treatment for hemorrhoids (Johanson and Rimm 1992). In third- and fourth-degree hemorrhoids, IRC and BD should be avoided; some studies demonstrated for infrared photocoagulation a very high percentage of recurrence, persistence of the disease, and anal pain after surgery, when compared with RBL (Linares Santiago et al. 2001; Poen et al. 2000).

Complications are rare and usually minor. Compared with sclerotherapy, IRC is less technique-dependent and avoids the potential complications of misplaced sclerosing injection.

4.4 Cryotherapy

Cryotherapy is based on damage to the tissue from very low temperature (between -70°C and -196°C), using liquid nitrogen or nitrous oxide, causing necrosis and destruction of the tissue (Traynor and Carter 1984). The procedure is time-consuming, and patients experience pain and a foul-smelling rectal discharge that persists for 5–8 days. Significant complications include anal stenosis, sphincter damage, and fecal incontinence. This technique has been almost completely abandoned. We report a recent mexican randomized, prospective, longitudinal study with a Hemor-Rite[®] cryotherapy device based on cold therapy for topical application, that can produce vasoconstriction, tissue hypoxia, analgesia, and muscle relaxation. Author shows that this device is statistically similar or superior to proctology ointment in some of the parameters studied such as reduction of pain and hemorrhage (Guindic 2014). Additional studies are needed to obtain medical evidence.

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Part IV

Hemorrhoidectomy



Traditional Hemorrhoidectomy: Techniques and Results

17

Indru T. Khubchandani and David S. Bub

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Abstract

With the newly available techniques for non-surgical hemorrhoidectomy, surgical hemorrhoidectomy is being practiced much less frequently. However, for fourth-degree hemorrhoids and some third-degree, a well-performed traditional hemorrhoidectomy, with removal of the pathology and correction of the associated conditions, still remains the procedure of choice. The techniques of open (Milligan-Morgan) and closed (Ferguson) hemorrhoidectomy will be described and an analysis of their outcomes performed.

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1 Introduction

With the newly available techniques for non-surgical hemorrhoidectomy, surgical hemorrhoidectomy is being practiced much less frequently. However, for fourth-degree hemorrhoids and some third-degree, a well-performed hemorrhoidectomy, with removal of the pathology and correction of the associated conditions, still remains the procedure of choice.

Described by Milligan and Morgan in 1937, the open hemorrhoidectomy technique has been practiced for almost a century with low morbidity and excellent outcomes. In 1959, Ferguson (Ferguson and Heaton 1959) presented the closed technique, suggesting less pain and faster healing compared to the open hemorrhoidectomy. The techniques of open (Milligan-Morgan) and closed (Ferguson) hemorrhoidectomy will be described and an analysis of their outcomes performed.

2 Preoperative Preparation

Unless the history indicates otherwise, no preoperative testing is needed, especially if the patient had some other procedures performed in the past. An ECG is performed in the elderly only when there is a history of cardiac problems. A chest radiograph is not necessary. The patient should be approved for anesthesia preoperatively during the preadmission testing. The patient should fast after midnight on the day before surgery, and report to the Ambulatory Surgical unit on the morning of surgery, after having self-administered a disposable phosphosoda enema. An intravenous line is established with a 250ml solution of 0.5% normal saline in 5% dextrose. The patient is delivered to the Operating Room after the patient has had sedation in the holding room.

Anticoagulation will need to be held prior to surgery. Warfarin is held for 5 days prior to surgery. Those patients requiring ongoing anticoagulation are either admitted for a heparin switch or maintained as an outpatient on Enoxaparin (Lovenox). Dabigatran Etexilate (Pradaxa) and Apixaban (Eliquis) are held for 24 h prior to surgery. Clopidogrel (Plavix) and other antiplatelet

agents are preferably held for 5–7 days prior; however, we often will perform hemorrhoidectomy on patients without stopping these drugs. Aspirin may be continued without added complication. The timing for restarting anticoagulants must be individually managed based on the individual patient risk for postoperative bleeding versus the risk of a thrombotic complication.

3 Technique: Open Hemorrhoidectomy

Milligan and Morgan first described the technique of open hemorrhoidectomy in 1937, and it has remained the standard by which all hemorrhoid surgeries are compared. Essentially, open hemorrhoidectomy is a low ligation with excision of the hemorrhoids and can be easily performed with a minimal requirement for surgical instruments and suture. Performed in the lithotomy position, general anesthesia or heavy sedation is easily administered during the open technique.

3.1 Position and Anesthesia

Open hemorrhoidectomy is most commonly described in a lithotomy position (Golligher 1976; Khubchandani et al. 2009). This allows easy access to a patient's airway allowing for heavy sedation or general anesthesia with little risk. Milligan described using only an injectable epinephrine solution for hemostasis without the use of local anesthetic. It is our preference to perform all hemorrhoidal surgery in a prone jack-knife position. Sedation is administered cautiously by an anesthesiologist during which a perianal block is administered with a combination of 1% lidocaine, .5% bupivacaine, 1/200,000 epinephrine and sodium bicarbonate. The block is administered into the perianal subcutaneous tissues as well as submucosally in the anus. Approximately, 15–25 cc of solution is usually required. With a complete anal block limited sedation is required with Propofol (Diprivan). Antibiotic prophylaxis is not necessary except for patients with prostheses requiring so.

3.2 Technique

With the patient in lithotomy position, it is necessary to position the patient with the buttocks projecting off the edge of the table. “Candy Cane” stirrups with the feet padded is our preference. Even with general anesthesia, we inject the combination of local anesthetic and epinephrine to relax the anal sphincter, induce vasoconstriction thereby improving hemostasis, and for postoperative pain control.

The procedure begins by using a hemostat to grab the external component of the hemorrhoid in all three quadrants inducing prolapse of the internal component. The internal component is also then grasped with a clamp. Hemorrhoids are classically in the left lateral (9 o'clock in the lithotomy position) right anterior (3 o'clock) and right posterior (7 o'clock). With all three clamps under tension the pink rectal mucosa of the upper piles are exposed as well as the mucosal folds between them. This is the classic triangle of exposure of Milligan.

We begin in the left lateral position. The clamps are placed in the left hand and the index finger placed in the anal canal to further delineate the hemorrhoid. Curved mayo scissors are used to incise the perianal skin, dissecting the external component off the external sphincter complex. As the dissection is continued cephalad, the tissue is dissected off the internal sphincter. One must take care to limit the lateral dissection of healthy mucosa to avoid causing anal stenosis.

At this time, a 3-0 polyglycolic acid or 3-0 chromic suture is used to ligate the apex and the hemorrhoid excised. Electrocautery can be used for hemostasis. With a clamp retracting the suture held by the assistant, a similar procedure is performed on the remaining right sided piles. The skin bridges of a Milligan-Morgan hemorrhoidectomy are often much smaller than a closed technique. With completion, a simple small telfa dressing is applied. If needed, a small pack with surgical and gelfoam can be placed into the anal canal. The skin edges remain open to heal by secondary intention. An old adage states: “If it looks like a clover your troubles are over. If it looks like a dahlia it's a failure” (Ferguson and Heaton 1959).

4 Technique: Closed Hemorrhoidectomy

Closed hemorrhoidectomy is associated with the technique first described by Ferguson and Heaton in 1959. The technique has been modified considerably from the one first described.

The procedure performed by us is in a prone jackknife position and not in a left lateral Sim's. The anesthesia used is largely local (0.5% Lidocaine[®] with 1:200,000 Epinephrine), as described by us in 1972 (Khubchandani et al. 1972). The suture material used is fine; we have elected to use 5-0 polyglycolic acid for many years, on account of its appropriate tensile strength, and the dissolution in about 10–12 days when the wounds are generally healed, if closed without tension. We apply a simple over-and-over *apposition* closure, not hemostatic with tension, and leave a dead space without incorporating the underlying sphincter musculature. A deeper bite into this space causes pain and contributes to dehiscence following stretching and contraction.

4.1 Positioning

A prone jackknife position is used, and the buttocks are retracted with adhesive tape on both sides (Fig. 1). The hips are flexed, and both arms are extended. The patient is sedated with Propofol[®] (Zeneca) and/or Midazolam[®] (Roche) (Fig. 2). The



Fig. 1 Prone Jackknife position (Pictures were obtained from Dr. Khubchandani's text (Khubchandani et al. 2009))

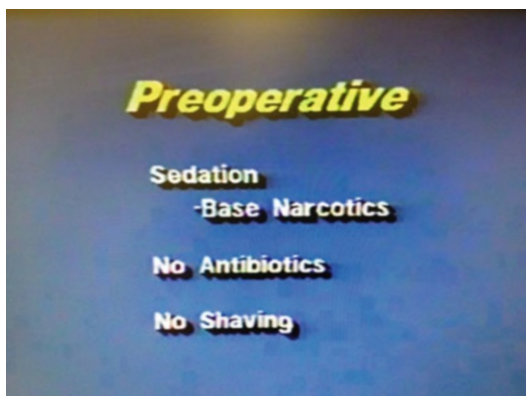


Fig. 2 Patient in prone jackknife position with buttocks retracted with adhesive tape. (Pictures where obtained from Dr. Khubchandani's text (Khubchandani et al. 2009))

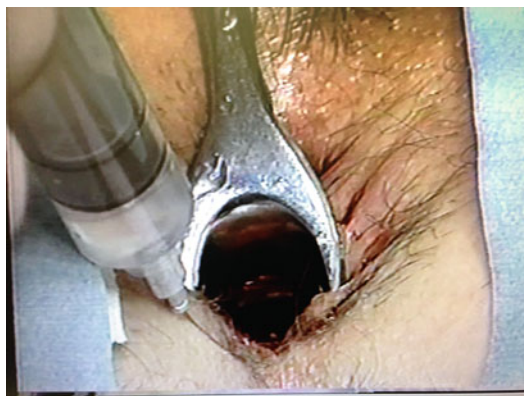


Fig. 4 Intramucosal injection (Pictures where obtained from Dr. Khubchandani's text (Khubchandani et al. 2009))

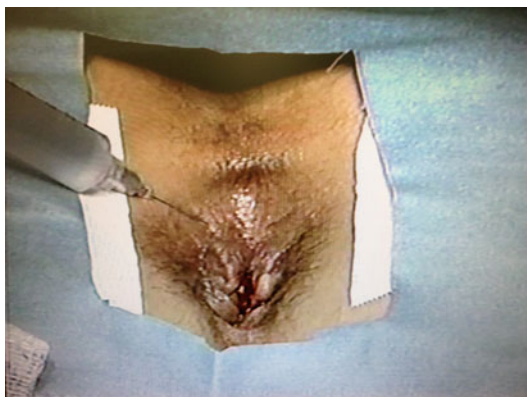


Fig. 3 Subcutaneous infiltration of anesthesia mix (Pictures where obtained from Dr. Khubchandani's text (Khubchandani et al. 2009))

local anesthesia used is 0.5% Lidocaine[®] with 1:2000,000 epinephrine. About 15 ml of this solution is used per procedure. A subcutaneous, circumferential infiltration is performed with a no. 30 needle using approximately 5 ml of this solution (Fig. 3). Another 8 ml is then deposited in the submucous plane, 2 ml in each of the four quadrants with a finger or a pediatric Hill-Ferguson retractor in the anal canal (Fig. 4). If the solution is inadvertently deposited in the plane outside of the sphincter muscle, no ill effects are encountered. The anesthetic effect is instantaneous and complete with adequate relaxation of the sphincter.

4.2 Technique

A medium-sized Hill-Ferguson retractor is inserted, and the anal canal is inspected. A plan is outlined for the extent of the required dissection. As a rule, three classic primary hemorrhoidal complexes (i.e., left lateral, right posterior, and right anterior quadrants) are excised. However, the author chooses to remove the larger, seemingly symptomatic complex or complexes only. Care is taken to avoid making excisions in the anterior and posterior midline, where an unhealed wound may result. A knife is used to make a radial elliptical incision, encompassing the primary hemorrhoidal complex, starting at the point proximal to the dentate line and extending well beyond the anal verge (Fig. 5). Using scissors, the skin is lifted from the underlying external sphincter, and the mucosa is freed from the internal sphincter cephalad, proximal to the dentate line. With local anesthesia, the tissue planes are remarkably easily demarcated, and the anatomic definitions are perfect. Due to vascular constriction, the blood loss is minimal, often requiring only a few 4 × 4 sponges for the entire procedure. A suction device is not necessary. The proximal point is reached when the attachment of the muscle of Treitz (longitudinal fiber complex) is seen to anchor the internal sphincter to the mucosa. Using scissors, this mucosal suspensory ligament is divided, the



Fig. 5 Elliptical incision (Pictures where obtained from Dr. Khubchandani's text (Khubchandani et al. 2009))

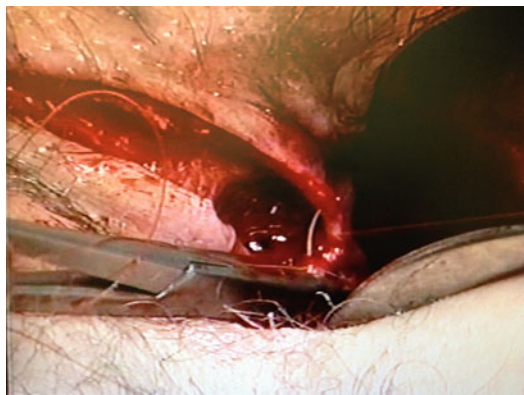


Fig. 8 Primary closure initiated (Pictures where obtained from Dr. Khubchandani's text (Khubchandani et al. 2009))



Fig. 6 Dissection of hemorrhoidal mass off underlying sphincter (Pictures where obtained from Dr. Khubchandani's text (Khubchandani et al. 2009))



Fig. 9 Complete closure of the wound (Pictures where obtained from Dr. Khubchandani's text (Khubchandani et al. 2009))



Fig. 7 Excision of hemorrhoidal mass (Pictures where obtained from Dr. Khubchandani's text (Khubchandani et al. 2009))

salmon-colored proximal part of the internal sphincter is dissected free (Fig. 6), and the hemorrhoidal complex is excised (Fig. 7). This is the so-called "pedicle" described in the literature, and it does not bleed. The use of sphincterotomy in the base of the wound has been abandoned. In a prospective randomized study, internal sphincterotomy did not relieve pain and caused deficit in continence (Khubchandani 2002). The wound is closed primarily with one continuous, simple over-and-over suture of 5-0 polyglycolic acid, beginning at the apex (Fig. 8), the most proximal point of the excised tissue, and ending at the external verge, where no attempt is made to leave any open area for drainage (Fig. 9). Reinforcing sutures are not used.

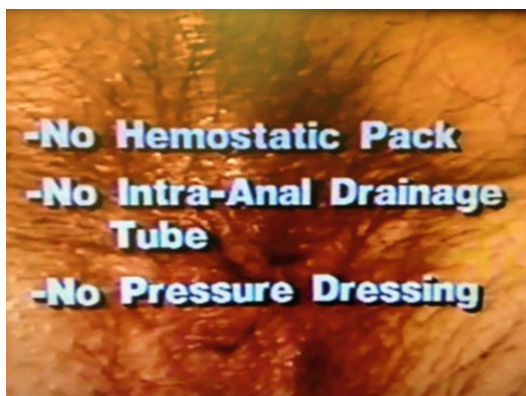


Fig. 10 Closure without any packing or drain tube. (Pictures were obtained from Dr. Khubchandani's text (Khubchandani et al. 2009))



Fig. 11 Appearance at conclusion of surgery (Pictures were obtained from Dr. Khubchandani's text (Khubchandani et al. 2009))

The suture should not be pulled tight. It is intended to approximate the tissue, rather than act as a hemostatic constriction. Contrary to the traditional surgical axiom, no attempt is made to eliminate the potentially contaminated deep space. The underlying sphincter muscle, therefore, is not incorporated into the suture. No drainage tubes or hemostatic packs are inserted, and no compression dressing is considered necessary (Fig. 10). Only an external Tefla[®] dressing may be applied. A completed three-column hemorrhoidectomy is shown in (Fig. 11).

4.3 Postoperative Care

The patients are returned directly to the Ambulatory Suite. They are given a snack and a drink soon afterwards, and if necessary, an oral analgesic. Patients are discharged one-half to one hour after surgery with appropriate instructions.

The follow-up regimen consists of Sitz baths (patients are given a disposable Sitz bath to be placed over the commode with connections for plumbing), and patients are advised to take an oral laxative Dulcolax[®] on the evening of surgery to promote a bowel movement. In addition, patients are advised to take a bulk supplement, such as psyllium seed, to facilitate bowel activity. An appointment is scheduled 10 days postoperatively, when the sutures will have absorbed. The next visit is scheduled for three weeks later (if necessary), when the wounds are completely healed.

5 Results

Closed hemorrhoidectomy: Table 2 lists the complications in a series of 3274 cases. The low incidence of urinary retention (3.7%) is explained by the limited use of intravenous hydration during the procedure (Ferguson and Heaton 1959). There is a low incidence of infection and abscess formation (0.18%). Postoperative pain is always difficult to evaluate. However, most patients do not finish a 20-tablet prescription for analgesic medication (Oxycodone)[®].

5.1 Long-Term Follow-up

Long-term follow-up was carried out on 582 patients who had closed hemorrhoidectomy performed at least one to seven years previously. Of the 441 patients suitable for the study, 54 (7.7%) developed significant anorectal or colonic pathology. Thirty-three (7.5%) had treatment for residual symptomatic hemorrhoidal problems. One required repeat excisional hemorrhoidectomy (Table 3). Satisfactory long-term results were obtained in 92.6% of patients (Fig. 4).

Table 1 Results of Randomized Controlled Trial (You et al. 2005)

Parameter	Open group (n = 40)	Closed group (n = 40)	P
Wound healing			
2 weeks	1 (2.5%)	5 (12.5%)	NS
3 weeks	7 (17.5%)	30 (75%)	< 0.01
Wound dehiscence		3 (7.5%)	
Painful skin tag	8 (20%)	2 (5%)	0.059
Urinary retention	3 (7.5%)	1 (2.5%)	NS
Early bleeding	1 (2.5%)	0	NS
Late bleeding	0	0	

Table 2 Complications of closed hemorrhoidectomy in 3274 cases

Complications	Number (%)
Bleeding:	
Requiring packing	16 (0.49)
Requiring reoperation	0 (0)
Abscess formation:	
Opened in office	4 (0.12)
Requiring reoperation	2 (0.06)
Suture line dehiscence:	
One-quarter only	163 (4.97)
Circumferential	2 (0.06)
Urinary retention	121 (3.70)
Excessive edema requiring reoperation	199 (6.08)

5.2 A Comparison of Open Hemorrhoidectomy (Milligan-Morgan) vs. Closed Hemorrhoidectomy (Ferguson)

The debate between open and closed hemorrhoidectomy has been ongoing since the description of the closed technique by Ferguson and Heaton. The Milligan-Morgan hemorrhoidectomy is performed almost exclusively in Europe and the rest of the world whereas the closed technique is performed predominantly in the United States. Those performing closed hemorrhoidectomy implicate the large exposed areas after open hemorrhoidectomy as the source of ongoing postoperative pain and criticize the prolonged healing of these open wounds. Not surprisingly, as surgeons we perform and support the technique by which we were trained.

Ferguson professed that the closed technique was associated with less postoperative pain, faster

wound healing and less risk of anal stenosis requiring dilatation. McConnell and Khubchandani also described their experience performing closed hemorrhoidectomy with less postoperative pain and rapid wound healing (McConnell and Khubchandani 1983). More recent studies have contradicted older results by demonstrating no difference in pain scores between surgical groups, however, confirming more rapid wound healing with the closed technique (Arbman et al. 2000; Carapeti et al. 1999; Gencosmanoglu et al. 2002; You et al. 2005).

Most recently, You et al. performed a randomized trial comparing open and closed techniques among equal groups of 40 patients each (You et al. 2005). Results demonstrated less postoperative pain among the closed group as measured by oxycodone hydrochloride use during the first week. Wound dehiscence occurred in only 7.5% of patients in the closed technique and wound healing occurred much more rapidly. They concluded closed hemorrhoidectomy to be superior to open in these measures (Table 1).

6 Discussion

Open hemorrhoidectomy has been performed for almost a century with excellent results, and low morbidity. As newer techniques evolve including closed techniques, the use of diathermy, or application of staplers, these methods will need to prove superiority to the standard open technique.

Closed hemorrhoidectomy with local anesthesia is the preferred choice for surgical management of hemorrhoidal disease in the United States. A questionnaire sent by Wolfe et al. to members of

Table 3 Long-term follow-up closed hemorrhoidectomy

Treatment of residual hemorrhoid problems			
Treatment	Number	Percent	Comment
Barron ligation and/or injection	24	5.5	16 ligations and 16 injections in 24 patients
Excision of thrombotic hemorrhoid	4	0.9	
Hemorrhoidectomy	1	0.2	
Medical management	4	0.9	Suppositories, sitz baths, etc.
Total:	33	7.5	

the American Society of Colon and Rectal Surgeons revealed that 65.6% of surgeons who performed a closed hemorrhoidectomy used local anesthesia (Wolf et al. 1979). These authors prefer the closed hemorrhoidectomy technique because it affords faster healing (per primum), less pain, and fewer complications. The procedure can be performed in an ambulatory setting, requiring about a two-hour stay at the hospital. Resumption of full activity, particularly in the motivated patient, occurs in about one to two weeks.

7 Conclusion

Postoperative pain has been a major deterrent to acceptance of excisional hemorrhoidectomy. Various alternatives such as rubber band ligation are available. Certain advanced third- and fourth-degree hemorrhoids are, however, best suited for surgical excision.

Use of local anesthesia, closure of the wounds using minimal trauma and fine absorbable suture material minimizes postoperative discomfort. The patients have a small percentage of wound infection (0.18%), without the use of any antibiotics, and the healing is per primum with low dehiscence rate. The urinary retention is low (3.7%) thanks to the use of limited intravenous fluids. The incidence of incontinence was reduced to almost zero following abandonment of internal sphincterotomy during the procedure (Khubchandani 2002).

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Modern Hemorrhoidectomy: Techniques and Results

18

Giovanni Milito and Giorgio Lisi

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Abstract

Hemorrhoidectomy is frequently associated with significant postoperative pain and prolonged hospital stay. New techniques to reduce these problems are constantly under evaluation. Among these, LigaSure™ hemorrhoidectomy is a safe and fast technique that fulfills the requirements of low-complication rate, fast wound healing and quick return to work, reduction in postoperative pain, and hospitalization. The authors detail all the steps of the surgical

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procedure: operative position, hemorrhoids exposure, dissection, vascular pedicle ligation, hemorrhoidal removal, and final control. Besides this, the attention is focused on the technical features of LigaSure™ technology, given that understanding of technical background is a prerequisite for adequate handling of the LigaSure™ device.

1 Introduction

Hemorrhoidal disease is a common disorder, affecting 4% of the world population. Surgical treatment is generally reserved for those patients who have failed to respond to conservative measures, about 5–10% of patients. Surgical treatment is the initial option in the management of symptomatic third- or fourth-degree hemorrhoids (according to the Colliger scale, the most used classification in the worldwide literature), or in patients with acute hemorrhoids that have not improved with other therapies (Rivadeneira et al. 2011).

According to the literature, hemorrhoidectomy is considered the gold standard and the most effective and definitive treatment for grades 3 and 4 hemorrhoids, and Milligan-Morgan's and Ferguson's procedures are the most widely used hemorrhoidectomy techniques throughout the world. Although these techniques have yielded excellent results and low complication rates, they are usually associated with postoperative pain (Schubert et al. 2009).

The LigaSure™ vessel sealing system (Tyco Healthcare, Boulder, CO) has been recently introduced (Sayfan et al. 2001) as an instrument conceived to upgrade the conventional treatment of hemorrhoids: it consists of a bipolar electrothermal device which offers an optimized combination of pressure and radiofrequency, sealing blood vessels up to 7 mm in diameter and generating an energy tailored to the tissue impedance, with a thermal injury confined to 2 mm over the surgical site. This limited spread reduces anal spasm and allows to perform a bloodless hemorrhoidectomy with reduced postoperative pain and fast healing.

Thus this operation could be recommended as the ideal technique because of the potential reduction in tissue trauma (Kennedy et al. 1998).

2 Indications

The commonest indication was persistent grade 3 and grade 4 hemorrhoids after failure of conservative management, instead there was no consensus yet regarding emergency hemorrhoidectomy for thrombosed or strangulated hemorrhoids – undertaken routinely by 20% of the Association of Coloproctology of Great Britain and Ireland (ACPGBI) and 18% of the Association of Surgeons of Great Britain and Ireland (ASGBI) respondents (Beattie et al. 2002). In rare cases of large hemorrhoids in young patients, especially in female patients after pregnancy, the hemorrhoids may recur, so hemorrhoidectomy should not be performed on pregnant women and should be postponed until the age of 30–35 years. Inflammatory bowel diseases such as Crohn's disease and immune deficiency due to AIDS are both contraindications to this procedure, as live cancer cells can be implanted in open wounds.

3 Preoperative

The device allows to perform hemorrhoidectomy as a day case procedure, so prior to hospital admission, the patient should be advised to take the appropriate steps to ensure healthy bowel habits and passage of soft stool. Our preoperative protocol includes a phosphate enema performed 12 h although in the ACPGBI/ASGBI trial preoperative bowel preparation was often used, with enema being used in 61% of ACPGBI group cases and 43% of ASGBI group and suppository being used in 13% ACPGBI group cases and 16% ASGBI group. Nowadays, a significant number of surgeons prefer no bowel preparation. As reported in the international literature, before surgery no antibiotic therapy is used at the beginning of surgery.

4 The Device

The LigaSure™ Vessel Sealing System is a bipolar electrothermal device that seals blood vessels through an optimized combination of pressure and radiofrequency. After providing pressure on the tissues by LigaSure™ forceps application, the force triad energy platform generates energy tailored to the tissue impedance, reducing fusion cycle time and tissue desiccation with consistently controlled tissue effect. The completion of coagulation is signaled by the feedback sensors and the tissue can be excised along the line of coagulum. LigaSure™ preserves the patient's own collagen and uses it to form a permanent autologous seal that is strong enough to withstand up to three times the normal systolic on vessels or tissue bundles. This result makes LigaSure™ comparable to the mechanical methods of vessels occlusion; it ensures complete coagulation of arteries and veins up to 7 mm in diameter with minimal surrounding thermal spread up to 2 mm in diameter and limited tissue charring. Thus, a decrease in thermal injury at the surgical site may reduce anal spasm and pain. The area of thermal spread after monopolar electrocoagulation depends on many factors: time of applications, power of electrocoagulation, and number of application.

5 Surgical Technique

5.1 Position

Open hemorrhoidectomy can be performed in the lithotomy or prone position; according to our experience to get a better exposure of each pile, we used lithotomy position. In the prone position, the patients lie face down, hips on a 6-in. gel ridge, with the buttocks projecting upward. In lithotomy, the buttocks are raised by a firm to project over the edge of the table. Although the prone position may reduce venous circulation from the anorectal area, extra care should be taken to prevent restriction of breathing and ensure proper lung inflation during surgery. In both positions, the buttocks are

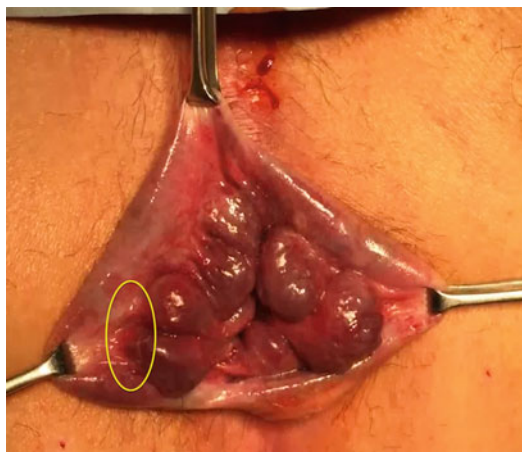


Fig. 1 Fourth-degree hemorrhoids. Allis clamps closed the piles to treat. *Yellow line* show the junction between the mucosal wall (*internal*) and the perianal tissue (*external*)

strapped back with an adhesive tape to facilitate access; it may help in obese patients.

5.2 Hemorrhoids Presentation

The main hemorrhoidal masses are identified and delineated, usually in the “classical” location corresponding to the sites of inferior hemorrhoidal vessels – left and right posterolateral and right anterior quadrants (Fig. 1). The hemorrhoids are prolapsed out from the anal canal with Allis clamps or similar pick up forceps. Tension should be applied to visualize the junction between the mucosal wall (*internal*) and the perianal tissue (*external*).

5.3 LigaSure™ Hemorrhoidectomy

A small V-shaped anodermal seal is performed by applying the LigaSure™ forceps close to the edge of each pile. We advice to treat pile at hour 3–9 and 12. Care should be taken to limit the amount of tissue removed paying attention to preserve anodermal skin and mucosal bridge as much as you can to avoid stricture risk and severe

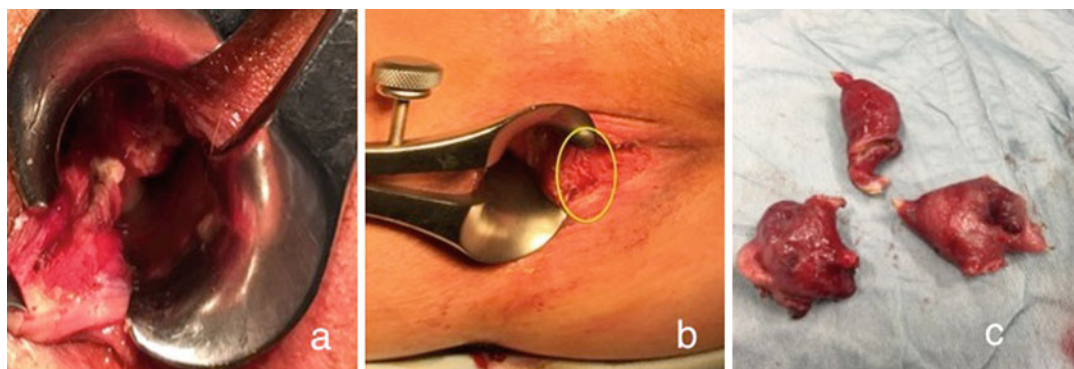


Fig. 2 (a) Resection line of LigaSure™ hemorrhoidectomy (b) Yellow line shows the anal sphincter carefully preserved (c) Piles removed

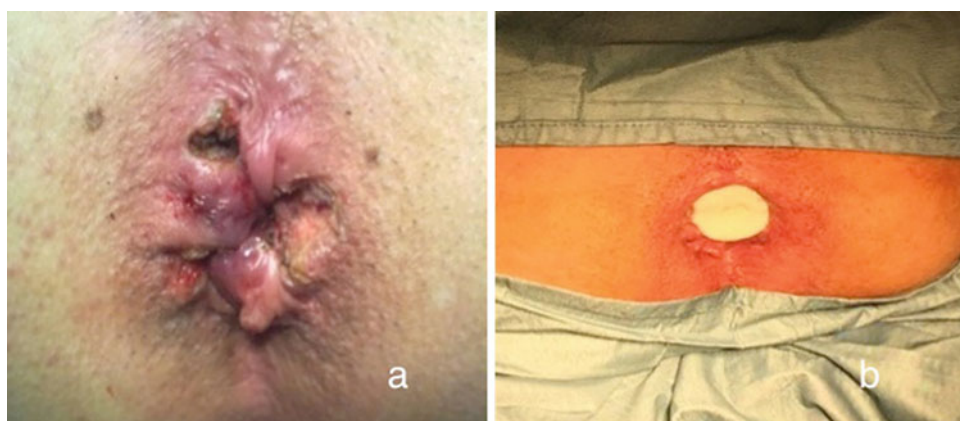


Fig. 3 (a) Final results (b) Gelatin sponge in the anal canal

postoperative pain (Fig. 2). Repeated applications of the device are performed, and the excision is continued into the anal canal, lifting the pile from the internal anal sphincter to the level of the vascular pedicle that is finally sealed by LigaSure™ and divided. No suture points are applied.

5.4 End of the Procedure

The area is inspected with the Eisenhammer retractor to ensure perfect hemostasis. The operation is terminated by placing a hemostatic absorbable gelatin sponge in the anal canal (Fig. 3).

The most important difference between LigaSure™ hemorrhoidectomy and conventional diathermy is that in this procedure the vascular pedicles are not transfixed but sealed as shown in Fig. 2a. The device warranties an excellent hemostasis; in our recent retrospective study with 1000 patients (Table 1), three postoperative bleeding were detected; these patients did not require a reintervention. Furthermore, vascular pedicle ligation might be a contributing factor to the development of ischemia and necrosis in the area where the sutures transfixing the vascular pedicle incorporate the sphincter muscle, which might be one of the causes of acute postoperative pain.

Table 1 Worldwide experience with LigaSure™ Hemorrhoidectomy

Author [ref]	Year	No. patients	Operative time, min	Pain score	Hospital stay, days	Stricture, %	Hemorrhage, %	Follow-up, months	Recurrence, %
Sayfan et al.	2001	40	11	—	—	5	0	6	0
Jayne et al.	2002	20	10	5	—	0	5	3	0
Palazzo et al.	2002	18	5.1	5.2	—	0	0	1.5	—
Thorbeck et al.	2002	56	—	2.3	2	0	0	6	0
Milito et al.	2002	29	9.2	4.7	1.8	3.4	0	6	0
Franklin et al.	2003	17	6	3.3	1	—	—	3	—
Chung et al.	2003	30	15	6.5	3.2	0	10	1.5	0
Lawes et al.	2004	17	—	—	—	—	—	12	11.8
Peters et al.	2005	14	—	—	—	—	—	36	7
Wang et al.	2006	42	11.3	5.1	2.2	2.4	2.4	2	—
Pattana et al.	2006	24	21.7	—	—	—	—	—	—
Bessa et al.	2008	55	8	5	1	0	0	6	0
Altomare et al.	2008	146	30	4.2	0.87	0.6	1.3	1	—
Castellvi et al.	2009	37	12	3	—	0	0	12	0
Fareed et al.	2009	40	9	5.4	2.2	5	0	6	0
Sakr et al.	2010	34	20.8	5.5	2.2	2.9	2.9	12	2.9
Sakr et al.	2010	42	15.3	4.7	2.2	2.4	2.4	12	2.4
Chen et al.	2013	666	18.7	4.1	1.5	3.2	0.15	36.2	3.1
Milito et al.	2016	1000	15	3.9	1	4	3	84	7.8

6 Postoperative Management

This is a day surgery procedure; the patients were discharged the same day of the surgery. Postoperatively, all the patients receive lactulose (15 ml per day for 2 weeks), analgesics (Paracetamol 1 g on demand, never more than three times a day), and topical 0.2% GTN ointment three times daily. No antibiotic therapy is used. According to our experience the wound dressing are only inspected for bleeding during the 48 h. Bath twice a day after the second postoperative day is strongly encouraged to keep wound clean.

7 Complications

Early postoperative bleeding (within 48 h) occurs in 1–3% of cases and as shown in the literature, may be due to inadequate hemostasis. Late postoperative hemorrhage occurs in 1.5% of cases, between 7 and 14 days after surgery and is caused by pedicle ischemia or necrosis. In our retrospective study of 1000 consecutive patients, early postoperative bleeding was lower in radiofrequency technique group ($P = 0.001$). As for late bleeding (between the 7th and the 14th postoperative day), the radiofrequency technique leads to the formation of small scabs, which rarely fell down, opening the wound again. The diathermy technique is characterized by bigger scabs, which spontaneously fell after some postoperative days. Moreover, the ligation of the vascular pedicles may cause chronic ulcerations of the anal mucosa, with subsequent bleeding as reported in the literature. Muzi et al. (2007) compared clinical outcomes of 250 patients with either grade 3 and grade 4 hemorrhoids randomized LigaSure™ and diathermy. In their study, although not statistically significant, there was a difference between the two groups with respect to postoperative bleeding: postoperative hemorrhage in 3/125 in the LigaSure™ group and 7/125 in the diathermy group. Chen et al. (2013) also reported 21 cases of postoperative bleeding; the interval from the time of hemorrhoidectomy to bleeding was 7.2 days (range, 4–12). Most cases of bleeding resolved spontaneously; three patients

(0.4%) required reoperation because of persistent bleeding, and all were found to have oozing from the edges of an unhealed dehiscent wound. Fourteen patients (2.1%) experienced mild recurrent bleeding but all were found to have mild residual hemorrhoids on examination.

The most common complication after hemorrhoidectomy is postoperative anal pain; several factors may contribute to develop it, therefore a special paragraph is presented below. Late postoperative complications may include anal stenosis, fissure and fecal incontinence. Recent reports of anal injury suggest that LigaSure™ hemorrhoidectomy is not without complications. It has been suggested that cauterization may contribute to anal stenosis from thermal or electrical injury (Peters et al. 2005). In a report of 203 patients who had the LigaSure™ procedure, Gravante and Venditti (2007) described four patients (2%) who developed postoperative anal stenosis. Further, Wang et al. (2006) reported one case of anal stenosis in 42 patients treated with LigaSure™. As correctly pointed out by Ramcharan and Hunt (2005), to prevent injury to the skin bridges, the perianal skin should be retracted away from the bipolar blades, thereby avoiding contact. Similarly to previous trials in our recent study, we detected only one case of late anal stenosis (0.1%), compared with a rate of 4–5% for conventional hemorrhoidectomy. Concerning anal fissure, in our recent study with the largest number of patients (Milito et al. 2017) in the literature (Table 1), 35 anal fissure were detected but the patients were managed conservatively, and there was no need to surgery; moreover, to avoid these complications we always try to preserve anoderm more as we can and enough mucosal bridge. According to our opinion it is important to focus on the posterior bridge because as reported in the literature there is a great incident of anal fissure in that side of the anal canal. Chen et al. (2013) reported seven anal fissures during 2 years of follow-up; all these patients required surgery. Gentile et al. (2011) in their clinical randomized trial observed one case of anal stenosis treated with anal dilator associated with nifedipine with good final results. An area of concern with anorectal surgery is the potential for anal sphincter

injury causing fecal incontinence. In their study, Muzi et al. (2007) found no cases of sphincter damage, neither incontinence of flatus nor soiling was reported during the follow-up. Jayne and coworkers also reported no case of sphincter injury, assessed by fecal incontinence score at 12-weeks follow-up. Chen et al. (2013) in their retrospective study showed 11 patients (1.7%) with gas incontinence, but he did not report neither surgical nor medical treatment. In our study we did not report incontinence or sphincter injury despite and we did not use any preoperative incontinence score system. Intraoperative sphincter stretching, which is minimized by using the LigaSure™ system, may play a role in impairment of fecal continence post surgery.

8 Postoperative Anal Pain

Despite the complications after LigaSure™ and conventional hemorrhoidectomy are well known, more about postoperative pain need to be done. Several factors may contribute to the development of postoperative anal pain: sphincter fibers entrapped in the pedicle sutures, excessive excision of anal skin, wound infection, tissue charring with coagulation, edema of surrounding tissues, and retention of endoanal foreign material.

In our recent paper with 1000 consecutive patients, we evaluated postoperative pain during 7-years follow-up using VAS score (Visual Analogue Scale). Postoperative pain was well controlled after the operation by analgesic drugs administration: during the first postoperative day (3.9 mean VAS score), while three (3.4 mean VAS score) and 4 days after the operation (mean 2.5 VAS score) with a lower need of analgesic drugs, after 1 week, the decrease of the pain was considerable (mean 1.9 VAS score), but it was closer to the baseline (no pain at all) at the 15th day (0.5 mean VAS score). Finally, 30 days after operation, mean VAS score was 0.1; although 49 patients (4.9%) still felt pain after the first months, it was well controlled with analgesic drugs twice a day until its resolution during the second months after surgery. All patients returned to work activities 8.2 days after the operation. This result may be due to radiofrequency

combining permanent denaturation of elastine and collagen with mechanical pressure exerted by the pliers of the device on the target tissues. This system produces a synthesis of vessels up to 7 mm in diameter, avoiding the ligation of the vascular pedicles, which often causes ischemia, tissue necrosis, and consequently an increment of postoperative pain. LigaSure™ hemorrhoidectomy has been shown to produce significantly less pain than conventional hemorrhoidectomy ($P = 0.01$). Franklin and coworkers (Franklin et al. 2003) randomized 34 patients between LigaSure™ and diathermy and reported a reduction of postoperative pain in the LigaSure™ group, not only on day 1 and 14 after the operation but also after first evacuation. Chen et al. (2013) also reported a mean VAS score of 4.1, but the study reported pain score only on the first postoperative day. Also Chung and Wu (2003), in a larger series of patients (patients randomized to LigaSure™ and to the Ferguson procedure), demonstrated a significant reduction in postoperative pain on days 1 and 2. The measurement of the blood lost was not included in the study design, but the surgeons observed a reduction of postoperative bleeding using LigaSure™. Gentile et al. (2011) randomized 52 patients between radiofrequency and diathermy hemorrhoidectomy; their study showed that the difference of pain between the two groups was not significant although patients in the LigaSure™ group required a lower need of analgesic drugs and they returned to work earlier than the diathermy group (12.2 days vs. 16.4 days, $P < 0.001$).

9 Meta-analyses and Randomized Trials

Several randomized trials comparing LigaSure™ and different techniques such as Ferguson and conventional hemorrhoidectomy showed that the LigaSure™ procedure is a safe and simple method to improve surgical outcomes and outlined the benefits of the procedure such as, effective hemostatic control with reduced bleeding and operative time, less tissue injury and postoperative anal pain, possibility of day-care procedure, reduction of wound healing time, and faster return to work and

daily activities. However, some limitations of the trials included in the abovementioned meta-analyses should be underlined: the limited sample size and the heterogeneity of the studies owing to the different operative protocols and outcome measures. Moreover, the limited follow-up of the studies, up to 6 months in several trials, affected the evaluation of long-term results in terms of continence impairment, anal stenosis, and relapses.

10 Limitations

Despite the promising results showed, economic aspect still remains an important limitation. Radiofrequency device is much more expensive than monopolar scalpel (approximately 300 euros), although the economic balance seems to be to the advantage of the former because of a shorter operative time (allowing the execution of an higher number of operation per day) and also a lower recurrence rate, in the era of spending review the cost of the device limits its use. If radiofrequency will be more cost effective, this technique could be the gold standard in third- and fourth-degree hemorrhoids.

11 Cross-References

- [Literature Review on Hemorrhoidectomy](#)
- [Literature Review on Outpatient Treatments for Hemorrhoids](#)
- [Main Advantages of Hemorrhoidectomy](#)
- [Main Disadvantages of Hemorrhoidectomy](#)
- [Technical Tips and Tricks of Hemorrhoidectomy](#)

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Why and When I Do Prefer the Hemorrhoidectomy

19

Mario Trompetto and Paola Campenni

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Abstract

Over the years, numerous techniques, more or less invasive, have been proposed for the treatment of hemorrhoids. In cases of failure of conservative therapy, or in advanced hemorrhoidal disease, surgical treatment is necessary. Therapeutic choice is guided by an accurate clinical examination and symptoms severity. Conventional hemorrhoidectomy is the standard surgical treatment for advanced hemorrhoidal disease, although it is characterized by severe postoperative pain. Currently various modifications of the technique have been introduced to reduce postoperative discomfort. It is indicated in cases of voluminous external prolapse not reducible, necrotic thrombosis, and recurrence. Severe immunodepression, radiation proctitis, and chronic perianal

inflammatory disease are considered relative counter-indications and can be discussed individually. Recent studies compared hemorrhoidectomy with minivasive techniques reporting variable results due to short-term follow-up, differences on disease classification, and study population.

1 Clinical Considerations on the Indication of Hemorrhoidectomy

Hemorrhoidal disease is one the most common anorectal disorders. According to their origin, hemorrhoids are classified in external (distal to the dentate line) and internal hemorrhoids (proximal to the dentate line). Their connective and vascular nature has also been related with the control of fecal continence and the passage of formed stool. Hemorrhoidal disease has a multifactorial pathogenesis but it is common knowledge that they are caused by deterioration of the supportive connective tissue due to excessive straining, aging processes, and life-style-related factors.

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Classification of hemorrhoids is useful for their correct management but patients need a thorough anorectal evaluation for the selection of a tailored treatment.

According to the SICCR guidelines (Trompetto et al. 2015), several nonoperative methods are available to treat patients with grade I–II and initial grade III hemorrhoids.

Surgical approach, particularly the excisional one, is based on symptomatology as well as on clinical evaluation.

Surgical approach has been suggested in patients with hemorrhoidal disease who undergone office procedures without clinical benefits, in large grade III–IV hemorrhoidal prolapse, in case of symptomatic recurrences, necrotic thrombosis, or when others concomitant clinical conditions are present, such as fistula, fissure, ulcer, condyloma, voluminous skin tags.

Hemorrhoidectomy represents a counter-indication in immunodeficiency, such as patients with perianal Crohn's disease, in case of fecal incontinence or sphincter lesions and post-radiation, because it has an unacceptable risk of local complications. In these cases, the hemorrhoidectomy can be associated with excessive removal of anal tissue, reducing the sensitive anoderm with fecal incontinence or resulting in anal deformity and/or stenosis.

A conservative treatment should be offered to pregnant women suffering from hemorrhoids, to hematologic patients, and in case of cirrhosis. However, in very symptomatic and selected cases, a tailored hemorrhoidectomy can be performed.

In order to minimize related risks, alternative energy devices and modifications of traditional hemorrhoidectomy have been introduced.

Several excisional techniques have been proposed for hemorrhoids treatment after the first description by Milligan & Morgan in 1937, which used a sharp dissection with suture ligation of the pedicle (Milligan et al. 1937). Different surgical instruments are available to perform Milligan-Morgan hemorrhoidectomy: electrocautery, scissors, scalpel, laser bipolar scissor, LigaSure™, and harmonic scalpel.

In all cases, the wounds are left open and this causes a frequent severe postoperative pain that is the major drawback of this procedure.

Open hemorrhoidectomy is the most common operation for hemorrhoids in Europe and is the most effective surgical technique compared with others procedures (Kaidar-Person et al. 2007). The original technique comprised the excision of hemorrhoidal piles at 3, 7, and 11'clock of the anal canal in lithotomy position for every patient, although a tailored hemorrhoidectomy is widely accepted. It is indicated in patients with symptomatic unreducible prolapse and particular care must be taken to preserve vital mucosal bridges into the anal canal to avoid postoperative stenosis (Fig. 1 a, b).

Close hemorrhoidectomy described by Ferguson (Ferguson et al. 1971) differs from the Milligan Morgan procedure because the wounds are sutured primarily, with consequent less pain and faster healing. Unfortunately up to 25–50% of

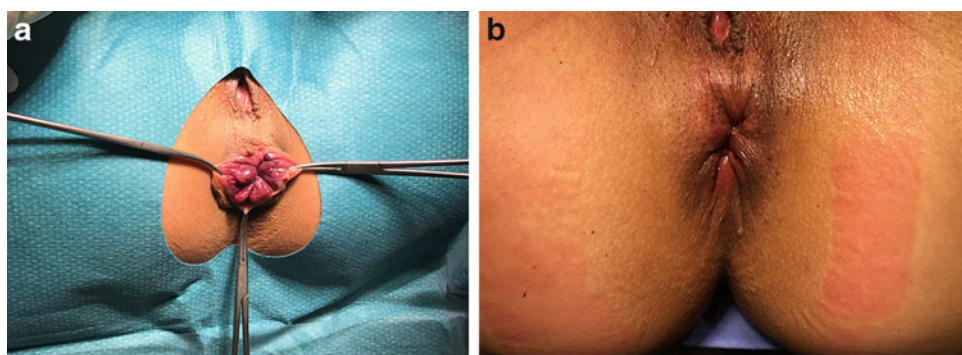


Fig. 1 (a) Unreducible hemorrhoidal prolapse; (b) after Milligan Morgan procedure

the cases can have a partial or total breakdown of the sutures, diminishing the supposed advantages of this technique.

Three old randomized trials comparing open and close hemorrhoidectomies reported no differences in postoperative pain (Ho et al. 1997; Carapeti et al. 1999; Arbmman et al. 2000). Results in favor of the close technique have been reported in a more recent prospective randomized trial (You et al. 2005).

A variant of this technique is the diathermic hemorrhoidectomy, carried out using electrocautery dissection (Loder and Phillips 1993; Sharif et al. 1991), with no pedicle ligation. This kind of dissection seems to be less painful if compared with the sharp one with an equivalent effective hemostasis (Seow-Choen et al. 1992). In a larger trial comparing closed diathermy and scissor hemorrhoidectomy, no significant differences regarding pain scores were noticed although analgesic requirements were reduced in the group of patients who underwent closed diathermy (Ibrahim et al. 1998).

Alternative surgical techniques for excision of hemorrhoids, such as laser hemorrhoidectomy (Wang et al. 1991) (Hodgson and Morgan 1995; Davis 1992) or ultrasonic waves, have been introduced to minimize postoperative pain and improve perioperative outcomes, including faster recovery and earlier return to daily activities, but available data do not confirm their superiority (Senagore et al. 1993).

Three randomized controlled trials evaluating the ultrasonically activated scalpel showed conflicting results in terms of postoperative pain (Khan et al. 2001; Tan and Seow-Choen 2001; Armstrong et al. 2001).

A prospective, double-blinded study, comparing harmonic scalpel hemorrhoidectomy, bipolar scissors hemorrhoidectomy, and regular scissors for grade IV hemorrhoids showed that the harmonic scalpel was as efficient as the bipolar scissors in terms of perioperative bleeding incidence, but harmonic scalpel was superior to the other methods when analyzing postoperative pain and patient satisfaction (Chung et al. 2002). This result is related to the minimum damage caused to adjacent tissues, with less discomfort and faster healing.

In a more recent Cochrane Review comparing traditional to LigaSure™ hemorrhoidectomy, there was a trend towards less pain and a lower incidence of postoperative complications with LigaSure™, but some of these results cannot be considered statistically significant (Nienhuijs and de Hingh 2009).

At present, Park's submucosal hemorrhoidectomy (Parks 1956) and Whitehead's circumferential hemorrhoidectomy (Whitehead 1887), recommended in cases of circumferential mucosal excess and large external hemorrhoids, are rarely used because of their complexity and high rate of complications (Fig. 2 a, b).

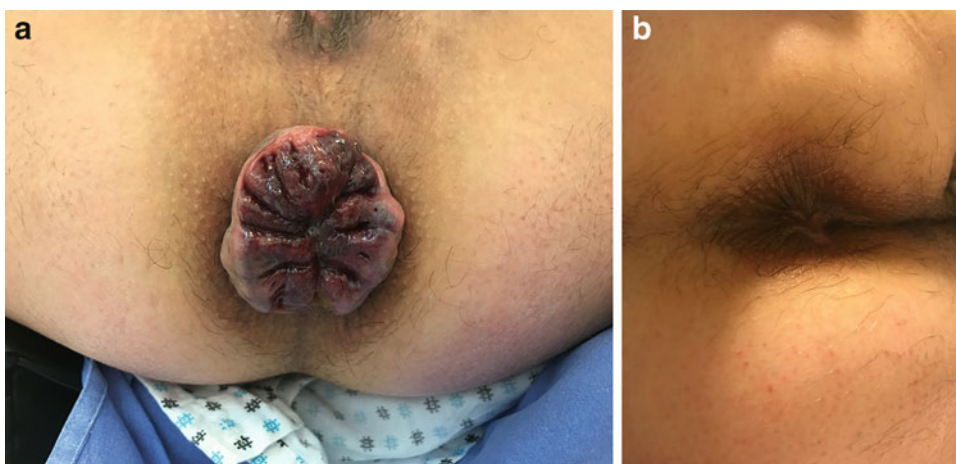


Fig. 2 (a) Circumferential hemorrhoidal prolapse; (b) after Whitehead's hemorrhoidectomy

A very difficult clinical dilemma is represented by performing an emergency hemorrhoidectomy in cases of incarcerated or gangrenous hemorrhoids.

Some papers showed that it can be done safely by expert operators, with results comparable to those obtained after elective hemorrhoidectomy, but no definitive consensus has been reached on this specific issue (Eu et al. 1994).

Some articles compared minimally invasive approach to conventional hemorrhoidectomy for advanced hemorrhoidal disease. Two recent meta-analysis (Simillis et al. 2015; Xu et al. 2016) showed that each surgical treatment for hemorrhoids should be taken into consideration: no statistically significant differences were reported between dearterialization with mucopexy and open hemorrhoidectomy with regard of recurrence and reoperations rate in short terms. Dearterialization should reduce the arterial overflow and the mucopexy should fixed prolapsing hemorrhoids to the rectal wall in order to reduce bleeding and external prolapse. This method seems to be safe and effective; however, a correct selection of cases is mandatory, excluding patients with fibrotic external hemorrhoids.

Future studies on large scale of high quality are needed to confirm these data.

Surgical skills and the cost of new surgical devices play a clear role on decision-making process as well as specific requests of the patient, who must be informed about advantages and disadvantages of each treatment, considering the stage of hemorrhoidal disease, symptomatology, and comorbidity, in order to minimize incidence of postoperative complications and recurrence.

The hemorrhoidectomy is the most common operation for fourth degree hemorrhoids. All different techniques reported should be considered valid, although, there is no doubt, that the surgical strategy is primarily based on personal experience and training in proctologic surgery of each surgeon.

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Technical Tips and Tricks of Hemorrhoidectomy

20

Francis Seow-Choen and Isaac Seow-En

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Abstract

Surgical hemorrhoidectomy is still an important part of the treatment of prolapsed and symptomatic hemorrhoids. While it is effective in most cases, troublesome and even serious side effects may follow surgery which had not been performed expertly. In this chapter, we draw from our extensive experience to highlight some tips and tricks which we believe will help surgeons obtain better results following hemorrhoidectomy.

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1 Introduction

The surgical treatment of hemorrhoids was first recorded in the Hippocratic Treatises about 460 BC (Ellesmore and Windsor 2009). Since that time, much has been written about this ailment which continues to affect a large number of people daily! Two editions of a book by this publisher, written by multiple authorities, in the management of this “minor” albeit common problem testify to its importance (Mann 2002; Khubchandani et al. 2009). We discuss here the tips and tricks to the performance of the most important hemorrhoidectomy techniques still widely used by surgeons for the management of this minor but often debilitating problem – a real pain in the butt. We do not intend to describe each step of each technique in detail. We will describe and emphasize only what we believe to be important tips and tricks which are not often emphasized by other authors to make these surgeries safer and easier in their performances. These tips and tricks are what we do and have found useful in clinical experience.

2 General Principles in Ensuring the Best Result in Hemorrhoidectomy

2.1 Ensure the Patient Has a Good Understanding of the Pathophysiology of Hemorrhoids

Hemorrhoids are not usually life threatening but patients consult surgeons for various reasons, which may range from cosmesis to continuous hemorrhage. An explanation of why hemorrhoids occur and what hemorrhoids are will help greatly, not just to educate patients but also to help patients decide on the type of surgery that may be required and to prevent recurrence. Therefore, it is essential to educate the patient adequately regarding the pathogenesis and pathophysiology of hemorrhoidal disease if surgeons are to obtain the best results following hemorrhoidectomy.

2.2 Ensure Both the Patient and the Surgeon Have Clear Understanding of the Reason for and Result of Hemorrhoidectomy

Importantly, the surgeon must understand why the patient is seeking surgical help. The sort of hemorrhoidectomy offered and whether additional maneuvers are required or not must be tailored according to the symptoms and signs of the hemorrhoidal disease, as well as the expectations of each individual patient. The most common fear following surgical removal of prolapsed hemorrhoids is postoperative pain.

Adequate emptying of the bowel is helpful in helping to decrease postoperative pain in our experience. The reason for this is that an increased amount of fecal content in the bowel means that there is need to pass more fecal matter across the painful hemorrhoidectomy wounds. We have found that good bowel preparation before hemorrhoidectomy helped to prevent painful defecation by decreasing the need to defecate in the first few days after surgery. In regards to this, we also emphasize the need to be dietary fiber-free for the first few weeks after surgery. An absolute stoppage of dietary fiber decreases the volume of fecal matter and the need for painful defecation and helps healing proceed more smoothly (Ho et al. 2012; Tan and Seow-Choen 2007b). A no-fiber diet results in low volume soft stools.

A prehemorrhoidectomy colonoscopy or other methods of large intestinal inspection in appropriate patients is important to rule out synchronous proximal cancers occurring together with hemorrhoids.

Besides the use of oral or intramuscular pain killers in the first few hours after surgery, we have also found the use of long-acting local anesthetic agents, e.g., bupivacaine, very helpful. The use of local anesthetics in our practice allows surgery to be performed with sedation alone, without the need for general anesthesia (Ho et al. 2000). However, even when general anesthesia is used the use of long-acting local anesthesia is very useful. We do not advocate the use of regional anesthesia, e.g., spinal or caudal anesthesia, as these tend to require patients

to lie down in bed for an extended period of time and increases the problem of deep vein thrombosis, acute retention of urine, and increases unnecessary bed usage and hospitalization. Local bupivacaine 0.5% or its equivalent may be injected either under the area to be excised or as a pudendal block or as an intersphincteric ring block around the anal muscles. Adding 2 ml of methylene blue to every 10 ml of 0.5% bupivacaine prolongs some effects of the bupivacaine anesthesia for up to 2–3 weeks after injection (Tan and Seow-Choen 2007a). In performing stapled hemorrhoidopexy, we inject this mixture around the circumferential purse-string before firing the stapler. The presence of blue coloration where the surgeon is cutting is also an indication of good anesthesia during excision itself.

The most common dissatisfaction that patients have after surgery are residual symptoms in spite of surgery. It is imperative therefore that the performing surgeon understands exactly what the patient undergoing hemorrhoidectomy is expecting from surgery. Certain symptoms may be treated effectively by hemorrhoidectomy, but some other symptoms may not be so amenable. Nonetheless, a thorough discussion of the expected result versus the patient's expectation will go a long way to ensure that both surgeon's and patient's aims in surgery are met. Some patients are more concerned about the other symptoms and not at all worried about residual skin tags. Other patients regard even a hint of residual skin tag following surgery as a monumental failure. Surgeons should manage these sorts of expectations during preoperative discussions and thereafter tailor their surgical maneuver accordingly as much as possible.

2.3 Emptying of the Bladder Preoperatively

Emptying of the bladder just before surgery is not often emphasized by authors. We believe that whatever anesthetic technique is practiced, it is always good practice to ask the patients to empty their bladder before surgery. We do not catheterize routinely our patients for hemorrhoidectomy as is the case for most surgeons. Preoperative emptying of

the urinary bladder prevents intra- and postoperative ballooning of the bladder, which will increase the risk of postoperative urinary retention.

2.4 Optimal Postoperative Care

As we perform all our hemorrhoidectomy as much as is possible as a same-day discharge procedure, it is important to ensure that all our patients undergo optimal postoperative care. Besides the various techniques mentioned above, we emphasize the use of lubricant jelly before passing motion, adequate oral analgesics, as well as the use of water or a bidet to wash the perianal region as opposed to the usage of toilet paper after defecation.

Toilet paper is harsh and causes severe friction no matter how soft. The use of a hose to deliver water to wash if a bidet is not available is very useful in this regard to decrease postoperative discomfort and improve surgical results. We have not found oral metronidazole to be more useful than a placebo in decreasing posthemorrhoidectomy pain. We have not found the addition of lateral sphincterotomy, trimebutine, or 0.2% glyceryl trinitrate useful for reducing posthemorrhoidectomy pain and do not use these currently (Ho et al. 1997b; Tan and Seow-Choen 2009). We, however, also use a micronized flavonoidic fraction preparation to help increase microcirculation to reduce postoperative bleeding (Ho et al. 1995).

3 Specific Tips and Tricks in Surgical Techniques of Hemorrhoids

Hemorrhoidectomy techniques discussed herein include:

- St Marks Milligan-Morgan hemorrhoidectomy
- Ferguson closed hemorrhoidectomy
- Ligature or harmonic scalpel hemorrhoidectomy
- Emergency hemorrhoidectomy

We present here our tips and tricks to ensure a successful operation when using each of these

techniques. Submucosal or Park's hemorrhoidectomy is out of date and seldom if practiced at all. We do not think that there is a place for Whitehead or radical hemorrhoidectomy as the alternative is far superior where a radical form of hemorrhoidectomy is needed. Therefore, we will not discuss tips and tricks for these techniques here.

3.1 St Marks Milligan-Morgan Hemorrhoidectomy

This is perhaps the most frequently performed technique of hemorrhoidectomy worldwide, with various versions of this technique being practised. It had often been said that at the end of surgery "If the operative wound looks like a clover, your troubles are over; if it looks like a dahlia, then it's a failure!" We will use this to impart our tips and tricks.

The clover is normally a leaf with three-leaflets or four leaflets spread around the central stalk. To achieve this sort of pattern, the surgeon should take care to remove all the three or four hemorrhoidal-skin complexes that are prolapsed external to the anal verge. This will ensure that there are no residual prolapsed hemorrhoids to continue to irritate the patient after surgery. In our experience, it is important to ensure that the edges of the leaflets are trimmed flush with the surrounding perineal skin. Untrimmed residual hemorrhoidal tissue/skin will result in an uncosmetic result of residual symptoms.

However, to prevent the clover from converting into a dahlia, it is important that adequate skin in between the excised tissues is preserved. This is especially important at the level of the anal verge where inadequate skin cover always leads to anal stenosis. Therefore, extra trimming of skin and mucosa should be performed at the end of surgery and not as surgery is proceeding so that anal stenosis may be prevented.

Filleting of hemorrhoids (Maeda and Phillips 2009) is an alternative to excising excessive mucosa lying underneath mucosal bridges. However, filleting should not cause these bridges to be completely separated from the underlying submucosa or anal sphincter muscles. We stress that only

very large hemorrhoidal tissue which are potentially symptomatic and at the edge of an intervening mucosal bridge should be filleted if at all. Complete separation of mucosal bridges often results in sloughing of these mucosal bridges and anal stenosis and converting the wound into a dahlia.

Skin/mucosal bridge division and resuture (Low and Seow-Choen 1995) is a technique where gross hemorrhoidal tissues beneath mucosal bridges are removed totally by division of these bridges, excision of hemorrhoidal tissues, and resuture of mucosal bridges. This is a dangerous technique if all mucosal bridges are thus treated. If more than one mucosal bridge thus treated dies or separates, anal stenosis will inevitably result. We strongly advise against performing more than one bridge division in this fashion as a dahlia is again liable to be produced. In our study comparing radical versus 4 pile hemorrhoidectomy, we stated that 4 pile operation was preferred to radical hemorrhoidectomy. Where large circumferential hemorrhoids dictate, other techniques are now available which are far superior to either of these previous methods, e.g., stapled hemorrhoidopexy.

Dissection of the hemorrhoidal pedicle should not proceed deep into the anal canal. We normally dissect to about the midpoint of the anal canal and not to the top of the anorectal junction. Dissection to the top of the anorectal junction is liable to result in more chances for anal stenosis and postoperative secondary hemorrhage. In our experience, we have found low excision to be as efficacious as high excision of hemorrhoids. The pedicle thus positioned being closed by the surrounding contractile anal sphincter without detaching the clover leaflets from its stalk.

We advise ligation of the hemorrhoidal pedicle after scissors isolation of the hemorrhoids. Initially, we practiced diathermy division without ligation (Seow-Choen et al. 1992; Tan and Seow-Choen 2001; Ibrahim et al. 1998) and found in our early trials that healing and postoperative bleeding were not inferior to those using scissors. With more experience, however, we have found that there is more lateral damage during the use of diathermy,

and we no longer use diathermy to excise or divide hemorrhoidal tissues. Indeed, diathermy causes enough damage to draw some prolapsed hemorrhoids back into the anal canal. Some of these prolapse out again when the diathermized portion sloughs off (Quah and Seow-Choen 2004). We therefore currently advise against the use of diathermy during the excision of hemorrhoids, as there is a small but increased risk of sloughing and secondary hemorrhage with its use albeit not obvious in the literature. Nonetheless, one of the studies we did that showed that the wounds after closed hemorrhoidectomy with diathermy gave way resulting in inferior results compared to open diathermy hemorrhoidectomy gives credence to this theory (Ho et al. 1997a). Currently, we also advise that the hemorrhoidal pedicle be secured with sutures for the same reason, otherwise all the leaflets may drop off the leaf stalk.

3.2 Ferguson Closed Hemorrhoidectomy

The closed hemorrhoidectomy technique was most popular in the USA and may be practised routinely still in some parts of the world as well.

In our early study, we found a high breakdown rate of the closed wound and advised that open hemorrhoidectomy may be superior to closed hemorrhoidectomy (Ho et al. 1997a). However, this may be a result of the lateral damage that occurs with the use of diathermy as discussed earlier. We therefore advise that clean excision of the hemorrhoids with a pair of appropriate scissors is important in assuring good results.

It is also important that less mucosa is resected in the initial excision of the hemorrhoidal tissue. After all redundant hemorrhoidal tissues are excised, the surgeon can then reexcise redundant mucosa if needed. If a brazen excision of mucosa plus hemorrhoidal tissues is performed without regard for maintaining adequate mucosa bridges, a very difficult problem to resolve may appear at the end of excision when the mucosal wounds are to be closed. We therefore also advise excision of all hemorrhoids first, reassess if more mucosa needs to be assessed,

and finally to close the mucosal wounds with interrupted absorbable sutures of 3/0 or 4/0.

During closure of the wound, it is important to avoid catching the exposed anal sphincter muscles to decrease postoperative pain. An interrupted suturing technique is also important to prevent loose suturing from causing tension on the wound.

3.3 LigaSure™ or Harmonic Scalpel™ Hemorrhoidectomy

As we noted above that diathermy has too much lateral damage and results in sloughing which may lead to secondary hemorrhage if the slough occurs over a hemorrhoidal artery or vein. Energy devices are said to give less lateral damage and been used for excising hemorrhoids. We have used both LigaSure™ (Valleylab, Boulder, CO, USA) or Harmonic scalpel™ to perform hemorrhoidectomy and published a study on the use of the harmonic scalpel (Tan and Seow-Choen 2001). Whatever energy device is used to excise hemorrhoids, however, sealing is only secure when applied to the mucosa and submucosa. Skin including subcutaneous tissues cannot be effectively sealed with these devices. The use of these devices is limited therefore to excising and sealing the mucosal part of prolapsed hemorrhoids while the external cutaneous portion should be cut with scissors.

3.4 Emergency Hemorrhoidectomy

Circumferentially prolapsed, severely edematous, thrombosed, or gangrenous hemorrhoids are not an infrequent problem encountered in our practice. It is taught in some clinics that operative treatment of such hemorrhoids inevitably results in anal stenosis and therefore the best management is complete rest in bed for several weeks while awaiting resolution of the swelling. We take the opposite view. Due to the large numbers of such patients presenting to our clinics, we almost always take a more aggressive approach. However, there are some considerations before surgery is undertaken.

The surgeon has to distinguish between acutely prolapsed circumferential hemorrhoids and those that are limited to less than a quadrant of the anal circumference. Those prolapsed hemorrhoids that are limited to about less than a quadrant or so of the anal circumference can be treated effectively without hemorrhoidectomy. These sort of hemorrhoids may be managed by immediate evacuation of the blood clot in the outpatient setting. We mix 10 ml of 0.5% bupivacaine with a few drops of 1:10,000 adrenaline and 2 ml of methylene blue. We inject a few ml of this mixture over the thrombosed area and make a nick with the needle over the mucosa where the clot is most obvious. When the area is numb, the base of the clot can be easily grasped between the finger and thumb and squeezed out. It is important to make sure that all the clots are evacuated if there is to be complete resolution. Inadequate evacuation results in recurrence within 24 h.

The surgeon also has to make a distinction between a first time prolapse with clots and edema and a chronic recurrent prolapse with clots and edema. Most of the latter will need surgical intervention especially if they are often symptomatic from recurring prolapse.

In any case if severely prolapsed edematous thrombosed hemorrhoids are to be operated on, the first step is to make the needle nick over the biggest clots as in point 1 in as many points as needed and squeeze the clots out with the patient anesthetized in the operating theater. Once the clots are evacuated, the prolapsed thrombosed hemorrhoids normally shrink dramatically in size and can be dealt with in the normal fashion and the mucosal and skin bridges that are needed to be preserved can be better assessed.

4 Conclusion

We have presented in this chapter our tips and tricks to make hemorrhoidectomy safer for surgeons and patients. A clear understanding of both the pathophysiology of the hemorrhoids and the wishes of the patient as well as the limits of surgery will go a long way to ensure that results obtained are as expected.

5 Cross-References

- ▶ [Modern Hemorrhoidectomy: Techniques and Results](#)
- ▶ [Traditional Hemorrhoidectomy: Techniques and Results](#)

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Pros and Contrasts of Hemorrhoidectomy

21

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Abstract

One of the trickiest decisions, when conservative procedures in the treatment of hemorrhoids fail, is represented by the selection of which kind of surgical approach should be performed in a patient with a determinate clinical presentation of hemorrhoids, and why and where some strategies should be chosen or avoided. The most important aspect remains the communication and the match with

patient's expectations and needs, and not least the ability, availability of devices, and confidence of the surgeon who is approaching to treat hemorrhoids with a determinate technique.

1 When to Perform Hemorrhoidectomy?

Around 5% of the general population has hemorrhoidal disease to some extent, especially those aged >40 years (Arslani et al. 2012; Cohen 1985). There are a vast number of available therapeutic methods, and hemorrhoidectomy is well established as the most effective and definitive treatment for III and IV symptomatic hemorrhoidal disease (Cataldo et al. 2005)

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according to the classification by Banov and colleagues (Jr et al. 1985) (prolapsed hemorrhoids requiring manual reduction and nonreducible prolapsed hemorrhoids, respectively).

Operative hemorrhoidectomy is indicated for patients with both internal and external symptomatic hemorrhoids who have failed dietary and lifestyle modification and office procedures (Dennison et al. 1989).

Lifestyle and dietary modifications are referred from the changes in defecatory habits than the correct intake of liquids, fibers, and probiotics according to the patient's need.

The aim of these behavioral modifications is to obtain soft stools, in order to reduce straining at defecation.

If after following all these measures the patient continues to have symptoms at the defecation such as bleeding or outlet obstruction, the operative option must be taken in consideration.

In general III and IV degree hemorrhoids are more likely to require operative procedure, such as conditions in which there is a coexistence of hemorrhoids and anal fistula or fissure (MacRae et al. 2002). Statistically, only 5–10% of patients need surgical treatment.

2 Which Kind of Hemorrhoidectomy Should Be Performed?

When the decision to perform an operative approach is taken, various aspects must be taken into consideration.

First of all, the patient should be informed that various surgical strategies may be selected, and the option must be oriented by the match between patient's preferences and surgeon's advices.

While **excisional procedures** guarantee the lowest rate of recurrences and can treat also additional anorectal pathology, it must be told that the main disadvantage of this techniques is represented by pain, from the early postoperative until the first weeks.

Another bad aspect is the need of periodical care for the first 3–4 weeks.

These aspects obviously reflect the time needed to return to normal activities. The potential compliances of every hemorrhoidectomy procedures, represented by bleeding, anal stenosis, flatus, or fecal incontinence, should not be forgotten.

Other procedures like **stapled hemorrhoidopexy** and **THD** reduce postoperative pain and there is no need of wound care, which leads to rapid return to normal activities. Despite these considerable advantages for the patient, these procedures show higher recurrence rates on long term, and sometimes need additional procedures; moreover, external anorectal pathologies like anal fissures are not taken into consideration.

Moreover, extremely rare severe complications are described in literature, especially for the stapled procedure including rectal perforation, rectovaginal fistula, retroperitoneal, and pelvic sepsis. It must be said that after mastering the technique, the complication rate drop off consistently.

3 Techniques

Conventional surgical treatment includes **excisional hemorrhoidectomy** and **hemorrhoidopexy**.

3.1 Excisional Hemorrhoidectomy

Excisional hemorrhoidectomy can be performed in various ways.

There are two main strategies and their technical variations:

1. Open (Milligan-Morgan (Milligan et al. 1937)): Excision of the external and internal hemorrhoid components leaving the skin defects open to heal by secondary intention over a 4–8 week period.
2. Closed (Ferguson (Ferguson and Heaton 1959)): Excision of the external and internal hemorrhoid components with closure of the skin defects primarily.

The advantage of excisional strategies is represented by the radicality of the procedure, which is demonstrated by the lower rate of recurrence compared to hemorrhoidopexy techniques.

Despite great results, the hemorrhoidectomy is a little popular intervention for the postoperative **pain** and for the necessity of a delicate wound care, which affects the time needed to return to routine activities and the possibility to potentially affect the mechanism of anal continence.

The use of analgesics in the early postoperative time than after the first week is often required to relieve pain, and patients usually return to their usual activities in 2–4 weeks.

Furthermore, open and closed hemorrhoidectomies were associated with greater operative blood loss and a longer operating time compared with other surgical techniques. Pairwise comparison of open and closed hemorrhoidectomies demonstrated significantly more postoperative complications with closed hemorrhoidectomy, suggesting an advantage of open over closed hemorrhoidectomy.

Many technical variations have been experimented in order to reduce pain and bleeding.

3.2 Diathermic Device-Assisted Hemorrhoidectomy: LigaSure™ Hemorrhoidectomy (LH), Harmonic Hemorrhoidectomy, Bipolar Scissors Hemorrhoidectomy, Laser Hemorrhoidectomy

LH can be considered a conventional hemorrhoidectomy, assisted by the action of LigaSure™ vessel-sealing system, which consists of a bipolar

electrothermal hemostatic device that allows complete coagulation of vessels up to 7 mm in diameter with minimal surrounding thermal spread and limited tissue charring. The advantages of this method include simple and easy learning, excellent hemostatic control, minimal tissue trauma, lower postoperative pain, and shorter wound healing time. Trials that compare different excision techniques (scissors, laser, LigaSure™, Harmonic) showed that the employment of thermocoagulation and dissection devices can improve the results in terms of bleeding reduction and operative time, but data about pain reduction are not uniform in different trials. The majority of randomized trials have shown no difference between diathermy and scissor excision hemorrhoidectomy in terms of pain as shown in Tables 1 and 2.

A recent network meta-analysis (Simillis et al. 2015) contrariwise showed that LigaSure™ and Harmonic® hemorrhoidectomies resulted in decreased postoperative pain and fewer postoperative complications, a shorter duration of surgery, less operative blood loss compared with open and closed hemorrhoidectomies. The decreased complication rate and reduced pain were reflected in shorter time to the first bowel movement and the quicker return to normal activities after LigaSure™ and Harmonic® hemorrhoidectomies.

Furthermore, the additional costs accrued through the use of these devices and the lack of documented superior results with these techniques precludes recommendation for routine use. Laser hemorrhoidectomy was initially suggested to be associated with decreased postoperative pain; however, a randomized trial comparing Nd:YAG laser versus cold scalpel did not detect any difference. Furthermore, the trial reported increased costs and decreased wound healing with the use of laser.

Table 1 Randomized prospective studies of Ligasure™ versus diathermy hemorrhoidectomy

Author	N	Operative time	Blood loss	Hospital stay	Postoperative pain	Complications
Jayne	40	L < D	L < D	L < D	n.s.	n.s.
Palazzo	34	L < D	?	n.s.	n.s.	n.s.
Franklin	34	L < D	?	n.s.	L < D	?

L LigaSure™, D diathermy, n.s. not significant; ? not reported, N number

Table 2 Randomized prospective studies of Harmonic[®] versus diathermy hemorrhoidectomy

Author	N	Operative time	QOL	Postoperative pain	Complications
Khan	30	n.s.	n.s.	H > D	n.s.
Tan	50	n.s.	?	n.s.	n.s.
Armstrong	50	?	?	H < D	n.s.
Chung	86	n.s.	n.s.	H < B	n.s.

H Harmonic[®], D diathermy, n.s. not significant, QOL quality of life, ? not reported, N number

3.3 Other Strategies

Many other strategies are developed in order to reduce postoperative pain like performing limited incisions, suturing the vascular pedicle without any incisions, performing a consensual lateral internal sphincterotomy, using metronidazole, using anal sphincter relaxants, and injecting local anesthetics.

All these strategies, however, have shown mixed results and are not recommended for routine use.

In terms of long-term complications, the rates of persistent **incontinence** range from 0 to 20%, which is related mostly for flatus or fecal soiling, although cases of stool incontinence are reported. In the majority of cases, incontinence may occur in the early postoperative period and then resolve spontaneously (McConnell and Khubchandani 1983).

Incontinence may be the result of unintentional anal sphincter injury (van Tets et al. 1997), due to retractors or uncautious maneuvers, or be the consequence of the asportation of anal cushions within the procedure. Thomson postulated that the anal cushions are an important structure of continence (Thomson 1979); based upon that theory, excision of the hemorrhoids themselves may cause incontinence. Li et al. (2012) aim to investigate if the anal cushion excision can justify the incontinence.

In this study, 66 patients were divided into three groups according to their preoperative saline threshold volume before undergoing Milligan-Morgan procedure. The results showed that only the patients with lowest saline threshold volume experienced an important reduction of continence function measured by Cleveland Clinic incontinence scores, but no patient in that group

showed frank incontinence. These results suggest that anal cushions are not solely responsible for anal continence; some other mechanism is necessary to explain the changes.

Other studies (Abbasakoor et al. 1998; Johannsson et al. 2013) show how patients that reported fecal incontinence after Milligan-Morgan hemorrhoidectomy can usually have sphincter defects demonstrated on anal ultrasound. These studies stress the importance of a meticulous surgical approach to avoid injuries to the sphincteric muscles.

Another major complication of hemorrhoid surgery is **anal stenosis**, which is held accountable to 90% of cases (Brisinda et al. 2009).

It is widely accepted that the scars left after an insistent hemorrhoidectomy can lead to stricture formation, and that stresses the importance of the preservation of adequate bridges of the rectal mucosa to avoid this possible complication. For that reason, some authors (Racalbuto et al. 2004) address the improvement of surgical procedure to the reduction of strictures development in terms of anoderm sparing, and the use of anal dilators in the postoperative time.

3.4 Stapled Hemorrhoidopexy (SH)

Because of pain in the aforementioned procedures, which is determined by the dense innervation in the area of the anoderm, in proximity of the dentate line, other techniques have been developed that avoid excision in that area, reducing postoperative pain and a quicker return to routine activities.

SH consists a circular excision of the prolapsing rectal mucosa and submucosa proximal to the dentate line using a circular stapling device,

the rectal wall is innervated by the sympathetic and parasympathetic nerves; thus, excising the rectal mucosa should be painless. The stapling technique does not create any external wounds. This procedure is more a *hemorrhoidopexy* than a hemorrhoidectomy and has also been known as *stapled anopexy*, *procedure for prolapse and hemorrhoids (PPH)*, *stapled mucoprolaxectomy* or *Longo procedure* (RowSELL et al. 2000; Longo 1998).

The hemorrhoids are not mandatorily removed, but rather repositioned in their physiological position and devascularized, providing to maintain an important continence mechanism that is guaranteed by anal cushions. This structure may in fact contribute to the low rate of incontinence after this operation. This procedure is best reserved for second- and third-degree hemorrhoids, and fourth degree reducible under anesthesia. For anesthesiological and cost reason, the stapling procedure does not seem practical to take care of I and II degree hemorrhoids. It is conceivable that SH is more technically demanding and operator dependent. If the purse-string suture is not at an inadequate level or depth, serious postoperative pain may be provoked (Correa-Rovelo et al. 2003). Moreover, it is to say that stapling procedure does not take care of external anal pathology such as fibrotic external hemorrhoids, fissures, or skin tags. A 2010 Cochrane review comparing stapled versus conventional surgery for hemorrhoids was updated including 22 studies (Lumb et al. 2010), which shows that stapled technique reduces immediate postoperative pain but increases rate of recurrent symptoms and need for additional procedures.

Despite these encouraging aspects and safety profile, rarely several serious complications have been reported including rectal perforation, retroperitoneal sepsis, and pelvic sepsis, rectovaginal fistula, and Fournier's gangrene (Cirocco 2008; Ripetti et al. 2002; Maw et al. 2002; Ripetti et al. 2002). The main complication of the procedure is bleeding from the staple line, which can be easily controlled by oversewing the bleeding point on the staple line. One other disadvantage of the stapling procedure is the recurrence of hemorrhoidal symptoms.

In terms of functional outcomes, there is a nonsignificant trend toward less anal stenosis after a stapled procedure, but a nonsignificant trend toward a higher rate of soiling, incontinence, and fecal urgency (Wong et al. 2003; Molloy and Kingsmore 2000; Pessaux et al. 2004; Van de Stadt et al. 2005). Fecal incontinence or soiling after 1 year ranged from 0% to 10%. The highest rates of urgency and pain were reported (30%) early after introduction of the technique (Cheetham et al. 2003). After the first 5 years of learning curve, literature showed a significant reduction of severe complication rate, from .7% to 0.3% of total analyzed procedures (Naldini 2011; Brusciano et al. 2004, 2015).

A critical aspect in performing the procedure is represented by the placement of the purse-string suture, which if too close to the dentate line can result in the inclusion of the anoderm and even the anal sphincter muscle in the stapler, and may be the cause of pain. Anal stenosis occurred in 0–2% of patients (Boccasanta et al. 2001; Hetzer et al. 2002; Shalaby and Desoky 2001; Palimento et al. 2003; Racalbuto et al. 2004).

A large number of randomized controlled trials comparing stapled hemorrhoidopexy with conventional hemorrhoidectomy have been published. The majority of studies show that stapled hemorrhoidopexy is less painful, and allows earlier return to work compared with conventional hemorrhoidectomy. A systematic review of stapled hemorrhoidopexy concluded that the procedure was as safe as conventional hemorrhoidectomy and was associated with shorter operative time and hospital stay, earlier return to normal activity, and a trend toward improved patient satisfaction, but the rate of recurrence appears higher than the other procedures.

A 2013 meta-analysis (Yang et al. 2013), including 5 RCTs, for a total of 397 patients comparing stapled hemorrhoidopexy (SH) with LigaSure™ hemorrhoidectomy (LH) was published (Table 3).

That study shows that the operating time for SH was significantly longer than for LigaSure™ procedure. In terms of early postoperative pain, measured by VAS scores, there was no significant difference between the two groups.

Table 3 Characteristics of randomized comparisons of stapled hemorrhoidopexy and LigaSure™ hemorrhoidectomy reported in the literature

Ref.	Technique	Operation time (min)	Hospitalization (days)	Postoperative pain (VAS)	Parenteral analgesic use	Postoperative urinary retention	Postoperative bleeding	Return to normal activity	Incontinence for gas or stool after the procedure	Anal stenosis	Residual skin tags	Wound problems	Recurrence
Arslani et al. 2012	SH	NR	NR	3 (1–5)	36	1	3	3–4 wk	2	2	6	NR	5
	LH			3 (1–6)	41	2	1	2–4 wk	1	1	0		1
Basdanis et al.	SH	15 (8–17)	4 (2–10)	3 (1–6)	1	7	0	NR	1	NR	NR	6	3
	LH	13 (9–16)	5 (2–10)	6 (3–7)	0	5	1	2	2			39	0
Chen et al.	SH	19.0 ± 6.4	3.3 ± 1.1	3.1 ± 1.3	23	NR	4	NR	NR	NR	NR	4	1
	LH	12.0 ± 4.1	5.2 ± 1.4	5.4 ± 2.4	35		1					3	0
Kraemer et al.	SH	21 (6–54)	1.6 (1–2)		3.8 (2–12)						0	2	NR
	LH	26 (10–80)	2.1 (2–3)		3.2 (1–8)						0	1	
Sakr et al.	SH	26.9 ± 3.26	2.44 ± 0.50	5.3 ± 0.9	5.7 ± 0.85	1	2	8.65 ± 0.48 d	4	2	8	0	4
	LH	20.8 ± 3.35	2.21 ± 0.41	5.5 ± 1.02	5.0 ± 0.77	2	1	7.68 ± 0.63 d	2	1	2	1	1

NR Not reported, LH LigaSure™ hemorrhoidectomy, SH Stapled hemorrhoidopexy

Moreover, the incidence of recurrence after the procedures was significantly lower in the LH group than in the SH group, but it must be said that no data about preoperative hemorrhoidal degree were specified.

Another evidence resulted in this study is that the incidence of residual skin tags and prolapse was significantly lower in the LH group than in the SH group.

Other aspects investigated shows no statistical difference in terms of time needed to return to normal activities, despite showing a trend toward a faster recovery in SH group (He and Chen 2015; Wang et al. 2013; Cerato et al. 2014; Madiba et al. 2009).

3.5 Transanal Hemorrhoidal Dearterialization (THD)

Another procedure that stresses the importance of the anodermal skin sparing in order to achieve a better postoperative pain management is the THD (transanal hemorrhoidal dearterialization) procedure, which is not an hemorrhoidectomy and can be considered a, but more like than a, mucopexy associated to a Doppler-guided dearterialization of the terminal branches of the superior hemorrhoidal artery, providing to reduce hemorrhoid symptoms.

As mentioned earlier, it lowers the postoperative pain, provides low rate of complications, but increases tax of recurrences on the long term that ranges from 11% to 59% (Giordano et al. 2009a).

THD procedure seems to have a low tax of postoperative complications. In a case series on 693 patients that underwent THD procedure, only 0–0.4% experienced incontinence (De Nardi et al. 2014; Denoya et al. 2013; Giordano et al. 2009b; Ratto 2014). Anal stenosis is not reported.

Postoperative pain and postoperative complications are believed to be the most important disadvantages of these techniques. An impressive systematic review and network meta-analysis published in 2015 (Simillis et al. 2015) including 98 trials, 11 surgical treatments, and 7827 patients with III and IV degree hemorrhoids compares clinical outcomes and effectiveness of surgical treatments for hemorrhoids.

The results show that open and closed hemorrhoidectomies had significantly more postoperative complications than LigaSure™, Harmonic®, and THD procedures, and resulted in significantly more postoperative pain than stapled, THD, LigaSure™, and Harmonic® hemorrhoidectomies. The increased complication rates and higher levels of pain related to open and closed hemorrhoidectomies resulted in a longer hospital stay and a later return to normal activities. Furthermore, open and closed hemorrhoidectomies were associated with greater operative blood loss and a longer operating time compared with the other surgical techniques. Nevertheless, open and closed hemorrhoidectomies were found to have a lower recurrence rate than THD and stapled hemorrhoidectomies, which is perceived to be the most important advantage. Pairwise comparison of open and closed hemorrhoidectomies demonstrated significantly more postoperative complications with closed hemorrhoidectomy, suggesting an advantage of open over closed hemorrhoidectomy.

Alternative surgical techniques for excision of hemorrhoids have been developed with the aim of reducing postoperative pain and improving perioperative outcomes, including faster recovery and earlier return to normal daily activities. Standard pairwise meta-analyses comparing conventional hemorrhoidectomy with LigaSure™ hemorrhoidectomy showed the latter to have better outcomes with regard to duration of surgery, operative blood loss, postoperative pain, length of hospital stay, and time to return to normal activities. In addition, a previous standard pairwise meta-analysis that compared conventional with Harmonic® hemorrhoidectomy showed that the Harmonic® procedure resulted in fewer postoperative complications, less postoperative pain,

4 Critical Evaluation of the Surgical Techniques

Two commonly used excisional procedures worldwide are open (Milligan-Morgan) and closed (Ferguson) hemorrhoidectomies.

and earlier return to work. Similarly, the present network meta-analysis showed that LigaSure™ and Harmonic® hemorrhoidectomies resulted in fewer postoperative complications, a shorter duration of surgery, less operative blood loss, and decreased postoperative pain compared with open and closed hemorrhoidectomies. The decreased complication rate and reduced pain were reflected in the shorter time to the first bowel movement and the quicker return to normal activities after LigaSure™ and Harmonic® hemorrhoidectomies.

Stapled hemorrhoidectomy (or hemorrhoidopexy) is another technique developed to decrease postoperative pain, resulting in faster recovery; nevertheless, concerns have been raised regarding its high recurrence rate. Previous standard pairwise meta-analyses comparing conventional with stapled hemorrhoidectomy showed stapled procedure to have better outcomes with regard to operating time, postoperative pain, length of hospital stay, and time to return to normal activity. However, stapled hemorrhoidectomy was also reported to have higher rates of skin tags, hemorrhoid recurrence, and recurrent prolapse than conventional hemorrhoidectomy. Furthermore, previous pairwise meta-analyses comparing stapled versus LigaSure™ hemorrhoidectomy showed the stapled procedure to have a higher recurrence rate, with no difference in postoperative complications, postoperative pain, and length of hospital stay. Similarly, stapled hemorrhoidectomy needed a shorter operating time and resulted in less postoperative pain than open and closed hemorrhoidectomies. As a result of the decreased pain levels, stapled hemorrhoidectomy resulted in a shorter hospital stay and quicker return to normal activities. Nevertheless, the recurrence rate was higher after stapled hemorrhoidectomy than after open, closed, and LigaSure™ procedures. Furthermore, stapled hemorrhoidectomy was associated with more postoperative complications compared with Harmonic® hemorrhoidectomy and a higher postoperative bleeding rate than THD. Stapled hemorrhoidectomy is expensive and the cost of this technique should be taken into consideration in the decision process, together with its

higher rate of complications and recurrences. The increased cost of the stapling instrument may be largely offset by the shorter hospital stay, decreased operating time, and earlier return to work.

Another standard pairwise meta-analysis comparing THD with stapled hemorrhoidectomy showed no difference between the two treatments with regard to duration of surgery, postoperative complications, and recurrence of hemorrhoids. Nevertheless, the aforementioned network meta-analysis demonstrated that fewer people had postoperative bleeding after THD compared with open or stapled hemorrhoidectomy, and this resulted in THD being associated with fewer emergency reoperations than open, closed, stapled, and LigaSure™ procedures, with a high probability of being the best treatment for reoperation rate. In addition, THD was found to have fewer postoperative complications, shorter operating time, and decreased levels of postoperative pain than the other surgical techniques. These resulted in THD having a shorter length of hospital stay and an earlier time to the first bowel movement. On the other hand, THD had a higher recurrence rate than open, closed, LigaSure™, laser, and radiofrequency hemorrhoidectomies and, importantly, the highest probability of being the worst treatment for recurrence of hemorrhoids. The low cost of THD, low complication rate, shorter operating time, and decreased levels of postoperative pain, but higher recurrence rate, may suggest THD as a safe, quick, and easy initial surgical option. On the contrary, open hemorrhoidectomy, which is associated with increased postoperative complications and greater postoperative pain, could be a better approach for refractory hemorrhoids owing to its low recurrence rate.

The weapons in the arsenal of the coloproctologist who is approaching to treat hemorrhoids with surgical procedures are many, and the real ability lays in the choice to achieve the most effective result with the well tolerated procedure. The technology available in each surgical department and the cost of surgery also play a role in the decision-making process. Every surgeon should be aware of the individual advantages and

disadvantages of each surgical treatment, and should discuss these with the patient.

The first aspect that must be taken in consideration in order to success in hemorrhoidal surgery is the preoperative interview in order to evaluate patient compliance and expectations to the planned treatment, whether the priority is faster recovery and earlier return to normal activities, or a lower risk of recurrence.

For example, for patients with bleeding and low-grade prolapse, either stapled hemorrhoidectomy or transanal hemorrhoid dearterialization with or without mucopexy poses minimal to no risk of incontinence or anal stenosis. However, external hemorrhoids or tags are not treated, and the rate of recurrent symptoms is higher than after conventional hemorrhoidectomy. For patients with significant external hemorrhoids or failures of other treatments and patients wishing to avoid a higher recurrence rate, excisional hemorrhoidectomy is the appropriate choice. For those patients, it is important to minimize stretching of the anal sphincter muscles during surgery, use meticulous technique to avoid injury to the sphincter muscles, and limit the amount of anoderm excised, but it must be known that these cautions are pertinent regardless of the technique utilized. Most important thing is that the patient should be provided with all the information available in this and be allowed to make a fully informed decision. This will ensure that the best treatment and appropriate personalized care is provided to all patients.

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Main Advantages of Hemorrhoidectomy

22

Hsien-Lin Sim and Kok-Yang Tan

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Abstract

Surgical therapy provides satisfactory results in comparison to conservative measures especially for grade III and IV hemorrhoids. To date, there are a variety of surgical procedures available to treat hemorrhoids with equivalent success rates. Conventional hemorrhoidectomy

aims to remove hemorrhoids, allowing both internal and external components to be excised. This approach has been proven to be the most effective and associated with the most durable results for grade III and IV hemorrhoids. However, the external wounds in the innervated perianal skin pose problems of post-

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operative pain and wound healing. Hence, oral analgesics and stool softeners are usually prescribed to ameliorate discomfort during post-operative recovery. Various adjuncts such as pharmacotherapy and hemostatic devices have been described to improve short-term outcomes associated with conventional hemorrhoidectomy. These adjuncts would be further discussed in this chapter.

1 Pathophysiology

Hemorrhoids are a very common anorectal disease defined as symptomatic enlargement with or without distal displacement of the anal cushions. The true pathophysiology of hemorrhoid development is likely multifactorial (Lohsiriwat 2012), including sliding anal cushions, hyperperfusion of hemorrhoid plexus, vascular abnormality, tissue inflammation, and internal rectal prolapse.

Classification of hemorrhoids is based on their location. Internal hemorrhoids originate above the dentate line and are covered by anal mucosa. External hemorrhoids originate below the dentate line and are covered by anoderm. Lastly, there are hemorrhoids which are a mixture of both. Internal hemorrhoids are further graded based on their degree of prolapse.

The treatment of hemorrhoids is on the patient's type and severity of hemorrhoids, patient's preference and the surgeon's expertise.

2 Selection of Cases for Conventional Hemorrhoidectomy

A thorough history and physical examination is crucial prior to decision on need for surgery. It is of utmost importance to exclude rectal prolapse and malignancy and ensure that there are no contraindications to conventional hemorrhoidectomy such as fecal incontinence and inflammatory bowel disease. The commonest adverse effect associated with conventional hemorrhoidectomy is pain and hence the patient should be

ascertained to be symptomatic from his or her piles prior to discussion on surgery.

The choice of the method of hemorrhoidectomy is dependent on the severity of the external component, the extent of the prolapse, and any concomitant mucosal rectal prolapse. Appropriate indication and method of hemorrhoidectomy will provide the patient with the most satisfaction.

The open hemorrhoidectomy is highly suitable for patients who are troubled by the external components such as external hemorrhoids or skin tags. Patients who have bleeding or prolapsing third degree piles and failed ligation or conservative management can be deemed suitable for open hemorrhoidectomy. Some patients have fibroepithelial polyps associated with symptomatic piles, both pathologies can be removed effectively with open hemorrhoidectomy. Occasionally, the patient presents with fourth degree hemorrhoids complicated by edema or thrombosis. Generally, majority of such cases are managed conservatively with hypertonic saline or dextrose packs. In the setting of acutely thrombosed external hemorrhoid, the patient may benefit from emergency hemorrhoidectomy as it provides immediate symptomatic relief.

The colorectal surgeon has to use his or her discretion to determine whether excision of the hemorrhoidal pedicles with preservation of adequate skin bridges will resolve the patient's presenting complaints. Circumferential third degree hemorrhoids especially those with mucosal rectal prolapse will benefit from stapler hemorrhoidectomy. Open hemorrhoidectomy performed for such cases will result in higher incidence of anal stenosis and patient dissatisfaction.

3 The Ideal Case for Conventional Hemorrhoidectomy

Patients who present with persistent bleeding or prolapse from third or fourth degree hemorrhoids with isolated external components (in the form of skin tags or external hemorrhoids) (Fig. 1) are



Fig. 1 Isolated hemorrhoids with internal and external components



Fig. 2 Isolated hemorrhoidal mass with preservation of mucosal bridges



Fig. 3 Dissection of hemorrhoidal mass off internal sphincter



Fig. 4 Completed open hemorrhoidectomy

highly suitable for conventional hemorrhoidectomy. Excision of the external components with the adjoining internal hemorrhoids (Fig. 2), dissection of the entire pile mass off the internal sphincter

(Fig. 3) with preservation of the mucosal bridges will bring the patient great symptomatic relief and the most sustainable long-term outcomes in comparison to other surgical techniques (Fig. 4).

4 Adjuncts to Conventional Hemorrhoidectomy

Open hemorrhoidectomy is associated with considerable postoperative pain. This often leads to patient discomfort, prolonged hospital stay and increased costs. The amount of pain is dependent on a number of factors such as surgical technique, postoperative analgesia, use of stool softeners, adequate education, and subjective pain threshold. Various adjuncts to conventional hemorrhoidectomy have been studied and improvements in short-term outcomes have been reported. These various adjuncts will be discussed.

5 Intradermal Methylene Blue

Methylene blue has been widely used as a biological dye. However, it also possesses disinfective properties and is an inhibitor of soluble guanylate cyclase. It has also been found to reduce cyclooxygenase products. Intradermal methylene blue has been used successfully in intractable pruritus ani. The mechanism of action of methylene blue is likely related to the destruction of dermal nerve endings (Eusebio et al. 1990).

We conducted a randomized single blind clinical trial of intradermal methylene blue on pain reduction after open diathermy hemorrhoidectomy (Sim and Tan 2014). Patients were randomized to intradermal injection at hemorrhoidectomy of either 4 ml 1% methylene blue and 16 ml 0.5% marcaine or of 4 ml saline and 16 ml 0.5% marcaine prior to surgical dissection. The mean pain scores were significantly lower and the use of paracetamol was also significantly lesser in the methylene blue group during the first three postoperative days. The risk ratio of acute urinary retention occurring when methylene blue was not used was 2.320 (95% CI 1.754–3.067). There was no significant difference in the complication rates between the two groups.

Perianal injection of methylene blue was not associated with significant adverse effect. None of the patients in this trial reported any skin reaction

or infective complications associated with the intradermal methylene blue injection.

To date, this is the only study reporting on the role of wound infiltration with methylene blue in reduction of postoperative pain associated with conventional hemorrhoidectomy. More studies may be necessary to clarify the long-term effect of methylene blue injection.

6 Glyceryl Trinitrate Ointment After Hemorrhoidectomy

One of the reasons of pain after hemorrhoidectomy is believed to be due to spasm of the internal anal sphincter (IAS). When spasm occurs, it leads to further increase in the anal canal pressures and further propagates pain. Another controversial belief is that postoperative pain may be associated with delayed wound healing which leads to epithelial denudation.

Although the spasm of the voluntary external sphincter may also play a role in generating pain, internal sphincter spasm is thought to be the major contributor (Wasvary et al. 2001). Chemical and surgical solutions had been proposed to reduce this effect. Several studies have failed in demonstrating pain control at 12 h after surgical intervention (53.8% vs. 48.7% $p = 0.8$) and at 1 week after surgery ($p = 0.05$) (Khubchandani 2002). Moreover, there is also an added risk of incontinence (as high as 5%) (Nelson 2010).

Exogenous glyceryl trinitrate (GTN) ointment is a nitrous oxide donor which relaxes the internal anal sphincter and thus reduces pain (Loder et al. 1994). The reduction of IAS spasm and reduced pressure will increase anodermal blood flow and hence improve wound healing. There have been a number of randomized-controlled trials that have examined the role of GTN ointment after open hemorrhoidectomy as an analgesic and in wound healing (Wasvary et al. 2001; Tan et al. 2006).

A meta-analysis conducted by Ratnasingham et al. has shown that GTN ointment is significant as an analgesic in the intermediate time period (day 3–7). Moreover, wound healing is also

significantly improved at 3 weeks. GTN is associated with headaches and hence a proportion of patients may not comply due to this adverse effect. There are existing limitations with this study as the number of patients recruited for the trials is low and the assessment of wound healing may potentially be biased. Hence, there may be a need for larger double-blinded randomized controlled trials to better assess the effects of GTN ointment on post-hemorrhoidectomy patients.

7 Hemorrhoidectomy Performed with LigaSure™ Device

Several surgical techniques and devices have been developed to overcome some of the postoperative problems associated with hemorrhoidectomy. The LigaSure™ vessel sealing system (Valleylab, Boulder, CO) is a hemostatic device designed to seal blood vessels up to 7 mm in diameter with minimal sticking, charring, or thermal injury to adjacent tissues (Ratnasingham et al. 2010).

We had assessed the effectiveness of LigaSure™ tissue sealing device in comparison with the conventional diathermy hemorrhoidectomy (Milligan Morgan) using a prospective randomized controlled trial (Riegler and Cosentini 2004). The patients' demographics and grading of hemorrhoids were similar between the two groups. LigaSure™ hemorrhoidectomy has significantly shorter operative time and lesser intraoperative bleed. At 3 weeks, patients after LigaSure™ hemorrhoidectomy had an odds ratio for complete epithelization of 3.1 over diathermy hemorrhoidectomy (95% CI 1.8–8.2).

Li Xu et al. had conducted a meta-analysis of randomized controlled trials comparing the outcomes of LigaSure™ hemorrhoidectomy versus Ferguson hemorrhoidectomy. There were five trials with 318 patients included in the meta-analysis. The urinary retention rate and early postoperative pain scores were higher in patients who underwent Ferguson hemorrhoidectomy. Patients who were treated with LigaSure™ hemorrhoidectomy had a significantly shorter operative time and hospital stay compared to

those who underwent Ferguson techniques. The blood loss during operation was lesser in the LigaSure™ group. There were also no significant differences in the postoperative complications.

There are limitations with the trials as the numbers involved are small. Variations in the surgical protocol, postoperative care, and methods of outcome measures will result in higher statistical heterogeneity. Most studies reported only short-term outcomes and hence large volume multicenter trials may be required to evaluate the long-term outcomes and recurrence rates.

In conclusion, LigaSure vessel sealing system is a safe and effective device for hemorrhoidectomy. However, it is still important to adhere to the surgical principles of preservation of adequate skin and mucosal bridges. We also have to ensure that the pile mass is dissected off the internal sphincter during LigaSure hemorrhoidectomy to avoid injury to the internal anal sphincter which can result in postoperative pain and anal stenosis.

8 Comparison of Conventional with Stapler Hemorrhoidectomy

Circular stapler hemorrhoidectomy was first described by Longo in 1998 as an alternative to conventional hemorrhoidectomy. In contrast to the traditional approach, it does not remove the hemorrhoidal tissue. It excises the tissue above the dentate line and results in mucosa to mucosa anastomosis. Hence it results in a relocation of the anal cushions with disruption of the feeding arteries. As the excision is above the dentate line, it avoids a painful wound in the somatically innervated anoderm. Earlier studies demonstrate lesser pain and faster recovery associated with stapler hemorrhoidectomy.

With emerging evidence and over time, critics question the inadequacy of stapler anopexy in handling external hemorrhoids. Two meta-analyses (Burch et al. 2008; Shao et al. 2008) comparing stapler with conventional hemorrhoidectomy concluded that stapler hemorrhoidectomy was associated with less postoperative pain but higher

incidence of recurrence of prolapse. A Cochrane review (2008) also concluded that stapler hemorrhoidectomy is associated with higher incidence of symptom recurrences and need for additional surgeries compared to conventional hemorrhoidectomy.

9 Comparison of Conventional Hemorrhoidectomy with Transanal Hemorrhoidal Dearterialization (THD) with Mucopexy

THD was first introduced in 1995 by Morinaga et al. (1995). Through ligation of the hemorrhoidal artery, reduction of arterial inflow will result in shrinkage of the hemorrhoids. Mucosal prolapse is a predictor of recurrence and hence mucopexy is added to the original procedure.

Xu et al. (2016) published a meta-analysis of four randomized controlled trials comparing transanal hemorrhoidal dearterialization (THD) with mucopexy and conventional hemorrhoidectomy. Sample size of the trials varies from 33 to 133 patients. The operative time using Doppler-guided THD was longer than conventional hemorrhoidectomy. Return to normal activities was faster with THD. Unfortunately, the measurement for pain scores was not uniform and hence not reported in this meta-analysis. Moreover, the interpretation of the results of this meta-analysis was limited by the inclusion criteria of grade II–IV hemorrhoids. Hence, it was difficult to predict the efficacy of THD on grade III and IV hemorrhoids. Standardized outcome measures and longer follow-up period would be necessary to effectively compare THD with mucopexy and conventional hemorrhoidectomy in future larger scale studies.

External components and skin tags are not addressed with THD and hence conventional hemorrhoidectomy is more suitable for patients who are troubled by the external components.

In addition, THD is definitely more expensive than conventional hemorrhoidectomy with a cost of approximately 315 Euros per patient.

10 Summary

An ideal operation for hemorrhoids should remove internal and external components of hemorrhoids completely, have minimal postoperative pain and complications, demonstrate less recurrence, and should be easy to learn and perform. Cost effectiveness of the procedure should also be a consideration. So far, excisional hemorrhoidectomy is the mainstay operation for grade III–IV hemorrhoids. The evidence has also suggested that conventional hemorrhoidectomy is associated with lesser recurrence of symptoms and prolapse. Postoperative pain and wound healing are the main concerns of conventional hemorrhoidectomy and hence multiple adjuncts have been described to address these concerns which can potentially improve short-term outcomes.

11 Cross-References

- ▶ [Anatomy, Physiology, and Pathophysiology of Hemorrhoids](#)
- ▶ [Classification of Hemorrhoidal Disease and Impact on the Choice of Treatment](#)
- ▶ [Literature Data on the Hemorrhoidal Disease Management](#)
- ▶ [Literature Review on Hemorrhoidectomy](#)
- ▶ [Selection of Patients to the Surgical Treatment of Hemorrhoids](#)

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Main Disadvantages of Hemorrhoidectomy

23

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Abstract

Hemorrhoids are one of the most common anorectal disorders. Surgical treatment is usually indicated for the more advanced cases

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(grades III and IV). Numerous surgical techniques have been described, yet there is still an ongoing debate over the best operation regarding efficiency, safety, pain reduction, low complication and recurrence rates, earlier return to work, and overall cost. For us, the most efficient technique to treat fourth degree hemorrhoids is still conventional hemorrhoidectomy (CH). However, CH is also associated with a number of disadvantages: postoperative pain, prolonged healing time, longer time of return to regular activities, and complications such as urinary retention, bleeding, anal stenosis, and fecal incontinence. These may occur when the

indication is inappropriate or when serious technical errors are made. Other surgical procedures have been developed to circumvent these pitfalls (stapled hemorrhoidopexy, transanal hemorrhoidal dearterialization with or without rectal pexy, etc.), and prospective randomized trials have shown they may reduce pain and permit an earlier return to work, but they are associated with higher rates of prolapse and bleeding recurrences. Thus we believe CH remains the best treatment option for grades III and IV hemorrhoids, and as long as it is well performed.

1 Introduction

Hemorrhoidal disease is one of the most common anorectal afflictions. It is estimated that around 5% of the general population display hemorrhoidal symptoms, with 50% of the population over 50 years of age reporting at least one symptom at some point of their lives (Arbman et al. 2000). Surgical treatment is necessary in approximately 10–20% of symptomatic patients who seek medical attention (Bleday et al. 1992; Song and Kim 2011).

Despite the development of a variety of more conservative treatment modalities such as minimally invasive procedures (sclerotherapy, rubber-band ligation, infrared laser coagulation, etc.), surgical treatment is the only modality capable of providing permanent eradication of hemorrhoidal tissue (Sardinha and Corman 2002).

Criteria-based surgical indication, accurate surgical technique, and careful postoperative care are indispensable for obtaining good surgical results. Lack of one of the above can result in frustration for the patient and the surgeon. Therefore, adequate knowledge of hemorrhoidal pathophysiology and

of the various forms of clinical presentation of the disease, familiarity with the anatomy of the anal canal, as well as technical ability and experience are fundamental prerequisites for successful surgical treatment of hemorrhoidal disease.

A variety of techniques for hemorrhoidectomy have been described to date, but few have consolidated themselves like the proposals by Milligan-Morgan, Parks, and Ferguson, whose techniques are based upon the resection of internal hemorrhoids and any external component, plus the ligation of its vascular pedicles (Sardinha and Corman 2002).

Conventional hemorrhoidectomy with total resection of the vascular anal cushions is recommended for cases with voluminous external components (grades III/IV), cases with strangulation/thrombosis, and cases with associated conditions (anal condylomata, fissures).

There are basically three variations of conventional hemorrhoidectomy: the open technique, the closed technique, and Whitehead's circumferential technique, with a number of variations thereof, in a bid to improve healing time and to accelerate return to work (Table 1). In conventional hemorrhoidectomy, the manipulation of the cutaneous region (somatic innervation), which is rich in nerve endings, is responsible for the intense pain in the postoperative phase. Thus the development of new technologies such as transanal hemorrhoidal dearterialization and stapled hemorrhoidopexy.

Complications are infrequent, and they generally occur when the indications were inappropriate (degree of illness and technique), as well as when serious errors in the surgical procedure are made (extensive wounds, mass ligatures, inadequate hemostasis, nonpreservation of cutaneous-mucosal sutures, sphincter injury). Lack of adequate

Table 1 Prospective randomized studies: closed versus open hemorrhoidectomy

Author	N	Pain	Incomplete healing	Analgesia requirements	Hospital stay	Complications
Ho et al. (1997)	67	NS	O > C	NS	NS	NS
Carapetti et al. (1998)	36	NS	NS	NS	NS	NS
Arbman et al. (2000)	77	NS	C > O	NS	NS	NS
Gencosmanoglu et al. (2002)	80	C > O	C > O	C > O	NS	C > O

NS nonsignificant difference, C closed, O open

Table 2 Main complications related to conventional hemorrhoidectomy

Pain
Urinary retention
Hemorrhage
Constipation/fecal impaction
Infection/abscess/Fournier's gangrene
Residual skin tags
Residual fissure
Mucosal prolapse
Anal stenosis
Fecal incontinence

postoperative care and orientation also increase complication rates. The most commonly observed early complications of hemorrhoidectomy are: **pain, urinary retention, bleeding, infection, and constipation**, which can lead to fecaloma in a few days after surgery (Table 2). Among later complications, **anal stenosis** is the most important, although fortunately its frequency is currently low. Other disadvantages of CH are prolonged healing time and delayed return to daily activity.

2 Disadvantages

2.1 Pain

Pain in the early postoperative period should not be considered a complication, as it is inherent to the surgical procedure. It is directly related to the technique employed and constitutes the main reason for most patients to avoid hemorrhoidectomy. It helps to explain why patients often postpone or avoid treatment, despite suffering from severe symptoms of hemorrhoidal illness (bleeding, prolapse, thrombosis, etc.).

Post hemorrhoidectomy pain is most intense between the second and fifth postoperative days and has multifactorial etiology: anoderm incisional trauma, local inflammation, local infection, sphincter spasm, and individual pain tolerance. Sphincter spasm, often suggested by some authors as the main cause (Bleday et al. 1992; Sardinha and Corman 2002), may be treated in various ways (internal sphincterotomy, botulinum toxin, etc.). Routine use of internal sphincterotomy is defended

by some authors (Schouten and van Vroonhoven 1986; Leong et al. 1994). Yet, it was shown to produce disparate results, as well as the risk of fecal incontinence of varying degrees, principally in the elderly, and in females who have undergone multiple vaginal births (Schouten and van Vroonhoven 1986; Leong et al. 1994; Khubchandani 2002; Mathai et al. 1996). The sphincterotomy should be performed in patients with evident sphincter hypertonia confirmed by anorectal manometry and/or in cases associated with chronic anal fissure.

A study of 50 consecutive patients submitted to open hemorrhoidectomy randomized to receive botulinum toxin (BOTOX® 20 UI – 0.4 mL) or saline solution (0.4 mL) showed significantly reduced pain in BOTOX® patients mainly on the sixth and seventh postoperative days (Davies et al. 2003). Similar results were observed by Patti et al., who also observed a correlation between the intensity of pain and raised sphincter resting pressure (Patti et al. 2005).

Local infiltration of anesthetics (Ropivacaine 0.75% – 300 mg) in the anal sphincter shortly after the completion of the operation has been recommended for pain relief during the first 24 h with exciting results (Vinson-Bonnet et al. 2002).

Local infiltration of Toradol (Ketorolac tromethamine, 60 mg/2 mL) injected directly into the anal sphincter in two quadrants showed accentuated pain relief; however, an adverse effect was observed on urinary function (O'Donovan et al. 1994; Richman 1993).

Goldstein et al. recommended the use of a subcutaneous morphine pump for postoperative pain control in outpatients undergoing surgery and concluded that it was a cost effective alternative to inpatient surgery (Goldstein et al. 1993). The use of transdermic fentanyl (50 µg/h) following hemorrhoidectomy has also been recommended and was shown to be safe and effective for a period of 72 h (Kilbride et al. 1994).

In a randomized controlled trial, Carapetti et al. observed that orally administered metronidazole reduces postoperative pain from open hemorrhoidectomy through the secondary prevention of open wounds. This reduction was most pronounced on the fifth and seventh postoperative

days, providing better patient satisfaction and an earlier return to work (Carapetti et al. 1998). A randomized trial by Balfour et al. in patients submitted to closed hemorrhoidectomy did not observe a significant reduction in postoperative pain with orally administered metronidazole, however (Balfour et al. 2002). Topical application of 10% metronidazole cream was superior to placebo for pain control and healing in another study (Nicholson and Armstrong 2004).

Time to full return to daily activities (days of work) is another disadvantage of excisional methods (open and closed hemorrhoidectomy), as it may take 3–6 weeks for the complete healing of cutaneous wounds. Both methods are efficient in the eradication of grade III and grade IV hemorrhoidal disease, with a very low frequency of recurrence and the need for further surgery. With regards to the healing of the operative wound, however, results are divergent. While some authors observe a lower healing time with the closed technique (Arbman et al. 2000; Ho et al. 1997), others defend the open technique (Gencosmanoglu et al. 2002). In a comparative prospective randomized study of stapled hemorrhoidopexy and excisional hemorrhoidectomy, Hertzner et al. observed a faster return to work in the stapled group (6.7 days compared to 20.7 days; $p = 0.001$) (Hertzner et al. 2002). Similar results were reported by Racalbutto et al. in a prospective randomized study with 100 patients, comparing stapled hemorrhoidopexy to the Milligan-Morgan procedure. Return to work was faster in the stapled group (8.04 vs. 16.9 days) (Racalbutto et al. 2004).

A study comparing radiofrequency ablation with plication (RAP) to Milligan-Morgan hemorrhoidectomy for grade III hemorrhoids showed favorable results for the RAP group regarding time to return to laborious activity (7 vs. 17 days) and time to healing (17 vs. 38 days) (Gupta 2004).

2.2 Recurrence

If we analyze recurrence in a variety of operations, hemorrhoidectomy is still considered the “gold standard.” Conventional hemorrhoidectomy can

completely treat hemorrhoidal disease of grades III and IV, with a recurrence rate of less than 3% (Jayaraman et al. 2006; Milone et al. 2012; Chen et al. 2013). When conventional hemorrhoidectomy is compared with non-excisional methods in terms of long-term recurrence rate, the results clearly favor CH (Jayaraman et al. 2006; Nisar et al. 2004; Mattana et al. 2007; Giordano et al. 2009).

A systematic review including 1,996 patients who underwent Doppler-guided hemorrhoidal artery ligation showed a recurrence rate of 9% for prolapse, 8% for bleeding, and 5% for pain during defecation. The authors reported a higher recurrence rate for patients with grade IV hemorrhoids, recommending that this technique should be used preferably for grade II and grade III hemorrhoids (Giordano et al. 2009). Ratto et al. in a multicenter study of 803 patients with symptomatic hemorrhoids treated by transanal hemorrhoid dearterialization (THD) showed recurrence of hemorrhoidal prolapse of 6.3% after a mean follow-up period of 11.1 ± 9.2 months (Ratto et al. 2015).

2.3 Urinary Retention

Postoperative urinary retention occurs in around 2.1–15% of hemorrhoid surgery and is more frequent in individuals over 50 years of age (Goligher 1984). Its etiology is debatable, but the severity of the disease, surgical trauma, spinal anesthesia, the use of opiates, and excessive administration of liquids in the perioperative phase are predisposing factors (Bailey and Ferguson 1976; Salvati and Eisenstat 1991).

Zaheer et al. compared hemorrhoidectomy with other benign anorectal afflictions and observed a higher rate of urinary retention following hemorrhoid resection (Zaheer et al. 1998). Hoff et al. observed an incidence of urinary retention of less than 1% and related this fact to patients operated on as outpatients under local anesthesia, who recovered far from hospital environment (Hoff et al. 1994). Some important considerations must be made for the prevention of urinary retention in the postoperative phase: restriction of liquid ingestion in the perioperative phase, good

analgesia management without narcotics and anticholinergics, and seating in warm water multiple times per day. Kim et al. reduced the incidence of vesical catheterization from 69.6% to 7.5% with the use of pudendal nerve block instead of spinal anesthesia (Kim et al. 2005).

2.4 Hemorrhage

Bleeding is another complication post-hemorrhoidectomy and can occur in early postoperative phases (1–2 days) or later (7–14 days), with a mean incidence rate of 1% and a variance of 0.6–5.4% (Salvati and Eisenstat 1991; Chen et al. 2002).

Early bleeding occurs generally from loosening of the pedicle ligature or small points of bleeding from the excisional wound or edges of the cutaneous incisions, and tends to be diagnosed a few hours after the patient returns from the surgical suite to his/her room. In cases where the hemorrhoidal pedicle ligature is loosened, the patient should immediately return to the operating room for suture hemostasis. It is worth remembering that in some situations bleeding from the ligature can happen in the interior of the rectum and may not be externalized, thus causing the diagnosis to be made only later when the patient becomes hemodynamically unstable. In these situations, the patient should be immediately taken to the operating room and rectal cleansing should be performed with cold physiological saline under general anesthesia. The bleeding site should be identified and then neutralized by transfixing suturing.

Late bleeding generally occurs as a result of infection or suture erosion and is more frequent in patients requiring greater evacuatory effort. It is most commonly observed between 7 and 10 days after surgery when the patient is at home. It can appear as a discharge of small amounts of dark blood and it frequently requires surgical correction. Chen et al. studied 4,880 consecutive hemorrhoidectomies and reported that male sex and operations performed by inexperienced surgeons were independent risk factors for postoperative hemorrhage (Chen et al. 2002). In selected cases, treatment can be conservative (e.g.,

placement of a slightly moistened gelatin sponge of Gelfoam® or using a Foley catheter to tamponade the bleeding point) (Rosen et al. 1993).

2.5 Constipation/Fecal Impaction

The incidence of septic complications after hemorrhoidectomy is extremely low, in spite of the obvious massive colonization of the anal canal by millions of bacteria, possibly because of its rich vascularization and the specifics of its local immune system. Extra care should be taken when performing hemorrhoidectomies in immunocompromised individuals (patients with diabetes mellitus, alcoholism, patients under cancer treatment, chronic steroid users, HIV infection, etc.) and patients with valvular heart disease. The use of antibiotics is highly recommended in these cases. The presence of transient bacteremias has been described following anorectal surgery in up to 8.5% of patients submitted to proctoscopic examination (LeFrock et al. 1973; De Paula et al. 1991). In a study conducted at the University of São Paulo Medical School Clinics Hospital (“Hospital das Clínicas”) involving 475 hemorrhoidectomies, infection of the surgical wound was observed in 1.1% of cases (Nahas et al. 1997). The prevention of cellulitis and infection of the surgical wound may be prevented by adequate local hygiene and seated bathing. Fournier’s gangrene has been described as a complication of hemorrhoidectomy and other anorectal operations in immunocompromised patients, but it cannot be attributed to any particular surgical technique (Sobrado et al. 1997; Lenhardt et al. 2004).

2.6 Residual Skin Tags

The formation of residual skin tags is a frequent complication after hemorrhoidectomy, and it varies from 3% to 6%. It is generally the result of edema of the adjacent skin or when redundant skin is retained. To avoid the formation of skin tags, all bloody wounds should be kept smooth,

hemostatic, and without excess skin. The real incidence of residual skin tags following hemorrhoidectomy is difficult to estimate, since most of them are initially asymptomatic. Jones and Schofield found skin tags in 4% of patients after open hemorrhoidectomy (Jones and Schofield 1974). Sobrado et al. in a prospective study of 170 patients submitted to outpatient open hemorrhoidectomy under local-regional anesthesia reported an incidence of skin tags of 3.5% (Sobrado et al. 2001). The residual skin tags are rarely painful, and their main drawbacks are: poorer anal hygiene and, as a result, local and itchy irritation, besides being unesthetic. The sensation of local moistness and itchiness are relieved only when hygiene is done with water.

2.7 Anal Fissure

Residual anal fissure is an infrequent complication, and it results from small abscesses in the healing bed of one of the wounds. It occurs in patients with anal hypertony and evacuatory difficulty. The repeated trauma caused by hardened feces complicates the healing process and is responsible for residual ulcers. The precise diagnosis of sphincter hypertony in the preoperative phase can only be done by clinical examination associated to anorectal manometry. In these situations, measures such as anal dilation, infiltration of botulinum toxin in the anal sphincter, or internal sphincterotomy may be necessary. Postoperative care, such as a fiber enriched diet, enemas, and cortisone-based creams or chemical sphincterotomy (ointments containing glyceryl trinitrate or calcium-channel blockers), can be prescribed. In patients with residual fissures and absence of anal hypertony, surgical treatment may be necessary, with excision of the ulcer and anoplasty.

2.8 Mucosal Prolapse

Advanced stages of hemorrhoidal disease with exuberant prolapse may be followed by inadequate resection of the mucosal prolapse or

inadequate fixation of the interior of the anal canal thus resulting in residual mucosal prolapse. Frequently, the prolapses are unique, in which case they may be treated by rubber-band ligation in the office. In cases of circumferential and voluminous prolapse, the patients should first be examined to exclude the presence of rectal procidence and then treated by resection or fixation.

2.9 Anal Stenosis

Anal stenosis is a more common complication of open than closed hemorrhoidectomies and is generally caused by extensive resection of tissues and absence of adequate cutaneous-mucosal bridges. Jones and Schofield reported a frequency of 6% of anal stenosis in 100 hemorrhoidectomies, and five of these responded well to treatment with anal dilation in an outpatient clinic (Jones and Schofield 1974). It is a fearful but preventable complication, if some technical caveats are respected: to avoid mass ligatures and to maintain integer and well-vascularized cutaneous-mucosal bridges. In some situations where the anus is found to present little elasticity, or in the presence of chronic anal fissure associated with hemorrhoidal disease, or in large skin tags and swollen hemorrhoids, a two-stage operation or, potentially, a concurrent anoplasty with hemorrhoidectomy can be carried out (Habr-Gama et al. 2005). If there is any evidence of anal stenosis during the first follow-up visits, the patient should be directed to anal dilations with a Hegar dilator or candle or to digital examination with corticosteroid-based creams. Other postoperative recommendations include a fiber-rich diet, osmotic laxatives, and suppositories.

2.10 Fecal Incontinence

The presence of fecal incontinence or soiling can occur in the early postoperative period, but, after 4–6 weeks, sphincter control is re-established. This transient alteration of sphincter control is most commonly seen in the elderly or in multiparous women, and no difference is observed

between the open and closed techniques. Jones and Schofield observed only one case of incontinence in 100 hemorrhoidectomies (Jones and Schofield 1974). Bennet et al. evaluating late results of hemorrhoidectomies observed that 29% of patients had some kind of continence disturbance: 9% presented flatulent incontinence, 6% fecal liquid incontinence, and 17% presented sporadic soiling in their underwear (Bennet et al. 1963). In 475 patients submitted to hemorrhoidectomy, we observed three cases of temporary partial incontinence, but no permanent incontinence (Nahas et al. 1997). It is important to state that we did not use forceful digital dilation or routine sphincterotomy in these patients (Nahas et al. 1997).

3 Hemorrhoidectomy with New Devices

The main disadvantages of conventional hemorrhoidectomy, often leading to postponement of definitive treatment by most patients, are postoperative pain, time-to-healing, and prolonged time to normal physical activity return. Recent studies using modern anesthetic techniques, new surgical devices, and more powerful analgesics have not shown better control and resolution of these inconveniences (Bennet et al. 1963).

In an attempt to reduce the pain factor, alternative techniques of dissection, with the use of new surgical devices, were investigated. Sealing machines such as Ligasure® (Valleylab, Boulder, CO, USA), a device that uses bipolar energy, or an ultrasonic scalpel (Harmonic® shears, Ethicon Endosurgery, Cincinnati, OH, USA) were evaluated as tools for hemorrhoidectomy. With the null hypothesis that they create less thermic injury to tissues and less unnecessary tissue destruction, various studies compared the use of these devices with the use of cautery for open hemorrhoidectomy. The majority of studies were carried out with a reduced number of individuals, involving at most 30–86 patients (Sneider and Maykel 2010; Song and Kim 2011; Schouten and van Vroonhoven 1986; Cintron and Abcarian 2007). They showed a reduction of postoperative pain with the use of either the sealing machines or

the harmonic scalpel. Previous meta-analyses were published, all of them with studies comparing conventional dissection with dissections using a sealer (e.g., Ligasure®). The results showed that the use of the sealing machine resulted in less postoperative pain, lower hospitalization, quicker healing, and shorter convalescence time compared to dissection carried out with scissors or electric scalpel (Song and Kim 2011; Mastakov et al. 2008). Main differences between the various interventional techniques are summarized in Table 3.

Despite the lack of long-term studies with these devices, there is no cause to think they would result in better outcomes, since these techniques use the same surgical principles, that is, the removal of prolapsed hemorrhoids, and they only differ in the energy source applied to the dissection. We can infer, therefore, that recurrence and reoperation rates in the long term will be the same as with conventional techniques: low, in other words. These techniques with new devices may be recommended; however, they necessarily imply higher costs.

4 Conclusion

Surgical (conventional) hemorrhoidectomy is the best treatment to permanently eradicate hemorrhoidal disease. The majority of patients remain symptom-free, and the expected recurrence rate is less than 3%. Studies comparing open and closed techniques showed good results for both. The majority of published articles by specialized centers report highly satisfactory long-term results, leading us to conclude that the most important factor for success is a well-defined, criteria-based selection of patients and surgical performance by expert surgeons.

For the specialist treating hemorrhoidal disease, deep knowledge of the anatomy and physiology of the anorectal region is essential, as is the knowledge of the various treatment options, since patients will differ in their symptomatology, socioeconomic status and cultures, and hemorrhoid degrees. They will, therefore, require tailor-made treatment strategies. As such, we

Table 3 Advantages and disadvantages of the most accepted hemorrhoid surgical treatments

Characteristics and complications	CH	LT	RBL	PPH	THD
Post-op pain	High	Low, involves less tissue damage	Low	Low	Low
Post-op bleeding	Frequent, may also present mucus discharge	Infrequent	Infrequent	Frequent	Frequent
Fecal dysfunction	Frequent, may be temporary or permanent	Infrequent	Less frequent	Possibility of minor and transient sphincter dysfunction	Possibility of minor and transient sphincter dysfunction
Anal stenosis	More frequent, depending on pile number	Infrequent	Infrequent	More frequent	Not described
Infection	More frequent, perchance of locoregional sepsis including Fournier's syndrome	Infrequent	Infrequent	More frequent, perchance of rectal fistulas, perforation and sepsis	Rare
Recurrence rate	The lowest, possibility of cure	Higher, possibility of insufficient treatment	Higher, may need repeated procedures	Low	Low
Cost of the procedure	Low	High	Low	High	High
Applicability	Universally applicable	Not applicable to all hemorrhoid degrees; not applicable to hemorrhoidal and mucosal prolapse	Usually not applicable to all hemorrhoid degrees Usually degrees I–II	Applicable to degrees II–IV	Universally applicable
Need of incisions	Yes	No	No	No external incisions	No
Need for disposable instruments	No	No	No	Yes	Yes
May be performed as ambulatory procedure	Yes	Yes	Yes	No	Yes
Postoperative care measures	Increased postoperative care measures and later return to work	Less measures needed; early return to work	Less measures needed; early return to work	Less measures needed; early return to work	Less measures needed; early return to work
Other characteristics	Longer known historical knowledge and follow-up	High precision	May need repeated sessions	Leaves hemorrhoids intact and in situ	Possibility of transient tenesmus; acts directly in hemorrhoidal tissue

CH conventional hemorrhoidectomy, *LT* laser treatment, *RBL* rubber-band ligation, *PPH* procedure for prolapse and hemorrhoids, *THD* transanal hemorrhoidal dearterialization

believe that optimal results of hemorrhoidectomies will be obtained if carried out by knowledgeable and experienced surgeons as stated above.

5 Cross-References

- ▶ The Acute Management of Hemorrhoids
- ▶ Anatomy, Physiology, and Pathophysiology of Hemorrhoids
- ▶ Classification of Hemorrhoidal Disease and Impact on the Choice of Treatment
- ▶ Clinical Assessment of Hemorrhoids
- ▶ Epidemiology of Hemorrhoidal Disease
- ▶ Literature Review on Hemorrhoidectomy
- ▶ Main Advantages of Hemorrhoidectomy
- ▶ Main Disadvantages of Hemorrhoidectomy
- ▶ Main Disadvantages of Outpatient Treatments for Hemorrhoids
- ▶ Modern Hemorrhoidectomy: Techniques and Results
- ▶ Pros and Contras of Hemorrhoidectomy
- ▶ Pros and Contras of Outpatient Treatments for Hemorrhoids
- ▶ Selection of Patients to the Surgical Treatment of Hemorrhoids
- ▶ Technical Tips and Tricks of Hemorrhoidectomy
- ▶ Technical Tips and Tricks of Outpatient Treatments for Hemorrhoids
- ▶ Traditional Hemorrhoidectomy: Techniques and Results
- ▶ Why and When I Do Prefer the Hemorrhoidectomy

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Literature Review on Hemorrhoidectomy

24

Guy R. Orangio

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Abstract

The surgical hemorrhoidectomy remains the gold standard for the management of symptomatic grade III and grade IV Hemorrhoids. In 1937, Milligan-Morgan described the surgical hemorrhoidectomy, leaving the wounds open, the term open hemorrhoidectomy came to symbolize the excisional hemorrhoidectomy (Milligan et al., Lancet 233:1119–1124, 1937). In 1959 Ferguson et al., described the technique of modifying the Milligan-Morgan hemorrhoidectomy by closing hemorrhoidectomy wounds, the term closed hemorrhoidectomy came to symbolize the modification of the Milligan-Morgan procedure (Ferguson and Heaton, Dis Colon Rectum 2:176–179, 1959). The “closed” hemorrhoidectomy has become the main technique for hemorrhoidectomy instructed in General Surgery and Colon and Rectal Surgery residencies in the United States. The principal of the surgical hemorrhoidectomy is to completely excise all of the hemorrhoidal tissue, in the three most common quadrants, the right anterior, right posterior and left lateral areas of the anal canal. The most common complaint for patients is postoperative pain, and the disability caused by the pain. This postoperative pain is the driving force in the development or “quest” for the “painless” hemorrhoidectomy. All other procedures are compared to the excisional hemorrhoidectomy, for postoperative pain, disability, bleeding, stricture formation and recurrence. There are multiple modalities that are utilized to diminish post hemorrhoidectomy pain, which I will discuss. There has been development of new technology for “non-excisional” hemorrhoid procedures with the promise to decrease post hemorrhoidectomy pain and disability. The two most commonly used alternatives today is the Procedure for Prolapsed

Hemorrhoids (PPH) more commonly known as the “Stapled Hemorrhoidopexy” and the other is the Doppler-Guided Hemorrhoidal Artery Ligation, known as Transanal Hemorrhoidal Dearterialization (THD) with plication of the Hemorrhoids (ligation anopecty or mucopexy) (Yeo and Tan, World J Gastroenterol 20:16,976–16,983, 2014; Lohsiriwat, Tech Coloproctol 12:229–239, 2015).

The standard tools for the surgical hemorrhoidectomy are the scalpel, scissors or electrocautery, however efforts to decrease the amount of intraoperative bleeding, and the associated post-operative pain and disability have led to the development of alternative energy devices to dissect and excise the hemorrhoidal tissue: the LigaSure™, a computer-guided bipolar electrothermy device (BED), and the Harmonic Scalpel™, which is vibratory energy (VE) (Mastakov et al., Tech Coloproctol 2:229–239, 2008; Neinhuijs and de Hingh, Cochrane Database Syst Rev 1:CD 006761, 2009; Chung et al., Dis Colon Rectum 45:784–794, 2002; Armstrong et al., Dis Colon Rectum 44:558–564, 2001). This chapter will discuss the literature leading up to the current management of patients with advanced hemorrhoidal disease and the procedures and the methods utilized to minimize postoperative pain and disability.

Abbreviations

AUC	Area under quality of life curve
BED	Bipolar electrothermy device
BPI	Brief Pain Inventory
BSH	Bipolar scissors hemorrhoidectomy
BT	Botulinum toxin

CBT	Clostridium botulinum toxin
CH/CSH	Conventional surgical hemorrhoidectomy
DEH	Diathermy excisional hemorrhoidectomy
DFB	DepoFoam bupivacaine
DFH	Diathermy Ferguson hemorrhoidectomy
DH	Diathermy hemorrhoidectomy
DPIS	Distal partial internal sphincterotomy
FH	Ferguson hemorrhoidectomy
GT/GTN	Glyceryl trinitrate ointment
HSB	Harmonic scalpel [®] hemorrhoidectomy
HSS	Hemorrhoidal symptom scores
LH	LigaSure [™] hemorrhoidectomy
LIS	Lateral internal sphincterotomy
LOS	Length of stay (hospital stay)
MMH/OH	Milligan-Morgan (open) hemorrhoidectomy
MRP	Maximal resting pressures
MSP	Maximal squeeze pressures
N=	Number of participants
NO	Nitrous oxide
NRS	Numeric rating scale
NSAIDS	Nonsteroidal anti-inflammatory drugs
NTG	Nitroglycerin
PC	Pedicle coagulation
PES	Pain expectation scores
PJ	Petroleum jelly
PL	Pedicle ligation
PO	Placebo ointment
PPH/	Procedure for prolapsed
SRM/SH	hemorrhoids
PPS	Postoperative pain score
QALY	Quality-adjusted life-years
RBL	Rubber band ligation
RCT	Randomized controlled trial
SCH/	Semi-closed hemorrhoidectomy
Parks	
THD/	Transanal hemorrhoidal
HAL	dearterialization
THE	Traditional excisional hemorrhoidectomy

VAS	Visual analogue scale
VE	Vibratory energy

1 Literature Review of Hemorrhoidectomy

1.1 Conventional Surgical Hemorrhoidectomy (CSH)

The conventional hemorrhoidectomy weather open or closed technique is utilized was originally described and is still performed by many surgeons with sharp dissection. The introduction of energy devices over the decades has been for two main reasons to decrease intraoperative bleeding and to minimize postoperative pain and disability. The discussion will begin with utilization of energy devices in order to achieve the goal of minimal blood loss and minimizing post hemorrhoidectomy pain.

2 Energy Devices

2.1 Diathermy Excisional Hemorrhoidectomy

Diathermy Excisional Hemorrhoidectomy (DEH), this energy source is for the management of the hemorrhoidal pedicle by coagulation rather than ligation. There are articles that have discussed the DEH technique might be associated with less postoperative pain (Sharif et al. 1991; Seow-Choen et al. 1992). A more recent study designed compared the effects of pedicle ligation (PL) versus pedicle coagulation (PC) on postoperative pain in patients undergoing elective 3 quadrants DEH for Grade III or IV hemorrhoids. It was a single blinded prospective randomized clinical trial. All complications were recorded including postoperative pain, bleeding, urinary retention, and duration of hospital stay. Postoperative pain was evaluated by means of a visual analog scale (VAS) from 0 to 10, with 10 the most severe pain. The patients recorded their VAS score each morning in the first

10 postoperative days. The number of analgesic ampoules (intravenous) utilized for each patient in the first 24 h was recorded. A total of 120 of 136 patients completed the study, 60 in each group. The patient demographics in both groups did not differ as to age, sex, and duration of symptoms or grade of hemorrhoids. The postoperative complications including urinary retention, bleeding (early or late hemorrhage), median hospital stay, and median follow up in both groups were not statistically significant. There was a statistically significant difference ($P < 0.001$) in operative time in the PC group (median 15 min, range 14–20 min) and the PL group (median 14.5 min, range 12–18 min). The daily pain VAS scores for the first 10 postoperative days did reveal some interesting data, in the PC group throughout the first 6 postoperative days, the median pain score was statistically significant ($P < 0.001$) versus the PL group. Interestingly from the 7th to 10th postoperative days there was no statistical difference in the median pain scores between the groups. In the PC group the daily median pain scores were lowest on days 1–3, then gradually increased with a peak on days 6–8, then decreased on days 9–10, but did not reach the level of the scores of days 1–3. The PL group had the highest median scores on days 1–4 and then decreased over the next 6 postoperative days. The overall median pain scores for the first 10 postoperative days was statistically significant in the PC group versus the PL group (4.65 vs. 6.56, $P < 0.001$). There was a statistically significant ($P < 0.001$) difference in the median number of analgesic ampoules required in the first 24 h postoperatively; the PC group (median 1, range 0–3 ampoules) versus the PL group (median 3, range 1–3 ampoules). Over all in the PC group 11.7% of patients did not require analgesic ampoules in the first 24 h. The author felt that the study did show a significant decrease in postoperative pain in the PC group versus the PL group. He felt that the pedicle ligation may increase postoperative pain by incorporating sensitive anal mucosa despite meticulous surgical technique, the ligation may incorporate viable tissues that will eventually become ischemic, necrotic and infected and lastly incorporating of fibers of the internal sphincter

may cause anal spasm. The author postulated that with pedicle coagulation the postoperative pain might be decreased because of the diathermy burn to the sensitive anal mucosa and nerves, essentially creating anesthetic third degree burn (Bessa 2011).

2.1.1 Alternative Energy Devices

Alternative energy devices were developed for improved hemostasis and to decrease collateral tissue damage (thus decreasing postoperative pain), less than the diathermy energy devices.

2.1.2 Computer-Guided Bipolar Electrothermy Device (LigaSure™)

The LigaSure™ utilizes the computer guided-BED that is a vessel sealing system that combines pressure applied by the jaws of the device with the energy tailored to tissue impedance supplied by a platform generator. An automatic advanced computer-guided feedback system incorporates intelligent sensors that recognize tissue changes 200 times per second and then adjusts the output current and the voltage based on the power setting in order to maintain a constant effect across the different tissue densities and resistance. The high frequency current provides hemostasis by denaturing collagen and elastin from the vessel wall and surrounding connective tissue. The BED device insures almost complete coagulation and seals the hemorrhoidal tissue between the jaws of the device with minimal collateral thermal injury to adjacent tissue. The sealed denatured protein has strength comparable to suture. The improvement in the BED system is low voltage and high current resulting in the cold-cutting of tissues at lower temperatures.

The surgical hemorrhoidectomy is the gold standard utilized to compare surgical outcomes. The Ferguson Hemorrhoidectomy (FH) is a Modification of the Milligan-Morgan, and both techniques also have similar postoperative complications including pain and disability, bleeding, urinary retention, difficult defecating, anal fissure formation, anal stenosis, gas or fecal incontinence, prolonged operative time, and prolonged hospital length of stay (LOS). In 2015 meta-analysis of

Table 1 Postoperative complications LigaSure™ hemorrhoidectomy (LH) versus Ferguson hemorrhoidectomy (FH)

Procedure	Complications ^a				
	Bleeding (Intra operative)	Urinary retention	Operative time	Early postoperative pain scores	Hospital LOS
LH versus FH	OR −18.52; 95% CI −26.13, −10.90; $P < 0.00001$	OR 0.32; 95% CI 0.13, 0.79; $P = 0.01$	OR −15.12; 95% CI, −2.18, −2.10; $P < 0.00001$	OR −2.09; 95% CI −2.18, −19.40; $P < 0.00001$	OR −0.98; 95% CI −1.46, −0.51; $P < 0.00001$

^aThere was no significant heterogeneity among the compared trials under each of these categories. Methodology was a fixed-effects model to measure the P Value

randomized controlled trials (RCT) comparing LigaSure™ Hemorrhoidectomy (LH) versus Ferguson Hemorrhoidectomy (FH) comparing all postoperative complications (Xu et al. 2015). In this study there were five RCTs with a total of 318 patients that qualified for the meta-analysis. The postoperative complications of postoperative hemorrhage, difficult defecation, anal fissure, anal stenosis, and incontinence to flatus or stool did not show a statistically significant difference between LH and FH, RCTs. However there was a significant difference in intraoperative bleeding, urinary retention, operative time and early postoperative pain scores and disability between LH and FH Xu et al. (2015) (Table 1).

Some conclusions that can be drawn from this meta-analysis is that the LH did take significantly less time than the FH, which the authors believe can be attributed to the BED ability to decrease intraoperative bleeding which will enhance visibility, and also eliminating the suture ligation of the vascular pedicle (FH) and farther decreasing time of closing the excision site (FH). In theory the BED technology does have minimal thermal spread which would contribute to less collateral tissue injury and necrosis which may lead to less postoperative pain. One of the problems with a meta-analysis looking at a number of RCTs is that we do not know if all FH were performed with electrocautery as an energy source, or all if the surgeons were “purists” performing the procedure with sharp dissection, in that situation there is no collateral tissue damage. However with the elimination (as with the LH technique) suture ligation of the vascular pedicle and then closing the excision site (approximate) the anal canal and perianal

skin, this may lead to less postoperative pain, as a secondary gain. The LH technique only decreased the postoperative pain scores within 24 h of the procedure: which always brings in the question of validity of pain score evaluations and surveys. Over all the BED technology is a safe and effective device to utilize for hemorrhoidectomy.

2.2 Vibratory Energy (Harmonic Scalpel®)

Vibratory energy (VE) consists of cutting shears that vibrate at 55,500 Hz, at amplitudes of 60–100 microns. The VE results in disruption of hydrogen bonds that cause denaturing of intracellular proteins it also causes a shearing of the coapted tissue thus creating a “sticky” hemostatic coagulum that farther assists in hemostasis. The VE is able to cut tissue utilizing pressure that results from compression (coaptation) of the “vibratory” blade onto a “static” pressure pad on the opposite blade of the shears. This combination of focused pressure and VE optimizes division of the coapted tissue.

The utilization of VE with hemorrhoidectomy has been around since the early 2000’s and there are several studies that have reported a decrease in postoperative pain. In 2001 a prospective randomized trial comparing Ferguson Hemorrhoidectomy (FH) with Harmonic Scalpel® Hemorrhoidectomy (HSH) for patients with symptomatic Grade II or Grade III hemorrhoids. The study evaluated the difference between techniques in operative time, postoperative pain, fecal incontinence and quality of life (Short Form-36 survey) and postoperative complications. The results did not show statistical

difference in operative time, postoperative pain on day 1 or at the 6-week time frame between FH group and HSH group $P < 0.82$. On postoperative day 7 the difference in pain in FH group versus HSH group approached significance a $P < 0.06$ but was not significant. There was a statistically significant difference in pain in the FH group that was not seen in the HSH group between postoperative days 1–7 ($P < 0.001$). There was no difference between both groups in number of narcotic pills used; the incidence of incontinence (flatus) was similar in both groups. Overall there was no difference in the number or type of complications in either group. The author's conclusion; there was no specific advantage in postoperative pain, fecal incontinence, operative time or complications utilizing the Harmonic Scalpel[®] when compared to the Ferguson Hemorrhoidectomy (Khan et al. 2001).

In a study comparing postoperative pain in patients with symptomatic Grade III or Grade IV hemorrhoids who were randomized to Diathermy Hemorrhoidectomy (DH) and Harmonic Scalpel[®] Hemorrhoidectomy (HSH). The aim of the study was based on decreasing lateral thermal injury during tissue dissection during Open Hemorrhoidectomy (Milligan-Morgan) or Closed Hemorrhoidectomy (Ferguson), using diathermy verses vibratory energy. The patients were randomized and pain was assessed using a visual analog scale (VAS) preoperatively and postoperatively on days 1, 2, 7, 14 and 28. 24 h narcotic usages were recorded postoperative for days 1, 2, 7, 14 and 28. There were no demographic differences in either group of patients as to gender, age, previous surgery, grade of hemorrhoids, open or closed hemorrhoidectomy or preoperative pain scores. There was a statistically significant difference in the postoperative pain in the HSH group versus the DH group in the overall pain scores with the VAS ($P < 0.01$) and the net pain (defined as postoperative pain minus preoperative VAS scores) VAS ($P < 0.01$) and less over all analgesic requirements for Days 1,2,7,14 and 28 ($P < 0.01$).

The disability (time off work) in HSH group was less than the DH with over 55% returning to work within 1 week of surgery while only 23% of the DH group was able to return to work in the first

week. The author's conclusion was that HSH has less lateral thermal injury, which means a decrease in postoperative pain and shorter disability time to normal activity (Armstrong et al. 2001).

In a double blind randomized trial comparing outcomes with vibratory energy or bipolar energy or sharp excision hemorrhoidectomies in 86 patients with Grade III symptomatic hemorrhoids. The 86 patients were randomized into three groups: Milligan-Morgan Hemorrhoidectomy (MMH) utilizing sharp excision of hemorrhoid tissue with vascular pedicle ligation, Bipolar Scissors Hemorrhoidectomy (BSH) with vascular pedicle coagulation and Harmonic Scalpel[™] Hemorrhoidectomy (HSH) with vascular pedicle coagulation and the outcomes of these groups were compared to 12 measured outcomes Table 2. The postoperative complications compared were urinary retention, hemorrhage, fever, impaired wound healing (at 4 weeks), anal stenosis (at 4 weeks), and incontinence to flatus (at 4 weeks). The postoperative pain score (PPS) was measured with the use of a linear analog pain scale from 0 to 10 (10 the worst) daily for days 1 to 7. The patient's pain expectation scores (PES), which measures the pain experience from –5 to 5. A score of 0 indicated the postoperative pain experienced was equivalent to the anticipated preoperatively. If the PES was –5 the actual pain was less than expected or if the PES was 5 the pain was far more severe than

Table 2 Measured outcomes comparing Milligan-Morgan, bipolar scissor and harmonic scalpel[™] hemorrhoidectomy

Measured outcomes
Operative time
Blood loss
Postoperative hospital stay
Pain score (mean)
Pain expectation score
Date of first bowel movement
Number of narcotic injections (24 h)
Number of oral analgesics
Time off work or normal activity
Wound healing
Satisfaction score
Postoperative complications

Table 3 Significant outcomes comparing DFH group versus HSH group

	DFHG ^a (<i>N</i> = 71)	HSHG ^b (<i>N</i> = 80)	<i>P</i> < value
Postoperative complications			
Mean hospital stay (d)	1.2 ± 0.4	1.0 ± 0.1	0.001
Time to normal activity (d)	16.0 ± 6.3	10.6 ± 2.1	0.001
Operative times (minutes)	25.5 ± 7.7	16.8 ± 2.1	0.001
Postoperative hemorrhage	4.2	2.0	NS
Urinary retention	28.2	16.3	0.05
VAS 24 h postoperative	6.8 ± 1.8	5.4 ± 0.7	0.001
VAS 7 d postoperative	5.2 ± 1.2	4.0 ± 0.8	0.001
VAS 28 d postoperative	1.4 ± 0.2	0.01 ± 0.1	0.001
Need for total postoperative analgesic at 24 h (mg)	1096.12 ± 194	790.6 ± 206.9	0.001
Need for total postoperative analgesic at 7 d (mg)	1000 ± 259	619.3 ± 234.2	0.001
Recurrence	6	5	NS
Fecal incontinence	1.4	0	NS

^aDiathermy Ferguson hemorrhoidectomy group^bHarmonic scalpel[®] hemorrhoidectomy group

expected. The PES was obtained daily for postoperative days 1 to 7. The 86 patients were randomized into MMH group (*N* = 27), BSH group (*N* = 30) and HSH group (*N* = 29). There was no statistical difference in sex or age in the three groups. The results showed in all three groups there was no significant statistical difference in operative times, PES, day of first bowel movement postoperatively, number of oral narcotics taken, postoperative hospital stay and time required to return to work or normal activity. Blood loss in both the HSH group and BSH group were significantly less than the MMH group. There was a statistically significant difference in PPS among the three groups: HSH group had a better PPS score than both the BSH group and the MMH group. The HSH group had a statistically significant better patient satisfaction scores than the BSH group and the MMH group. The authors stated that the HSH is safe and effective with a similar complication rate with significantly less postoperative pain. The alternative energy sources were associated with significantly less blood loss (Chung et al. 2002).

In 2013 a prospective randomized trial comparing outcomes utilizing the Harmonic Scalpel[®] Hemorrhoidectomy (HSH) versus Diathermy Ferguson Hemorrhoidectomy (DFH) in 151 patients with symptomatic grade III or grade IV hemorrhoids. There were 151 patients

randomized in to the HSH group or the DFH group. The study compared operating time, postoperative pain, duration of disease, number of issued analgesics, length of hospital stay (LOS), time to return to normal activity and postoperative complications: bleeding, anal stenosis, urinary retention, postoperative infections. Postoperative pain score were by visual analogue scores (VAS) days 1, 7 and 28. The total analgesics were also counted on days 1, 7 and 28. Both groups were demographically similar as to age and sex. There was a statistically significant difference between HSH versus DFH to mean operative time, postoperative VAS pain scores (days 1,7 and 28), LOS, average return to normal activity, and the total analgesic doses (days 1,7 and 28) (Table 3). The authors concluded that HSH is preferred for surgical treatment of patients with Grade III or Grade IV hemorrhoids (Bulus et al. 2014).

3 Postoperative Pain Management: Conventional Surgical Hemorrhoidectomy

The conventional surgical hemorrhoidectomy (CSH) is a painful operation, and in the previous section utilizing alternative energy sources may decrease the severity of the pain, but there is currently no CSH technique that is painless. The

actual cause of post hemorrhoidectomy pain is not known. The pain is multifactorial and includes individual pain tolerance, incorporation of smooth muscle fibers and mucosa in the transfixed vascular pedicle, epithelial denuding of the anal canal, associated spasm of the internal sphincter, the development of linear wounds that extend the length of the anal canal, bacterial fibrinolysis and defecation stress. So for decades there have been multiple modalities that have been utilized to diminish the postoperative discomfort some directed at decreasing internal sphincter pressure others to enhance healing.

3.1 Lateral Internal Sphincterotomy

Khubchandani in 2002 performed a prospective randomized study in patients with hemorrhoidectomy with and without lateral internal sphincterotomy (LIS). He randomized 42 consecutive patients with grade III or grade IV symptomatic hemorrhoids, with 21 of them receiving a distal partial internal sphincterotomy (DPIS). Pain was assessed for pain at 4 h after surgery, after first bowel movement and 4 days post-surgery utilizing a pain assessment sheet. The results showed there were no difference in perception of pain post hemorrhoidectomy in the DPIS group and the no LIS group (Khubchandani 2002).

In a study in 2005, a prospective trial evaluating patient with hemorrhoids (grade III and IV symptomatic) with associated anal fissures was found to have elevated maximal anal resting pressures over a control group. A normal value in their laboratory for Maximum Resting Pressure (MRP) is 40–40 mmHg and the Maximum Squeeze Pressure (MSP) is 80–180 mmHg. The fissure group MRP was higher than the hemorrhoid group but both groups MRPs were elevated over the control group. The pressures in the fissure and hemorrhoid groups were measured 1 month presurgery and month 1, 3, 6, and 12 post-operatively. The presurgical MRP in the fissure group was significantly higher than the hemorrhoid group

(138 ± 28.4 mmHg vs. 108.4 ± 23 mmHg, $P < 0.0001$). The presurgical MSP in the hemorrhoid group was significantly higher than the control group (108.4 ± 23 mmHg vs. 73 ± 12.8 mmHg, $P < 0.0001$). The fissure group underwent lateral internal sphincterotomy (LIS) and the hemorrhoid group underwent Milligan-Morgan hemorrhoidectomy (utilizing a bivalve retractor). 1 month post operatively the hemorrhoid group MRP decreased to the level of the control group. At 12 months postoperatively the hemorrhoid and fissure groups were significantly higher than the control group (103.6 ± 21.5 mmHg vs. 73 ± 5.9 mmHg, $P < 0.0001$). The authors felt the LIS treated fissures by decreasing the MRP; the hemorrhoidectomy also did because they felt using the bivalve retractor caused stretching of the internal sphincter there by decreasing MRP. The sphincter in this case recovered back to an elevated level by 12 months postoperatively. These authors' discouraged surgeons from utilizing LIS during surgical hemorrhoidectomy (Alper et al. 2005); however, there are multiple authors who supported the practice of LIS with surgical hemorrhoidectomy as a method of decreasing postoperative pain (Angelici et al. 1987; Galizia et al. 2000).

4 Chemical Sphincterotomy

4.1 Botulinum Toxin (Botox®)

4.1.1 Mechanism of Action

Botulinum toxin injection is known to decrease the MRP of the internal anal sphincter. The mechanism is that the toxin binds and prevents release of acetylcholine from the presynaptic nerve endings and prevents the release of norepinephrine from sympathetic nerve endings. It induces a relative weakness of the internal sphincter, which is mediated by a transient blocking of the neuromuscular transmission without abolishing voluntary control. This theoretically will decrease the "reflex" muscle spasm which in turn decreases postoperative hemorrhoidectomy pain. The effect is within 3 to

4 h and last until growth of the neuromuscular impulses resumes within three to 4 months.

4.1.2 Clinical Application

In 2003, the first randomized study utilizing Clostridium Botulinum Toxin (CBT) (Botox®) to reduce postoperative pain after hemorrhoidectomy was reported. The primary outcome was to determine the pain intensity by utilizing a visual analog scale (VAS) and secondarily to analyze the intravenous analgesic requirements in the first 24 h then to quantify the quantity of oral analgesics for the first week and the time to first defecation after surgery. All patients had symptomatic grade III or grade IV symptomatic hemorrhoids all patients (50 consecutive) received a Milligan-Morgan Hemorrhoidectomy was performed in 24 patients receiving 20 U of CBT and the control group (25) which received 0.4 ml of normal saline. The daily average VAS was lower for the CBT group throughout the study period, reaching significance on day 6 and 7 ($p = 0.02$ and 0.04) versus the control group. In the first 24 h no statistical difference in the amount of morphine used, nor was a difference found in the study for average daily oral analgesic utilization. When the total number of oral analgesics taken during the study period was correlated with the combined daily average VAS for each patient there was a significant difference between groups ($P < 0.0001$). The authors stated that the patients who received Botulinum toxin had significantly less pain towards the end of the first week after surgery (Davies et al. 2003).

In 2005 a randomized study utilizing Botulinum toxin (BT) injection (15 patients) versus normal saline injection (15 patients) post Milligan-Morgan Hemorrhoidectomy patients with symptomatic grade III or grade IV hemorrhoids. The BT group showed a significant decrease in the MRP versus the normal saline group ($P < 0.01$) on the fifth postoperative day. The authors state that the time of healing of the wounds was shorter in the BT group versus the normal saline group (23.8 ± 4.1 days vs. 31.3 ± 5.5 days $P < 0.05$). The VAS and the MAP on the fifth postoperative day indicate a correlation between the intensity of

sphincter spasm and the pain scores ($P < 0.001$) (Patti et al. 2005).

A randomized trial in post hemorrhoidectomy patients comparing the efficiency of Botulinum Toxin (BT) versus Topical Glyceryl Trinitrate Ointment (GT) in decreasing postoperative pain. Thirty patients with symptomatic grade III or grade IV hemorrhoids were randomized into two groups all had a Milligan-Morgan Hemorrhoidectomy. Measurement of MRP was performed preoperatively, 5 days and 40 days postoperatively. One group received one injection of 20 IU of BT and the other group applied 300 mg of 0.2% Glyceryl trinitrate ointment three times per day for 30 days. There were no significant differences among the groups as per age, gender, or ASA classification. The manometry studies were performed with the reference group of healthy controls with a MRP of 77 ± 11.6 mmHg. The BT group had preoperative MRP of 85 ± 15 mmHg and the GT group was 87 ± 11 mmHg both were significantly higher than the control ($P < 0.05$). MRP was found to be significantly reduced at the fifth day when compared to the preoperative values for the BT group decreased to 68 ± 11 mmHg ($P < 0.001$) and in the GT group decreased to 78 ± 11 mmHg ($P < 0.05$). The MRP 40 days post hemorrhoidectomy in the GT group was not significantly different from both the preoperative and the fifth day postoperative values. The MRP 40 days post hemorrhoidectomy in the BT group was increased when compared with the fifth postoperative day, although they were still reduced from preoperative values ($P < 0.001$). Over all the MRP in the BT was significantly lower than the GT group ($P < 0.001$). The outcomes of duration of operation (minutes), hospital length of stay (day), time of first defecation (hours), time to healing (days) and return to work (days) were similar in both groups. The postoperative pain at rest was evaluated by the "generalized estimation equation model, which showed a significant reduction in the GT group versus the BT group ($P = 0.01$). The major side effect of the GT application in five patients (30%) was moderate to severe headaches. The authors concluded that a single injection of BT into the anal sphincter at the time of hemorrhoidectomy

was more effective and tolerable than the repeated application of GT in reducing postoperative pain at rest but not during defecation (Patti et al. 2006).

4.2 Chemical Sphincterotomy

4.2.1 Mechanism of Action

Nitric Oxide (NO) is an inhibitory neurotransmitter in the internal anal sphincter. Organic nitrates: nitroglycerin (NTG) is degraded by cellular metabolism to NO. Applying Isosorbide Dinitrate or Glyceryl Trinitrate (GTN) to internal sphincter decreases the mean resting pressure and may enhance healing by increasing blood flow (Rittan and Chadker 1992; Brisinda et al. 1993).

4.2.2 Clinical Application

One of the earliest papers utilizing Nitroglycerine Ointment (NTGO) for postoperative hemorrhoidectomy pain was a randomized, double-blind placebo-controlled trial. An excisional hemorrhoidectomy was performed on 39 patients who were then randomized to receive 0.2% nitroglycerine ointment group ($N = 19$) and or a placebo ointment (PO) group ($N = 20$). Application of the ointments was three times daily for 7 days. Patients recorded their pain assessment on a visual analog scale (VAS) daily. They also kept a diary on utilization of narcotic medication, nonsteroidal anti-inflammatory drugs and acetaminophen for 7 days. There were no demographic differences between the two groups studied. In the NTGO group versus the PO group there was an overall perceived pain benefit shown on the VAS scores but it did not reach statistical significance ($P = 0.961$). In the PO group versus the NTGO group there was a higher utilization of narcotic on a daily basis but it only reached significance on postoperative day 2. There was a significant difference in headaches in the NTGO group (47.36% (9/19)) versus the PO group (5% (1/20)). Also in the NTGO group there was a significantly higher intake of acetaminophen and nonsteroidal anti-inflammatory drugs (NSAIDs) as compared to the PO group. The authors concluded using nitroglycerine ointment for reducing

postoperative hemorrhoidectomy pain is it worth the “headache?” (Wasvary et al. 2001).

The use of Glyceryl Trinitrate (GT) for diminishing post hemorrhoidectomy pain was studied in a prospective, randomized, double-blind placebo-controlled trial. A total of 69 patients (9 were removed for noncompliance) underwent an elective diathermy Ferguson hemorrhoidectomy (DFH) for symptomatic grade III or grade IV hemorrhoids. The patients were randomized in to GTN group ($N = 30$) or petroleum jelly (PJ) placebo group ($N = 30$). The GTN (nitroglycerine) was diluted to 0.2% preparation/ointment. Both ointments looked similar and were in identical dispensers. All patients completed a hospital anxiety and depression questionnaire before hemorrhoidectomy. Post hemorrhoidectomy all patients completed questionnaires to assess medication use and postoperative pain measured by a visual analog scale on days 1, 3, and 7. Patients were seen for follow up visits weeks 1, 3, and 6 after surgery to determine healing of the wounds. Wound healing is defined as complete epithelial covering of the wounds as observed by the surgeon. In the GTN group there was a significantly lower perceived pain by the VAS on postoperative days 1, 3 and 7 than the PJ group ($p < 0.02$). The GTN group consumed significantly less analgesics than the PJ group ($P = 0.006$). Wound healing the GTN group was significantly larger than PJ group (76.7% vs. 46.7%), a $P = 0.02$. Only 2 of 30 (6.7%) patients in the GTN group developed headaches. There was no difference in postoperative complications in both groups when compared for urinary retention, bleeding, pruritus and anal stenosis. However the GTN group did use more nonsteroidal (NSAIDs) and acetaminophen than the PJ group. The authors concluded that GTN topical ointment decreased postoperative pain and enhanced wound healing after hemorrhoidectomy (Karanlik et al. 2009).

In a study combining topical 0.2% Glyceryl Trinitrate (GTN) and 2% Lignocaine Ointments in patients post Milligan-Morgan hemorrhoidectomy comparing analgesic efficacy and rate of wound healing was published in 2014.

This was a multicenter double blind, prospective, randomized controlled trial. There were a total of 210 patients with symptomatic Grade III or Grade IV hemorrhoids of which 192 were divided into three groups: Group A ($N = 67$) received a combination of 0.2% GTN and 2% lignocaine ointments, Group B ($N = 64$) received 2% lignocaine ointment and Group C ($N = 61$) 0.2% GTN ointment. The demographics of all three groups were similar. The ointments were applied twice daily up to the 7th postoperative day. Pain scores and quantity of oral analgesics used were compared daily until the 7th postoperative day and were measured on a 100 mm Visual Analog Scale (VAS). The time to complete healing (weeks) was recorded. A total of 9 (4.68%) patients left the study due to relocation: 5 from group A and 4 from group B. A total of 5 (2.48%) patients suffered from severe headaches in groups A and C and were removed from the study. A total of 6.77% of patients suffered from mild to severe headaches, probably related to the lower dosage of GTN. The difference in VAS pain scores in-group A was significant when compared to group B and C from the 1st to the 4th postoperative days ($P < 0.05$). There was a significant difference between group A and C when compared to group B on the second day postoperatively ($P = 0.016$). The number of daily oral analgesics used on a daily basis was significant for group A compared to groups B and C only on postoperative days 1, 2, and 3 ($P < 0.05$), but no significant difference between groups A and C when compared to group B and the use of oral analgesics ($P > 0.05$). Mean wound healing time when comparing group A (4.45 weeks) to group B (5.07 weeks) and group C (4.48 weeks). The mean healing time when comparing group A to group B was significant ($P < 0.0001$) also when comparing group C to group B ($P < 0.001$). Important to note that when comparing mean healing times of group A and C there was no statistical difference ($P = 0.892$). The authors concluded that the combination of topical lignocaine and 0.2% GTN (Group A) had a better analgesic efficacy from postoperative days 1 through 4. When comparing the GTN with lignocaine ointment (Group A) to

the GTN alone (Group B) the significance was only seen in days 1–3. They also concluded that the combination of lignocaine and GTN and GTN alone had faster healing times due to the benefit of increased blood flow. The use of postoperative oral analgesics was only found to be significant for postoperative days 2 and 3 when comparing group A to group B. Since all patients were in hospital for till postoperative day one there was no difference in oral analgesic usage in all groups. All patients on operation day received intramuscular injections of a diclofenac sodium as nonsteroidal anti-inflammatory drug (NSAID) q12 h (Khan et al. 2014).

4.3 Calcium Channel Blockers

4.3.1 Mechanism of Action

Diltiazem and nifedipine are calcium channel blockers that block up take of calcium in the myocytes, thus decreasing contraction of the internal anal sphincter and have been shown to be effective in treating anal fissures.

4.3.2 Clinical Application

A study in small study in 2005, utilizing diltiazem was studied to determine if there was improvement in post hemorrhoidectomy pain. A total of 18 patients underwent Ferguson Hemorrhoidectomy for Grade III or Grade IV symptomatic hemorrhoids and did not differ demographically. The patients were randomly assigned to 2% diltiazem ointment ($N = 9$) and Vaseline placebo[®] ($N = 9$) and applied the ointment three times per day for 7 days postoperatively. The Visual Analog Scale (VAS) on a daily basis measured postoperative pain. There was a significant difference in pain scores in the group utilizing diltiazem on days 1–2 ($P < 0.001$), days 3–5 ($P < 0.001$) and days 6–7 ($P < 0.001$). There was no significant difference in postoperative complications or with morbidity related to the use of diltiazem. There was no significant difference between groups as to utilization of oral narcotics or nonsteroidal anti-inflammatory agents and acetaminophen (Silverman et al. 2005).

5 Other Topical Agents Utilized to Diminish Post Hemorrhoidectomy Pain

5.1 Metronidazole

5.1.1 Mechanism of Action

The mechanism of action of metronidazole (topical or oral) in relieving post hemorrhoidectomy pain is unclear. It could be related to the anti-bacterial properties that interfere with bacterial wound colonization after hemorrhoidectomy. Metronidazole does have anti-inflammatory properties that also may play a role.

5.1.2 Clinical Application

In 1998, oral metronidazole has demonstrated a significant decrease postoperative pain after open hemorrhoidectomy (Milligan-Morgan) (Carapeti et al. 1998). In a prospective randomized trial comparing post hemorrhoidectomy pain and wound healing using topical metronidazole (10%) versus a placebo carrier (petrolatum cream) applied three times a day for 28 days, post Harmonic® Scalpel Hemorrhoidectomy ($N = 20$). Postoperative pain was evaluated by a visual analog score (VAS), on days 1, 2, 7, 14, and 28, the pain was ranked 0 to 10 with 10 the most severe. 24 h oral narcotic analgesic requirements were also measured for 4 weeks postoperatively. Wound healing was evaluated at 2 weeks utilizing digital photographs. The wound was graded (a) on a scale of 1 to 10, based on incisional edema with 10 the most extensive edema, (b) primary versus secondary wound healing, scale of 1 to 10 with 10 wide open incision and (c) each surgeon ranked each photograph and the mean rank was calculated. The patients were randomized in to two groups: group 1 ($N = 10$) 10% topical metronidazole cream versus group 2 ($N = 10$) petrolatum cream, there was no demographic differences in patients randomized into either group. The results showed no significant difference between groups in preoperative pain scores or postoperative day 1 and 2 scores. In the 10% metronidazole group there was a significant difference in scores on day 7 and 14 ($P = 0.002$, $P = 0.02$,

respectively), there was no significant difference between groups on day 28. There was no significant difference in daily oral analgesic usage between the groups. Wound healing in the 10% metronidazole group showed significantly less postoperative edema ($P < 0.01$) and overall wound healing ($P = 0.03$). The authors concluded that 10% metronidazole has efficacy in diminishing postoperative pain and improving hemorrhoidectomy (Nicholson and Armstrong 2004).

A in 2008, a randomized, double blind, prospective placebo-controlled trial to evaluate the effectiveness of 10% topical metronidazole, in reducing postoperative pain and pain on defecation after open hemorrhoidectomy. Forty-seven patients were randomized in to two groups; 25 patients in to the 10% metronidazole group versus 22 in the placebo carrier group, each group applied the ointment three times per day. Postoperative pain was evaluated using visual analog scale (VAS), with 10 the most severe pain. VAS scores were obtained within 6 and 12 h of surgery and on post-operative days 1, 2, 7, and 14, pain on first defecation was also evaluated using the VAS. The groups had similar demographics. The patients in the metronidazole group had significantly less post-operative pain. Table 4. Pain on defecation was significantly less in the metronidazole group on day 2 ($P = 0.02$) but no significant difference on days 7 or 12 versus the placebo group. There was also significantly less oral analgesics group at 12 h postoperatively and on days 2 and 7 postoperatively ($P < 0.05$). The authors concluded that the addition of 10% metronidazole postoperatively maybe efficacious

Table 4 Comparison of 10% metronidazole versus placebo carrier post open hemorrhoidectomy

Time hours/days post hemorrhoidectomy	P value
Hour 6	$P = 0.03$
Hour 12	$P < 0.01$
Day 1	$P = 0.04$
Day 2	$P < 0.01$
Day 7	$P = 0.03$
Day 14	$P < 0.01$

to reduce pain in patients post hemorrhoidectomy (Shahram et al. 2008).

5.2 Sucralfate

5.2.1 Mechanism of Action

Sucralfate is a basic aluminum salt of sucrose Octasulfate, used as a common antiulcer medication. It has a mechanical barrier because of a strong electrostatic interaction of the medication and proteins at the ulcer site and has antibacterial activity. It has been shown to cause epithelialization on burns, and it binds fibroblasts to prevent its degradation and “promote” healing.

5.2.2 Clinical Application

The authors postulated that because of the characteristics of Sucralfate it would improve healing of the hemorrhoidectomy wounds. A total of 116 patients with symptomatic grade III or grade IV hemorrhoids post open hemorrhoidectomy were randomized into two groups 58 patients to the 7% Sucralfate cream (applied three times per day) plus oral analgesics and 58 patients to oral metronidazole (250 mg PO twice per day for 7 days) plus topical petrolatum placebo (applied three times per day) and oral analgesics. Postoperative pain was evaluated using visual analog scale (VAS), on postoperative days 7, 14, 21 and 28. Two independent surgeons evaluated wound healing (defined as complete epithelial covering) by the end of 4 weeks. The Sucralfate group experienced significantly less pain versus the petrolatum placebo group at day 7 ($P < 0.002$) and day 14 ($P < 0.01$). There was no significant difference in VAS scores between both groups at the 4-week mark. During the first 7 days there was no significant difference between groups for number of analgesics used however the Sucralfate group took a significantly less total amount of analgesics over the 4 weeks of the study. At the end of 4 weeks 82% of the wounds were healed in the Sucralfate group while the placebo group had 55% healed with a 100% healing rate at 41 days for the Sucralfate group versus the placebo group 52 days ($P < 0.01$). The authors concluded that

topical Sucralfate application decreases postoperative pain and improves wound healing post open hemorrhoidectomy (Gupta et al. 2008).

6 Local Anesthetics to Control Postoperative Pain

6.1 Bupivacaine Extended-Release Liposome

The principal is injecting a local analgesic in order to provide effective postoperative pain relief for a longer duration than current agents; in theory it could be a useful option for post hemorrhoidectomy pain management. This study was a randomized, double-blind, placebo controlled, parallel-group phase 3 study that investigated the efficacy, safety and duration of analgesia provided by a single dose of DepoFoam Bupivacaine (DFB) (300 mg) intraoperatively administered for postoperative hemorrhoidectomy (Mulligan-Morgan) pain in patients with symptomatic grade III or grade IV hemorrhoids when compared with placebo (0.9% sodium chloride). The pain intensity was measured using numeric rating scale (NRS) at the end of general anesthesia and before the first dose of morphine at 1, 2, 4, 8, 12, 24, 36, 48, 60, and 72 h after surgery. The patients completed brief pain inventory (BPI) at 24 and 72 h postoperatively. Assessment of patient satisfaction with postoperative analgesia was evaluated at 24 and 72 h, utilizing a 5-point categorical scale (response range extremely satisfied to extremely dissatisfied). The patients were then followed at days 8 and 30. A total of 186 patients completed the study 95 patients were randomized in to the DFB group and 94 patients in to the placebo group, no significant demographic differences between groups was noted. Pain intensity and the proportion of no opioid rescue was significantly less in the DFB group through the first 72 h $P < 0.0008$. The DFB group patient satisfaction with postoperative analgesia was significantly better than the control group ($P = 0.007$). The authors concluded that DFB had a statistically significant lower pain scores and decreased opioid

requirements in the acute postsurgical period (Gorfine et al. 2011).

7 Topical Analgesia for Postoperative Pain

7.1 Policresulen and Cinchocaine

7.1.1 Mechanism of Action

Policresulen high molecular weight organic acid (Ph. = 4.0) and a half-life of 4 h which has been shown to have hemostatic activity by causing coagulation of blood proteins and causing contraction of smooth muscle of small vessels. It has antimicrobial activity because of its acidity and it interacts with plasma membranes to debride devitalized tissue.

Cinchocaine (dibucaine) is a topical amide anesthetic, which is fast acting (15 min) and last about 3 h.

7.1.2 Clinical Application

The study was a prospective controlled trial, of patients with symptomatic grade III or grade IV hemorrhoids undergoing Milligan-Morgan Hemorrhoidectomy. The patients (total $N = 43$) were divided into two groups: first group (control $N = 13$) received routine post-operative instructions without the use of topical ointments and second group topical treatment, received routine post-operative instructions plus a prescription for topical ointment applied to the wounds three times per day for 7 days. The topical treatment group ($N = 15$) was divided in to two groups: patients who used Policresulen and Cinchocaine and patients who used a placebo ointment ($N = 15$) composed 30% petroleum jelly, 30% lanolin and 3% EDTA and propylene glycol. All patients received dipyrone 1 g and 100 mg intravenous ketoprofen during the procedure by the anesthesiologist. In the first 24 h post procedure the received 1 g dipyrone intravenously every 6 h, 50 mg tramadol hydrochloride intravenously every 8 h. All groups were examined 6–8 h post procedure for discharge evaluation. Patient's pain levels were evaluated by a Visual Analog Scale (VAS color scale) based on a 0–10 scale with level 10 the most severe pain.

The mean pain intensity of all groups at time of admission was 42.84 with no significant difference between groups. The mean pain intensity of all groups for days 1–3 was 4.09, and day 7 was 5.73 with no significant difference between groups. The mean pain intensity with first evacuation on any day showed that there was no significant difference between all groups. The authors concluded that the use of ointments does not reduce the intensity of pain in patients post hemorrhoidectomy (Junior et al. 2014).

8 Other Modalities to Control Post Hemorrhoidectomy Pain

The quest to decrease postoperative hemorrhoidectomy pain has been a creative journey. Just to mention a few in 1993 the use of a home subcutaneous morphine pump (SQMP) was a novel approach but never stood the test of time or logic (sending patients home with injectable morphine) (Goldstein et al. 1993). In 2014 in a randomized single-blind study utilizing intradermal injection of 4 ml 1% methylene blue and 16 ml 0.5% Marcaine at the hemorrhoidectomy site was an interesting concept. The methylene blue is theorized to temporarily ablate dermal nerve endings (however electron microscopy has not been able to demonstrate cutaneous nerve fibers). The authors did find a significant difference in pain scores between the methylene blue group and control group ($P = 0.026$) (Tan and Sim 2014). However is a “blue anus” the answer to decreasing postoperative pain?

9 New Technology for Hemorrhoidal Disease

9.1 Stapled Hemorrhoidopexy/ Procedure for Prolapse and Hemorrhoids

There have been continuing efforts to develop new techniques and or modifications of hemorrhoid surgery in order to decrease the postoperative pain and shorten the disability.

With the introduction in 1998 of the Longo Hemorrhoidectomy, a procedure for prolapsed hemorrhoids (PPH), which utilized a circular stapling instrument to excise a ring of redundant rectal mucosa or internal hemorrhoids, that promised to decrease the postoperative pain with a faster return to normal life (Longo 1998).

9.2 Comparing Stapled Hemorrhoidopexy and Conventional Hemorrhoidectomy

Shao et al. in 2008 performed a meta-analysis of 29 of 34 (met criteria) trials a total of 2056 (total of 20 to 200 patients per trial) patients comparing Milligan-Morgan hemorrhoidectomy (conventional) with stapled hemorrhoidopexy (PPH) in patients with symptomatic grade III or grade IV hemorrhoids. The authors stated that over 20,000 patients in China had PPH procedures performed, but there is still controversy with the PPH procedure versus conventional hemorrhoidectomy. They looked at short term and long term outcome measures; duration of procedure, length of stay, time to return to normal activity, postoperative pain scores, and analgesic requirements, and anal manometry, patient satisfaction and incontinence scores. They also looked at operative and postoperative bleeding, urinary retention, anal stenosis, residual skin tags, anal fissure, sphincter injury, wound discharge, postoperative thrombosis, recurrent prolapse and total complication rates. The median follow up was 6 weeks to a median of 62 months. They did estimate trial heterogeneity using the Cochrane Q static test. They defined I^2 statistic as the proportion of total variation among studies that is likely to be explained by between-study heterogeneity rather than chance. Substantial heterogeneity exists when I (Ferguson and Heaton 1959) > than 50%.

The meta-analysis did not find significant difference in total complications between groups. Hemorrhage, usually occurring in the first week postoperatively, was found in both groups, but the PPH group had a significant higher incidence requiring re-intervention $P = 0.023$. Although there was

higher incidence of postoperative thrombosis of external hemorrhoids in the PPH group versus the CH group it did not reach statistical significance $P = 0.105$. In the PPH group there was a lower incidence of difficult defecation ($P = 0.008$ and less time to first bowel movement ($P = 0.02$). The PPH group did have a higher incidence of sphincter injury (in pathology reports or endoanal ultrasound evaluations) than the CH group $P = 0.016$. When comparing both groups there was no significant difference with urinary retention or anal stenosis or fissure formation. When comparing the PPH group with the CH Group there was a significant difference in operative time ($P < 0.001$), shorter length of stay ($P < 0.001$) and a shorter return to normal activities ($P < 0.001$) in favor of the PPH group. Postoperative pain was scored on a visual analogue scale (VAS) (0 to 10 with 10 the most severe); the PPH group had a significantly lower VAS in the first 24 h ($P < 0.001$), at the time of first postoperative bowel movement ($P < 0.001$), and also in the 1–2 weeks after surgery ($P < 0.001$). Recurrent prolapse and requirement was significant in the PPH group than the CH group ($P = 0.004$), however there was no significant difference (even though there was a trend higher in the PPH group) with need for reoperation between groups ($P = 0.246$). There was no significant difference between groups for fecal incontinence or change in anal manometry for anal squeeze or resting pressures. There was a significant difference of postoperative skin tags in patients who had a PPH procedure ($P = 0.011$). Overall, patient satisfaction scores did not indicate a significant difference between both groups when comparing VAS scores ($P = 0.125$) but in the PPH group the patients did perceive that there was a higher rate of operative success ($P = 0.003$). The authors did conclude that the stapled hemorrhoidopexy did offer some benefit and can be considered for patients with grade III or grade IV hemorrhoids in the short term (Shao et al. 2008).

Ripetti et al. in 2015 in a randomized trial compared stapled rectal mucosectomy.

(SRM) (Longo 1998) versus open hemorrhoidectomy (OH)¹ and semi-closed hemorrhoidectomy (SCH)(Parks 1956) in patients with symptomatic grade III or grade IV hemorrhoids. The authors randomly assigned 180 patients in to

a 3-arms: Scheme ($N = 60$), OH ($N = 60$) and SRM ($N = 60$), and they assessed the intensity of postoperative pain, week one using a visual analog scale (VAS) and days to return to work or normal activity. The secondary end points of duration of surgery, analgesic intake in the first week, the intensity of pain after the first week and pain at the first defecation and at digital examination, days to complete wound healing (defined as no symptoms from surgery), recurrence rate and minor and major complications. All of the patients were followed up at 2 weeks and at 1, 3 and 4 months post operatively with a digital exam and endoscopic evaluation. The mean duration of disability for the OH group was 20.2 ± 4.2 days and for the SCH group was 12.2 ± 4.2 days. Over 89.5% of the patients were discharged on the second postoperative day and 10.5% were discharged after the second postoperative day (comorbidities and delay in evacuation). The SCH group has significantly less pain intensity and less analgesic intake at the end of the first postoperative week versus the OH and SRM groups ($P < 0.01$ and $P < 0.001$ respectively).

Both the SCH and the SRM groups had a significantly earlier return to work than the OH group ($P < 0.05$), however all groups had no significant difference in pain relief. The OH group had significant higher VAS value and pain intensity at each follow up time with digital exam and endoscopic evaluation than the SRM and SCH groups ($P < 0.01$). The VAS scores were more intense in the SCH group versus the SRM group ($P < 0.01$). The authors concluded that at the first week the SCH group had less pain intensity but 2 weeks post-operative it was equal to the SRM group, while the OH group had greater pain intensity and longer disability then the SRM or the SCH groups (Ripetti et al. 2015; Watson et al. 2016).

Probably the most important study comparing stapled hemorrhoidopexy (SH) and traditional excisional hemorrhoidectomy is the eTHoS trial (Watson et al. 2014). The eTHoS trial was a large, open-labeled, multicenter (32 centers); pragmatic randomized controlled trial in patients with symptomatic grade II-IV hemorrhoids. There were 777 patients randomized (1:1) with

388 patients assigned to traditional excision hemorrhoidectomy (TEH) and 389 patients assigned to stapled hemorrhoidopexy (SH) between the dates of January 13th, 2011 through August 1st, 2014, the study was terminated July 8th 2016. This study was from England where approximately 25,000 Hemorrhoid procedures are performed per year. The primary outcome were grade of hemorrhoids (II, III, or IV), baseline EuroQol 5 dimensions 3 level (EQ-5D-3 L) descriptive system score and sex. The patients were followed for 24 months including one clinic visit at 6 weeks postoperatively, and by multiple mailed questionnaires including the EQ-5D-3 L and visual analogue scale (VAS) at weeks 1 and 3 postoperatively. Then at 12 and 24 months questionnaires (EQ-5D-3 L) were distributed to all patients. The primary outcome was the area under the quality of life curve (AUC) over 24 months derived from the EQ-5D-3 L measurements, taken at weeks 1, 3, 6 and 12 and 24 months. The AUC is expressed in years as quality-adjusted life-years (QALYs). A cost-effectiveness analysis in terms of incremental cost per QALYs gained was performed. The median follow up for the SH group was 731 (range 377–736) days and the median follow up for the TEH group was 731 (range 514–738) days. In the TEH group 84% (272 patients) received the Milligan-Morgan procedure. The SH group had similar Hemorrhoidal Symptom Scores (HSS) as the OH group at 6 weeks, the SH group had significantly higher HSS at 12 ($P < 0.001$) and 24 ($P < 0.005$) months postoperatively which would be consistent with a patient perceived recurrence of hemorrhoids disease in the SH group of 32% versus the OH group of 14% a significant difference ($P < 0.001$). The VAS scores in the SH group were significantly less at 1 and 3 weeks postoperatively but no difference at 6 weeks versus the OH group. The analgesia use was less in the SH group at the 3 weeks but no difference at the 1 and 6 week time versus the OH group ($P < 0.001$). The persistence of symptoms in the SH group was greater at 6 weeks, 12 and 24 months than the OH group ($P < 0.001$).

Serious postoperative events were similar for the SH group (7%) versus the OH group (9%); these events included, infection, urinary retention, pain and bleeding, pain and stenosis, constipation and urinary retention, bleeding, and postoperative fissure. The cost of the SH procedure was greater than the OH procedure (95% CI 251–423). The QALY results were much better for the OH group than the SH group (95% CI $-0.127 - -0.011$).

The eTHoS trial showed that overall quality of life in the OH group was better than the SH group at the 24 month long term follow-up. The SH group was favored in the short term quality of life up to 6 weeks mainly due to less pain, but this difference disappeared from 6 weeks to 12 months follow up. The SH group had higher complaints of incontinence, recurrence of hemorrhoidal disease, more re-interventions than the OH group. There was no difference between groups when comparing operating time, length of hospital stay or time to return to normal activities at 6 weeks (Watson et al. 2016). In a study by Burch et al. they stated that the cost of the stapler was offset by the decreased hospital stay (Burch et al. 2008); this concept was not supported in the eTHoS trial. The authors questioned the overall efficacy of SH procedures due to the higher costs, higher recurrence rate, more tenesmus, worse continence, and equivocal pain VAS scores at 6 weeks postoperatively and equivocal complications then the OH group (Watson et al. 2016).

9.3 Comparing Stapled Hemorrhoidopexy Versus Alternative Energy Devices

9.3.1 Stapled Hemorrhoidopexy (SH) Versus LigaSure™ Hemorrhoidectomy

In a 2008, meta-analysis of randomized controlled trials comparing outcomes for SH versus LH for outcomes in symptomatic people with grade III or grade IV hemorrhoidal disease. The studies end points were pain, recurrence rates, and postoperative bleeding. Postoperative pain was evaluated by a visual analogue score (VAS), for the first 24 h and up to the first 5 days after surgery. The pooled

mean VAS scores comparing the SH groups and the LH groups did not reach statistical significant difference ($P = 0.139$). Comparing recurrence of symptoms between SH groups and LH groups did show that there was a statistically significant greater rate of recurrence in the SH groups ($P = 0.16$). Comparing SH groups and LH groups there was no statistically significant difference in postoperative bleeding ($P = 0.871$). The authors concluded that this meta-analysis only found that there was a significantly higher recurrence rate with the SH procedure when compared to the LH procedure (Lee et al. 2013). In a meta-analysis study in 2013 comparing SH versus LH hemorrhoidectomy the authors showed that the operating times were significantly greater in the SH groups versus the LH groups ($P < 0.0001$). The LH groups had a significantly less incidence of residual skin tags and prolapse ($P = 0.0004$) and recurrence of symptoms then the SH groups ($P = 0.003$). The authors concluded that the SH and LH were both valuable techniques but the LH procedure has more favorable immediate results and technical advantages (Yang et al. 2013).

9.3.2 Stapled Hemorrhoidopexy (SH) Versus Harmonic Scalpel® Hemorrhoidectomy (HSH)

In a prospective randomized study comparing SH versus HSH patients' grade III or IV hemorrhoids comparing post hemorrhoidectomy; for short and long-term outcomes. The study divided 99 patients in to two groups: HSH ($N = 48$) and SH ($N = 51$) patients. The demographics of age, sex, presenting symptoms, grade of hemorrhoids, operative time, duration of hospital stay, return to daily activities, postoperative complications and postoperative pain. The short and long-term complications were assessed at 1, 6, and 24 months postoperatively. Evaluation of postoperative pain was done with using a linear visual analogue scale (VAS) by the patient, surgeon and an independent blinded assessor. The VAS scores were grouped as mild (0–3), moderate (4–6) and severe (7–10). Analgesics were given in the first 24 h via intramuscularly then orally after that. There were no statistically significant difference between groups in terms of age, grade of hemorrhoids, sex, clinical

characteristics, hospital stay, mean hospital stay, postoperative pain (mild, moderate), analgesic requirement and time to return to daily activities. The mean duration of follow up was 24 (6–36) months. In the HSH group there was a statistically significant difference in operative time ($P < 0.05$) and severe pain ($P < 0.05$) than the SH group. There was no difference in wound complications in the short or long-term between groups. At the end of 2 years the HSH group had 2.1% (1 case of recurrence Grade IV) and in the SH group there was 8.8% (3 cases recurrence Grade III) and 13.7% (4 cases of recurrence Grade IV). The authors concluded that the HSH procedure was a safer and faster technique and was associated with lower long-term recurrences (Bilgin et al. 2015).

9.3.3 Long-Term Outcomes of Stapled Hemorrhoidopexy

In 2011 a long-term study of SH for prolapsed hemorrhoids was done to assess results in 153 patients with a 1–6 year follow up. This study was a prospective trial of patients operated on at a single academic hospital. The authors utilized a questionnaire to record the patients self-reported symptoms before and after the SH procedure. The questionnaire contained five questions about anal symptoms and five questions about continence function. The anal symptoms were presence of pain, itching, bleeding on defecation, soiling and the necessity of manual reduction of mucosal prolapse after defecation. The continence symptoms were episodes of incontinence of flatus, liquid or solid stool and use of a protective pad. The questions were graded according to frequency of symptoms: never, every month but not every week, 1–6 times per week and every day. The replies were scored as 0, 1, 2, and 3 points with a maximum score of 15. The authors defined failure as: (1) prolapse requiring manual replacement at least once per week, (2) a total symptom score of ≥ 5 that occurred daily or weekly, (3) a continence score of ≥ 6 with incontinence daily or weekly, (4) persistent need for manual reduction of mucosal prolapse (at 12 months) and (5) recurrence of prolapse later than 12 months. Anatomical grading of prolapse was defined as Grade 1 (no prolapse), Grade

2 (prolapse seen on proctoscopy) and Grade III (manual reduction of prolapse).

The study had 153 patients: 81 women and 72 men, with median age of 54 years, and 67% (103) had Grade III hemorrhoids, and all patients had a Longo SH with a mean distance between staple line and dentate line of 1.9 cm along with partial or complete excision of skin tags in 75% (115) of the patients. Over 90% of the patients (140/153) were discharged on day of surgery. There was a 95% (147) response rate of the questionnaires. The median interval from day of operation was 32 months (12–72 months). Of the 147 respondents 12 underwent reoperation for continued or recurrent prolapse: 6 patients within the first year and 6 patients after the first year. Another 12 patients reported recurrence of mucosal prolapse with manual reduction. At the end of the study the recurrence rate of rectal mucosal prolapse requiring manual reduction was 13% (19 patients). Overall the control of all symptoms comparing preoperative and postoperative scores was significant with a $P < 0.001$ for all grades of hemorrhoids. There were 25 (17%) patients that had persistent symptoms of which 7 had persistent mucosal prolapse and 11 had impaired continence. Of the 25 patients 5 (20%) had symptom scores higher than preoperative scores of these 2 had recurrent prolapse, 1 had urgency and 2 had frequency. At 1–6 years 12 (48%) of 25 had a postoperative score > 5 for Grade III prolapse and symptoms with 7 (28%) patients had both symptoms. Fourteen (56%) of patients had incontinence scores of > 6 postoperatively.

Preoperatively women had more continence disturbances for soiling and flatus than men ($P < 0.01$) and needing to wear a pad ($P < 0.05$). Postoperatively there was a significant improvement in continence postoperatively in both male and female patients with a fall in continence scores from 4.7 to 2.6 points by the end of the study ($P = 0.01$). In patients with a preoperative continence score of ≥ 6 there were 63 patients and 25 patients at the end of the study (postoperatively): with 11 (44%) also had failure of controlling hemorrhoidal symptoms. In patients with preoperative ≥ 6 incontinence score also had a high incidence of postoperative failure secondary

to control mucosal prolapse ($P < 0.001$). Immediate postoperative complications were seen in 30 (19.6%) patients including urinary retention in 11 (37%), severe pain in 2 (6.67%) and bleeding in 2 (6.67%) one of which required reoperation. A late complication of stenosis of staple line was found 2 (6.67%) patients (one required dilatation), 8 (26.7%) patients suffered from urgency and one developed a staple line diverticulum requiring surgical correction. The authors concluded that 35% of patients reported one or more complaints of residual prolapse or symptoms of hemorrhoidal disease from 1–6 years post SH procedure. They also concluded that 50% of the “< 1 year recurrence of mucosal prolapse” was due to technical failure. Overall the authors stated that the SH procedure did significantly decrease hemorrhoidal associated symptoms and continence, but with 35% of the patient had inferior outcomes including recurrent mucosal prolapse in 13% (Gerjy et al. 2011).

9.3.4 Transanal Hemorrhoidal Dearterialization

This technique was described in 1995, and it is an “excision less” approach to symptomatic hemorrhoidal disease. The procedure utilized an anoscope with an ultrasound that isolates the six branches of the superior rectal artery that are located proximal to the dentate line. After isolation of these vessels: a circumferential ligation is performed and if necessary an anopexy of any redundant hemorrhoidal or mucosal tissue is sutured to the internal anoderm. Since there is no excision this will lead to less postoperative pain and disability (Morinaga et al. 1995).

9.3.5 Transanal Hemorrhoidal Dearterialization Versus Open Hemorrhoidectomy

In a randomized trial in 2013 comparing transanal hemorrhoidal dearterialization (THD) to open hemorrhoidectomy (OH) in patients with symptomatic grade II or grade III hemorrhoidal disease the aim of the study was measuring postoperative pain. The authors divided 40 patients in to two groups: group A ($N = 20$) for THD and group B ($N = 20$) for OH. The demographics of both groups were not

significantly different. After discharge the patients maintained a daily diary for the first 14 days; postoperative pain was scored on a 0–10 scale (10 the worst pain): the patients scored the worst daily pain and then the average daily pain score. The patients had a clinical evaluation after 8 to 12 weeks (median, 12; range of 9–23 weeks) and after 12 months (median 12; range 11–15 months) after surgery. Early results showed significant difference in operative time; THD (36 min) versus OH (20 min) with a $P < 0.001$. The peak pain scores were significantly lower in the THD/A group in the first 5 days post procedure versus the OH/B group with a $P < 0.05$. The median peak pain score was significantly less in the THD/A group versus the OH/B group with a $P = 0.010$. However the overall pain score, analgesic utilization and return to work was not significantly different between the groups. Early (first 30 days) postoperative complication rate was evaluated: 12/39 (30.7%) of patients had 13 (33.33%) complications: 7 (17.94%) had urinary retention 4 in the THD/A group and 3 in the OH/B group; of which 5 were admitted overnight in hospital, 2 of which required urinary catheter for 3 days. In the OH/B group 2 patients returned with bleeding one required reoperation to stop the bleeding. In the THD/A group one presented with thrombosed hemorrhoids, one need re-intervention for severe pain (technical error) and 3 patients presented with re-prolapse with in the first week (technical error) one healed spontaneously the other 2 had re-interventions one-year postoperatively. Reduction of hemorrhoid symptoms (pain, bleeding and manual reduction of hemorrhoids) was improved in both groups at 1 year ($P < 0.05$). Soiling was reduced in both groups after 2 to 4 months ($P < 0.05$), but remained significant only in the OH/B group after 1 year. After 1 year 2 patients in the THD/A group and 1 patient in OH/B group had remaining grade III hemorrhoids, while 7 patients in the THD/A group and 3 in the OH/B group had remaining grade 2 hemorrhoids ($P = 0.06$). The authors concluded that THD is a safe method without serious complications for symptomatic grade 2 or grade 3-hemorrhoid disease (Elmer et al. 2013).

A 3-year assessment of patients ($N = 40$) who were in a randomized trial comparing THD with

mucopexy ($N = 20$) procedure with conventional hemorrhoidectomy (CH) ($N = 20$) for symptomatic grade III or grade IV hemorrhoids. The aim was to determine recurrence of hemorrhoids (defined by internal hemorrhoids on proctoscopy) and chronic complication (defined by non-resolving adverse events associated with surgery). The median follow up was 36 (range of 27–43) months, 13 (32.5%) of patients were lost to follow up leaving 12 patients in THD group and 15 patients in the CH group. The study showed that there was no significant difference in persistent symptoms ($P = 0.681$), recurrent symptoms ($P = 0.212$) or recurrent internal hemorrhoids on proctoscopy ($P = 0.411$) between the THD and the CH groups. The authors concluded that THD with mucopexy was as good as conventional hemorrhoidectomy in the longer term for recurrence and patient satisfaction (Denoya et al. 2014).

In a 2016 trial-comparing recurrence of hemorrhoids in patients being treated with hemorrhoidal artery ligation (HAL) verses rubber band ligation (RBL) for the management of grade II grade III hemorrhoids (HubBLE). This was a multicenter, open-labeled, randomized controlled trial including patients from 17 acute United Kingdom National Health Service (NHS) trusts. Eligible patients (372/ 986 screened) were randomly (computer generated) assigned (1:1 ratio) to either RBL ($N = 187$) or HAL with Doppler ($N = 185$). Of the patients randomized 337 had primary outcome data (176 patients in RBL and 161 in HAL with Doppler). There were pre-randomization questionnaires: EQ-5D, pain visual analogue scale (VAS), Vaizey fecal incontinence score and the Hemorrhoid Symptom Severity (HSS) score. Postoperatively the questionnaires were done on Day 1, 7, and 21 and were collected at the 6-week clinical visit, and questionnaires were done after the 12-month. The primary outcome was the proportion of patients with recurrent hemorrhoids 12 months post procedure. Secondary end points were assessed at 6 weeks and 12 months were: symptom severity, incontinence assessment, pain assessment, surgical complications, further therapy and persistence of symptoms. The authors calculated the costs by using a three-stage approach; identification of resource use,

measurement, and valuation using the National NHS reference costs. The median time from surgery to follow-up was 367 days (range, 365–385) for RBL group and 367 days (range, 365–374) for HAL group. The number of patients with recurrence at 12 months was 87 (49%) in the RBL group compared to 48 (30%) in the HAL group (OR 2.23, 95% CI 1.42–3.51, ICC-0.000; $p=0.005$). In the RBL group there was a high rate of additional procedures following the initial intervention 32% when compared to the HAL group 14% at the 1 year follow up. At 6 weeks, 29% of RBL group reported their hemorrhoids were unchanged or worse compared to 12% of the HAL group. There was no difference in the Vaizey fecal incontinence score between groups. The health-care cost analysis with the HAL cost at £ 1000 more expensive than the RBL. Even with the higher recurrence (i.e., single RBL procedure vs. HAL) in the RBL group the cost-effectiveness ratio in terms of cost per recurrence avoided is approximately £5000. The authors concluded that HAL is more effective than single RBL; however with repeat RBL the procedures are equally effective. The symptom severity score, complications, quality of life and continence score are not different between RBL and HAL. HAL is significantly more expensive and unlikely to be cost-effective (Brown et al. 2016).

10 Discussion

The excisional hemorrhoidectomy is the gold standard for the management of symptomatic late hemorrhoidal disease. The complications of excisional hemorrhoidectomy have been discussed at great length in this literature review: the most discouraging complication is the postoperative pain and resultant disability. The actual cause of post hemorrhoidectomy pain is not known. The pain is multifactorial and includes individual pain tolerance, incorporation of smooth muscle fibers and mucosa in the transfixed vascular pedicle, epithelial denuding of the anal canal, associated spasm of the internal sphincter, the development of linear wounds that extend the length of the anal canal, bacterial fibrinolysis and

defecation stress. I have reviewed the literature and attempted to assist our surgical community with alternatives energy devices, oral (non-narcotic agents) and topical methods of decreasing postoperative pain and non-excisional surgical procedures so they may draw their own conclusions as to the “assisted devices and methods” that they may choose for diminishing postoperative complications.

The utilization of the sharp dissection for hemorrhoidal disease is the foundation of excisional hemorrhoidectomy and has been implicated as causing postoperative pain. This started with the introduction of energy devices, in order to decrease intraoperative bleeding and minimize post hemorrhoidectomy pain. I must admit that subjugating meticulous surgical dissection and implicating that there is collateral tissue damage caused by this dissection and then instituting energy devices to replace this technique somewhat confuses me. I do agree that there is less intraoperative bleeding with energy devices than with sharp dissection. But is there that much “intraoperative bleeding” during excisional hemorrhoidectomy to inhibit visibility? I also must admit that I utilize for teaching purposes each energy device in order to broaden our residents understanding of operative techniques of excisional therapy.

The principal of managing postoperative hemorrhoid pain has been to target “reflex anal spasm” with LIS or DLIS and agents that diminish MRP. I think that the principal of surgical LIS for surgical hemorrhoidal disease has been shown to be ineffective and to my mind an unnecessary addition to excisional hemorrhoidectomy without associated fissure disease. The utilization of the other methods chemical sphincterotomy, topical or long acting injected analgesics was difficult for me to determine their true significance, because of the small studies and often-conflicting outcomes. The United States Colorectal Surgeons do not have the luxury of admitting our post hemorrhoidectomy patients to hospital, all of our patients are discharged the same day as surgery. So comparing United States literature to international literature is difficult. The literature that I reviewed was variable as to which day the patient

benefited from any of these agents so it is difficult for me to incorporate them in to my postoperative management plan.

The “new” technology stapled hemorrhoidopexy (PPH) procedure has fallen from, “grace “in the United States for all the reasons mentioned in the superb eTHoS trial Watson et al. (2016) but also for the complications of rectovaginal fistula, postoperative sepsis, and the chronic pain syndrome. These complications have f “fueled” a well-established medical malpractice fire storm pertaining to this device. The transanal hemorrhoidal dearterialization (THD) with anopexy is a technique that has evolved since its introduction in 1995 (Morinaga et al. 1995), the procedure has some supportive data but the literature I reviewed are small trials and it has made it determine efficacy. The recent well-designed Hub-BlE trial (Brown et al. 2016) has certainly raised concern about the THD cost and efficacy but even though it did have less recurrence than RBL in the long term.

The excisional hemorrhoidectomy remains to my mind the gold standard for the treatment of hemorrhoidal disease, with the lowest recurrence rate when compared to the “new” technologies. Postoperative pain management for excisional hemorrhoidectomy still remains a challenge for surgeons and our patients. The PPH and THD do play a role in the management of symptomatic hemorrhoidal disease and should be offered to patients in an open an honest discussion of each method of therapy including short term, long-term outcomes, overall cost and efficacy so they can make the correct decision for the management of their hemorrhoidal disease.

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Part V

Stapled Hemorrhoidopexy

Stapled Hemorrhoidopexy: Techniques and Results

25

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Abstract

Hemorrhoidal disease is one of the most frequent reasons for consultation found in the daily clinical practice of the colorectal surgeon. The clinical manifestation that most frequently forces the patient to consult is the rectal bleeding, and the diagnosis is performed by physical examination. The different treatment options

are indicated according to the degree of hemorrhoidal prolapse.

There are many therapeutic options, ranging from conservative measures to invasive techniques. Among the surgical techniques, the most used techniques are those based on hemorrhoidectomy. However, in the 1990s, the technique of Longo or hemorrhoidopexy was described, based on the fact that correcting the anatomical situation of prolapsed hemorrhoidal plexus would be the ideal treatment for hemorrhoidal disease and not the radical exci-

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sion of the plexus as had been done since ancient times.

The advantages of this procedure initially seemed clear: less postoperative pain, shorter hospital stay, less time to social reinsertion, among others. But with the development and implementation of the procedure, have appeared some problems and reviews that do not currently be implemented by all professionals.

The experience of our group with the technique of Longo is about 14 years and the results obtained are good. It can be affirmed that, with a good indication and performed by expert hands, it is an available technique for the treatment of hemorrhoidal pathology.

1 Introduction

Hemorrhoids are vascular structures located in the anal canal made up of dilated arteries and veins with arteriovenous communications, smooth muscle and connective tissue. They suppose an adjacent mechanism of continence by ensuring a more effective anal closure.

Hemorrhoidal disease occurs when these vascular structures move distally and with the defecation, some of this can become thickened, prolapse through the anal margin, become congested, and produce clinical symptoms.

The treatment can be medical or surgical depending on the degree that the patient presents. Interventional treatments are reserved for grade III or IV hemorrhoids in which the prolapse is larger and difficult to reduce and the symptoms are less tolerated by the patient. They exist from instrumental treatments that can be carried out in the consultation until the surgical options.

The techniques traditionally performed have been Milligan and Morgan and Ferguson's technique, both based on performing a resection or excision of hemorrhoidal tissue leaving extensive wounds in the anal area. The main limitations of these procedures are the great postoperative pain,

being occasionally accurate analgesic type minor and major opioids, resulting in a delay in the social reinsertion of the patient.

In recent years, a new technique called hemorrhoidopexy has been developed as an alternative to hemorrhoidectomy, based on the fact that by resecting a segment of the rectal mucosa, the hemorrhoidal packets would be located in their anatomical situation, correcting prolapse and avoiding irritation.

There are studies that compare hemorrhoidopexy with conventional hemorrhoidectomy techniques, and we see advantages but also disadvantages that we will develop throughout this chapter (Porret et al. 2015).



2 Hemorrhoidopexy

Hemorrhoidopexy with circular stapler or anopexy or Longo technique is a surgical procedure that emerged in the 1990s for the treatment of hemorrhoidal disease and has allowed important advances in the management of this pathology.

It was designed by the Italian doctor Antonio Longo in 1993 who presented his results of 144 patients at the World Endoscopy Congress held in Rome in 1998.

Subsequently, it has been evaluated by a multitude of clinical trials and meta-analyses, but despite this, there is still controversy about its indications and what are the long-term results of this technique.

In some of these initial studies, it was verified that after a 12-month follow-up, in 79%

of the patients the bleeding had been remitted, 67% had ceased pain, 63% had fouling, and 100% edema and episodes of thrombosis had disappeared. Patient tolerance to surgery and pain was excellent with a score of 2 out of 10 on the visual analogue scale (VAS), on the first two postoperative days and being less than 1 out of 10 on the fourth day of the intervention. The hospital stay medical was also reduced and was of 6 h. The social reinsertion was also lower, having a mean value of 42 h (Sultan 2015).

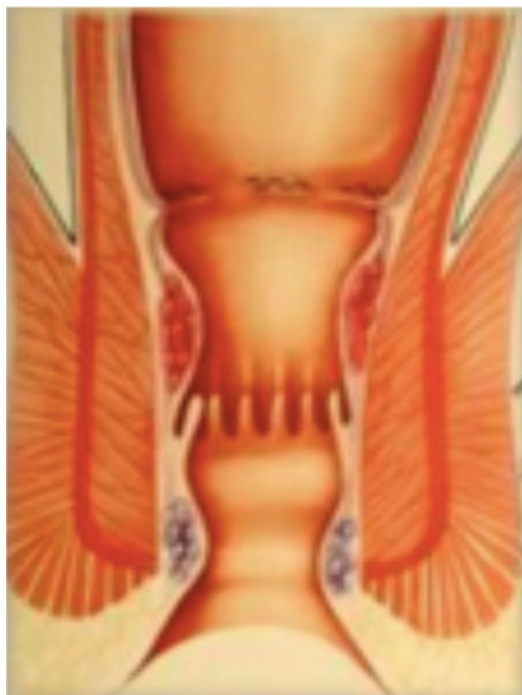
Given these results, hemorrhoidopexy seemed a better technique than conventional ones. The acceptance in Europe was very good; however, some countries had to limit its use since many procedures were being carried out when the technique was not yet validated and their indications were unclear.

2.1 Pathophysiology

Milligan and Morgan and Ferguson are procedures based on the hemorrhoidectomy. So, they involve the excision of prolapsed hemorrhoidal bundles and the ligation of their vascular pedicles. They are procedures that bring great pain and some complications such as postoperative bleeding, requiring reinterventions in some cases.

The circular hemorrhoidopexy described by Longo includes a complete circumferential resection of the mucosa and submucosa, including hemorrhoidal vascular pedicles, with consequent interruption of the arterial flow that would allow hemorrhoidal bleeding to cease.

This technique is based on the belief that some authors have that there is no real hemorrhoidal prolapse. This prolapse would be due to a loss of the mechanisms of support of the rectal mucosal tissue of the anal canal. Therefore, by correcting rectal prolapse by performing a mucosal resection, the hemorrhoidal packets will return to their anatomical position, avoiding the inflammation suffered by the hemorrhoidal packages when they are prolapsed.



Mucosal mucosa anastomosis in a region with few pain receptors and the absence of surgical incisions are two of the factors responsible for the very limited discomfort that patients present in the postoperative period. This fact is also responsible for the technique emerging as a valid treatment option for hemorrhoidal disease (Arroyo et al. 2011).

2.2 Surgical Technique

The current technique has been modified by many authors and, although it maintains common characteristics, differs from the one initially described by Antonio Longo. In addition, the stapler has been modified to be more ergonomic, the size of the metal staples has varied, as well as there have been changes in the technique and not only in the instruments.

2.2.1 Original Technique Described by A. Longo

The procedure can be carried out with locoregional anesthesia or with general anesthesia. The patient

will be placed in a lithotomy position and antibiotic prophylaxis should be administered.

The first step is to perform a manual progressive dilation of the anal canal. Later, we would be able to introduce a dilator-separator of plastic that will be fixed to the skin with spots of silk.

The next step will be to insert a plastic anoscope into the dilator. Subsequently and with the surgical field exposed thanks to the previous step, a continuous suture will be made of a “tobacco pouch” of the mucosa and submucosa with a polypropylene wire of 00 normally, approximately 3–4 cm above the pectine line and circumferential. It is essential that this suture preserve the smooth muscle and the pectine line, and it is not located too high in the anal

canal because this fact could cause some stenosis. The stitches will be given close enough to each other to avoid any irregular fold of the mucosa.

With this, the suture can be located, but it must be removed as the same time that we are tightening the tobacco pouch in order to avoid the spiral effect.

The anoscope is then removed and the stapler fully opened. The “tobacco bag” suture will be closed manually around the stapler axis and then closed. The stapler must be properly aligned with the anal canal. The ends of the suture should be tensioned progressively, taking care that the pectin line is not enclosed between them, which would lead to intense pain.

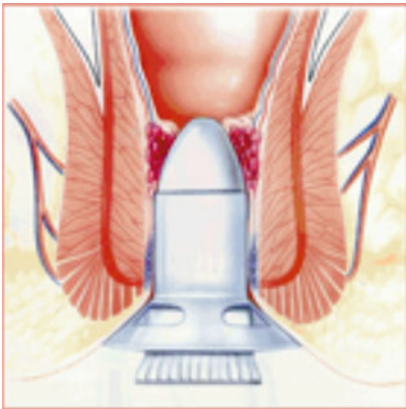


Fig. 1 Introduction plastic dilator-separator

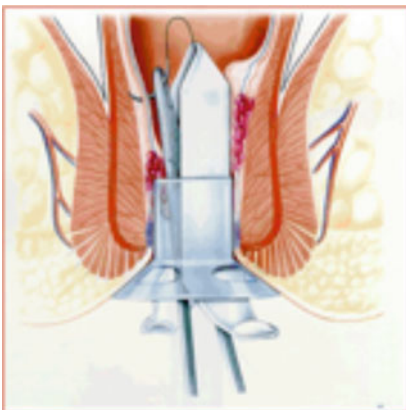


Fig. 2 Tobacco pouch

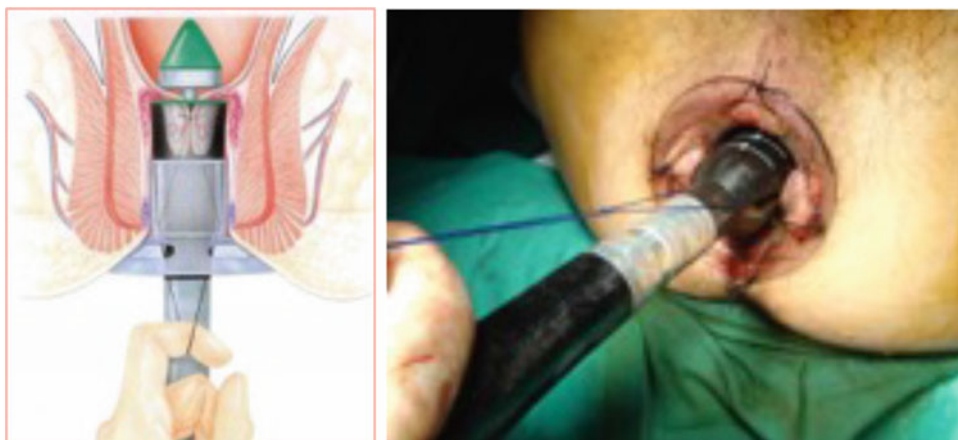


Fig. 3 Section and stapling

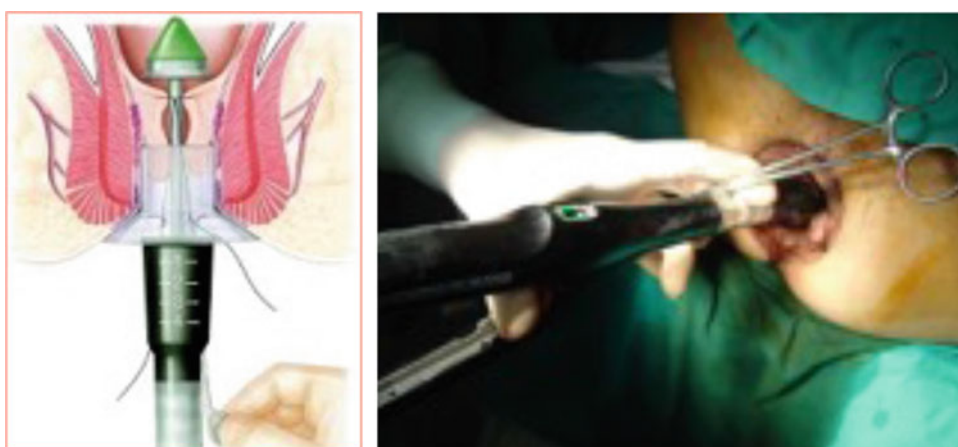


Fig. 4 Check the suture

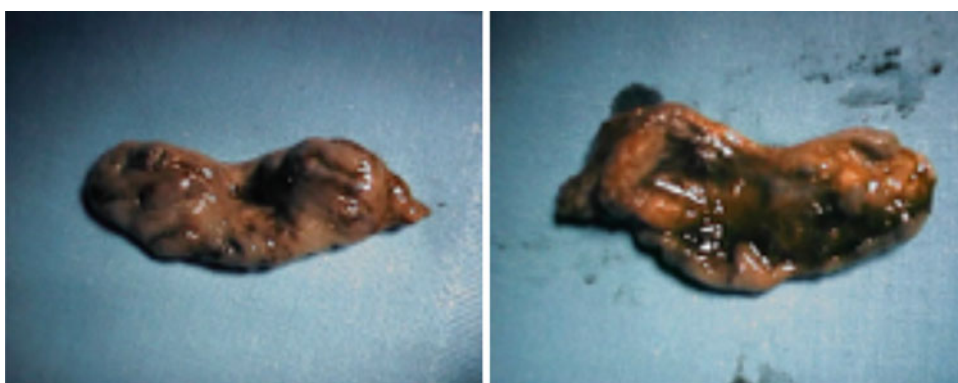


Fig. 5 Resected mucosal segments

In female patients, special care should be taken to perform the technique without including the posterior wall of the vagina, and in the male the prostate. Therefore, the inclination of the stapler should be directed away from the front face.

Next, the section and stapling will be performed and, immediately afterwards, the suture will be checked with direct vision with anoscope. This will check the anastomosis and that there is no bleeding point and no immediate defect or complication. The metallic staples would contraindicate the accomplishment of vascular hemostasis with electrocauterization. Therefore, any bleeding will have to be stopped by vascular sutures or ligatures.

The resected mucosal segment or “donut” will measure approximately 2–3 cm long.

The metal staples detach after 1 month of surgery or can remain months and even several years without causing any symptoms.

The postoperative care of these patients does not take any special consideration. The use of oral laxatives and analgesics from the second step of the World Health Organization (WHO) is recommended for the control of pain.

This procedure can be associated with others such as sphincterotomy, cutaneous skin excision, but risk-benefit should be assessed. In many cases it results in an increase in postoperative pain and morbidity.

There are some specific contraindications to the technique such as anal stricture, rectal prolapse externalized, proctitis, and anal suppuration (Arroyo et al. 2006a).

Original Device

The stapler used first is 33 mm disposable similar to that used in colorectal and esophagogastric surgery and is called PPH-33-01 (Sultan 2015).

It has the following characteristics:

- Two suture lines
- Twenty-eight metal staples
- Length of the staple of 5.5 mm
- Height reached with the closed clip 1–2.5 mm



2.2.2 Modifications

In recent years the technique and the device has undergone some modifications in order to improve the final result, to reduce the number of complications, and to avoid recurrences.

There are several studies in relation to these modifications.

Our group has performed several studies, among which highlights the realization of double suture in “tobacco pouch” instead of a simple one, and the advantages of using the new pistol called PPH33-03.

Modifications of the Technique

The realization of double suture in “tobacco pouch” instead of a single one has been evaluated by our group and others in different studies that have related the double technique with the lower incidence of postoperative pain, bleeding, or relapse. We also analyzed whether the surgical time is lengthened with this modification.

According to our results, postoperative pain during the first week is significantly lower in the double suture group than in the simple one, with a visual analogue scale (EVA) score of 2.08 and a 3.56, respectively. Pain during defecation was also observed lower with results reaching statistical significance.

Surgical time, expressed in minutes, is somewhat higher in the double-bag group (32.10 min vs. 31.86), but in this variable, the results did not reach statistical significance.

The number of relapses was also lower in the double suture group. This could be explained by

the fact that the resected mucosa segment is bigger than patients in which simple suture is performed, thus preventing recurrence due to residual prolapse. However, the results of this variable also do not reach statistical significance.

Therefore, the technique of double suture in the form of “tobacco pouch” can be deduced that you get better results especially in what a postoperative pain is concerned.

For this reason patients will also presumably have an earlier social and work reintegration, reducing the number of days of rest and the number of work casualties. However, in order to be able to verify if there is any relationship with the other variables analyzed in several studies, larger samples would be needed (Arroyo et al. 2011; Pérez-Vicente et al. 2006).

Modifications of the Instruments

The stapler that has traditionally been used to make the Longo technique has already received and is called PPH33-01. It has undergone a series of modifications over the years, which makes the process more effective and with greater security, obtaining better results.

Some reasons that have forced to investigate on the type of stapler to use:

- Intraoperative bleeding of the suture line is in some cases elevated.
- The presence of granulomas in the staple line, related fundamentally to the transitional points that occur with bleeding of the anastomotic line during surgery, can also be high.
- There are no inconsiderable percentages of patients who present tenesmus or discomfort in defecation, a fact that could be related to the appearance of granulomas described in the previous section.

Nowadays, the gun that is used is a modification of the same one that receives the name of PPH33-03 and that presents some advantages with respect to the first among which they stand out:

- Improvement of the design, developing a new stapler, with a handle and hammer more ergonomic to allow less force on the shot and perform stapling more smoothly.
- Fast closing: with the PPH33-01 the procedure required 17 turns of stapling gun, whereas with the new PPH33-03 only 6.5 are necessary. This allows the procedure to be carried out more quickly.
- The height of the staple is lower with the PPH33-03. This will allow to increase the compression of the tissue and of the blood vessels contained in the line of stapling, thus obtaining less bleeding and less suture points.
- The clip has a lower height with the PPH33-03 (4 mm) than with the PPH33-01 (5.5 mm). This results in 24% less metal in the suture line and in a more esthetic anastomosis.

There are no differences in the suture line which remain 2 and in the number of staples, which remains at 28 (Arroyo et al. 2006b).

The differences between PPH33-01 and PPH33-03 are summarized in the following table:

The staplers are sold commercialized in what is called “kit of Longo,” which consists of:

- Circular stapler, either PPH33-01 or PPH33-03
- Transparent anoscope
- Ports for suture pins
- Fixed anvil, which reduces accidental separation

Table 1 Differences between PPH33-01 and PPH33-03

Code	Suture lines	Staples number	Length of the stapled	Height of the closed stapled	Scalpel diameter	Units per box
PPH01	2	28	5.5	1–2.5 mm	24.4 mm	3
PPH03	2	28	4	0.75–1.5 mm	24.4 mm	3



3 Results of the Technique

Longo technique, described in 1993, is used as an alternative to conventional hemorrhoidectomy methods, including the Milligan and Morgan technique, the Ferguson technique, and also, although later, hemorrhoidectomy with LigaSure®.

Currently, we have enough material in the literature to be able to obtain results about the Longo technique in the short, medium, and long term.

There are many patient series in which the good results of the Longo technique are shown (Sultan 2015; Jong-Sung et al. 2013).

The advantages of it were mainly in:

- Less hospital stay. The observed mean is around 24 h of hospitalization.
- Decreased operative time, with an average of 23 min. This fact led to the procedure could be carried out in units of surgery without admission.
- Reduction of the time that has elapsed until the patient's socio-labor reinsertion.
- Less postoperative pain. There are studies in which there is a decrease in postoperative pain in the first months, but there are cases of recurrence of pain during the long-term follow-up, with an average of 6 months after the intervention.
- Decreased complication rate.

3.1 Complications of the Technique

Although the scientific literature shows a series of patients showing encouraging results, there are studies that are quite critical and reveal different problems, questioning the quality of the technique and the indications described by Antonio Longo.

The group at the St. Marks Hospital in London evaluated the technique and reported pain and defective urgency at 1 year of surgery in 31% of patients treated. Another study performed by this group found less pain with short-term circular mucosectomy, but at 6 months of follow-up, some patients began to have symptomatology.

Another criticism of the technique has been the observation of cases of retroperitoneal sepsis and the observation of circular and longitudinal smooth muscle fibers in the resection pieces submitted for anatomo-pathological study.

External hemorrhoidal thrombosis usually appears 7 days after surgery with a median onset of 1.5%. Its appearance seems to be related to the lack of elimination of hemorrhoidal tissue, as well as to the distance of the line of staples to the anal margin that will behave as a factor predisposing to the development of this external hemorrhoidal thrombosis, especially in the long term. The treatment of thrombosis of external hemorrhoids will be the baths of seat and surgical excision. It is also proposed, as a preventive measure, to avoid the constipated habit with the daily use of lactulose.

Anal fissure may also appear frequently. It is explained by the existence of mucous folds in the suture line. The folded mucosa can be unfolded and thus allow the development of an anal fissure, which will not heal unless the staples are removed. There are cases of proctitis after hemorrhoidopexy and appear to be related to local ischemic frenzes.

Anal stenosis presents an incidence of 0–15.6%, and the risk factors for its development are:

- Advanced degree of hemorrhoidal disease
- Sphincteric residual hypertonia
- Presence of smooth muscle fibers in the resected mucosa

In many cases it is solved with repeated digital dilatations. However, in some cases anopexy should be performed, which is the most frequent reintervention in these patients.

Fecal incontinence occurs more as a late complication. It could be due to the use of the anoscope, or damage to the internal anal sphincter during stapling. The use of a Eisenhammer separator to perform the “tobacco bag” suture instead of the anoscope included in the “Longo Kit” has caused these incontinence figures to decrease.

The defective urgency presents an incidence that can oscillate, depending on the series, from 5% to 31%, with a median of 8.28%. It is usually a transient symptom and usually disappears after 3 months.

Severe complications can occasionally occur, such as gas gangrene, rectovaginal fistula, rectal perforation, pneumomediastinum, or complete rectal stenosis. Its presentation and incidence is similar to that of other techniques.

Some series present cases of patients who have sepsis, which led to patient readmission, antibiotic treatment, and reintervention on certain occasions. The mortality derived from the severe sepsis is around 10%. The most common cause is rectal perforation associated with peritonitis.

In cases in which the septic process requires surgical treatment, the most performed intervention is an anterior resection with ileostomy or terminal colostomy. Some authors refer to and insist on the need to avoid including muscle tissue in the tissue section of the stapler in order to prevent the entry of microorganisms into the perianal tissues.

In addition to these criticisms and despite the good results reported in later studies, there are still some unanswered questions. The most important:

- What would be the appropriate treatment for the external hemorrhoidal component, sometimes bulky and symptomatic?

The first point is discussed shortly after the launch of the technique. So, is there an indication to perform the Longo technique in patients with grade IV hemorrhoids? This doubt is generated

because there are works that demonstrate that, being a larger prolapse, it can result in an insufficient resection and an early recurrence. So there are authors that do not contemplate this indication and there are others that contemplate it, but individualizing each case.

In this sense, in the literature, there is a randomized study carried out by the Ortiz H. group, in which 31 patients with grade IV hemorrhoidal prolapse were studied, divided into two groups: 15 patients treated with hemorrhoidopexy and 16 with hemorrhoidectomy. After a 12-month follow-up period, prolapse persistence was observed in eight patients in the group treated with hemorrhoidopexy and none in the hemorrhoidectomy group, with statistical significance reaching this result ($p = 0.001$). The study concludes therefore that hemorrhoidopexy is a technique that should not be performed in patients with grade IV hemorrhoids, regardless of whether the prolapse can be reduced during anesthesia or the surgeon has experience with the procedure. This is because, in view of the results, hemorrhoidectomy allows better results (Arroyo et al. 2006b; Porret et al. 2015; Sultan 2015; Jong-Sun et al. 2013).

3.2 Comparison of Results with Conventional Techniques

In the literature, comparative studies can also be found in which the results of mucosectomy are analyzed with respect to other techniques described for the treatment of hemorrhoidal disease.

The results of the most studied comparisons are discussed below.

Longo Versus Traditional Hemorrhoidectomy Procedures

Many studies, including some meta-analyses, compare Longo’s technique with traditional hemorrhoidectomy. The results obtained are very good in terms of surgical time reduction, hospital stay, better pain management, among other parameters evaluated. However, many of these studies contain mistakes, especially in terms of the indication of the technique. Sometimes

patients with hemorrhoids are included in grade II, III, and IV, which makes the comparisons and the results are not completely reliable.

The results of these studies in terms of mean hospital stay, surgical time, or the time elapsed until the social and work reintegration of the patient are reduced by half in the group in which the circular mucosectomy is performed.

Postoperative pain is less intense and yields earlier in patients in whom the Longo technique has been used than in the traditional hemorrhoidectomy group. Patients require less analgesia during the postoperative period and the healing process takes place more quickly so postsurgical care is simpler. However, compared to other techniques such as elastic band ligation, the pain is greater.

This residual pain is more than 15 months in some cases, and although its causes are not yet clear, it is related to the inclusion of smooth muscle fibers in ring mucosectomy and to the rectal inflammatory response to the stapling line. It is also postulated as a possible cause, an insufficient distance from the suture in "tobacco pouch" with respect to the pectine line, or an inadequate depth of points of this suture. A "tobacco pouch" suture located about 3–4 cm from the dentate line has been found to result in a significant decrease in this pain.

The suspicion of complications must be greater in patients who suffer prolonged and excessive pain after being subjected to the Longo technique.

There is no treatment for persistent pain today. Different interventions have been proposed such as internal chemical or surgical lateral sphincterotomy, pudendal nerve surgery, extraction of staples, or application of local anesthetics or analgesics.

It should be mentioned that when we talk about functional results, the effectiveness of the technique is evaluated by the comments that patients make in the consultation. And it can be verified how the level of satisfaction is high in 90% of cases, regardless of the technique of hemorrhoidectomy that is carried out.

The presence of residual hemorrhoidal disease, internal hypertonic anal sphincter, anal fissure, or fibrosis adjacent to the staple line, and the occurrence of suture dehiscence and even sepsis are

factors that contribute to prolonged pain. It is suggested that this occurs more frequently in male patients, patients with grade IV hemorrhoidal prolapse or in the presence of elevated sphincter pressures.

It is described a higher incidence of skin tags after circular mucosectomy than in conventional techniques. It will be more frequent to a greater degree of hemorrhoidal prolapse. However, the size of the cutaneous tags decreases with the mucosectomy, although this fact is not demonstrated in all the reviewed studies.

It is suggested that when the "tobacco pouch" is made at least 2.5 cm from the pectine line, both the external hemorrhoidal prolapse and the internal component will be elevated and, thus, the appearance of residual skin tags will be diminished. It is also possible to add the excision of the tags to the mucosectomy, but sometimes it will result in greater postoperative pain and discomfort.

Postoperative bleeding is the complication that occurs most frequently in the Longo technique. However, these incidence rates have not been found to be lower than those of conventional hemorrhoidectomies.

This bleeding associated with circular mucosectomy often appears on the seventh postoperative day and several possible origins are suggested:

- Arteriolar bleeding, pertaining to the stapling line
- Performing a poor technique that will lead to damage to the mucosa
- An inflammatory process secondary to the body's reaction to staples

A lot of procedures have been described to stop these bleeds such as compression with a Foley catheter, different types of sutures, placement of meshes, or adrenalin injections. However, in some cases blood transfusion is also necessary to restore hemoglobin values.

Several factors have been related to the occurrence of relapses, and this appears to be more frequent in patients with grade IV hemorrhoid digests. There are articles that show recurrence

rates of 22% in patients operated using the Longo technique, compared to 3.6% who underwent conventional procedures.

In particular, the appearance of long-term prolapse seems to be more frequent in patients operated by the Ferguson technique. However, in a recent meta-analysis, prolapse figures of 1% are reported for the Ferguson technique and 8% for patients operated using the Longo technique. This has led many authors to affirm today that the Longo technique should be contraindicated in patients with grade IV hemorrhoidal prolapse, because the recurrences can be high, reaching up to 50%.

This can be explained by the irreducibility of prolapse: the more irreducible it is, the lesser the levitating effect offered by circular hemorrhoidopexy.

It has also been verified that the technical characteristics of the procedure have relationship with the recurrence, either by the place where the tobacco pouch is made, the level at which the stapling line is located, or the check of the complete mucosectomy checking the integrity of the mucosal rings in the stapler.

The rate of reintervention following circular mucosectomy, whether due to persistent bleeding or relapse, is high in the long term. The technique proposed for any of these conditions is the ligation with elastic bands.

Immediate complications, such as acute urinary retention, hemorrhage, stenosis, anal fissure, hematochezia, painful or fecaloma defecation, have a similar incidence in conventional techniques and in circular mucosectomy.

Hematochezia presents an incidence of 0.18–33% and is a frequent cause of late bleeding.

Regarding the preservation of continence, there has been no greater incidence with mucosectomy, but it can be affirmed that there is a greater risk of damaging the sphincter when performing the Longo technique for several reasons:

- The anal dilatation performed to place the anoscope and the stapler.
- Perform stapling at a very low level in the anal canal.
- Inclusion of muscle fibers in the mucosectomy, which can be observed in the results of

pathological anatomy of the rings of 36–100% of the mucosectomies.

As far as economic analysis is concerned, many studies conclude that the differences between the techniques are minimal and that the economic excess that the technique of Longo can present with respect to the traditional techniques is compensated by the decrease of the surgical time, the reduction of the hospital stay, and the days of resting until the social reinsertion of the patient (Ortiz 2007; Jong-Sun et al. 2013).

Long Versus Hemorrhoidectomy Technique with LigaSure®

The LigaSure® is a vascular sealing device that uses the combination of pressure and electrical energy to ensure complete coagulation of the vessels with a minimum of heat diffusion and carbonization to the surrounding tissues. These characteristics make LigaSure® a good device for the treatment of hemorrhoidal prolapse. It allows an efficient resection and at the same time a correct coagulation and a scar tissue trauma.

Hemorrhoidal resection with LigaSure® represents, according to some studies, a possible alternative superior to the conventional hemorrhoidectomy procedures of Milligan and Morgan and the technique of Ferguson. It has been shown that this technique allows a reduction in surgical time, a decrease in postoperative pain, and the need for analgesics in the first 24 h.

There are also studies comparing the Longo technique with the hemorrhoidectomy performed with LigaSure®. In these, it is concluded that both techniques are equally valid for the treatment of hemorrhoidal prolapse. However, in the hemorrhoidectomies performed with LigaSure®, technical advantages and better results can be observed in the shorter term than with the Longo technique.

In these studies, the variables analyzed do not differ in those analyzed in other studies comparing circular mucosectomy with conventional techniques and are detailed below.

Regarding the operative time, it is verified how in the hemorrhoidectomy realized with LigaSure®

is significantly inferior, being of 7 min less in some series. This delay is mainly due to the more complex technical characteristics of the Longo technique: the use of the anoscope, the realization of the “tobacco pouch,” whether double or simple, checking the integrity of the rings when extracting the Stapler and stitches necessary to stop bleeding of the anastomosis, which can occur frequently. All these steps are not performed in the hemorrhoidectomy performed with LigaSure[®], and, in addition, there is a lower risk of bleeding due to the excellent vascular sealing that exerts on the blood vessels, all leading to a reduction in operative time.

Postoperative pain assessed by visual analogue scale (VAS) does not seem to be related to the use of one technique or another. There are very large series of patients, in which this variable does not reach statistical significance. Regardless of this fact, the figures are similar, giving patients an approximate EVA score of 5 in both groups, especially in the first few days after the intervention. This value decreases progressively in the controls performed during the follow-up.

The incidence of postoperative bleeding was also evaluated, and although it appears to be lower in patients treated with LigaSure[®] (2.5%) compared to patients treated with the Longo technique (2–8%), the results are not statistically significant. As already mentioned, LigaSure[®] is a good vascular sealing device and for this reason the incidence of postoperative bleeding could be lower in patients treated with this technique. In patients undergoing circular mucosectomy, postoperative bleeding, which usually results from the anastomosis, is quite common, and in many cases requires hemostatic points to stop bleeding.

Fecal incontinence seems to be higher in patients operated using the Longo technique than in patients operated with LigaSure[®], but there are insufficient data to demonstrate this association. Incontinence, which occurs immediately after surgery, is usually due to pain, as it inhibits voluntary contraction of the sphincter. There are complex patients with large prolapses that will require a correct circular mucosectomy. In them, sphincter damage and incontinence can occur more frequently, mainly due to the inclusion of smooth

muscle fibers between the mucosa to be resected. Patients who undergo LigaSure[®] also have the risk of developing incontinence, and this is due to the device and the technique. When using the device and clamping the hemorrhoidal tissue, there is a risk that some internal anal sphincter fibers will also clamp. The heat from the device will be transmitted to these muscle fibers, damaging them in some cases.

For the hospital stay, both procedures present a decrease with respect to traditional hemorrhoidectomy techniques. Between the circular mucosectomy and the hemorrhoidectomy with LigaSure[®], the hospital stay is more or less similar oscillating between 1 and 10 days but does not obtain the statistical significance in this variable. This is why, it cannot be said that a decrease in the stay in any of the two treatments is significant.

The incidence of cutaneous tags is significantly lower in patients operated with LigaSure[®] than in those who have performed the Longo technique. This can be explained because in the case of the Longo technique, the section made is on the mucosa, but the hemorrhoidal packages are not excised.

Finally, the rate of recurrences is also analyzed in almost all the works exposed in the scientific literature. An incidence of relapses of 1.2% for patients with LigaSure[®] and 7.5% for patients with circular mucosectomy is estimated, and these results reach statistical significance. Nevertheless, all these works present little follow-up time and this does not exceed 2 years. If this time was longer, the hemorrhoidectomy with LigaSure[®] may have a higher incidence figure, so it is necessary to work with these characteristics to check these results (Yang et al. 2013; Lee et al. 2013).

Technique of Longo Versus Transanal Hemorrhoidal Dearterialization (THD)

THD is a recent technique described for the management of hemorrhoidal pathology. It is a non-excisional procedure in which with a specific proctoscope and a Doppler probe branches of the upper rectal artery will be located and ligature, reducing the arterial flow without compromising the venous.

The effects of this technique are the reduction of blood supply and the reduction of congestion of the hemorrhoidal plexus. In this way, there will be a collapse of prolapsed hemorrhoids, decreasing bleeding and pain. This procedure also involves a regeneration of the connective tissue that will facilitate the retraction of the same towards the anal canal, thus reducing the prolapse.

With this technique, it is possible to avoid damaging the caudal anoderm to the pectine line, thus minimizing postoperative pain and favoring an earlier recovery.

This technique shares two fundamental characteristics with circular mucosectomy: surgery of the nonexcisional hemorrhoidal pathology and advantages in terms of postoperative pain and patient recovery time.

There are studies in the scientific literature comparing both procedures with disparate results at present.

As for the postoperative pain variable, different results can be observed in several studies. In some studies, a lower intensity of postoperative pain was observed in the group treated with the THD technique than in the patients operated on with Longo procedure (EVA 4 vs. EVA 8, $p < 0.05$). In contrast, there are other comparative studies in which pain intensity is observed in patients treated with the THD technique (12.7% vs. 6.6%, $p = 0.161$).

Postoperative bleeding occurs more frequently in patients undergoing circular mucosectomy

(2–8%) than in the group of patients treated with THD (0–5.9%). These results are not statistically significant.

During long-term follow-up, which is established in 7 years as the mean value, a recurrence rate of 10% is observed in patients treated with THD and 14% in patients operated on with Longo procedure, without reaching this data again. Statistical significance ($p = 0.2$). In other series, this recurrence rate appears higher in the group treated with THD (25.4%) than in the group treated with hemorrhoidopexy (8.2%). In this sense, it is noteworthy how in Longo's technique, patients with long-standing hemorrhoidal prolapse obtained better results in terms of recurrence than the THD technique (11.1% vs. 25.4%, $p = 0.021$). This fact could be explained by the mucosal resection that is achieved with the accomplishment of the circular mucosectomy, pathophysiological fact that is not included during the realization of the THD technique.

Therefore, it can be perceived that THD would be better than Longo, improving the rates of postoperative pain, time of socio-labor reintegration, postoperative complications, and rate of recurrences. However, in order to verify this statement and to draw conclusions leading to a modification in the interventional treatment of the hemorrhoidal pathology, a larger study would have to be carried out (Lucarelli et al. 2013; Leardi et al. 2016).



Fig. 6 Specific proctoscope and Doppler of Transanal Hemorrhoidal Dearterialization (THD)

4 Personal Experience of the Authors

Our group has been developing the Longo technique for 15 years.

We have been improving in technical details, patient selection, and the new PPH-03 stapler, and finally, our results have improved too (Arroyo et al. 2006b, 2011; Pérez-Vicente et al. 2006).

4.1 Learning Curve

An analysis of the first 100 patients treated at our center was carried out, comparing our results with those of the literature. The first 50 patients were analyzed in group 1, and in group 2, the next 50 patients.

In terms of demographic data, two variables were considered: sex and age. In both groups, the male sex was predominant (65% of men in group 1 and 59.72% in group 2), coinciding this data with what is observed in the scientific literature (62%). The mean age of patients in both groups was 48.69 years, similar to that reviewed in the scientific literature.

The most frequent symptomatology for which our patients were consulted was rectal bleeding (86%) and secondarily the occurrence of hemorrhoids with defecation (83%). Both data exactly coincide with that reviewed in the literature.

On physical examination, 73% of patients in group 1 had three pedicles, 82% in group 2, while in the review, this percentage was 77%.

As a mean in both groups, 56% of patients had a grade III hemorrhoidal prolapse and 44% had grade IV.

As for the anesthetic technique performed, 80% received subdural regional anesthesia; 17% underwent general anesthesia and 3% local anesthesia and sedation.

Mean surgical time was 32 min in both groups, similar to the rest of the studies reviewed.

The interventions were performed in the unit of surgery without admission of our center, receiving the patient the discharge in the first 24 h normally.

As for the complications that more frequently could be observed, the postoperative pain stands out. It was evaluated using the visual analog scale (EVA) and in group 1 an average value of 3.62 was obtained, in group 2 of 2.13, and in the literature, the mean was 2.66.

	Normal	0–5 (0–20)	>5 (0–20)
Group 1	42	8	0
Group 2	47	3	0
N	89	11	0

Some patients had bleeding. This complication was classified as: minimal, moderate hematoma, and hemorrhage. The majority of patients experienced a minimal hematoma (57%), a moderate hematoma (35%), and bleeding (2%).

Continence was also assessed using the Cleveland scale. The majority of patients in both groups did not present continence alterations (42 patients in group 1 and 47 patients in group 2). Only eight patients in group 1 had a mild degree of incontinence and three patients in group 2. No patient in any group experienced severe incontinence.

4.2 Selection of Patients

The best known indication of the Longo technique is the treatment of grade III and grade IV hemorrhoidal prolapse.

However, the indication in the case of patients with grade IV hemorrhoidal prolapse continues to generate doubts. This is because there are studies that show that, being a larger prolapse, it can lead to insufficient resection and early recurrence.

Our group has performed several works in which some modification of the technique is made as it will be discussed later: the double suture in “tobacco pouch.” And it is that, the conventional technique described by Longo, we remember that only contemplates the realization of a single suture.

The hypothesis of these works is as follows: a second suture in “tobacco pouch” in front of the first, results in a larger resected mucosal ring, reducing residual prolapse.

That is why, in our daily clinical practice, we indicate the Longo technique in the following cases:

- Patients with internal hemorrhoids grade II, refractory to other treatments
- Patients with grade III and grade IV hemorrhoids of predominant internal component
- Patients with mucosal prolapse

4.3 Modifications in the Instruments

Our group has developed studies that try to evaluate the different types of staplers. These included a prospective randomized study of patients diagnosed with grade III and IV symptomatic hemorrhoids.

The sample size was 60 patients: 30 belonged to group 1, submitted to hemorrhoidopexy with the stapler PPH33-01; and 30 belonged to the group 2, who were patients operated with the PPH33-03 stapler.

The intervention was performed in the unit of surgery without income in ambulatory surgical centers (ASC), as is usual in this type of interventions.

A simple colon preparation was performed with enemas of sodium dihydrogen phosphate. No antibiotic or thrombotic prophylaxis was performed.

The patient's position was the lithotomy position; the anesthesia was subdural.

The discharge occurred in the first 12–24 h.

In this study, also performed by our group, the modification was introduced in the technique described above, and in all patients, the suture was performed in a double and not the single “tobacco pouch.”

Three types of variables were studied:

- Variables related to surgery
- Variables related to monitoring
- Variables related to postoperative complications in the medium term

Variables Related to Surgery

First, the operative time was compared, and the group treated with PPH33-01 was greater (29.90 min) than in the group treated with PPH33-03 (20.10 min). However, these results did not obtain statistical significance.

Other variables such as the size of the ring resulting from the mucosectomy and the distance to which the suture of the pectine line was located also presented different results in both group 1 and 2. The size of the ring was 4.05 cm in the first group and 3.55 cm in the second group. The distance from the suture to the pectine line was 3.36 cm in group 1 and 3.16 cm in group 2. However, these results do not obtain statistical significance, which is explained by the authors for an insufficient number of cases in the sample size of the study.

In this study, we also studied a variable that referred to a bleeding of the anastomosis, being necessary for its cessation a transfixive point. In the group treated with PPH33-01, bleeding occurred in 15 patients, while in the patients treated with PPH00-03, there were only four cases of bleeding. In addition, in the patients in the group 1, there was a higher incidence of granulomas in the suture line than in the group 2. This fact is also related to the greater need to perform transfixive points to stop bleeding in patients operated with PPH33-01.

Variables related to surgery	Total N = 60	Group 1 N = 30 PPH33-01	Group 2 N = 30 PPH33-03	p value
Operation time (minutes)	25 (10.1)	29.90 (9.8)	20.10 (10.4)	>0.05
Bleeding	17	15	4	0.009
Donut size (cm)	4.30 (0.7)	4.05 (0.65)	3.55 (0.48)	>0.05
Distance from the suture (cm)	3.26 (0.8)	3.36 (0.9)	3.16 (0.7)	>0.05

Variables Related to Monitoring

Postoperative pain and pain with defecation were assessed. In the first case, the pain was slightly more intense in patients in group 2 than in patients in group 1 (VAS of 2 and 2.08, respectively). However, these results do not reach statistical significance. In the case of the variable “pain with defecation,” 14 patients with this type of clinic are observed in group 1 and, on the contrary, in group 2, we only observe 6. It can

be affirmed that pain with defecation occurs less frequently in patients operated with the Longo technique using the PPH33-03 stapler than with the PPH33-01.

Variables Related to Postoperative Complications in the Medium Term

In this section we group the variables related to the complications that have appeared after a follow-up of 6 months.

We studied the occurrence of gas and stool incontinence at the first month and at the sixth postoperative month, persistent pain and recurrence rates.

Only three patients with incontinence were observed in both groups, in the control of the first month. At the sixth month, no patient had incontinence in either group.

The number of patients who continued with persistent pain after the control of the first week was very low. Only one case was observed in each group at the first month. By the sixth month, no patient continued to suffer.

The results of these two variables did not reach statistical significance, so it cannot be said that there is an association between them and you use a different stapler than the conventional one when performing the Longo technique. The recurrence rate was 0 for both groups, both at the first month of follow-up and at the sixth month. However, statistically significant results are not obtained in this variable either. The author explains this fact because of the short follow-up time the patients have had. A larger study with a larger number of patients and a longer follow-up period will be necessary to show that there are differences in the occurrence of recurrences depending on whether one stapler is used or the other.

Complication in the medium term (first month/sixth month)	Total	Group 1 N = 30 PPH33-01	Group 2 N = 30 PPH33-03	p value
Incontinence	6/0	3/0	3/0	>0.05
Persistent pain	2/0	1/0	1/0	>0.05
Recurrence	0	0	0	>0.05

5 Conclusions

Longo procedure is now a valid treatment option for patients with hemorrhoidal disease, especially in grades III and IV.

It is a procedure that is widely distributed and presents many advantages over traditional hemorrhoidectomy procedures, especially in the area of postoperative pain, surgical time, and time to the patient's social reinsertion. However, its indication remains controversial and the results in terms of recurrence and complications constitute its main limitation, so there are surgeons who continue to be faithful to conventional techniques, being hemorrhoidectomy today, the gold standard technique for treatment of hemorrhoidal prolapse.

The correct learning of the surgical technique and its modifications, the selection of patients, and the use of PPH-03 show better results and should be essential points in new studies to see the true results of the technique.

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Why and When I Do Prefer the Stapled Hemorrhoidopexy

26

Leonardo Lenisa

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Abstract

Stapled anopexy can be considered in patients with hemorrhoidal symptoms refractory to conservative treatments as an effective surgical option. The ideal patient will present with prolapsed piles and the concurrence of internal rectal prolapse, either mucosal or full-thickness. Resection of the redundant rectal tissue at the anorectal junction and relocation of external hemorrhoids into the anal canal are the milestones of the procedure. Complications of the procedure have been extensively reported but are presently comparable to standard hemorrhoidectomy. The slightly higher tendency to recurrence described in the first era is now counterbalanced by the almost infinite availability of devices with all ranges of diameters and casing volumes, fulfilling surgeons' willing and patients' need of resection.

Surgeon must be aware of the existence of a wide range of devices and must be confident with and properly trained to select them appropriately, according to patients' characteristics and prolapse size.

1 About Hemorrhoids and Prolapse

Internal hemorrhoids may cause bleeding, thrombosis with pain, moist anus, local discomfort, and pruritus. External prolapse of piles during straining or at rest, determining palpable or visible swelling, is generally considered an irreversible condition and undiscussed indication to surgery. Pain is generally associated with acute thrombotic complication and should be regarded with caution in patients with chronic hemorrhoidal symptoms, as pain is generally related to a diverse latent condition and it may persist or even get worse after surgery. The beginning approach to first-

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and second-degree hemorrhoids include directions in lifestyle, diet and bowel habits, stool softeners, and topical application of relievers, associated or not with lidocaine and steroids. Many outpatient procedures have been proposed for the treatment of persistent symptoms from hemorrhoids, as described in previous chapters. Indication to surgery for hemorrhoids is consistent when symptoms are persisting after conservative treatments have failed and patient has the willing to reach a better quality of life.

The Goligher classification of hemorrhoids is probably still the most used worldwide (Goligher 1984). First-degree is represented by bleeding but not prolapsing piles, second-degree by prolapsing piles reducing spontaneously, third-degree by prolapsing piles requiring digital manoeuvre to be reduced, fourth-degree present permanent prolapse and cannot be reduced even manually. Present classification is based on standard office observation “from outside,” i.e., observing the presented external piles. The cumulative experience with the routine adoption of proctoscope during office evaluation and circular anal dilators during stapled procedures has in some instance changed our ability to evaluate hemorrhoids, shifting the focus from the presented external piles to the concurrent evidence of internal rectal prolapse as a sustaining condition of hemorrhoidal disease. Moreover, there is not a linear relation between the entity of internal mucosal prolapse and the degree of hemorrhoids, being the latter in some cases very symptomatic in the early degrees, due to the presence of unreported or undetected rectal redundancy.

The pathogenesis of hemorrhoidal disease has evolved over the years thus leading to new surgical solutions intended to correct the causes rather than the symptoms of hemorrhoids. According to improved knowledge of the role of anatomy and physiology of the hemorrhoidal plexus in the mechanisms of anorectal and pelvic floor functions, three aspects can be commonly highlighted in hemorrhoidal patients: abnormal prolapse of anorectal mucosa, distal displacement, and venous engorgement of the hemorrhoidal plexus and the eventual presence of external skin tags. In

1975, Thomson described the anatomy of the anal cushions and defined their role in the mechanism of continence (Thomson 1975). Thompson hypothesized that prolapse of anal cushions and rectal mucosa is the main determinant of symptoms and perineal discomfort reported by hemorrhoidal patients thus constituting the theoretical basis in development of stapled surgical procedures. Prolapsed anorectal mucosa and hemorrhoids are often accompanied by fragmentation of the anal supporting tissue, the so-called Treitz’s ligament; moreover, if Park’s ligament is also torn, then there is a distal sliding of the anal skin as well. Prolapse of the anal cushions causes an alteration in their vascular structure, consisting in a stretching of the superior vessels and kinking of the arterial and venous connections between the internal and external vascular plexus determining a hindrance to venous flow.

As mucosal prolapse is the leading cause in supporting persisting symptoms of hemorrhoidal disease, then the intent to cure must be directed to correct or remove the prolapse itself rather than to excise hemorrhoids. In the pursue of this goal, stapled anopexy (SA) was proposed to correct mucosal and hemorrhoidal prolapse by means of excision of a transverse band of mucosa of the distal rectum at the anorectal junction. Excision of the mucosa at this level eventually determines interruption of the terminal branches of the superior rectal artery. The concept behind this approach is that correction of the prolapse, by restoring the normal anatomical relationship between the anal mucosa and the anal sphincter, leads as a consequence to an improvement in venous return. Restoration of the primitive anatomy of the anorectal junction and the anal canal is the clue to symptoms resolution and physiological functions preservation (Henry and Swash 1985). It should be remarked that *stapled anopexy is not intended to resect hemorrhoidal tissue and is in no instance a hemorrhoidectomy*. It has been conceived to leave the hemorrhoidal cushions intact: it should be intended as a procedure resecting prolapsed rectal mucosal and relocating prolapsed hemorrhoidal tissue into the anal canal. Residual external skin tags may be removed at the end of



Fig. 1 External asymmetric hemorrhoidal prolapse with rectal mucosa ectropion



Fig. 2 Same of Fig. 1 after manual reduction of prolapse and 38-mm circular anal dilator insertion. Internal rectal mucosa prolapses into the CAD over half of the length of the 4 cm dilator

procedure mainly for cosmetic reasons but the hemorrhoidal cushions at the inner anal canal must be preserved (Longo et al. 2009) (Figs. 1, 2, and 3).



Fig. 3 Same of Fig. 1 after a single 36-mm SA. The external component of the rectal prolapse is been resected, hemorrhoidal tissue is been relocated into the anal canal, and the anoderma is normally shaped inward the anal canal. Normal anatomy is restored without disabling external wounds

2 When to Perform a Stapled Anopexy

Indication to surgery is appropriate when there are persisting and perceived hemorrhoidal symptoms, combined with the willingness and motivation of the patient to solve the problem through surgery, which is generally reputed as being an extremely painful experience.

Almost 20 years have passed since the first presentation of stapled Anopexy by Antonio Longo (1998) and approximately 500 papers have been published describing indications, results, complications, and functional outcomes of Stapled Anopexy. In year 2007, following the results of a Health Technology Assessment performed by Burch and coworkers (Burch et al. 2009), the NICE- National Institute for Health and Clinical Excellence- from U.K. approved a technology appraisal guidance (Stapled hemorrhoidopexy for the treatment of hemorrhoids. Available at www.nice.org.uk/TA128.) stating that “Stapled haemorrhoidopexy, using a circular stapler specifically developed for

hemorrhoidopexy, is recommended as an option for people in whom surgical intervention is considered appropriate for the treatment of prolapsed internal haemorrhoids.” In present report, it was noted that randomized controlled trials underline a higher rate of recurrent prolapse after stapled hemorrhoidopexy when compared to conventional hemorrhoidectomy; nevertheless, recurrence rate varied on a case by case basis and no statistical significance was found in terms of postoperative complications, such as postoperative bleeding and incontinence. Moreover, a potential increase in the rate of reintervention was a less important factor than the expectation of a high level of postoperative pain for patients and clinicians and reintervention for prolapse after stapled hemorrhoidopexy did not pose a greater risk than reintervention after conventional hemorrhoidectomy. The guidance concluded therefore that performing stapled hemorrhoidopexy was “an appropriate use of NHS resources” and should therefore be recommended as an option for surgical treatment of prolapsed internal hemorrhoids.

In other words, Stapled Anopexy can be considered as a safe and effective surgical option for the treatment of hemorrhoids: the potential benefits in terms of reduced postoperative pain and faster recovery and return to work are counterbalanced by a higher rate of recurrent symptoms. For this reason, bulkier and fourth-degree hemorrhoidal prolapses were commonly deemed not suitable to SA. This evidence was mainly dependent on the limitation provided by the size of the case of the stapler, unable to entrap the full amount of prolapse. Naldini et al. demonstrated that, if the internal mucosal prolapse entering the Circular Anal Dilator overcomes half the length of the CAD, a standard 33 mm circular stapler will not be able to resect an adequate amount of prolapse, thus leading to symptoms recurrence (Naldini et al. 2009). The adoption of a variation of the technique by performing a double-stapled prolapsectomy in the STARR fashion was the choice of many surgeons in Italy and abroad (Boccasanta et al. 2007; Braini et al. 2013). Nonetheless, surgeons dedicated to trans-anal stapled procedures were still lacking the ideal device giving the surgeon the ability to resect to

their willing. For this reason, the technological development in the surgical device industry provided a multiple selection of circular staplers and dedicated kits with increasing diameter of the device, detachable anvils, higher volume of the cases leading to a wide variety of potential choices with the aim of giving the surgeon the possibility to resect as much as he deems appropriate. Today we can perform a standard 33 mm SA, a 34 mm High-Volume SA, a 36 mm Tissue-Selecting SA or a double-stapled prolapsectomy with the preferred size, with the final result for the surgeon of being able to resect a tailored amount of tissue. Nonetheless, the historical evidence of increased rate of recurrence and reports of severe complications over the years was the main reason for part of the surgical community to keep skeptic about the value of SA.

Concerning complications of SA, a recent review has been published (Porrett et al. 2015). The Authors report “early complication rates ranging between 2.3 and 52.5%, with the median complication rate being 16.1%, excluding pain. Few complications were specific to stapled hemorrhoidopexy; however, these included failure of the stapling gun, urosepsis, and pelvic sepsis. The most common complication was early bleeding, with the overall rate following the procedure ranging from 0 to 68%.” Regarding late morbidity, they report the “Overall late complication rates, excluding skin tags and recurrence, ranged between 2.5 to 80%, with a median value of 23.7%. Bleeding was again commonly reported, with the overall rate of late bleeding determined to range from 0.18 to 33%.” It is impressive how wide is the range of reported complications, suggesting the fact that there must have been underreporting in some publications and perhaps a lack of competence in other papers where complications are reported with such a high incidence. As well, it is my personal opinion that the occurrence of severe complications has been in some instances overemphasized in the first era, suggesting a confusion among technical failures and lack of appropriate skillness regarding a new technique. Surgery of the anorectal prolapse needs appropriate competence in patients’ selection, precise surgical technique,

and adequate skillness in the management of surgical complications. If all these conditions are given, results will definitely be satisfactory.

As previously mentioned, the limitation in performing SA in bulkier hemorrhoidal prolapses has been now overcome by the availability of a variety of devices with increasing size and increasing casing capacity with the aim to resect as much prolapse as needed in a “Tailored rectal prolapse surgery” vision. Naldini reports his multicenter experience with the new 36-mm stapling device with 160 consecutive patients treated and 89% of good to excellent patients’ satisfaction, with an ordinary rate of postoperative complications (Naldini et al. 2015). Together with the solution of bleeding and prolapse symptoms, SA provides effective improvement in evacuation as resection of redundant anorectal prolapsed tissue provides a better stool passage and prevents tenesmus and sensation of incomplete evacuation: this information reported by patients at postoperative controls since my early experience was one of the main determinants in adopting this valuable surgical technique for the treatment of symptomatic anorectal and hemorrhoidal prolapse.

In conclusion, Stapled Anopexy can be considered in patients with hemorrhoidal symptoms refractory to conservative treatments. The ideal patient will present with prolapsed piles and the concurrence of internal rectal prolapse, either mucosal or full-thickness. Surgeon must be aware of the existence of a wide range of devices and must be confident with and properly trained to select them appropriately, according to patients’ characteristics and prolapse size. The coexistence of skin tags is not a contraindication but they may be eventually excised separately at the end of procedure, as stapled procedures do not treat external anodermal tissue. Further, the external prolapse must be manually reduced by the surgeon at the beginning of the procedure, with the aid of a swab, during insertion of the Circular Anal Dilator; the nonreduced external component of the prolapse will eventually persist at the end of resection leading to an unsatisfactory result of the procedure. Manual excision is therefore indicated in those cases. The presence of an asymmetric or irregular prolapse must induce caution in the

surgeon, who must evaluate the risk of a non-satisfactory resection if a tailored adaptation of the surgical technique is not performed. Redo SA in recurrent cases of previous stapled procedures is feasible, but surgeon must evaluate case by case and must be sure to remove the entire previous staple line during the redo procedure, eventually adopting a “larger” stapler or performing a double-stapled resection. The latest cases must be evaluated or tutored by senior expert surgeons.

3 Cross-References

- ▶ [Literature Review on Stapled Hemorrhoidopexy](#)
- ▶ [Main Advantages of Stapled Hemorrhoidopexy](#)
- ▶ [Main Disadvantages of Stapled Hemorrhoidopexy](#)
- ▶ [Pros and Contrasts of Stapled Hemorrhoidopexy](#)
- ▶ [Stapled Hemorrhoidopexy: Techniques and Results](#)
- ▶ [Technical Tips and Tricks of Stapled Hemorrhoidopexy](#)

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Technical Tips and Tricks of Stapled Hemorrhoidopexy

27

Jonathan R. L. Wild and David G. Jayne

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Abstract

Stapled hemorrhoidopexy is an established technique for treating symptomatic prolapsing hemorrhoids. It is a safe procedure with benefits including less postoperative pain compared to conventional open hemorrhoidectomy, although increased rates of recurrence in the longer term. The key to success is meticulous surgical

technique. We describe a technique for stapled hemorrhoidopexy that has proven to produce reliable results and reduce the risk of complications.

1 Background

Stapled hemorrhoidopexy, also known as the procedure for prolapsing hemorrhoids (PPH), is a technique that results in excision of a circumferential strip of anal mucosa, submucosa, and hemorrhoidal vasculature at a distance of 2–3 cm proximal to the dentate line. It is performed with a 33 mm circular stapler – the Proximate[®] PPH

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Circular Hemorrhoidal Stapler (Ethicon Endo-Surgery, Cincinnati, OH), which applies a staggered double row of titanium staplers resulting in a simultaneous mucosal anastomosis. This results in mucosal lifting (anopexy) with a repositioning of the vascular cushions to a more normal anatomical position within the anal canal (hemorrhoidopexy). Devascularization of the hemorrhoidal tissue also occurs resulting in shrinkage of the hemorrhoids in the subsequent weeks following the procedure.

The technique of stapled hemorrhoidopexy was developed by Italian surgeons in the 1990s with the use of a circular stapling device for the surgical management of hemorrhoids first proposed by Allegra (1990). However, it was Longo's modification of the technique (Longo 1998) with a more proximal staple line away from the dentate line in a region devoid of pain fibers that provided an attractive surgical option for prolapsing hemorrhoids that avoided the painful anodermal wound and protracted postoperative recovery associated with conventional excisional hemorrhoidectomy. This led to widespread adoption of stapled hemorrhoidopexy, mainly across Europe and North America.

In 2008, a Health Technology Assessment by Burch et al. (2008), including 27 randomized control trials, revealed that stapled hemorrhoidopexy was associated with less pain in the immediate postoperative period and less unhealed wounds at 6 weeks than conventional hemorrhoidectomy. However, stapled hemorrhoidopexy is associated with a higher rate of residual prolapse and recurrent hemorrhoidal in the longer term. Both approaches are safe with equally low rates of adverse event with economic analysis concluding that the additional costs of the staple gun were offset by savings due to reduced operating times and hospital stay in patients undergoing stapled hemorrhoidopexy. These findings are supported by a more recent meta-analysis of surgical therapies for hemorrhoids (Simillis et al. 2015). However, the recent eTHoS trial (Watson et al. 2016), a large pragmatic multicenter randomized control trial from the UK, which compared stapled hemorrhoidopexy with conventional hemorrhoidectomy, concluded that although associated with

increased postoperative pain in the short term, conventional hemorrhoidectomy was superior to stapled hemorrhoidopexy with reduced recurrence rates and better quality of life scores at 24 months. Certainly, the risk of residual skin tags is higher with stapled hemorrhoidopexy, and it appears that those patients with irreducible grade 4 hemorrhoids are those who are at greatest risk of recurrence and need for re-intervention following stapled hemorrhoidopexy.

As with all the surgical options available for tailored treatment of hemorrhoids, stapled hemorrhoidopexy should be chosen based on the preferences of both the patient and the surgeon.

2 Patient Selection

Stapled hemorrhoidopexy is indicated in patients with symptomatic grade 3 and 4 hemorrhoids or with grade 2 hemorrhoids that have had failures of other treatment modalities, and in selected patient with muco-hemorrhoidal prolapse. Absolute contraindications are Crohn's disease or ulcerative colitis, active anorectal sepsis, and anal stenosis that does not permit the insertion of the stapler. Stapled hemorrhoidopexy should also not be performed in patients who engage in anoreceptive sexual intercourse. Relative contraindications include patients who have had previous anorectal surgery and suffer from decreased sphincter tone. It has also been suggested that stapled hemorrhoidopexy is best avoided in patients who may have reduced rectal compliance and those with rectal hypersensitivity. Additional caution should be taken in selecting patients for stapled hemorrhoidopexy who require continued anticoagulation due to the risk of bleeding from the staple line.

3 The Technique

3.1 Patient Preparation

Stapled hemorrhoidopexy is performed as a day-case procedure under either regional or general anaesthesia supplemented with a local anaesthetic anal block. A cleaning enema approximately 1 h

Fig. 1 Insertion of the circular anal dilator (CAD), held in place with four stay sutures, is then followed by insertion of the purse string anoscope which demonstrates a large prolapsing hemorrhoid in the left lateral position



before surgery is recommended. Prophylactic antibiotics are not mandatory and can be left to the discretion of the surgeon.

3.2 Patient Positioning

Stapled hemorrhoidopexy may be performed in either the lithotomy or prone jack knife positions depending on surgeon preference, patient physique, and anaesthetic considerations. In the lithotomy position it is important that the hips are fully flexed to expose the entire perineum. This position has the advantage in women of facilitating vaginal examination during the operation. This is important to prevent accidental inclusion of the posterior vaginal wall in the staple line. Prone jack knife positioning enables better visualization in the event of bleeding from the staple line. Skin preparation and draping is standard. A gauze swab can usefully be inserted into the lower rectum and withdrawn to reveal the extent of hemorrhoidal and mucosal prolapse.

3.3 Insertion of the Circular Anal Dilator (CAD)

Four quadrant silk sutures are inserted at the anal verge, cut long, and held with hemostats. Applying traction with these sutures facilitates insertion

of the CAD with obturator. The obturator is then withdrawn and the CAD is inserted fully into the anal canal. The anal columns and lower rectal mucosa should be visible with the CAD protecting the dentate line. The stay sutures are then fed through the openings in the flange of the CAD to hold it in place throughout the procedure (see Fig. 1).

Care should be taken at all times during the procedure not to injure the perineal skin or hemorrhoidal tissue. Gentle and progressive digital anal dilatation before introducing the CAD may decrease the occurrence of postoperative anal fissure. In older patients or those at risk of incontinence, one could consider the use of an Eisenhammer retractor instead of the anal dilator in order to minimize the risk of sphincter damage.

3.4 Insertion of the Purse String

The next step is to insert the purse string suture. The purse string anoscope is inserted and the purse string placed with a 2/0 polypropylene suture on a 30 mm round bodied needle. The dentate line is not always clearly visible whereas the proximal extent of the hemorrhoidal tissue is better visualized. It is therefore best to avoid using the dentate line as a landmark for the positioning of the purse string. Particular attention must therefore be

Fig. 2 The two suture ends are pulled through the side hole in the stapler head using a suture-threading instrument



applied to position the suture 1–2 cm above the apex of the hemorrhoidal tissue with the aim not to include all the hemorrhoidal tissue, but a cuff of rectal mucosa and the most proximal part of the hemorrhoidal complex. A purse string placed too close to the dentate line will result in persistent postoperative pain and defaecatory urgency.

The purse string is best started at 12 o'clock in the midline anteriorly. The anoscope should never be rotated in the anal canal but instead should be removed and reinserted at each step. Suture bites should take mucosa and submucosa and not include the muscularis propria of the rectum. Excessive muscle incorporation into the doughnut may risk introduction of bacteria into the perianal tissues which may result in the rare complication of perianal sepsis.

The surgeon must ensure that a continuous purse string is placed avoiding gaps that can later lead to bridges of stapled mucosa. The purse string anoscope is removed and a gloved finger placed into the rectum across the purse string in order to assess for any gaps in the purse string. One should feel mucosa only. Care should be taken not to pull the purse string closed while checking its position as this will make insertion of the stapler more difficult. A digital vaginal examination should be performed at this stage to ensure the purse string has not tethered the posterior vaginal wall. If there is any concern over the adequacy of the purse string then it should be taken out and reapplied.

3.5 Insertion of the Stapler

A suitable circular stapling instrument (Proximate[®] PPH Circular Hemorrhoidal Stapler –Ethicon Endo-Surgery, Cincinnati, OH) is opened to its full extent. The head can be lubricated before being advanced proximal to the purse string. The purse string is then cinched closed around the central rod to ensure the entire circumference of the rectal mucosa is snug around the central rod before being tied down. The suture ends are then pulled through the holes in the stapler head using the suture-threading instrument (see Fig. 2).

3.6 Closure of the Stapler

The two suture tails can be placed together in a hemostat which in turn can then be held in order to apply gentle traction on the purse string. At the same time the head of the PPH stapler is then closed fully by rotating the closure mechanism in an anticlockwise direction. One must ensure proper alignment of the stapling device with the axis of the anal canal. Closure is confirmed by the presence of the orange position marker in the green firing zone found on the handle of the 33 mm PPH instrument (see Fig. 3). A further check to ensure that the posterior vaginal wall is not included within the head of the instrument should be carried out at this point. Many surgeons prefer to keep the stapler in the closed position

Fig. 3 The stapler is closed whilst maintaining traction on the suture and ensuring the gun remains in the longitudinal axis of the anal canal



Fig. 4 Following firing, the stapler is removed and stapler head opened revealing an excised doughnut of mucosa. The suture can be divided to help retrieve the specimen from the stapler



for approximately 20 s before firing in order to compress any edema out of the rectal wall thus facilitating application of the staples.

3.7 Firing of the Stapler

The PPH stapler is fired by first releasing the safety mechanism and then closing the handles fully in a single motion. The purse string is not divided by the stapler when it has been fired as the suture remains within the instrument head. Once the stapler has been fired, it should be removed by opening the head and rotating the closure mechanism one half turns in the clockwise direction (see Fig. 4).

The excised doughnut of mucosa should be removed from the instrument head and sent for histopathology. The ideal specimen should have

no disruption to its continuity and be absent of smooth muscle fibers (see Fig. 5). Whilst the specimen is being retrieved from the instrument, a gauze swap should be inserted into the anal canal to facilitate hemostasis.

3.8 Checking the Staple Line

Bleeding is the most commonly reported complication, although occurring at a lower rate when compared to excisional hemorrhoidectomy. Typically, primary bleeding occurs immediately following the procedure with secondary bleeding from 7 days postoperatively. The incidence of bleeding from the staple line has been reduced with the development of more modern stapling instruments that have a reduced staple height. In order to minimize the risk of significant

Fig. 5 Excised mucosal doughnut revealing no disruption to its continuity



postoperative hemorrhage, a careful examination of the staple line is required.

The purse string anoscope should be re-inserted in order to facilitate systematic inspection for staple line bleeding. Irrigation and suction can be helpful in order to determine bleeding points which should be under-run using a 3/0 absorbable suture. Electrocautery should not be used around the staple line. A degradable anal sponge dressing can also be placed to promote hemostasis.

3.9 Postoperative Care

With minimal perianal trauma and no painful anodermal wounds, stapled hemorrhoidopexy lends itself to day case surgery (see Fig. 6). One should therefore aim to discharge patients on the evening of the day of surgery. Postoperative analgesia with a nonsteroidal anti-inflammatory drug as required is appropriate alongside a stool softener, such as lactulose 5 mLs up to three times a day for 5 days. Routine use of laxative reduces the risk of postoperative faecal impaction and may help reduce the risk of thrombosed external hemorrhoids. Routine use of prophylactic postoperative antibiotics is not indicated, however, may be used in selected high-risk patients.

Urinary retention is an occasional problem especially in elderly males and therefore patients should only be allowed home once they have passed urine normally. Patients should be warned

that passage of small amounts of blood per rectum is common in the days following operation. The low rectal staple line may incorporate visceral sensory nerve afferents that can result in symptoms of tenesmus and urgency. Patients should be warned of this and reassured that such symptoms settle with time. Patients should also be advised to contact the surgical team if they experience increasing anorectal pain, fever, or impaction of faeces as these symptoms may indicate perineal infection. Patients should be encouraged to resume normal daily activities as soon as possible.

4 Conclusion

Stapled hemorrhoidopexy is a safe procedure with a low rate of postoperative complications. As with any surgical intervention, meticulous technique and careful patient selection is key to minimizing postoperative morbidity. Patients with reducible hemorrhoids who have failed nonoperative management and those patients who prefer an alternative that provides reduced short term pain but are willing to accept a higher recurrence rate are good candidates for stapled hemorrhoidopexy. Key steps to avoid postoperative morbidity include: accurate placement of the purse string suture 2–3 cm above the dentate line, avoidance of incorporating muscle in the purse string, ensure adequate staple line hemostasis, and use of short-term postoperative laxatives.

Fig. 6 Minimal perianal trauma and no anodermal wounds results in significantly reduced levels of postoperative pain in the short-term compared with excisional hemorrhoidectomy



5 Cross-References

- Classification of Hemorrhoidal Disease and Impact on the Choice of Treatment
- Literature Review on Hemorrhoidectomy
- Postoperative Complications Following Surgical Procedures for Hemorrhoids and Their Management
- Selection of Patients to the Surgical Treatment of Hemorrhoids

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Pros and Contrasts of Stapled Hemorrhoidopexy

28

Gabriele Naldini and Bernardina Fabiani

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Abstract

Stapled hemorrhoidopexy has always been a hotly debated topic among surgeons in favor and against this kind of procedure. Surgeons in favor have always emphasized the advantages over the traditional excisional surgery (less pain at rest and on defecation, earlier return to bowel function and normal activities, etc.) while surgeons opposed to the procedure have always documented its limits and severe complications. For this reason also literature has undergone these currents of thought, becoming unreliable for those who would have a clear and unequivocal view of this procedure. So, in my opinion, the stapled surgery is a good surgical option

when performed by expert surgeons and especially with right indications. In fact, a careful selection of patients can lead to a good outcome with a reduction of recurrence rate and risk of complications. For this reason, I am trying to write in an objective way about the pros and cons of the procedure, explaining its rationale.

1 Introduction

Stapled surgery for hemorrhoidal disease, performed since nearly 20 years, is still one of the most debated topics in colorectal surgery. This kind of procedure has experienced several historical phases: a rousing beginning in which only the advantages were highlighted (also because of a strong boost trade); a second phase of great contrasts between surgeons who were either

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absolutely in favor of stapled procedure or totally against; a third phase of relative disinterest (because of a boost trade reduction); and, luckily, a fourth phase of awareness, in which surgeons consider benefits of stapled procedure, trying to reduce the disadvantages, finding the right indications and improving technology to obtain a better outcome and to reduce complications.

None of this would happen if it was not a good technique and it did not give great satisfaction to surgeons and patients. Of course, we must also consider the great confusion that was generated around this technique, which has led, for example, many authors to call off this procedure. Stapled hemorrhoidectomy is an absolutely wrong notion and often it misled the technique and results. The etiopathogenetic principle at the base of this procedure should not be considered as a dogma and, consequently, stapled hemorrhoidopexy cannot be considered the only one solution to treat hemorrhoidal diseases.

In the fourth phase of awareness, surgeons obtain better results with a combination of great postoperative comfort of patients, the reduction of complications and the improving of long-term outcome. In order to be able to give some objective indications on pros and cons about stapled procedure, I cannot rely too much on the analysis of the literature because it reported everything and its opposite, depending on the point of view from which results were analyzed.

2 Considerations on the Rationale of the Technique

The unitary theory of the prolapse by Longo, which hypothesizes the evolutivity of hemorrhoidal prolapse until to the external prolapse, is absolutely fascinating, but, in my opinion, it represents more the rationale of the technique (a regulated rectal resection in consideration of the amount of rectal prolapse) rather than the real etiology of hemorrhoidal prolapse. It is certainly true that behind every hemorrhoidal prolapse there is an internal rectal prolapse, but unfortunately, the treatment of the internal rectal prolapse does not always solve all the symptoms that lead the patient to the surgeon. The typical evidence is that the hemorrhoidal component is extremely small in the external prolapses, so the progression from hemorrhoidal prolapse toward rectal prolapse is fascinating but visually unsustainable (Fig. 1).

The biggest mistake that the scientific community continues to make is to consider all patients with symptoms related to hemorrhoidal disease as equal. Those who deal with this disease know that it is absolutely not true. All the efforts of the authors are in comparing the various techniques, without considering that, in this way, they compare the surgical techniques without taking into consideration the great variability of clinical and anatomical presentations.

Fig. 1 Complete external rectal prolapses with small hemorrhoidal component

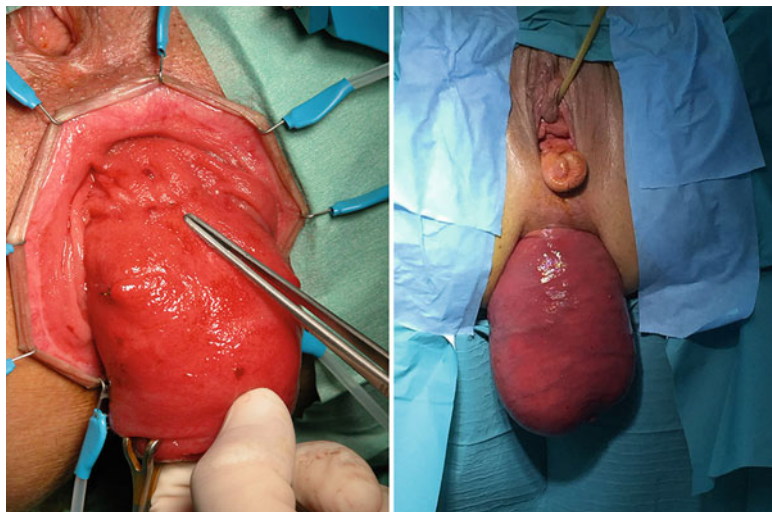
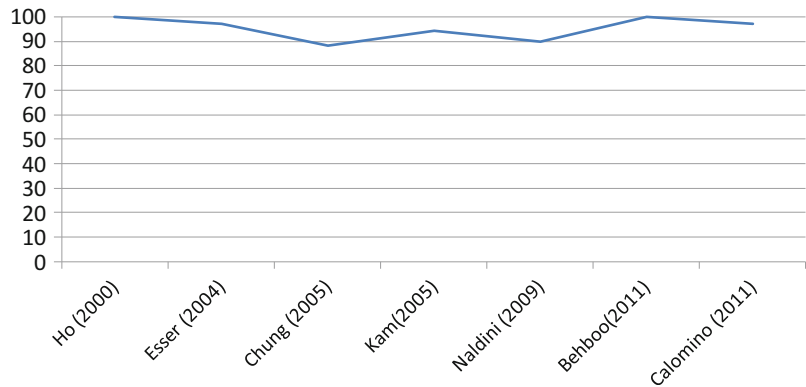


Fig. 2 In literature many authors reported more than 80% of specimen with muscle after stapled procedure



Unfortunately, Goligher's classification does not help us very much in this, because it considers only the reducibility or not of prolapse, that are absolutely not enough for a proper patient classification.

Goligher's classification does not give us any information on the size of the prolapse and its impact on the quality of life.

In addition to not give us information on the size of the prolapse and its impact on quality of life, I want to emphasize that the reducibility or not of the prolapse is mainly linked to the patient's habits, and it does not correlate absolutely with the "severity" of the clinical situation.

Surgeons who perform stapled surgery treat rectoanal prolapse to resolve symptoms related to hemorrhoids. The first thing to underline is that surgeons continue to consider a false message that comes from literature in which stapled procedure is deemed as a mucosectomy. Daily experience and literature showed that the treatment with stapler lead always to a full thickness resection (Ho et al. 2000; Esser et al. 2004; Chung et al. 2005; Kam et al. 2005; Naldini et al. 2009; Behboo et al. 2011; Calomino et al. 2011) (Fig. 2).

If it could be possible to perform a mucosectomy (representing a technical mistake), the results would be worse as pointed out by Festen et al. (2012). So, categorically, those who think that a full thickness resection of the rectum (or some minimal portions of the rectum) could be an over-treatment for hemorrhoids should not perform this technique hiding themselves behind a lie. This cannot be the strongest topic against this surgery, concluding accordingly that the complications can be more serious. Severe septic complications have

been described in all kinds of surgical treatment for hemorrhoidal disease, and all of these procedures involve not only mucosa but also the deeper layer of the rectal wall (Albuquerque 2016; Berstock et al. 2010; MCloud et al. 2006).

About possible limits of this technique, in a portion of patients with symptoms due to the external component of hemorrhoids (for example in recurrent thrombosis) or to large hemorrhoids difficult to reposition inside the anal canal (Fig. 3a), stapler procedure could not guarantee a complete resolution of the symptoms. In this case, an hemorrhoidectomy is mandatory and sometimes it could be associated with a stapler procedure.

The resection of a rectal prolapse restores or decreases the dimension of the rectal ampulla with the risk of onset of incontinence or more often a worsening of it. This complication is rare in case of a normal anatomy and functionality of the sphincters, but it is more frequent in case of functional and/or anatomical alterations. A good selection of patients is very important to reduce these complications (Naldini et al. 2015).

3 Pros

- *Operative time*: It should be considered in this period in which costs analysis is important but, in my clinical practice, it does not represent a support element of the technique, because it could be related to the difficulties of the clinical situation regardless of the technique used.
- *Shorter hospital stay*: In my opinion, this should not be considered as a pros factor



Fig. 3 Limits of stapled hemorrhoidectomy: (a) Hemorrhoidal prolapse with a large external hemorrhoidal component in which hemorrhoidectomy is mandatory;

(b) Reducible hemorrhoidal prolapse with internal prolapse evaluation in which stapler procedure is indicated

because all types of procedures for hemorrhoidal disease could be performed on day surgery or with a day of hospitalization on the basis of the preferences or needs of the surgeon. I want to underline the concept of the needs of the surgeons, often forced by the administrations to an early discharge. A technique without early complications does not exist, and anyway there is no evidence of superiority among the various techniques on this point.

I emphasize again that the management of proctologic complications at your home can present many difficulties, because for the patient it is a not visible and difficult to manage area. For this, if it is possible, I prefer to discharge the patients the morning after the procedure.

- *Less pain at rest and on defecation:* It is certainly true that in most cases pain is very little or absent since the day after surgery. As in all techniques for hemorrhoids, we prescribe analgesic therapy at home for at least 3 or 4 days, but sometimes pain may be very strong. It depends on two factors: the quality of the surgical treatment and the proper management of intraoperative and perioperative analgesia.

Unfortunately, years of experience and the attendance of operating rooms around the world have led me to understand that the stapled hemorrhoidectomy is “the most interpreted operation” in the world. Everyone does it in his own way. The most important factor, that is the level of the suture line, is a subject very little discussed, instead representing the key to pain and outcome.

Very low sutures could give more pain, instead very high sutures could give tenesmus, poor lifting effect (residual or recurrent disease), or new difficulties to evacuate for hour-glass rectum. Also the need to give many hemostatic stitches, especially in the posterior wall, may be hazardous to the risk of involving puborectalis muscle, creating fixity on the floors below.

- *Earlier return to bowel function due to less painful defecation:* This is the most important factor. The patient, who is informed that the first bowel movement will not be painful, lives the first defecation with less anxiety and consequently less spasm of pelvic muscles.

For years, pain represented the major fear and deterrent to undergo surgery for patients.

For this reason, patients went to the surgeon when hemorrhoidal disease became unbearable, presenting many advanced anatomical situations. After stapled procedure, without open wounds or multiple running sutures, but only an anastomotic line, pain is really very little.

- *Shorter time off work and earlier return to normal activities:* This is undeniable also because, even though patients might have the same pain compared with a stapler hemorrhoidopexy, in a Milligan Morgan hemorrhoidectomy, the presence of secretions and open wounds, that require more diligent and scrupulous hygiene, represent a deterrent to the resumption of normal activities. In conclusion, I can definitively say that with a good indication and a good selection of patients (about 60–70% of patients with symptoms from hemorrhoids), stapled hemorrhoidopexy is the procedure that best combines good post-operative comfort with a good outcome at medium and long term.

4 **Cons**

- *Early complications:* It is interesting to note that in a recent systematic review (Porrett et al. 2015) about complications published in 2015, including 86 articles in the bibliography, only 2 were published after 2010! This could mean that either complications were reduced thanks to technological improvements, better indications and completion of learning curves, or the attention to the problem decreased because of the reduction of “media pressure.” By analyzing literature and clinical practice, it is undeniable that there was a peak of complications and new complications. Many kinds of complications, some of which severe, were reported in literature, but almost all of them were reported in case reports and not in clinical trials. This is also the result of great economical and philosophical debate that was unleashed on this procedure. In the review by Porrett et al. (2015), early complications rate ranged from 2.3% to 58.9% with five deaths on

a overall complication rates ranged from 3.3% to 81%. How it is possible? Or we do not perform the same procedure, or we do not operate the same patients or we do not do the same job, or someone tells lies. But if there really were all these problems, surgeons who perform stapled procedure would be masochists and certainly their patients would abandon them immediately. In literature, some really “bizarre complications” are reported, like rectal lacerations and rectal closure. Rectal lacerations due to difficulty in pulling out the stapler after firing: How is it possible? If the surgeon fails to pull out the stapler, he can open the stapler completely and remove it under direct vision. Rectal closure due to an incorrect introduction of the stapler after performing purse string suture: this is a severe technical error and I think it cannot be considered as a possible complication of the technique!

One thing is absolutely true: being a super-specialist technique, it should not be performed by a general surgeon who occasionally treat hemorrhoids (this was the initial problem of the trivialization of the technique under the commercial drive), but the procedure should be performed by experienced surgeons in this area, especially in performing stapler procedure.

But we have to consider that, being still a rectal resection although sometimes partial, complications may also include the possible involvement of the mesorectal and still extraluminal tissues. Thanks to improved technology, bleeding complications from intraluminal suture drastically decreased, equating to all other techniques. The most severe complications are pararectal hematomas and anastomotic dehiscences. In these cases, two things are really important: surgeon must have experience in the management of these complications and above all he must manage his own complications. It is also crucial to recognize the complication promptly. Pararectal hematoma can self-restraint or, if it is active, it could be managed through selective embolization or intrarectal package. In presence of intraoperative dehiscence of the anastomoses,

surgeon can perform again the suture with transanal stitches. But in case of postoperative dehiscence, if it is a partial one and the patient is asymptomatic (as in most of the cases), surgeon may avoid surgical treatment and observe patient. It is frequently a more aggressive attitude by a surgeon who treats the complication after stapler procedure performed by others.

- *Late complications*: They could be the following:
 - *Pain*: It is not always true that stapler procedure is painless, but it is certainly the least painful approach. I disagree with Khubchandani et al. (2009) about his definition of post-PPH (stapler Procedure for Prolapse and Hemorrhoids) pain syndrome. The causes of prolonged postoperative pain can be basically two: Performing stapler procedure on patients suffering pain before surgery, mistakenly thinking that chronic pain could be secondary to hemorrhoids (chronic pain is not a typical symptom of hemorrhoidal disease); Involving, even slightly, the pelvic floor muscles with the suture (wrong inclination of the stapler) or with hemostatic stitches. In these cases, the suture remains fixed on the tissues below, so it gives referred pain due to the traction on the muscular tissue during physical activity or rectal stimulation. The first case is an evident and unfortunately frequent error about indications. In case of chronic pain in association with hemorrhoidal prolapse, every kind of operation, and in particular stapler procedure, can only worsen the situation. The second case is a “normal” postoperative complication (like the stenosis after hemorrhoidectomy) that it must be treated surgically as soon as possible with the removal and mobilization of the painful suture as reported in literature by Menconi et al. (2016). This study showed high rates of success when surgical approach is precociously performed.
 - *Urgency and incontinence*: Repositioning within the hemorrhoids through the resection of the prolapse, the stapler procedure

can surely reduce the size and therefore the compliance of the rectum. For this reason also in this case a correct selection of patients is very important, in fact this kind of procedure is not indicated for patients with preoperative anal continence diseases or anatomical sphincter defects, or patients with diarrhea or irregular bowel and in those with rectal hypersensitivity because of irritable bowel syndrome (IBS). In our experience, urgency is present in 17% of patients at 1 week after stapler hemorrhoidopexy with high volume device and it resolved in about 67% of cases after within 6 months after surgery, furthermore good results were obtained with pelvic floor rehabilitation (Giani et al. 2014). However, I reiterate that the problem is the selection of patients.

- *Stenosis*: Many authors talk about anal stenosis, but it would be more correct to talk about anastomotic stenosis and, although it is a rare complication, it must be considered. Stenosis is not related to the kind of device and its dimension or the kind of suture (double or multiple one, etc.). Stenosis seems to be related to preoperative or postoperative proctitis and to postoperative diarrhea. As in postoperative chronic pain, also in stenosis, the removal of a portion of the suture is indicated. The following use of dilators is highly recommended to reduce the risk of recurrence. Certainly, anastomotic stenosis is more manageable than anal stenosis.
- *Recurrence*: Literature is drastic about recurrence after stapled hemorrhoidopexy, and I confirm the pessimistic view of long-term recurrence. For this reason, some surgeons and I started to resect more tissue using two staplers and then a high volume stapler in case of major prolapse. Despite the same technique adopted, the first produced staplers are often insufficient to correct large prolapses because of their small case that it cannot hold all the prolapsing tissue, so more staplers or an high volume one are necessary to receive in the case all

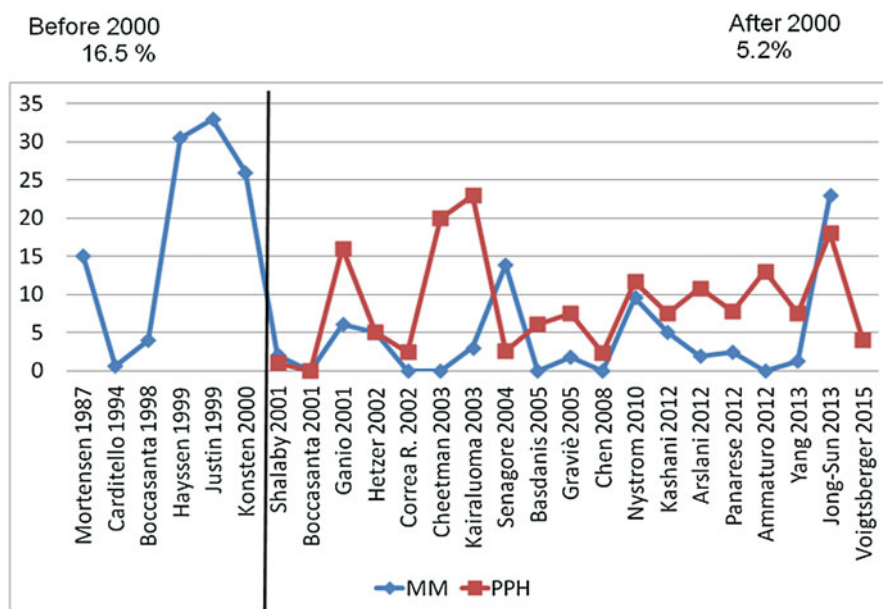


Fig. 4 Stapled surgery effect on the Milligan Morgan results. *MM* Milligan Morgan Hemorrhoidectomy recurrence, *PPH* recurrence after stapled procedure for prolapsed hemorrhoids

the prolapse to be resected. Moreover, the PPH was not a real dedicated device to this use (being the first product tool and never upgraded) and only subsequently dedicated devices were produced to solve these needs. Adopting tailored prolapse surgery philosophy, which allows to resect the amount of tissue that surgeon feels the need to remove in a specific case also on the basis of the amount of prolapsing tissue, recurrence rate dramatically decreased (Naldini et al. 2015). This does not mean to change the kind of operation. I just pointed out that the procedure implies a full thickness resection, also using a PPH, so complications that could occur are the same. The same happens during a colonic resection in which the length of the bowel tract resected (10 or 20 cm) does not change neither the probability nor the type of complications. I agree with the literature that stresses that Milligan Morgan technique guarantees the lowest recurrence rate, but it is equally true and singular that literature showed a marked

improvement of recurrence rate after Milligan Morgan since stapler surgery was born (Fig. 4). We could assess that one of the real benefits of stapled surgery was to improve the Milligan Morgan results.

- *Costs*: I am sure that I would never accept to undergo to a less comfortable operation with some doubts (outcome) and some certainties (postoperative pain), to save few money. I say this especially considering the important role that the anal region plays on the serenity and quality of life. An anal disease could interfere with the general and above all psychological welfare, so the cost of anything that might help to improve the treatment of this area is warranted. That said, the costs have dropped and they are expected to fall further, thanks to new competitors who have decided to invest mainly in the proctological field. In countries where cost-effectiveness is calculated including also the “social costs,” surely a surgery that allows an early return to work appears to be advantageous.

5 Conclusions

I hope I have been able to communicate my real feeling about surgery with stapler for treatment of hemorrhoidal disease. My thoughts can be summarized as follows: stapled procedure is an excellent option (in my opinion the best) for the treatment of hemorrhoidal disease, in case of good indications and performed by dedicated surgeons who are able to treat any complication in high volume centers. It is dangerous to argue that stapled hemorrhoidopexy is suitable for treating all types of hemorrhoids, that it is a simple procedure without complications and postoperative pain, and that can be done by all. This message could lead to bad results and many problems.

6 Cross-References

- [Classification of Hemorrhoidal Disease and Impact on the Choice of Treatment](#)
- [Literature Review on Stapled Hemorrhoidopexy](#)
- [Main Advantages of Stapled Hemorrhoidopexy](#)
- [Main Disadvantages of Stapled Hemorrhoidopexy](#)
- [Stapled Hemorrhoidopexy: Techniques and Results](#)
- [Technical Tips and Tricks of Stapled Hemorrhoidopexy](#)
- [Why and When I Do Prefer the Stapled Hemorrhoidopexy](#)

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Main Advantages of Stapled Hemorrhoidopexy

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Juan García-Armengol and José V. Roig

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Abstract

It is rational to recommend a tailored surgery in the treatment of different grades of symptomatic hemorrhoids. For this reason, the colorectal surgeon needs to perform different procedures and to know very well the advantages and disadvantages of them.

Our aim is to review the main advantages of stapled hemorrhoidopexy during the short and long-term follow-up. We will compare these outcomes with traditional excisional surgery or conventional hemorrhoidectomy, and with the new procedures like transanal hemorrhoidal dearterialization with mucopexy.

There is scientific evidence on the advantages of the stapled hemorrhoidopexy in terms

of less postoperative pain and a shorter recovery time compared with excisional hemorrhoidectomy. The concern of significantly higher symptomatic recurrence in the long term after stapled hemorrhoidopexy would recommend a tailored indication of the different surgical procedures, independently or in association with stapled hemorrhoidopexy.

1 Introduction

It is clear and rational to recommend a tailored surgery in the treatment of symptomatic hemorrhoids that are refractory to office procedures, usually in large external hemorrhoids or significant prolapse grade III to IV (Rivadeneira et al. 2011). It could be necessary to use different procedures according to the grade of hemorrhoids, and even to the grade for each main cushion or hemorrhoidal plexus in a case of asymmetric prolapse. For this reason, the colorectal surgeon

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needs to perform different procedures and to know very well the advantages and disadvantages of them.

In 1998, Longo proposed a stapled hemorrhoidopexy (Longo 1998). This technique makes a circumferential rectal mucosectomy without trauma or dissection of the very sensitive anal mucosa or anoderm, with a stapled mucosa anastomosis, approximately 3 cm above the dentate line. The aim is to reduce hemorrhoidal prolapse based on the etiology of symptomatic hemorrhoids that are determined by an internal rectal prolapse descending into the anal canal or beyond the anal verge, pushing-out the anorectal mucosa and hemorrhoidal plexus. For this reason, stapled hemorrhoidopexy could be very effective for important internal prolapsing disease. However, for large external hemorrhoids this procedure may not address it adequately.

Our aim is to review the main advantages of stapled hemorrhoidopexy in terms of efficacy related to its safety, postoperative symptoms and recovery time and, finally, prevention of recurrence of prolapse and symptoms during a long-term follow-up. We will compare these outcomes with traditional excisional surgery or conventional hemorrhoidectomy, and with the new procedures like transanal hemorrhoidal dearterialization with mucopexy.

2 Advantages in Terms of Safety, Postoperative Symptoms, and Recovery Time

Stapled hemorrhoidopexy rapidly became a widely used surgical procedure, even as an “ideal” treatment, due to the short operative time and low postoperative pain without perianal wounds. Although hemorrhoidal surgery can be performed as an ambulatory surgery of whatever surgical procedure that we can choose for the treatment of symptomatic hemorrhoids, the possible advantages of stapled hemorrhoidopexy in terms of low postoperative pain allow to perform easily this procedure like a day-case surgery (Caviglia et al. 2009). Globally, all these factors facilitate a faster recovery time for the patients.

Since its introduction, a lot of randomized controlled trials and systematic reviews have confirmed these initial findings.

Burch et al. (2009) published a systematic review of twenty-seven randomized controlled trials (2279 patients included) comparing stapled hemorrhoidopexy and conventional hemorrhoidectomy. Seventeen (89%) and 14 (88%) studies reported a shorter operating time and hospital stay, respectively. However, recently, a new multicenter randomized controlled trial found a low operating time and length of stay in patients with a stapled hemorrhoidopexy, but there were no differences with traditional excisional surgery (Watson et al. 2016). Comparing stapled hemorrhoidopexy with transanal Doppler-guided hemorrhoidal artery ligation with mucopexy (DGHAL), Lehur et al. (2016), in a multicenter randomized controlled trial, found a longer mean operating time of DGHA compared with stapled hemorrhoidopexy (44 ± 16 vs. 30 ± 14 min; $p < 0.001$).

The overall complication rate after stapled hemorrhoidopexy is similar to traditional excisional surgery (Burch et al. 2009; Watson et al. 2016; Naldini 2011). Tjandra and Chan (2007) in a systematic review and meta-analysis of almost 2000 patients found a complication rate of 20.2% for stapled hemorrhoidopexy versus 25.2% for traditional excisional surgery ($p = 0.06$). In the same way, Lehur et al. (2016) found a similar rate of operative-related adverse events occurred after stapled hemorrhoidopexy (26%) and after DGHAL (24%) ($p = 0.70$). However, we cannot forget that although serious complications occur after all techniques performed for the surgical treatment of hemorrhoids, some publications have revealed early serious complications (presacral hematoma, rectovaginal fistula, rectal perforation, perineal sepsis, and rectal necrosis) associated with stapled hemorrhoidopexy (Naldini 2011).

Recently, Watson et al. (2016) in a multicenter and randomized controlled trial found serious adverse events in 24 (7%) of 338 patients with stapled hemorrhoidopexy and in 33 (9%) of 352 patients who received traditional excisional surgery. The rate of bleeding on its own was higher

in the stapled hemorrhoidopexy group with 6 cases (2%) versus 1 case (<1%) in the traditional excisional surgery group. With the aim to improve the rate of bleeding after stapled hemorrhoidopexy, Giuratrabochetta et al. (2013) have investigated the results with new stapler devices. They have compared the PPH03[®] or PPH01[®] stapler (Ethicon Endosurgery) with EEA[®] stapler (Covidien) in a prospective randomized controlled trial in four referral colorectal centers. They found that the median number of hemostatic stitches apposed in the EEA[®] stapler group was significantly lower (1 vs. 3; $p < 0.0001$). Bleeding during the postoperative period occurred only in two cases of the PPH03[®] group. They conclude that EEA[®] stapler has better hemostatic properties compared with the PPH01 and PPH03 groups.

Stapled hemorrhoidopexy became widely used because it was associated initially in several randomized control trials with a low postoperative pain and recovery time compared with excisional hemorrhoidectomy. In the above mentioned systematic review of Burch et al. (2009) with twenty-seven randomized controlled trials comparing stapled hemorrhoidopexy with conventional hemorrhoidectomy, 19 (95%) trials reported less pain and 14 (93%) a shorter recovery or convalescence time. Watson et al. (2016) found that stapled hemorrhoidopexy was less painful than excisional hemorrhoidectomy in the short term; however, this difference disappeared by 6 weeks.

Also in terms of postoperative pain and recovery time, Lehur et al. (2016) compared stapled hemorrhoidopexy with DGHAL. They found that DGHAL had significantly less pain in a visual analogic scale (postoperative: 2.2 vs. 2.8; $p = 0.03$; at 2 weeks: 1.3 vs. 1.9; $p = 0.01$) and a shorter sick leave (12.3 vs. 14.8 days; $p = 0.04$). However, the randomized trial published by Lucarelli et al. (2013) comparing stapled hemorrhoidopexy with transanal hemorrhoidal dearterialization and mucopexy (THD) in patients with grade III and IV hemorrhoids, the secondary outcome measures of postoperative pain, return to normal activities, complications rate, and symptom control were similar between the two procedures.

3 Long-Term Outcomes After Stapled Hemorrhoidopexy

After analyzing the advantages of the short-term after stapled hemorrhoidopexy, it is important to evaluate and to know its long-term outcomes and the quality of life after this procedure with the aim to keep a tailored surgery in the treatment of symptomatic hemorrhoids, with different possible procedures according to the grade of hemorrhoids.

Since its introduction, stapled hemorrhoidopexy had a fast and big “popularity,” with wide extension and experience all over the world. However, also it was clear of some concerns about the long-term functional results or potential degree of recurrences. In order to evaluate these concerns, long-term results have been published with enough number of randomized controlled trials during the last decade.

The experience of a single institute with a high number of consecutive patients ($n = 1144$) using stapled hemorrhoidopexy revealed during the follow-up a very low rate for functional disorders and a low rate of recurrences: 8 patients (0.7%) with inflammatory reaction at the staple line, rectal stenosis in 22 cases (1.9%), and recurrence in 46 cases (4%) (Voigtsberger et al. 2016).

Moreover, it is important to assess the type of recurrent symptoms and the possible impact on the level of satisfaction during the long-term follow-up. In this sense, Wolthuis et al. (2012) have published the results in 140 patients with a median follow-up of 43 months. At the end of follow-up, 79 (56%) patients remained symptom-free. The recurrent symptoms were: prolapse in 52 (37%) cases, bleeding in 46 (32%) cases, anal pressure or pain in 24 (17%), and pruritus in 21 (15%). Twenty (14%) cases required a surgical resection and 15 (10%) had sclerotherapy or rubber band ligation. Despite these high percentages of recurrent symptoms, 89% of the patients were satisfied with the procedure.

Aytac et al. (2015) compared the long-term outcomes and the quality of life assessed with questionnaires in patients with stapled hemorrhoidopexy and Ferguson hemorrhoidectomy. The level of satisfaction measured with positive answer to the possibility to perform the same

surgery again if needed was 81% in Ferguson hemorrhoidectomy and 83% for stapled hemorrhoidopexy. There were no differences between the groups in long-term anorectal pain, Cleveland global quality of life, fecal incontinence severity index, and fecal incontinence quality of life scores.

The systematic review of 27 randomized controlled trials (2279 patients included), published by Burch et al. (2009), comparing stapled hemorrhoidopexy with conventional hemorrhoidectomy, revealed in the longer term that prolapse and the number of reinterventions for prolapse were significantly higher after stapled hemorrhoidopexy.

More recently, Watson et al. (2016) in a multicenter and randomized controlled trial comparing also stapled hemorrhoidopexy with traditional excisional surgery found that the quality of life curve over 12 months after the operations showed no differences. However, over 24 months the quality of life curve was significantly higher in the traditional excisional surgery group. Likewise, clinical recurrence of hemorrhoids, tenesmus, and the Cleveland Clinic Faecal Incontinence Score was significantly higher at 12 and 24 months of follow-up.

About the concern of recurrence symptom in the long term after stapled hemorrhoidopexy, Altomare et al. (2016) has evaluated in a multicentric randomized controlled trial the role of a more extensive mucosal resection to prevent hemorrhoidal recurrence with the use of a PPH01/03 or an EEA stapler with a minimum follow-up of 4 years. However, they did not observe any significant difference in the long-term recurrence rate.

Likewise, for symptomatic external grade IV hemorrhoids or even if there is a clear residual prolapse or large external hemorrhoid after the firing of the stapler, Araujo et al. (2016) have published their long-term results after stapled hemorrhoidopexy alone and complemented by excisional hemorrhoidectomy. They conclude that the association of an excisional procedure was effective in advanced hemorrhoids and may have prevented a high recurrence rate with stapled hemorrhoidopexy alone.

Comparing stapled hemorrhoidopexy with transanal Doppler-guided hemorrhoidal artery ligation (THD), Infantino et al. (2012) published a prospective randomized multicenter study comparing both surgical procedures for third-degree hemorrhoids, and they found that late complications and the obstructed defecation score were significantly higher in the stapled hemorrhoidopexy group. No differences were found in residual hemorrhoids, need for further treatment of hemorrhoids, postoperative incontinence, and quality of life.

However, the multicentre randomized controlled trial of Lehur et al. (2016) comparing stapled hemorrhoidopexy with transanal Doppler-guided hemorrhoidal artery ligation with mucopexy (DGHAL) found at 1 year of follow-up that DGHAL led to more residual grade III hemorrhoids (15% vs. 5%) and a higher reoperation rate (8% vs. 4%). Similar results were obtained by Lucarelli et al. (2013) with their randomized trial comparing stapler hemorrhoidopexy with transanal hemorrhoidal dearterialization with mucopexy (THD) in patients with grade III and IV hemorrhoids, with the primary outcome of presence of recurrence in a median long-term follow-up of 42 months. They reported a recurrence rate of 25.4% after THD, significantly higher ($p = 0.021$) than the recurrence of 8.2% that occurred in the stapler hemorrhoidopexy group.

4 Conclusions

Our general recommendation is to indicate a tailored surgery in the treatment of symptomatic hemorrhoids that are refractory to office procedures, usually in large external hemorrhoids or significant prolapse grade III to IV. We accept clearly that stapled hemorrhoidopexy proposed by Antonio Longo has had the important role in directing a great attention to the importance of internal mucosal rectal prolapse in the etiology of symptomatic hemorrhoids. For this reason, in a lot of cases of symptomatic hemorrhoids we should avoid the damage or excision of the anal canal mucosa or anoderm.

There is enough scientific evidence of the main advantages of the stapler hemorrhoidopexy in terms of less postoperative pain and a shorter recovery time compared with excisional hemorrhoidectomy. Although the great interest for new procedures that might decrease the postoperative pain is quite logic, we cannot forget the need of a good technique to prevent initially as much as we can the possibility of serious complications that can occur after all techniques performed for surgical treatment of hemorrhoids and, of course, also specially after stapled hemorrhoidopexy.

It is clear the concern of significantly higher recurrence symptom in the long term after stapled hemorrhoidopexy compared with excisional hemorrhoidectomy. Likewise, we will need more evidence of major randomized trials about the long-term outcome of stapled hemorrhoidopexy compared with other new procedures like transanal hemorrhoidal dearterialization and mucopexy.

Thus, in our criteria, we can obtain the best advantage of stapled hemorrhoidectomy in grade III hemorrhoids with an associated circumferential internal rectal mucosal prolapse. For small grade IV hemorrhoids, it could be a less painful option but it will be important to inform the patient the higher possibility of recurrence at the long term compared with excisional hemorrhoidectomy. For large and very symptomatic external grade IV hemorrhoids our first option is traditional excisional hemorrhoidectomy. However, if we observe a clear circumferential rectal mucosal internal prolapse associated to the large grade IV prolapsed hemorrhoids or even if we observe intraoperatively a residual prolapse or large external hemorrhoid after the firing of the stapler, we would recommend at least to associate to the stapler hemorrhoidopexy some degree of external hemorrhoids excision if we want to have a good control of the postoperative symptoms during the follow-up.

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Main Disadvantages of Stapled Hemorrhoidopexy

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Abstract

The Longo technique, described in 1993, is proposed for the treatment of hemorrhoidal disease. The stapled hemorrhoidopexy has been introduced as an alternative to conventional hemorrhoidectomy. Despite a clear perioperative advantage regarding pain and patient comfort, the stapled hemorrhoidopexy may be

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followed by unusual postoperative complications. Complications may occur after stapled hemorrhoidopexy, some are particularly serious, especially bleeding and sepsis. Since 2002 more than 130 articles have been published reporting complications during and after stapled hemorrhoidopexy.

Complications were classified as being either early or late if they occurred within 7 days of the operation. Those occurring after 7 days were considered to be late.

The most common complication is early bleeding. Severe postoperative pain could be caused by dehiscence of the anastomosis or due to the fact that the anastomosis is too near to the linea dentata.

A lot of long-term complications have been described. Most of them are related to either an incorrect indication for surgery or technical errors. Severe complications leading to death have been described but are rare. The persistent anal pain after stapled hemorrhoidopexy has in the most cases the objective findings of the staple line hardened and fixed to muscular layer beyond. Irreversible urge incontinence due to lesions of the sphincter muscle or a diminished rectal capacity due to resection of too much mucosa is quite common complication if the procedure is not performed properly. Rectovaginal fistulas and anastomotic diverticula are very rare but possible.

Stapled hemorrhoidopexy (SH) was largely accepted as it was claimed that it would be completed in a minor time, with less postoperative complications and better postoperative outcomes in comparison of the standard surgical techniques for the treatment of hemorrhoidal disease (as Ferguson and Milligan-Morgan techniques). In comparison to traditional hemorrhoidectomy, stapled hemorrhoidopexy is characterized by a reduced postoperative pain, due to the absence of cutaneous wound and an earlier return to work (Sultan et al. 2010; Stolfi et al. 2008). In the latest years many studies regarding postoperative outcomes and complications of stapled hemorrhoidopexy have been published. All these

studies in literature have a too short postoperative follow-up to demonstrate the same result as the standard techniques in term of recurrence. Less postoperative pain and early return to work must be balanced to the higher cost of the procedure and also to the cost of the possible, even if rare, life-threatening complications. In literature we found a multicenter randomized clinical trial with a 7 years follow-up from Ganio et al. that in all small series of patients demonstrate the effectiveness of both techniques; its limit is the small number of patient selected, just 100 (Ganio et al. 2007). Although stapled hemorrhoidopexy is a simple operation, it may result in major complications. Both early and late complications have been described. The overall complication rates of stapled hemorrhoidopexy reported in international literature ranges from 3.3% to 81% with an incidence of early complications between 2.3% and 58.9% and late complications between 2.5% and 80%, excluding recurrence which occurred up to 58.9%. Recurrence rate is considered to be higher than after traditional hemorrhoidectomy. Several trials had reported a higher rate of recurrence in patients treated with stapled hemorrhoidopexy than in patients who underwent traditional hemorrhoidectomy: some authors retain that many cases of recurrence can be due to the not always correct indications to hemorrhoidopexy.

Complications are commonly divided into early and late depending on whether they occur before or after the seventh day. The most common early complications are bleeding, anal pain, urinary dysfunction, and suppuration. Perforation, obstruction, anastomotic dehiscence, edema of the anastomotic ring, pelvic sepsis, early fecal urgency, and early thrombosed external hemorrhoids are also described. The possible late complications are bleeding, thrombosed external hemorrhoids, anal strictures formation, fecal and flatus incontinence, fecal urgency, submucosal anastomotic cysts, and recurrence of hemorrhoids. In Literature "stapled hemorrhoidopexy syndrome (SHS)" is described as a late complication that includes the presence of urgency defecation, feeling of foreign body, and anal pain of variant amplitude (Efthimiadis et al. 2011).

1 Early Complications

1.1 Bleeding

Postoperative bleeding is the most common complication after stapled hemorrhoidectomy, but its incidence is lower than after traditional hemorrhoidectomy. Bleeding occurs more frequently immediately after surgery or from the postoperative day 7 onwards. Early postoperative bleeding incidence rate ranges from 0% to 68% (Stolfi et al. 2008); surgical reintervention for hemostasis is necessary in approximately 0–4% of cases (Lee and Jung 2016). In another review by Pescatori and Gagliardi the rates of rectal bleeding after PPH range between 1% and 11% and it is more like to occur in patients with fourth grade hemorrhoids (11%) (Pescatori and Gagliardi 2008).

Early postoperative bleeding is commonly secondary to an arteriolar bleed along the stapled line or to an injury to the mucosa caused by defective techniques, and it may be resolved with a manual oversewing of the stapled line and the use of an endoanal sponge. Some authors stated that the reason for severe postoperative bleeding is the transection of the terminal branches of the superior hemorrhoidal artery (Gerjy et al. 2011).

Chronic bleeding may be caused to postoperative proctitis or to a granulomatous foreign body reaction to retained staples.

The use of a stapler with a smaller staple height closure can be recommended: after the introduction of the newer circular stapler which has a closed stapled height of 0.75–1.5 mm (PPH 03) instead of the precedent which was 1–2.25 mm (PPH 01), the incidence of early postoperative bleeding has been reduced because of an increase in compression on rectal tissue and blood vessels (Sultan et al. 2010; Ceci and Picchio 2008). In order to obtain a better hemostasis the circular stapling device would be held closed and left in place for about 2 min (Grigoropoulos and Kalles 2001).

Early postoperative bleeding could also be due to the presence of folded mucosa in the stapled line (Pinto et al. 2014). In our experience it is

important to check accurately the staple line at the end of the operation, and if bleeding is present, putting nonabsorbable stitches rather than using electrocautery is recommended (Faucherin and Voirin 2010). In the study of Kanellos et al., 86.6% of patients needed an additional hemostasis during the operation (Kanellos et al. 2006).

It is important to distinguish the clinical significance of the postoperative bleeding; in this study no patients had a severe life-threatening postoperative bleeding. In literature, we found few recommended interventions to treat postoperative bleeding; it depends on its clinical significance and it includes compression with a Foley catheter (that is useful also to diagnose the bleeding), use of mesh, suturing, local injection of adrenaline, and in a small number of cases also blood transfusions (Stolfi et al. 2008). In some cases of postoperative bleeding, a reintervention may be necessary. The additional hemostasis could be done under proctoscopy, especially in cases that could be managed with injection of adrenaline; if the patient is not able to tolerate proctoscopy because of discomfort, an anesthesia is required.

Rectal intramural hematoma is a less frequent postoperative complication with an incidence of 1.5% (van Wensen et al. 2008). It can be suspected with a painful digital rectal examination showing a rectal mass. In rare cases the progression of an intramural hematoma may lead to ischemia, perforation, and hemoperitoneum (De Santis et al. 2012). The treatment of this complication is not codified; in case of stable hematoma a conservative treatment with a simple drainage is also possible. In a case described in literature, the hematoma was drained, the perforated bowel was sutured, and a loop ileostomy was performed. It is difficult to explain how the blood may flow into the rectal wall instead of the lumen; the reason could be found in the stitches placed too deep in the rectal wall that may cause a tear in an intramural rectal artery. Also ring dehiscence after SH may cause intra-abdominal bleeding with severe hemoperitoneum, which could lead to a low anterior resection (Blouhos et al. 2007). In the case of small intramural hematoma, a completely conservative treatment is allowed.

1.2 Pain

From its introduction in the common practice, stapled hemorrhoidopexy was considered, a procedure characterized by less postoperative pain than traditional hemorrhoidectomy, but when compared with rubber-band ligation, the procedure is associated with a higher level of pain (Stolfi et al. 2008).

The overall incidence of postoperative pain after Longo's procedure is reported to be 1.6–31% (Pescatori and Gagliardi 2008); 1.6% of patients required a readmission in a large series of 3711 cases for acute pain (Ng et al. 2006).

Rectal wall is innervated by the sympathetic and parasympathetic nerves, thus excising rectal mucosa should be painless.

Early pain after a hemorrhoidopexy procedure can be due to anal dilation because it can cause internal sphincter fragmentations in some patients. Progressive dilation of the anal canal and the rotation of the anoscope outside of the anal canal instead of the rotation directly in the anal canal may reduce the incidence of early postoperative pain.

Late postoperative pain has a different etiology: many authors reported that it could be correlated with the level of the anal suture because below the dentate line the epithelium is sensitive and richly innervated by somatic nerves. The ideal placement of the suture is approximately 3–4 cm above the dentate line. Purse string placement is not always precise, particularly when hemorrhoids are large and there is a high grade of prolapse. The height of the stapled line seems to be correlated with the duration of narcotic pain management and interval to return to work (Plocek et al. 2006). There are also reported cases in whom the staple line is well above the dentate line: in this context, elevated sphincter muscle tone is thought to be a cause of chronic pain (Ganio et al. 2007). Also the incorporation of smooth muscle into the doughnut and the induction of a staple line inflammatory response may increase the incidence of late postoperative pain (Stolfi et al. 2008). The formation of fibrosis near the staple line may chronically stimulate the nerve spindles located over the puborectalis muscle, causing a pudendal neuropathy with consequent chronic proctalgia

and fecal urgency (Petersen and Jongen 2001). Other possible causes of chronic postoperative pain are the presence of persistent hemorrhoidal disease, anal fissures, retained staples with the formation of granulation tissue, wound dehiscence and sepsis, functional disorders as sphincter or rectal spasm, and high anal resting pressures (Stolfi et al. 2008).

Post-defecation pain is a specific complication of stapler hemorrhoidopexy, and men with a high anal sphincter pressure seem to be at the greatest risk of developing this complication (Petersen and Jongen 2001).

Different features are reported in histologic exam on the specimen of patient with and without chronic postoperative pain. The histology results of Longo specimen of patient with pain are peripheral nerve trunk in rectal submucosa surrounded by cicatricial fibrous tissue similar to traumatic neuroma. On the other side, only peripheral nerve trunk in rectal submucosa and normal Schwann cells were described in the specimens of asymptomatic patients.

Another cause of postoperative pain after stapled hemorrhoidopexy is the possible formation of anal fissures. The occurrence of anal fissures (not present preoperatively) is reported to be more frequent in stapled hemorrhoidopexy than in hemorrhoidectomy: this may be partially due to the anal insertion of the anoscope CAD that is used in Longo's procedure (Stolfi et al. 2008).

When we consider the treatment of postoperative stapled hemorrhoidopexy pain, we can divide the patient in two groups: patient with pain not related with defecation (chronic proctalgia) which seems to be more frequent and patients with pain related with defecation (post-evacuatory pain). The possible treatments of stapled hemorrhoidopexy chronic postoperative pain are Nifedipin treatment, infiltrations with local anesthetics, and in some cases agraphectomy. Post-evacuatory pain is treated by conservative treatment. Chronic proctalgia in some cases may require a rectal wall resection with agraphectomy in particular in patient with a stapled suture below the dentate line. This procedure involves the excision of the staple line and the manual refashioning of the anastomosis (Ganio et al. 2007).

1.3 Urinary Retention

The incidence of postoperative urinary retention ranges from 0% to 13%. In a case series of more than 3500 patients, the admission for acute retention of urine was 4.9%; more than half of these patients require urinary catheterization (Ng et al. 2006). For some authors, urinary retention represents the major part of the hospital morbidity. Overall in-hospital morbidity for Sultan et al. was 9.3%, mainly caused by a 7.3% of urinary retention (Sultan et al. 2010). It can be due to the proctologic surgical intervention, but in several cases it is caused by spinal anesthesia and is temporaneous (Stolfi et al. 2008). It is managed conservatively or with the insertion of a Foley catheter. If urinary retention is associated with fever and abdominal pain, the surgeon must pose a suspect of a major complication like a perforation or an anastomotic dehiscence with pelvic sepsis (Butterworth et al. 2012).

1.4 Fecal Urgency, Incontinence

Early fecal urgency is a frequent postoperative complication of hemorrhoidopexy with a reported incidence of 3–31%. It usually disappears within the first weeks after surgery, but in a minority of cases it may persist. In high volume center the incidence of a prolonged fecal urgency is 0.66% (Sultan et al. 2010). The etiology is probably represented by the fact that muscle contraction in response to nerve and/or muscle irritation may decrease rectal compliance. Some authors reported that in some cases of persisting fecal urgency, removing the anastomosis and scar tissue may improve the symptoms (Petersen and Jongen 2001). For other authors the origin of defecation urgency could be found in the inflammation at the side of the staple line, disruption of the anatomy and function of the normal anal cushions, extreme lowering of the stapled line resulting in resection of the sensitive anal canal mucosa (Sultan et al. 2010). In some cases tenesmus and fecal urgency can be prevented by avoiding stapled hemorrhoidopexy in patient with preoperative reduced rectal compliance or increased rectal

sensation and in patients with fourth-degree piles. For these reasons a preoperative assessment of anorectal physiology is very important.

Fecal soiling may be induced by a low-placed stapled line or by fragmentation of the internal sphincter.

Incontinence is also described as a transitory consequence of stapled hemorrhoidopexy: it is due to excessive anal stretching secondary to circular anal dilator insertion. A risk factor is represented by previous anal surgery because of the possible presence of scar tissue. Anal dilation has been shown to cause internal sphincter fragmentation, but in many patients who complain postoperative fecal incontinence, endoanal ultrasonography shows an intact anal canal (Cheetham et al. 2000). No significant differences are reported in incidence of postoperative incontinence with respect to conventional hemorrhoidectomy (Ceci and Picchio 2008). The use of an intraoperative anal retractor should be minimized to avoid sphincter stretch in patients who have had previous anal surgery. A smaller-size device may be advisable in patients with weak sphincters (Brusciano et al. 2004).

In case of postoperative soiling or incontinence due to localized trauma of the internal sphincters, some advantages can be achieved with the use of bulking agents (as injectable silicone, carbon-coated microbeads, or autologous fat); sphincter repair is rarely needed.

1.5 Proctitis

The reported incidence of postoperative proctitis is estimated to be 10.9%, but there are not many data in literature. The diagnosis of postoperative proctitis can be made clinically when the patient complains anal pruritus and the presence of blood or mucus in stool after discharge in addition to erythema, edema, and contact vulnerability of the rectal mucosa during proctoscopy. At the histopathologic exam the rectal mucosa may present signs of subacute inflammation with epithelial regeneration and shallow cysts. The role of histopathology in the diagnosis of postoperative proctitis is not essential so some authors suggest to

not performing it because of the risk of bleeding and infection after the rectal biopsy. The pathophysiology of proctitis is probably represented by the irritation of the Morgagni crypts as a consequence of the operation. This may lead to an inflammation of the rectal mucosa with the onset of symptoms which is not immediate in the postoperative period. It is generally limited to the anal canal. There are no reported risk factors for the development of proctitis. Also the presence of smooth muscle fibers in the resected specimen seems to be an independent factor. The available treatments are only conservative and consist in medical therapy as the administration of Mesalazine suppositories, NSAIDs, and calcium dobesilate. Antibiotics are not recommended. Prognosis is generally good with a relief of symptoms in 4 weeks (Ambe and Wassenberg 2015).

1.6 Perforation, Anastomotic Dehiscence, and Pelvic Sepsis

Suppuration and septic complications are rare: the frequency of life-threatening septic complications is reported to be less than 0.1% with a mortality rate of 10%. Nevertheless, severe septic complications following stapled hemorrhoidopexy seem to be more frequent than other techniques used to treat hemorrhoid disease.

A possible etiology is thought to be the penetration of bacteria on the perirectal region due to the stapling. Full thickness stapling may also allow organism to reach the perirectal space with the consequential formation of perirectal abscess. To prevent this severe complication, the purse string must be placed within the submucosal plane and true rectal prolapse must be excluded preoperatively. Other possible causes are full-thickness resection because it can lead to anastomotic dehiscence and delayed staple line dehiscence owing to a staple defect. The staple line must always be checked at the end of the operation. In rare cases, rectal wall hematoma may spread reaching the rectosigmoid junction and cause a rectal or sigmoid perforation with

the developing of sepsis. Also rectal obliteration due to a wrong placement of the purse-string may be responsible for sepsis and subsequent rectal perforation with sepsis (Faucherin and Voirin 2010).

Suppuration and sepsis must be suspected when the patient presents with fever, abdominal pain, and urinary retention; also leukocytosis and an elevation of the C-reactive protein are generally present (Butterworth et al. 2012). The most specific exam to diagnose pelvic postoperative abscess is computerized tomography (CT).

Some authors suggest the use of antibiotic prophylaxis before the procedure because rectal injury causing either hematoma or retroperitoneal sepsis may occur.

There is no standard treatment for sepsis after stapled hemorrhoidopexy. Several different approaches have been described: exploratory laparotomy, drainage of the abscess, end colostomy. In some cases when the staple line is considered intact, a conservative approach with intravenous antibiotics administration may be sufficient (van Wensen et al. 2008). Also when the staple line is not intact reintervention will not always be indicated. An intramural or a small retroperitoneal perforation could be treated with conservative measures like bowel rest, total parenteral nutrition, and intravenous antibiotics. Surgical treatment is indicated in nonresponder patients and in those with intramural abscesses.

An intraperitoneal rectal perforation usually needs a surgical management. It depends on the size of the bowel injury, timing of the diagnosis, general conditions of the patient, and surgical experience. Hartmann procedure is still performed if the wound exceeds the 50% of the bowel circumferences. Smaller lesions could be treated with a primary closure with diverging colostomy; in case of patient with severe comorbidity, a loop colostomy could be the only one surgical treatment (van Wensen et al. 2008).

Intestinal perforation after stapled mucosectomy is described as a rare complication. It is due to an undiagnosed enterocele, which is considered a contraindication to this intervention by many authors.

1.7 Rectal Lumen Obliteration

Rectal lumen obliteration is considered to be a rare but severe postoperative complication. Several authors reported cases. This complication is usually due to errors of purse string suture technique. Many reasons of rectal lumen obliteration are described. The most frequent cause is probably the presence of an unrecognized internal rectal prolapse: the purse string suture may cross the prolapse with the consequent rectal lumen obliteration. Another mechanism is the skipping of the proximal suture at the stapler line when double purse string suture is applied. In order to prevent this complication, it is important to verify the existence of the lumen before introducing the stapler. After the procedure, the surgeon has to do a careful digital exploration of the rectum to exclude the complication and repair it immediately. Generally the treatment consists in removing the stapler punches in part where the rectal prolapse is included in the stapler suture line and fixed to the rectal wall. The mucosal defect at the removed punch sites should be repaired by some stitches (Buyukasik et al. 2009).

1.8 Early Thrombosed External Hemorrhoids

Thrombosis of external hemorrhoids is another complication of stapled hemorrhoidopexy because the hemorrhoids sinusoids are not removed and they may be traumatized during the procedure. Its incidence ranges around 3.5%, and it is one of the most frequent reasons for early surgical reintervention which globally occurs with a rate of 3.8% (Cheetham et al. 2000). The other most common causes for early surgical reintervention are bleeding and staple line dehiscence.

1.9 Rectal Pocket

It is a postoperative complication due to a partial slippage of the purse string with the subsequent

formation of a pocket in the lower rectum, resembling a diverticulum or an intramural fistula. This may lead to an intermittent collection of fecalith that may be responsible of inflammation, abscess formation, and local sepsis. The literature reported incidence is 2.5%. It may be necessary a surgical lay-open of the pocket, that is effective in most cases.

1.10 Rectal Ischemia

Unlike traditional hemorrhoidectomy, stapled hemorrhoidopexy does not remove hemorrhoidal tissue but interrupts the hemorrhoidal circulation and elevate rectal mucosa to reduce the prolapse. Rectal ischemia is a rare and probably underestimates postoperative complication. It may present with pain and rectal bleeding. An endoscopic evaluation may be useful to rule out this complication. Indeed rectal ischemia may cause mucosal and submucosal ulceration with exposure of vessels. The main reason for ischemia is thought to be a full thickness rectal resection caused by an excessively deep purse string suture or thrombosis and infarction in the hemorrhoidal tissue after pexy (Pinto et al. 2014).

1.11 Rectovaginal Fistula

Rectovaginal fistula (RVF) is defined as an abnormal communication between rectum and vagina. Obstetric injury, surgical trauma, radiation, inflammatory bowel disease, and malignances are the most common causes of this rare complication. It is an occasional complication after stapled hemorrhoidopexy which occurred just in one patient in a series of 449 patients with an incidence of 0.2% (Beck 2004; Angelone et al. 2006). The rectovaginal septum can be as thin as millimeters; therefore, precise position of the purse-string suture is essential to avoid this serious complication. It is a complication that occurs when the purse-string suture is placed full thickness at the anterior aspect of the rectum and into the posterior vaginal wall; in this way the vagina is

incorporated into the anastomosis. This uneventful complication is the result of a technical error. The insertion a finger into the vagina while placing the purse-string suture is the best way to avoid it. The suture must be tightened and placed under tension to exam the vagina for dimpling, suggesting incorporation into the suture line. Finally, when the stapler is closed, but prior to deployment of the staples, the vagina should be examined again for dimpling at the posterior aspect. Fistula that becomes evident days after the operation may be due to local ischemia rather than to a direct trauma.

Actually, a simple classification is available that divides RVF into two grades: simple RVF with a size of <2.5 cm and situated in the lower or middle one-third of the vaginal wall and the complex RVF with a size of >2.5 cm and located in the upper one-third of the vaginal wall (Rothenberger and Goldberg 1983). The simple one is mostly caused by surgical trauma or infection, the second one results from inflammatory bowel disease, radiation, or a malignant complication (Lo et al. 2016). In this study, 62 cases of RVF on a total of 341 were caused by surgical procedures concerning hemorrhoidal disease and anal fistula. More than a half of this patient was treated with simple repair, the others underwent surgical reconstruction.

The postoperative dyspareunia must raise suspicion of a rectovaginal fistula and the surgeon should perform a complete pelvic examination with vaginal speculum and anoscopy. It should be noted that not all patients with this complication necessarily experience dyspareunia.

The therapeutic option depends on the grade of the RVF. In the case of a simple fistula a conservative treatment should be considered, especially in patients with contraindications or who are not fit enough for surgery of anesthesia. A successful conservative treatment includes constipating diet, abstinence from sexual activity, metronidazole pessaries, rectal gel, and vaginal douches. If this treatment does not lead to a definitive resolution of the fistula, a simple direct closure could be a good solution. In the review of Reichert et al., anatomic fistula repair alone is associated with lower success rates compared to combined

procedures with the adjunctive interposition of healthy, vascularized tissue; the transposition of vascularized tissue into the perineal space between the rectal and vaginal wall obliterate the “dead” space, improves blood supply and the growing of granulation tissue, protect the sutures of anatomic fistula repair of the different layers, and prevent rectal and vaginal stenosis (Reichert et al. 2014). It could be done transvaginally either transanally.

In the case of a complex fistula a reconstructive procedure could be done transvaginally, transabdominally or transanally. One of the most common repairs for complex fistulas is the modified Martius flap repair (Reichert et al. 2014). This pedicled flap is composed of fibroadipose tissue from the interspace between the bulbocavernosus and ischiocavernosus muscle which receives its blood supply latero-ventrally from external pudendal artery branches and latero-dorsally from internal pudendal artery branches.

In the case of complex fistula, a diverting colostomy might improve the success of the repair (Reichert et al. 2014).

1.12 Rectal Displasia or Adenocarcinoma

Rectal dysplasia or adenocarcinoma may be due to a misdiagnosed hemorrhoid-like cancer or may arise from an internal polypoid pile lifted up after stapled mucosectomy. For these reasons, it is important to make a careful preoperative selection of the patient (an accurate recto-anoscopy is mandatory). The diagnosis of unrecognized rectal neoplasm can be made also sending the specimen for histology routinely.

2 Late Complications

2.1 Bleeding

Bleeding is also a common late complication whose rate ranges from 0.18% to 33%. This type of late complication occurs between postoperative weeks 6 and 16 (Pescatori and Gagliardi 2008).

Bleeding with defecation is commonly reported; a late frank hemorrhage is less commonly reported. Late postoperative bleeding may be due to inflammation and/or rejection of the staples (Porrett et al. 2015). If bleeding occur from residual staples or granulomas: in these cases remove of staples add or granulomas associated may be a solution (Petersen and Jongen 2001). In addition, inflammatory polyps at the staple line can cause a late bleeding. The use of suture reinforcement at staple line may cause an inflammatory reaction, but it is more likely that reaction to the staples caused the formation of polyps. Treatment with topical silver nitrate did not resolve the bleeding. Excision of the polyps did result in cessation of bleeding. The presence of exposed residual staples may also cause a late bleeding. The bleeding resolved after removal of the staples. This complication is one of the most frequent causes of reintervention after PPH.

2.2 Stapled Hemorrhoidopexy Syndrome

This syndrome consists of a combination of symptoms including urgency for defecation, cramping, anal discomfort, and sensation of foreign body. It was described in 2009 for Khubchandani et al. as a high prevalence (Khubchandani et al. 2009; Efthimiadis et al. 2011). Retrospective study comparing incidence of this syndrome to the presence in the surgical specimen of muscle fibers, transitional mucosa, as well as length of mucosal ring removed and the degree of disease did not find any statistically significant correlation. This may lead to the assumption that SHS is due to the irritating effect of the titanium clips in the rectal mucosa (Efthimiadis et al. 2011). The physiopathology of this syndrome is still unknown and further research is needed to find out the right answer.

2.3 Recurrence

Recurrence is a long-term outcome that is not well documented in world literature (White et al. 2011). The median incidence reported by some authors is 8.5%. The recurrence rate after stapled

hemorrhoidopexy is higher than that after manual hemorrhoidectomy (8.5% vs. 1.5% in the long term) (Pescatori and Gagliardi 2008). White et al. in a series of 169 patients found a recurrence of hemorrhoidal bleeding prolapse during the follow-up period of 11.2% (White et al. 2011). The mean time to recurrent symptoms was 11 months. Published recurrence rate in case series ranges from 0.3% to 27% (Gerjy et al. 2011).

Insufficient stapling has been suggested by some authors to be the main reason for recurrent symptoms. Inaccurate purse string suturing, particularly in patients with fourth degree hemorrhoids with a significant degree of mucosal prolapse, can result in an incomplete mucosal resection and residual symptomatic hemorrhoids (Beck 2004). The data of White et al. suggest that a half of this recurrence rate is caused by technical failures. In another series of patients the recurrent prolapse occurred in 9% of cases (Shao et al. 2008).

Reoperation rate for recurrent prolapse in this review was 7%. For White et al. the indications for repeat surgery were bleeding (83%), prolapse (52%), and pruritus with or without discharge (26%) (Gerjy et al. 2011). A second SH should be considered when symptomatic recurrence does not respond to conservative treatment. This study demonstrates that the second SH was more painful than the first with a superior analgesic use. Also the interval to the first bowel movement was prolonged, and this length was associated with intense pain after the second SH. This difference resulted also in a prolonged recovery time (Gerjy et al. 2011). About performing the second SH, Zmora et al. studied the risk of ischemia between the two staple lines and demonstrated no vascular compromise of excess fibrosis at 1 month after application of the second staple lines suggesting that a second SH is feasible (Zmora et al. 2004). In literature is also shown a more satisfactory post-operative course if the staple line is placed more than 20 mm above the dentate line (White et al. 2011). No difference was found if the staple line was at 15-19 mm compared with a lower lever, but also a too high staple line could be associated with early recurrence. If the stapled line is above 40 mm to dentate line, the risk of recurrence is

higher. The right position for the second SH for Raahave et al. is 15 mm above the dentate line; this is significantly lower than the position of the first procedure which was at 22.5 mm (Raahave et al. 2008). This means that also a high stapled line could be a cause of recurrence. A repeat of the SH creates a lower stapled line that may cause greater pain with a prolonged hospital stay and increased analgesic requirement but it is safe and feasible.

2.4 Anorectal Stricture or Stenosis

Lower rectum stenosis is an uncommon but disabling complication of stapled hemorrhoidopexy. In the majority of studies, it is defined as a stricture that cannot be passed by the finger. In literature, a rate of incidence is reported ranging between 0.8% and 5.0%, inferior than the rate described after traditional hemorrhoidectomy. The pathological mechanism that is responsible of postoperative lower rectal stenosis is probably submucosal inflammation due to ring dehiscence. Another possible cause is that the stapled ring is placed too deep in the anal canal with the consequent scarring of the rectal epithelium. Some authors report a full thickness excision of the rectal wall as another potential case for rectal stenosis but it is not documented in other studies. The incidence of postoperative lower rectal stenosis is higher in patients who had previously undergone proctologic surgery: this may be due to the presence of scarring tissue in the high anal canal. The first therapeutic approach is conservative and consists in the use of dilation device to enlarge the stenosis. For the majority of patients this approach is successful. In the nonresponsive case surgical therapy must be considered. A large variety of surgical approaches are available as mucosal advancement flap and many types of anoplasty. Endoscopic transanal stricturoplasty is also described (Petersen et al. 2004).

In a case series of a group from Singapore, the anorectal stricture that requires a surgical intervention is 1.4%, and in the most of these cases it is a postoperative complication that usually occurs in the first 3 months after surgery, usually about

2 weeks from surgery. If a stenosis is recognized earlier, into 2 weeks from surgery, a dilation can be easily performed because the fibrous tissue forming the stenosis is soft and easily disrupted (Ng et al. 2006). The stricture that occurs later than 3 months and that requires a surgical intervention is less common. Usually a late stenosis requires surgery.

2.5 Chronic Pain

Chronic proctalgia is an uncommon complication of hemorrhoidopexy. It is defined as “continuous pain that worsens during defecation with only a partial response to oral pain killers and that compromises lifestyle, lasting more than 3 months” (Benedetto et al. 2010).

In literature there are few studies that report the prevalence of this complication, but it is estimated that chronic proctalgia ranges from 1.6% to 31% after Longo's procedure. The specific etiology is not clear. First of all, chronic proctalgia was related to the smooth muscle incorporation in the surgical specimen, but in several studies this correlation has not been proved: the incidence of postoperative chronic pain is similar in patients with smooth muscle fiber present in the specimen and in patients without it (Cheetham et al. 2000). Other possible causes of chronic pain are sphincter or rectal spasm or high anal resting pressures, suture dehiscence with the consequent formation of scar tissue, anal fissures, retained staples, low anastomosis, rectal pocket syndrome, and chronic proctitis secondary to ischemia (Pescatori et al. 2006). Benedetto et al. supposed that persistent pain may be caused by hemostatic sutures, indeed they can incorporate the sphincter muscle and the staples determining ischemia and necrosis with the consequent formation of ulceration and infection.

Chronic postoperative proctalgia has to be differentiated from pain due to the persistence of hemorrhoidal disease. In patients with pain persisting more than 3 months after surgery, diagnostic studies as endoanal ultrasound and anorectal manometry must be performed in order to rule out the possible cause of the symptom and

to decide the therapy. Initially, a conservative treatment can be purposed (oral narcotics, steroids or local anesthetic injection, transanal electrostimulation). If this kind of treatments fails a surgical reintervention may be necessary as staple removal, agrapphectomy (the excision of the stapled line and the manual refashioning of the anastomosis). Further investigations are needed to understand the mechanism of chronic postoperative proctalgia and consequently the specific treatment.

2.6 Anal Fissure

Postoperative anal fissure may be related to a stretch in the anal canal during insertion of the anal dilator during the operation. There is no important difference between stapled hemorrhoidopexy and manual hemorrhoidectomy in the incidence of postoperative anal fissure in many reviews. Patients may complain of anal pain, but in most cases, postoperative anal fissures are asymptomatic and not associated with sphincter pain. The most cases reported in the literature have been successfully treated with trinitroglycerin ointment. In patients who do not respond to medical treatment, a surgical procedure as fissurectomy or internal sphincterectomy may be necessary (Brusciano et al. 2004).

2.7 Persistent Skin Tags/External Components

Skin tags are more frequent after stapled hemorrhoidectomy. In stapled hemorrhoidectomy, the external hemorrhoidal components are not dealt with directly, but these are observed to regress in the early postoperative period, eventually forming radial cutaneous folds.

In some series residual tags have been reported as being the main cause of postoperative symptoms, but excision is performed as a secondary operation in a small number of patients (Brusciano et al. 2004; Beattie et al. 2000). In any case, few patients require delayed skin tag excision after stapled hemorrhoidectomy.

Our recommendation is that perianal skin tags be excised at the time of stapled hemorrhoidopexy only if the specific tags are known to be symptomatic (e.g., bleeding, excoriated) or at the specific request of the patient for reasons of hygiene or cosmesis.

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Literature Review on Stapled Hemorrhoidopexy

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Abstract

This review of the current literature on stapled hemorrhoidopexy (SH) aims to give readers a summary of SH compared to other techniques in managing advanced-grade (i.e., grade III and IV) internal hemorrhoids, examining the most current data reported in the published literature.

1 Introduction

The stapled hemorrhoidopexy (SH), also known as stapled hemorrhoidectomy, procedure for prolapse and hemorrhoids (PPH), and “Longo procedure” is a well-established method for the treatment of symptomatic hemorrhoids. In this chapter, we outline the key studies that have been published in the peer-reviewed literature and guided practice in recent years, particularly examining the data comparing short-term and long-term outcomes of SH over other methods in treating grade III to IV internal hemorrhoids.

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2 Materials and Methods

We performed a comprehensive review including PubMed, OVID, Cochrane databases, using search terms: “stapled hemorrhoidopexy,” “stapled hemorrhoidectomy,” and “Longo’s Procedure.” We included only English articles and limited the search to between 2006 and 2016 to provide an up-to-date narrative review of the current literature.

3 Results

3.1 Comparative Studies of SH with all Techniques

Simillis et al. (2015) performed a large systematic review and network meta-analysis of 7827 patients with grade III and IV hemorrhoids from 98 randomized controlled trials. They simultaneously compared 11 surgical procedures for treating hemorrhoids, ranging from conventional hemorrhoidectomy (CH), SH, transanal hemorrhoidal dearterialization (THD), laser to hemorrhoidectomy using energy devices such as LigaSure™ and Harmonic® devices, and ranked these treatments according to outcomes of interest.

In terms of all postoperative complications, SH was ranked third after Harmonic® and LigaSure™ hemorrhoidectomy, with open and closed CH behind SH. For postoperative bleeding, the ranking was submucosal hemorrhoidectomy, THD, Harmonic®, LigaSure™, open CH then SH. However, SH resulted in fewer emergency reoperations for bleeding than open CH. For length of surgery, SH, together with Harmonic®, LigaSure™, Starion™, and radiofrequency hemorrhoidectomy had a significantly shorter operation duration than open and closed CH or submucosal hemorrhoidectomy. Length of hospitalization was shorter in THD and SH compared to LigaSure™ or CH, with SH ranking just second after THD for faster recovery back to normal activities. SH and THD was superior to all other methods for pain control on day 1 and 7. However, SH performed poorer to LigaSure™ and CH

in terms of recurrence of hemorrhoids and hemorrhoidal symptoms. No differences were found for anal stenosis, skin tags, or incontinence (Table 1).

3.2 Comparative Studies of SH with CH

Direct comparative studies of SH with CH should only be made for symptomatic advanced-grade internal hemorrhoids. This is because when used to treat external hemorrhoids, combined internal and external hemorrhoids, or significant bothersome external skin tags, SH has been shown to have disappointing results, with significant recurrence at 1 year, and overall double the recurrence rate over 5 years.

In the most recent and largest randomized controlled trial so far, the eTHoS trial (Watson et al. 2016) directly compared SH and CH among 777 patients with symptomatic grade II to IV hemorrhoids. The primary outcome was the area under the quality of life curve over 24 months, expressed as quality-adjusted life years (QALYs). The median follow-up was 731 days in both groups.

Quality of life, assessed using the EQ-5D-3 L scale, was slightly higher for SH in the initial 3 weeks. The overall quality of life was similar in both groups over 12 months (mean difference -0.010 [95% CI -0.039 to 0.019], $p = 0.48$), but was significantly better in the CH group over 24 months (-0.073 [95% CI -0.140 to -0.006], $p = 0.034$).

In the immediate 3 weeks following surgery, SH resulted in less pain according to a 10-point scale, but there was no difference after 6 weeks (mean difference -0.01 , 95% CI -0.35 to 0.33). Serious adverse events were noted in 7% of SH patients and 9% in CH patients, which included urinary retention, pain, rectal bleeding, and stenosis.

CH patients experienced significantly fewer hemorrhoidal symptoms like incontinence and tenesmus at 12 and 24 month. There were three times more recurrence of hemorrhoids over 12 months in the SH group than the CH group (32% vs 14%, OR 2.96, 95% CI 2.02 to 4.32) and about two times more recurrence at 24 months

Table 1 Summary of results from Simillis et al. (2015), SH: stapled hemorrhoidopexy, CH: conventional hemorrhoidectomy

Outcome of interest	1st	2nd	3rd	4th	5th	6th
All complications	Harmonic®	LigaSure™	SH	Open CH	Closed CH	
Postoperative bleeding	Submucosal	THD	Harmonic®	LigaSure™	Open	SH
Re-operation	THD	Laser	Harmonic®	SH	Open CH	Closed CH
Duration of operation	Radiofrequency	Harmonic®	SH	THD	Open CH	Closed CH
Hospitalization duration	Radiofrequency	Submucosal	THD	SH	Ligasure™	Open CH
Time to return to normal activities	THD	SH	LigaSure™	Open CH	Closed CH	Radiofrequency
Pain on day 1	THD	Starion™	SH	LigaSure™	Radiofrequency	Closed CH
Pain on day 7	THD	SH	LigaSure™	Closed CH	Open CH	Submucosal
Hemorrhoids recurrence	Submucosal	Radiofrequency	LigaSure™	Closed CH	Open CH	SH
Hemorrhoidal symptoms recurrence	Laser	LigaSure™	Closed CH	THD	Open CH	SH

(42% vs 25%, OR 2.25, 95% CI 1.46 to 3.46). The overall surgical complication rates, length of hospitalization, and operating time were similar in both groups.

While this cohort of patients from the eTHoS trial was not included in the network meta-analysis by Simillis et al. (2015), the eTHoS trial concluded similarly that patients undergoing SH experienced less pain in the immediate recovery period, but had more recurrence of hemorrhoids and hemorrhoidal symptoms in the long term.

The earlier trials and systematic reviews that were included in the meta-analysis by Simillis et al. (2015) found that patients undergoing SH experienced less postoperative pain, but more recurrences and associated symptoms.

For instance, the STOPP trial (Nystrom et al. 2010) comprising 180 patients reported similar prolapse recurrence at 1 year in both arms, with SH offering less pain that resolved faster ($p = 0.004$) but lesser symptom relief than CH (44% vs 69%, $p = 0.002$) after 1 year.

A meta-analysis (Giordano et al. 2009) that included 1201 patients within randomized trials examined 1-year outcomes after SH and CH. The SH group had a significantly higher incidence of prolapse recurrences (OR 5.5, $p < 0.001$) and additional corrective surgeries (OR 1.9, $p = 0.02$) than the CH group. This was corroborated in the Cochrane review (Jayaraman et al. 2006) of randomized trials from 1998 to 2006, which similarly concluded a higher recurrence rates, prolapse, and per-anal symptoms in the SH group.

Another randomized trial (Kim et al. 2013) evaluated outcomes in 122 patients after SH and CH for circumferential grade 3 hemorrhoids. They reported a similar recurrence rate after 5 years in this trial, which was 18% and 23% in the SH and CH group, respectively ($p = 0.65$). SH patients had less postoperative pain, and less per-anal symptoms after 4 weeks, though bleeding, urinary retention, and incontinence were similar in both groups. The authors concluded that SH was more comfortable than and as effective as CH in grade 3 hemorrhoids.

A few studies deal with cost-effectiveness, with results equivocal depending on the

parameters used during calculations. Such equivocal results are common in studies of cost-utility, can be viewed from either payers' or payees' perspective, and should be interpreted on a case by case basis.

In the aforementioned eTHoS trial based in the United Kingdom, the trial found equal duration of operation in both arms as well as similar length of hospitalization with most being performed as a day surgery case. SH was therefore more costly (£941 vs £602 per patient) and had a higher cost per QALY than CH, with an adjusted analysis mean difference in QALYs of -0.070 (95% CI -0.0127 to -0.011) between groups.

On the other hand, Ribaric et al. (2011) reported that compared to CH, SH had a reduced operating time and hospital stay for patients with third and fourth degree hemorrhoids, resulting in cost-savings of £27 per procedure, and an incremental cost of £33 after 12 months, with an incremental cost-effectiveness ratio of £4316/QALY.

The overall evidence points towards SH with shorter operating time, superior pain control, and quality of life in the immediate postsurgical recovery up to 3 weeks. Long-term outcomes, including peri-anal symptom recurrence, recurrence of prolapse, and the need for repeat procedures, were higher in SH group in many studies.

3.3 Comparative Studies of SH with Hemorrhoidectomy Using Energy Devices

Several studies have compared SH against either Harmonic[®] scapel or LigaSure[™]. Here we focus on the studies that were published after and therefore excluded from the meta-analysis from Simillis et al. (2015).

Bilgin et al. (2015) included 99 patients with grade III to IV hemorrhoids who were randomized to Harmonic[®] hemorrhoidectomy or SH. Operation time was shorter in the Harmonic[®] arm (17 mins vs 22 mins, $p < 0.05$) but which may not be clinically significant. The study noted significantly more patients with severe pain (12.5% vs 2%) in the Harmonic[®] arm than the SH arm, although overall pain scores were similar.

Otherwise mean hospitalization and time to return to normal activity were similar. There were more recurrences in the SH arm than Harmonic[®] arm (13.7% vs 2.1%, $p < 0.05$) after a mean follow-up of 24 months.

The results correspond to the meta-analysis from Simillis et al. (2015), which also reported longer operation time, less pain, and more hemorrhoidal recurrences among patients undergoing SH. However, Simillis et al. (2015) reported a shorter hospitalization and earlier return to normal activities for SH compared to Harmonic[®] arm.

3.4 Comparative Studies of SH with THD

Many surgeons include surgical mucopexy with THD to address concurrent mucosal prolapse, allowing THD to enjoy the purported benefits of prolapse reduction on par with SH while reducing hemorrhoidal recurrence rate (Trompetto et al. 2015).

In the meta-analysis by Simillis et al. (2015), a randomized controlled trial and a systematic review (Infantino et al. 2012; Sajid et al. 2012) were included. Beyond that, Venturi et al. (2016) randomized 70 patients with grade III and IV hemorrhoids. They found that after 3 years, SH was costlier but was slightly more effective in reducing recurrence ($p = 0.049$). Operative time, complications, pain, and return to normal activity were the same in both arms. The authors concluded that for grade IV hemorrhoids, SH may prove to be a better option than THD in reducing prolapse and obstructed defecation symptoms.

Leardi et al. (2016) assessed 100 patients with grade III hemorrhoids who were randomized to SH and THD. They reported lesser pain in THD group (visual analogue score 2 vs 6, $p < 0.01$). There was no difference in complication and time to normal activity. After a follow-up of 7 years, which is the longest period of follow-up to date, there was no difference of recurrence of hemorrhoids (10.0% in THD vs 14.0% in SH) or quality of life.

Tsang et al. (2014) reviewed 40 THD patients, who underwent additional mucopexy as needed, and compared their outcomes to a historic

database of 37 SH patients. More postoperative pain was reported in the SH arm (pain score 5.00 vs 1.71, $p = 0.00$) with later return to daily activities (6.78 vs 3.13 days, $p = 0.001$), and similar complication and recurrence rates.

3.5 Modifications of SH Technique

The literature suggests that SH performed well for shorter operative time, minimal pain experienced, and quicker return to normal activity with the absence of perianal wounds requiring care. However, compared to other methods, it did not perform as well for relapse of hemorrhoids and hemorrhoidal symptoms.

Several studies examined the modification of staplers to improve the recurrence rate of prolapse among patients who did not obstructive defecation syndrome, and thus not eligible for the stapled transanal rectal resection (STARR) procedure. Reboa et al. (2016) performed an Italian multicenter study using CPH34 which provided a higher volume and wider prolapse resection. There was prolapse involving more than half the length of the circular anal dilator in 79.3% of the 430 patients. At 12 months, only 1.9% of patients had residual hemorrhoids. During regression analysis, the preoperative constipation scoring system, Pescatori's degree, Goliger's grade, and volume of resection were significantly predictive of relapse. A high index of patient satisfaction and reduction of constipation scores were found with wider prolapsectomy.

4 Discussion and Current Practice

Unlike conventional hemorrhoidectomy, stapled hemorrhoidectomy should be viewed as a subspecialty procedure, and practitioners of SH should be regularly acquainted with proctological surgery, and if necessary be capable of performing a hand-sewn coloanal anastomosis. This overarching skillset is essential to achieve the best possible result depending on the appearance and lie of the rectoanal tissue during examination under anesthesia.

Compared with other modalities of surgery for hemorrhoids, SH also has the potential for the most morbid complications, including staple line bleeding, anastomotic breakdown, anal stenosis and complete occlusion of the anal canal, particularly when significant rectoanal mucosal prolapse is present. The surgeon performing SH must be cognizant of this and be able to deal with each potential complication during surgery.

SH is associated with better early postoperative pain and quality of life, but this improvement is no longer present by the end of week 2. It is also associated with increased recurrence of prolapse and bleeding, particularly if fully external grade 4 piles are already present.

Patient selection and managing patient expectations is paramount in selecting the correct surgical technique to address grade III and IV hemorrhoids. Based on the current understanding and most recent literature, SH remains a safe and efficacious option for patients who are concerned about postoperative pain and the acute phase of recovery. Patients should be aware of the relatively less satisfactory long-term outcomes and higher rate of recurrences compared to other techniques like CH, hemorrhoidectomy using energy devices, and transanal hemorrhoidal dearterialization with or without mucopexy.

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Part VI

Hemorrhoidal Dearterialization and Mucopexy



Dearterialization of Hemorrhoids and Mucopexy: Techniques and Results

32

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Abstract

The ligation of hemorrhoidal arteries and pexy of prolapsing rectal mucosa/submucosa seem to be one of the most effective therapeutic

approaches in the treatment of hemorrhoidal disease. This surgical procedure is primarily aimed toward the management of the main symptoms, i.e., bleeding, prolapse, and pain, intervening on its pathophysiological processes. It is based on two technical steps: first, the targeted ligation of hemorrhoidal arteries (called “dearterialization”); second, the plication and lifting of redundant and prolapsing rectal mucosa/submucosa (called “mucopexy”). This chapter examines technical aspects and

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perioperative management of the procedure. Moreover, results of dearterialization of hemorrhoids and mucopexy, as described in the Literature, are critically evaluated.

1 Introduction

Hemorrhoidal disease (HD) represents the most common condition presenting to proctology units, with its prevalence ranging from 5% to about 35% in Western populations (Johanson and Sonnenberg 1990; Loder et al. 1994). Recent findings, concerning the pathophysiology of the hemorrhoidal disease (Schuurman et al. 2009; Aigner et al. 2006, 2009, 2010) and the development of new technologies for surgical treatment (Ratto et al. 2010), have favored a rapid spread of innovative approaches. In fact, during the last two decades, non-excisional surgical approaches to hemorrhoidal disease have shown a high potential for cure with a theoretically reduced morbidity. Among them, the ligation of hemorrhoidal arteries, with or without pexy of prolapsing rectal mucosa/submucosa, seems to be one of the most effective therapeutic approaches.

This surgical procedure is primarily oriented toward the management of the main symptoms of hemorrhoidal disease (i.e., bleeding, prolapse, and pain), intervening on its pathophysiological processes. It is based on two technical steps: first, the targeted ligation of hemorrhoidal arteries (called “dearterialization”); second, the plication and lifting of redundant and prolapsing rectal mucosa/submucosa (called “mucopexy”).

This paper provides an overview of the background, technical aspects, perioperative management, and results of dearterialization of hemorrhoids and mucopexy.

2 Background

The pathogenesis of HD is unclear, but it is probably multifactorial. A number of elements have been claimed to be causative or predisposing factors. Disruption of supportive tissue surrounding hemorrhoids is considered to be an important

factor in hemorrhoidal prolapse (Shafik 1984) and a number of inflammatory mediators have also been cited (Klink et al. 2009; Taweevisit et al. 2008). A hypertonic internal anal sphincter has frequently been associated with HD and is regarded as a possible cause of hemorrhoidal symptoms (Vyslouzil et al. 2010). Hemorrhoidal vascularization appears to play a central role in the pathophysiology of HD.

However, the anatomical and physiological characteristics of hemorrhoids have not been elucidated fully. Microscopically, hemorrhoidal piles are sinusoids (vascular structures without a muscular wall) (Lucha 2009). Direct arteriovenous communications have been demonstrated histologically and radiologically, and some authors have noted a resemblance to erectile tissue (Loder et al. 1994). Traditionally, hemorrhoidal piles frequently appear to be localized to the left lateral, right posterolateral, and right anterolateral sites in the anal canal circumference with the patient in the lithotomy position; however, this configuration is demonstrated in less than 20% of patients (Thomson 1981). In reality, a wider network of arterial and venous vessels has been described (Shafik 2009), although the distribution and relationship to rectal and anal layers is unclear. Hyperplasia of the arteriovenous network within the anorectal submucosa (corpus cavernosum recti, CCR) results in increased vascular pressure. Blood overflow to the CCR should also cause increased intravascular pressure and is thus a significant predisposing factor for HD (Stelzner et al. 1962). Aigner et al. (2006) confirmed the relationship between arterial overflow and HD. Using a transperineal Doppler probe to investigate hemorrhoidal arteries, they found a significantly higher arterial caliber and flow velocity in patients with HD compared with controls. They then hypothesized that the coordinated filling and drainage of the anorectal vascular plexus is regulated by the intrinsic vascular sphincter mechanism, and that the morphological and functional failure of this vascular system may contribute to the development of HD (Aigner et al. 2009). Schuurman et al. (2009) highlighted how vascularization of the CCR is provided almost exclusively by branches of the superior rectal

artery (SRA), a terminal branch of the inferior mesenteric artery. A previous study by Shafik and Mostafa (1996) indicated that the lower half of the rectum is vascularized by the terminal branches of the SRA (two or three main branches), with plexiform patterns at the ends. The middle rectal artery has been reported in only 50% of cadaver specimens (Shafik and Mostafa 1996), and the functional role of this artery seems negligible in light of these anatomical inconsistencies. DiDio et al. (1986) also studied the middle rectal artery in 30 cadavers; it was present in 56.7% of specimens, bilaterally (36.7%) or unilaterally (20.0%). The middle rectal artery arose from the internal pudendal artery in 40% of specimens, the inferior gluteal artery in 26.7%, and the internal iliac artery in 16.8%. The consistent findings of the above studies appear to demonstrate that the SRA branches play a predominant role in CCR vascularization. Therefore, it is particularly important to define the topography of these vessels within the rectal–perirectal area. Aigner et al. (2004) analyzed five macroscopic preparations of human pelvis; they described the division of the SRA into left and right branches, then into three to five terminal branches penetrating the rectal wall in the middle and lower rectum. On examining microscopic preparations from 27 fetuses, they identified two to four terminal vessels penetrating the rectal wall and reaching the submucosa, especially in the posterolateral position (71% of specimens) (Aigner et al. 2004).

Later, our prospective study (Ratto et al. 2012b) was aimed to localize precisely the arteries running into the rectum and directed to hemorrhoids and, then, assess the optimal site for hemorrhoidal dearterialization. Fifty patients suffering of anal bleeding, with or without hemorrhoidal prolapse (5 patients, 10%, grade II; 41 patients, 82%, grade III; 4 patients, 8%, grade IV), entered the study and underwent endoanal–endorectal ultrasonography (ERUS) with color duplex imaging (Pro-FocusGreen™; BK Medical, Herlev, Denmark) fitted with endoanal–endorectal probes (models 2052 and 8848; BK Medical). During ERUS, the proximal edge of the puborectalis sling was identified to localize the anorectal

junction (ARJ), regarded as the best reference point. The lower rectal circumference was subdivided into six sectors (left anterolateral, left lateral, left posterolateral, right posterolateral, right lateral, and right anterolateral). From the upper limit (6 cm above the ARJ), the same procedure was repeated every 1 cm until the lower limit was reached (1 cm above the ARJ). The courses of arteries that reached hemorrhoidal piles were followed carefully, excluding all perirectal arteries not directed to hemorrhoids (vaginal, prostatic, and seminal vesicle arteries).

Moreover, the distance between the center of the arterial lumen and the ultrasound probe surface (defined as “arterial depth”) was calculated.

Significantly fewer sectors in the upper part of the low rectum were found having an arterial supply directed to the hemorrhoids than in the lower part (64.3%, 66.0%, and 66.0% at 6, 5, and 4 cm above the ARJ, respectively, versus 98.3%, 99.3%, and 99.7% at 3, 2, and 1 cm, respectively; $p < 0.001$).

In the majority of the upper sectors (97.9% at 6 cm and 90.9% at 5 cm from the ARJ), hemorrhoidal arteries were located in the perirectal fat, and only occasionally within the bowel wall. At 4 cm above the ARJ, a greater number of sectors had arteries located in the rectal muscle. At 3 cm, the arteries were shown to run into the submucosa in the majority of sectors, whereas at 2 and 1 cm above the ARJ almost all of the arteries had a submucosal location (in 96.6% and 100% of sectors, respectively); the differences were statistically significant ($p < 0.001$). As a consequence of these findings, a schematic representation of the arterial blood supply to hemorrhoidal piles is proposed in Fig. 1.

No hemorrhoidal arteries were detected in the left and right anterolateral sectors at 6, 5, and 4 cm above the ARJ, whereas such arteries were identified in the other sectors. At the lower three levels (3, 2, and 1 cm above the ARJ), hemorrhoidal arteries were identified in nearly all circumferential sectors. These findings suggested that the arterial pulses detected by Doppler ultrasonography in the anterior highest three levels of the low rectum during surgical procedures using this technology can be regarded as being

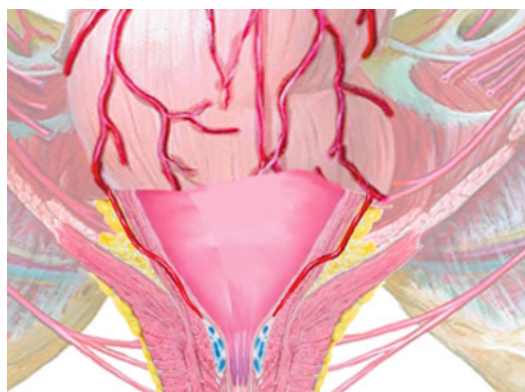


Fig. 1 Schematic representation of the arterial blood supply to hemorrhoidal piles based on the findings from Ratto et al.'s study (2012)

generated by vessels that are not directed to hemorrhoids. The mean hemorrhoidal arterial depth was significantly lower in more distal sectors than in more proximal sectors; a statistical comparison between each level showed all differences to be significant ($p < 0.001$). This was a consistent finding in each rectal sector. When mean arterial depths at each rectal level were compared, the differences between sectors were not statistically different at 6 cm above ($p = 0.674$) or 1 cm below ($p = 0.865$) the ARJ, whereas differences between sectors were statistically significant at 5, 4, 3, and 2 cm above the ARJ ($p = 0.022$, $p = 0.020$, $p < 0.001$, and $p = 0.005$, respectively).

Normally, the hemorrhoidal cushions are loosely attached to the circular muscle through the elastic rectal submucosa, which keeps the piles in the anal canal at rest. During defecation, rolling of the hemorrhoids inside the lumen occurs, favored by the internal anal sphincter relaxation.

The fecal bolus has a shearing effect on the cushions and facilitates their prolapse (Tagart 1974; Haas et al. 1984; Keighley and Williams 2008). On the other hand, the elasticity of the rectal submucosa keeps the piles inside the rectum. In patients with hemorrhoidal disease, due to altered defecation and other predisposing factors (Jackson and Robertson 1965), the rectal submucosa progressively loses its elasticity, determining hemorrhoidal prolapse (Haas et al. 1984; Keighley and Williams 2008; Gass and Adams 1950). The progressive disruption of both the connective

tissue stroma (Park's ligaments) and anchoring system (Treitz's muscle) plays a major role. Severity of prolapse is related to persistence of pathogenic factors, engorgement of piles, and progressive loss of the elasticity of the rectal submucosa. Transanal hemorrhoidal dearterialization with mucopexy provides plication of the rectal submucosa affected by the loss of elasticity. It is reduced stably into the rectal ampulla, recovering its anatomical position. Furthermore, the scarring process induced by the mucopexy attaches the plicated mucosa and submucosa to the underlying rectal muscle.

Both anatomical and physiological evidence obtained from the literature and our study have had implications for the various therapeutic approaches that are currently available, specifically for both stapled hemorrhoidopexy (SH, also known as Longo's technique) and Doppler-guided ligation of hemorrhoidal arteries, including THD (transanal hemorrhoidal dearterialization) and DG-HAL (Doppler-guided hemorrhoidal artery ligation) techniques. The goal of the first method is to treat hemorrhoidal prolapse by resecting the rectal mucosa approximately 3–4 cm above the dentate line (Corman et al. 2003); however, the level of anastomosis is frequently unpredictable as it is affected by the traction applied to the previously performed rectal purse-string. In fact, it has been established that, even though SH is performed according to well-established technical guidelines, the intended location of the staple line is too difficult to standardize, as demonstrated by the wide range of anatomopathological results reported by Ohana et al. (2007). In fact, this type of suture cannot ensure selective ligation of hemorrhoidal arteries as it can also involve both major and minor arterial vessels. Moreover, the circumferential suture could generate an unpredictable risk of venous outflow blockage, thus damaging the drainage system, as described previously (Aigner et al. 2009).

The correlation between SH and rectal vascularization was highlighted in another study in which a perineal Doppler probe was used in patients who underwent SH for HD and a group of healthy subjects (Aigner et al. 2010). In that study, baseline measurements differed

significantly between patient and control groups. Postoperative follow-up showed no significant alterations in physiological parameters. Patients with a higher rate of recurrence of HD had higher baseline arterial flow velocity values. The study showed that SH did not reduce arterial inflow in the vessels feeding the anorectal vascular plexus. In the Aigner's study (2010), the anastomosis was performed 3.5–4 cm above the dentate line, a level at which most terminal arterial branches are not in the submucosa. Indeed, a meta-analysis of large-scale studies of patients undergoing SH demonstrated that these patients are more likely to develop recurrent HD with prolapse and bleeding at any time than those having conventional hemorrhoidectomy (Jayaraman et al. 2006; Shao 2008).

The goal of THD and DG-HAL is to reduce significantly the arterial overflow to hemorrhoidal piles by the dearterialization. That is performed by a Doppler-guided ligation of the hemorrhoidal arteries in the upper part of the low rectum. The results of this approach, as shown in several reports, are generally and consistently encouraging (Cantero et al. 2008; Infantino et al. 2010; Festen et al. 2009; Ratto et al. 2010; Arnold et al. 2002; Scheyer et al. 2006; Greenberg et al. 2006; Wallis de Vries et al. 2007; Wałęga et al. 2008). In particular, most studies have shown that recurrent bleeding is limited to a minority of patients (5–20% after THD; 1–21% after DG-HAL) (Cantero et al. 2008; Infantino et al. 2010; Festen et al. 2009; Ratto et al. 2010; Arnold et al. 2002; Scheyer et al. 2006; Greenberg et al. 2006; Wallis de Vries et al. 2007; Wałęga et al. 2008). However, traditional dearterialization might fail to include the hemorrhoidal arteries in some sites owing to their deep location (within the muscularis propria or in perirectal fat), particularly on the anterior side of the rectum. The reported frequency of recurrent bleeding in patients undergoing dearterialization alone using the “high arterial ligation” technique (31%) (Ratto et al. 2010) supported this view. When mucopexy is included in THD or DG-HAL procedures, the possibility of excluding arteries was lower as the running suture (even one that begins in the upper part of the low rectum

to perform high ligation of hemorrhoidal arteries) was usually continued by transfixing the mucosa and submucosa to the ARJ, thus involving arterial branches directed to the hemorrhoidal piles. By selectively ligating the hemorrhoidal arteries using a very precise Doppler system (Ratto et al. 2010), the THD technique can accurately identify the location of arterial vessels in the submucosa of the low rectum, thus achieving a significant reduction in arterial overflow to hemorrhoids. Based on our study (Ratto et al. 2012b), dearterialization should be more effective if performed 1–2 cm from the ARJ, where almost all of the arteries are localized in the submucosa, with a mean depth of 1.9–2.4 mm.

3 THD Doppler Technique

A number of procedures have been devised using Doppler guidance and different surgical devices. A few reviews (Giordano et al. 2009; Pucher et al. 2013) have evaluated these techniques grouping them together. Here the THD Doppler technique is illustrated.

3.1 Preoperative Patient Assessment

An accurate assessment of patient's history is mandatory, particularly concerning symptoms related to hemorrhoidal disease. Then, both anorectal examination and anoscopy are carried out to evaluate hemorrhoidal engorgement, spontaneous bleeding, and eventual prolapse of piles and rectal mucosa/submucosa, both at rest and during straining. In particular, reducibility of hemorrhoidal prolapse should be assessed. Anal skin tags should also be noted and distinguished from real hemorrhoidal prolapse. Other anal and/or rectal diseases and functional disorders must be diagnosed/excluded. In particular, patients complaining of symptoms of obstructed defecation should be further investigated. Finally, endoscopic assessment of the colon and rectum should be performed according to the guidelines for colorectal cancer screening.

3.2 Indications

Transanal hemorrhoidal dearterialization should be reserved for patients presenting active hemorrhoidal disease despite lifestyle/diet interventions, drug therapy, and minor office procedures such as rubber band ligation or sclerotherapy. Indications should be established on the basis of the patient's symptoms and physical findings. If the main complaint is bleeding, this can be addressed by dearterialization alone, ligating of the hemorrhoidal arteries along the low rectal circumference. Usually, at least six arteries are found and ligated using the THD Doppler device. In case of bleeding associated with hemorrhoidal or mucosal and hemorrhoidal prolapse, mucopexy should be added to the dearterialization. In fact, mucopexy can be regarded as an "on-demand" step of THD, depending also on the location and severity of mucosal prolapse (in terms of its length). It is mandatory that the prolapsing hemorrhoidal piles and rectal mucosa should be reducible, so that they will reach their respective anatomical sites. Therefore, fibrotic piles cannot be treated with THD. When the prolapse involves the whole rectal circumference, six separate mucopexy sutures may be placed. Alternatively, if there is only limited circumferential involvement, a smaller number of running sutures should be used. Patients, who complain of mucosal and hemorrhoidal prolapse or hemorrhoidal prolapse alone, usually have a history of bleeding, which disappeared in the later phase of hemorrhoidal disease in accordance with the pathophysiological evolution of the disease. These patients should undergo both dearterialization and mucopexy following the same criteria mentioned above. Mucopexy can be adapted to different lengths of mucosal prolapse, making longer or shorter running sutures. However, attention must be paid to misdiagnosed internal rectal intussusception, which is not amenable to mucopexy used for the hemorrhoidal prolapse.

According to the Goligher's classification, first degree or initial second degree hemorrhoids, unresponsive to conservative treatment or minimal surgery, may be addressed by dearterialization alone. More advanced second degree,

third degree, and fourth degree (except in the case of fixed, fibrotic piles) should undergo dearterialization and mucopexy. Patients with skin tags should be advised that these are not real hemorrhoids, but the consequence of previous engorgement and dislodgement of hemorrhoidal cushions toward the perianal skin. Since THD does not provide any specific treatment for skin tags, only surgical excision can be a reliable treatment for them, when indicated or desired. Patients with hemorrhoids who suffer from inflammatory bowel disease deserve a special mention. There is a lack of studies specifically addressing patients with Crohn's disease or ulcerative colitis operated on with THD. However, providing that no severely active inflammation is demonstrated on the rectal mucosa, this method may be suitable in patients with hemorrhoids resistant to conservative treatments. The same concept applies to hemorrhoidal disease in patients with chronic radiation proctitis.

3.3 Preparation for Surgery

This is a matter of the surgeon's preference as there are no absolute guidelines in hemorrhoidal surgery. The same is true also for the THD procedure. Because it is performed within the lower rectum, one or two enema(s) should be prescribed. The Authors do not consider antibiotic prophylaxis as mandatory as in their experience no infections have been observed following this operation.

3.4 Anesthesia

Transanal hemorrhoidal dearterialization can be performed under both general and locoregional anesthesia. Propofol-remifentanyl anesthesia, with the placement of a laryngeal mask, combines general anesthesia, complete control of vital parameters, and quick reversion and discharge from the hospital. Spinal anesthesia may be limited to the most caudal metameric nerve roots avoiding any prolonged stay in bed. Unfortunately, spinal anesthesia is usually associated with a higher risk of

urinary retention, especially following hemorrhoid surgery. More limited locoregional anesthesia (i.e., posterior perianal block) does not ensure a complete intraoperative analgesia due to the visceral pain elicited by surgical ligation, suturing for plication, and tying knots on the rectal mucosa.

3.5 Intraoperative Management

The patient can be placed in either the lithotomy or the prone position, based on the surgeon's preference. However, it should be taken into consideration that the lithotomy position allows a more realistic position of the prolapsing hemorrhoids and rectal mucosa. An accurate intraoperative monitoring of blood pressure could be helpful. In particular, systolic pressure higher than 100–110 mmHg allows auscultation of a Doppler signal necessary for the identification of the hemorrhoidal arteries.

3.6 Equipment

Transanal hemorrhoidal dearterialization is performed using a specific device produced by THD S.p.A., Correggio, Italy. It consists of a proctoscope equipped with a Doppler probe and a light source. The Doppler probe utilizes a double crystal, which allows a more precise focusing of the ultrasound waves and capturing of large diameter arteries located in the superficial layers of the rectal wall. Sufficient space is provided around two crystals for their adequate vibration. The Doppler probe is mounted on an oblique support, oriented toward the operative window, so that the artery identified by the Doppler signal lies within the operative window and can be selectively ligated. The latest proctoscope model (THD Slide, THD S.p.A., Correggio, Italy, Fig. 2) has a sliding part comprising the operating window and the Doppler probe, so that the operator can move them proximally and distally without repositioning the proctoscope. The section of the proctoscope is elliptical, with an external maximum diameter of 32–34 mm and an internal diameter of 20–34 mm. The recommended suture is 2–0

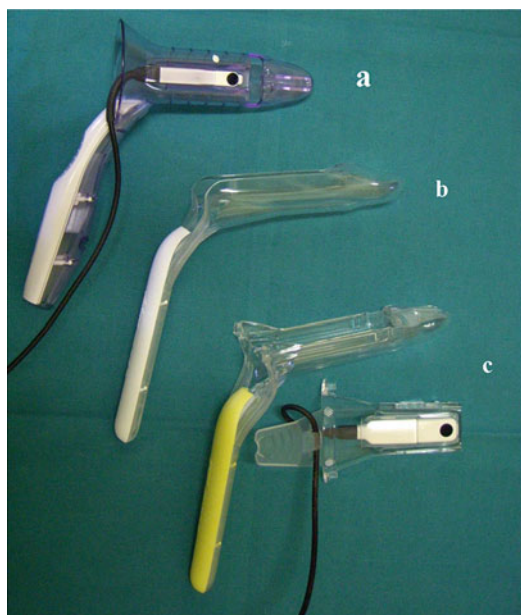


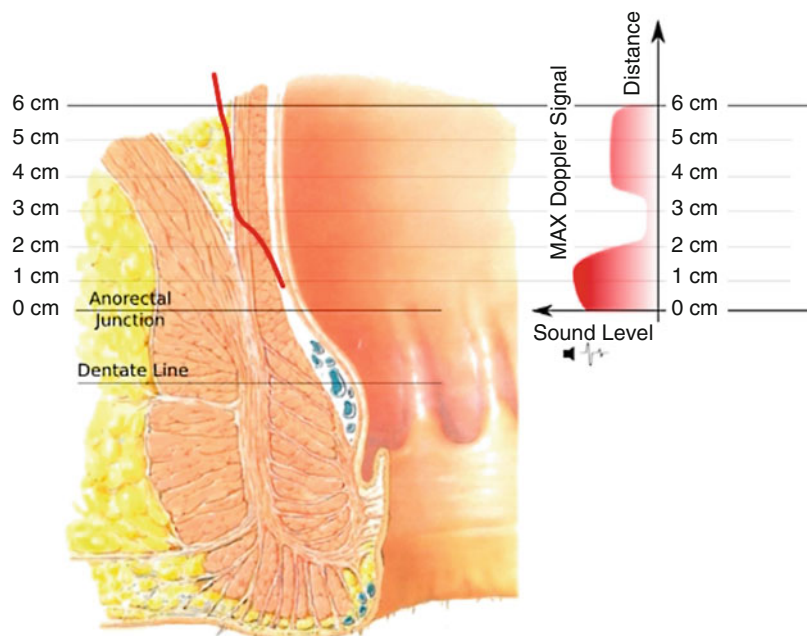
Fig. 2 Proctoscopes used in THD Doppler procedure over the time: traditional THD proctoscope, the “first device” (a); THD Surgi[®], the “second device” (b), used since July 2007 together with the “first device” to make the mucopexy; THD Slide[®], the “current device” (c), in use since September 2008

absorbable polyglycolic acid with a 5/8-in. needle. This is mounted on a specially designed needle holder, providing a mark on the tip where the needle should be held. With this configuration, the needle holder tip can be inserted into the pivot, and the needle rotates to transfix the rectal mucosa in a standard fashion. The depth of the transfixed stitches can be easily and safely calibrated up to a maximum depth of 6.5 mm, which includes only mucosa and submucosa avoiding penetration through the full thickness of the rectal wall and therefore lowering the risk of perirectal fistula and abscess. A knot-pusher is also provided in case is needed.

3.7 Distal Doppler-Guided Dearterialization (DDD)

Following gel lubrication, the proctoscope is inserted through the anal canal reaching the low rectum, about 6–7 cm from the anal verge. The

Fig. 3 Schematic representation of Doppler signal intensity, due to the hemorrhoidal arteries, as usually recorded investigating the low rectum



surgeon can decide to start the operation at any point of the rectal circumference and proceed in a clockwise or anticlockwise direction. The Doppler system is then turned on. The Doppler signal corresponding to all six main trunks of the hemorrhoidal arteries, which are usually located at 1, 3, 5, 7, 9, and 11 o'clock of the low rectal circumference, is sought by slowly rotating and/or tilting the proctoscope. However, searching with the Doppler probe makes possible correct identification of those arteries not located at the usual odd hour positions. The proctoscope is pulled slowly back to follow the artery distally up to hemorrhoidal apex, and the best Doppler signal is searched for. According to the above mentioned features from our previous study (Ratto et al. 2012b), the Doppler signal is quite clear at the proximal site (corresponding to the proximal part of the lower rectum, where, however, arteries could lie in the perirectal fat), attenuated or absent at the intermediate site (where the artery is perforating the rectal muscle), and again clear at the distal site (within the most distal 2 cm of lower rectum, where the artery lies in the rectal submucosa, just above the internal hemorrhoidal piles, Figs. 3, 4, and 5). As a consequence of anatomical and acoustic findings, the best place to find the

hemorrhoidal arteries should be the most distal part of the rectum. This is the fundamental principle of distal Doppler-guided dearterialization (DDD) (Ratto et al. 2012a, b). After identification of the best place for artery ligation, the Doppler system is turned off.

If the patient is a candidate for dearterialization alone (i.e., the patient only has bleeding without prolapse), the artery, once identified, can be directly ligated with a “Z-stitch” at the site of the best Doppler signal. When the patient needs to undergo dearterialization and mucopexy (due to hemorrhoidal or muco-hemorrhoidal prolapse), the rectal mucosa can be marked with electrocautery (“marker point”) at the site of the best Doppler signal (Figs. 6 and 7) to indicate where the artery will be ligated. Then, a mucopexy follows.

3.8 Mucopexy

Figure 8 shows the schema of the rectal mucopexy. Following the identification of the hemorrhoidal artery, the proctoscope is again pushed fully inside the distal rectum, and a “Z-stitch” is made as a proximal “fixation point” of

Fig. 4 Intraoperative step of THD Doppler procedure while searching an hemorrhoidal artery at the upper part of the low rectum. Schema of Doppler signal shows the level of sound intensity registered at that level (green dot)

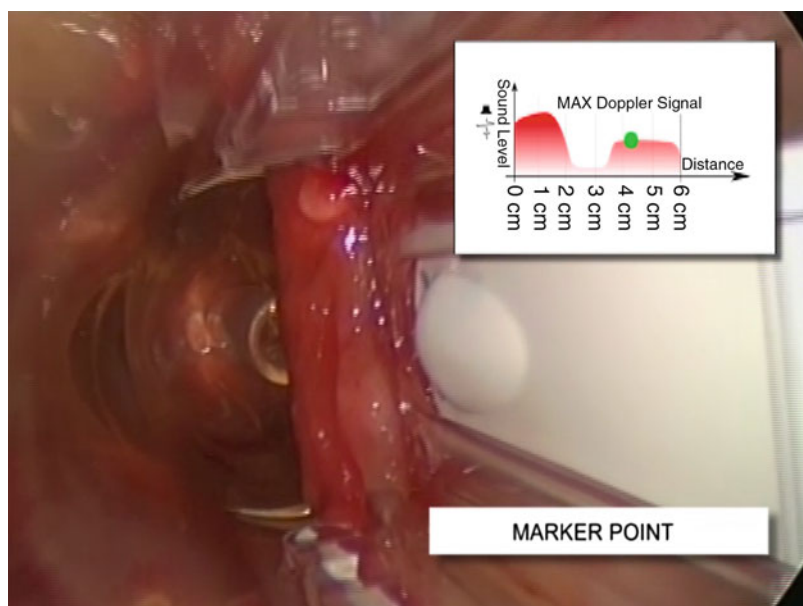
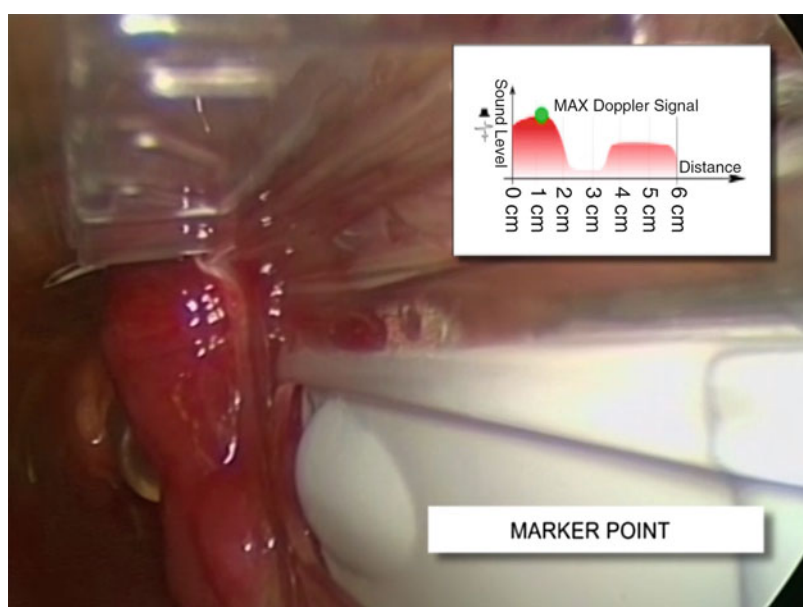


Fig. 5 Following intraoperative step of THD Doppler procedure while searching an hemorrhoidal artery at the lower part of the low rectum. Schema of Doppler signal shows the level of sound intensity registered at that level (green dot), which represents the best place to locate the hemorrhoidal artery



mucopexy (Figs. 9 and 10). The circular device pivot can be used to do this. The proximal end of mucopexy is not standard, depending on the length of prolapsing mucosa and submucosa. Then, the knot is tied (Fig. 11). Thereafter, the main proctoscope remains in place, and only its sliding part is moved back, exposing the rectal mucosa so that the mucopexy can be performed under direct

vision. Mucopexy is carried out with a continuous suture, including the redundant and prolapsing mucosa and submucosa, in a proximal-to-distal direction, along a longitudinal axis (Fig. 12). The recommended distance between each suture is approximately 0.5 cm, which is optimal in order to avoid sutures that are too tight (a shorter distance has a lesser plicating effect as well as

Fig. 6 Schematic representation of the highest Doppler signal intensity, due to the hemorrhoidal artery lying down into the rectal submucosa; that is the place of the “marker point” to perform the “distal Doppler-guided dearterialization – DDD”

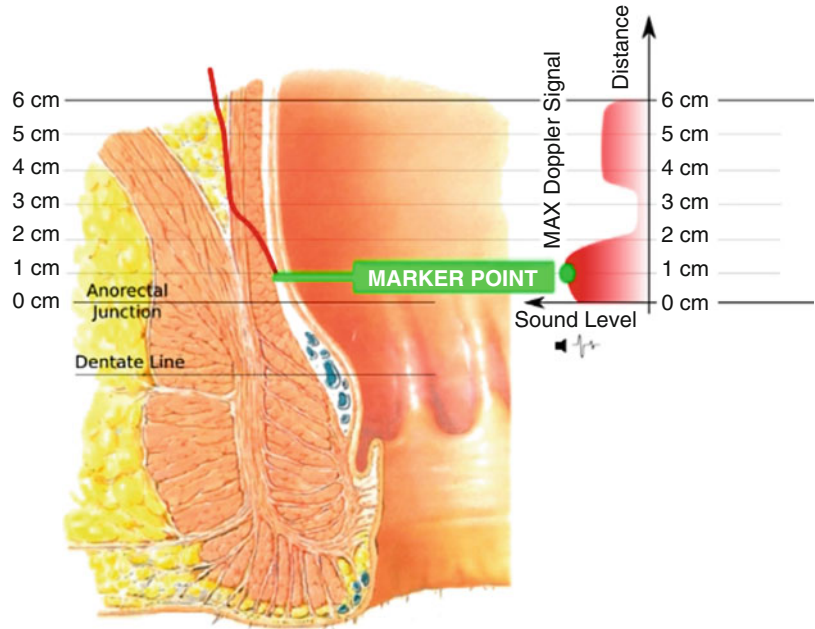
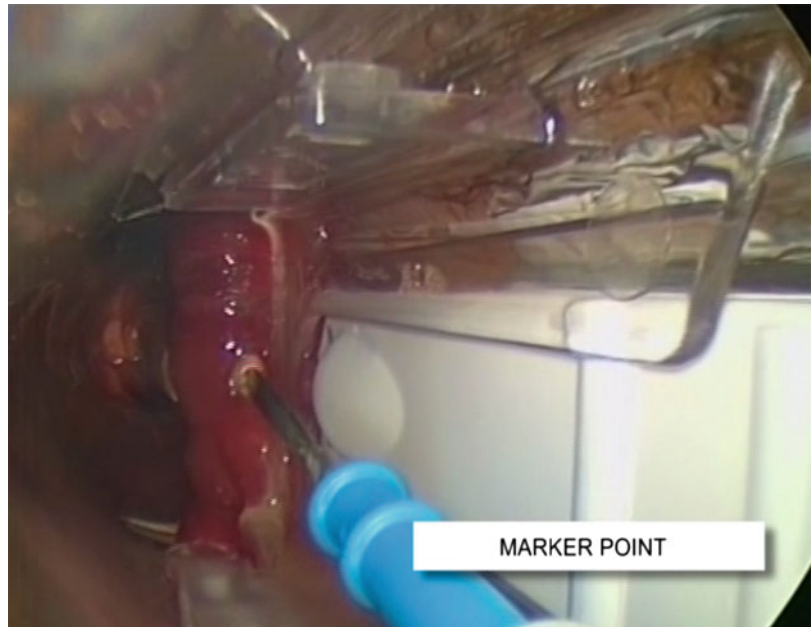


Fig. 7 The rectal mucosa is marked with electrocautery (“marker point”) at the site of the best Doppler signal due to the hemorrhoidal artery lying down into the rectal submucosa



increased risk of tissue ischemia) or too loose (a longer distance with consequent formation of wide enfolding of rectal mucosa/submucosa and increased risk of early postoperative rupture of the running suture). While performing mucopexy, when the “marker point” is visualized, the

surgeon takes care to make a passage of the running suture above and another below the “marker point,” in order to entrap the hemorrhoidal artery within the running suture and accomplish the dearterialization according to the DDD principle (Fig. 13). Each vertical row should be spaced

Fig. 8 Schema of the rectal mucopexy (right side) following the Doppler identification of the hemorrhoidal artery

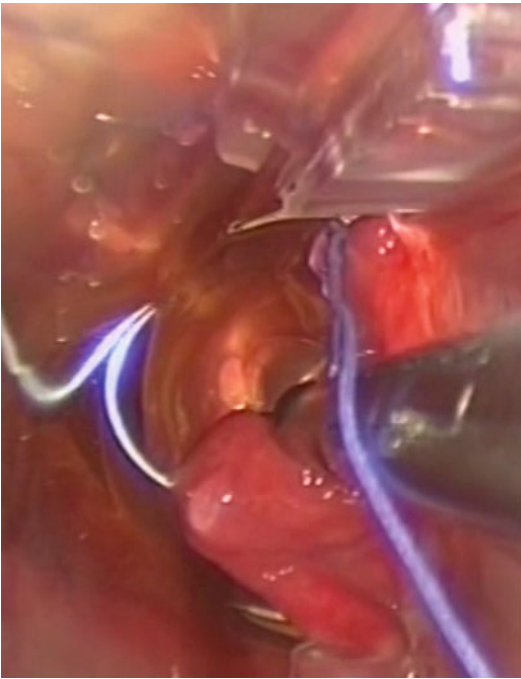
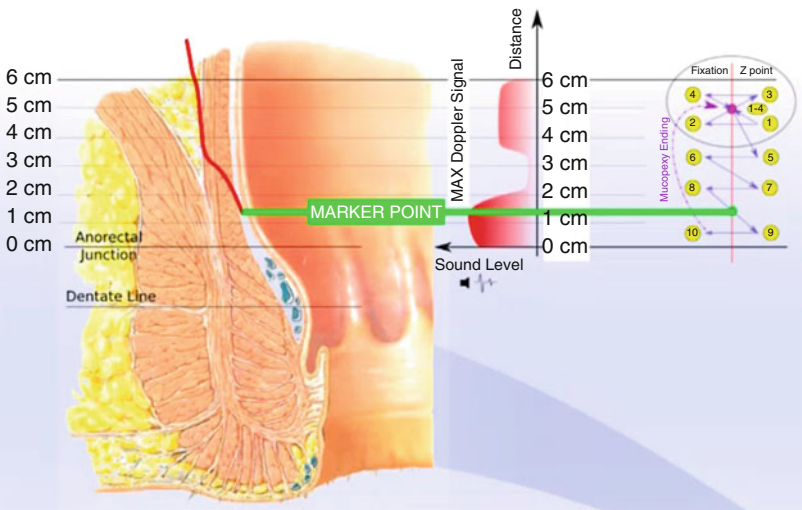


Fig. 9 First passage performing the "Z-stitch" at the level of the proximal low rectum, as a proximal "fixation point" of mucopexy

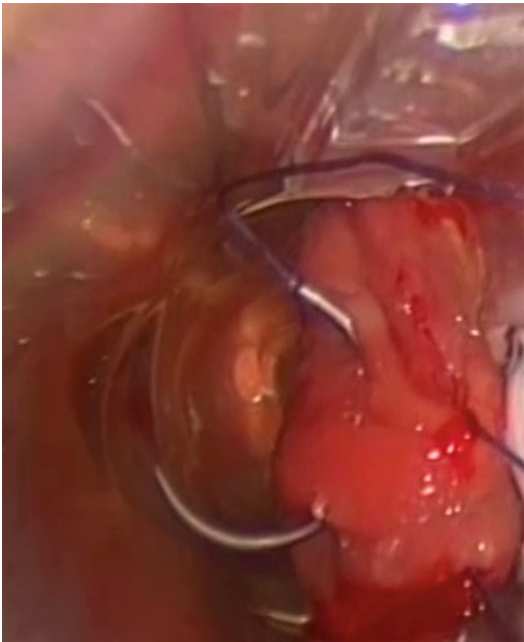


Fig. 10 Second passage (above the first one) performing the "Z-stitch" at the level of the proximal low rectum, as a proximal "fixation point" of mucopexy

from the adjacent one in order to guarantee enough blood outflow from the hemorrhoids via the venous plexus. In fact, a circumferential obliteration of rectal tissue might create a significant obstacle for the blood and consequently an increased risk of postoperative thrombosis. The

mucopexy running suture is stopped at the proximal apex of the internal hemorrhoid, avoiding its inclusion in the mucopexy. When performed this way, the THD method can effectively be considered a hemorrhoid-sparing procedure. Finally, the suture is gently tied (Fig. 14).

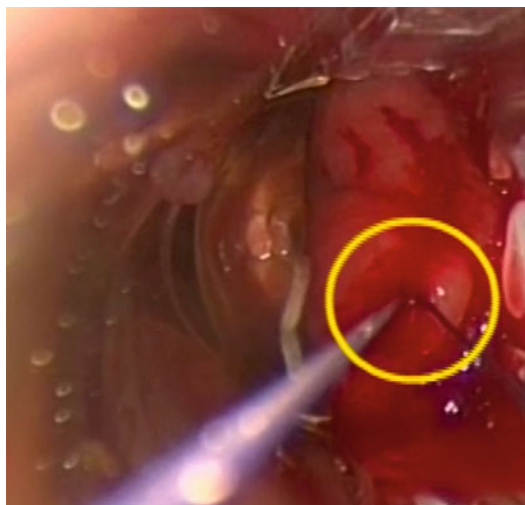


Fig. 11 Knot securing the “Z-stitch” at the level of the proximal low rectum, as a proximal “fixation point” of mucopexy

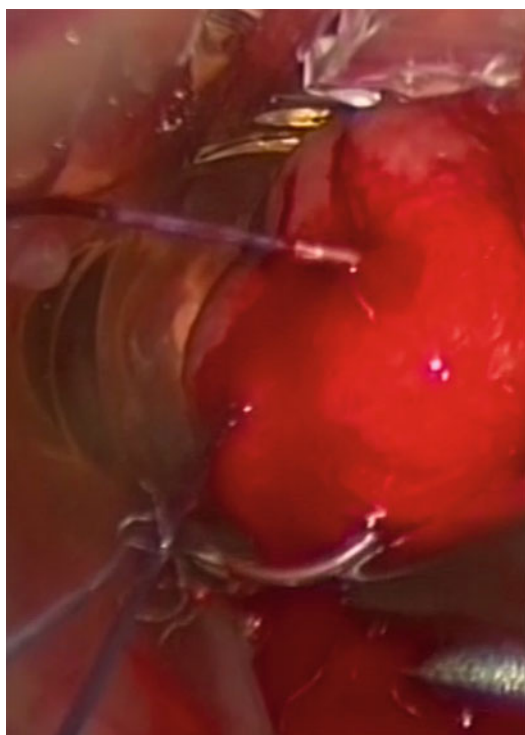


Fig. 12 Continuous suture during mucopexy, including the redundant and prolapsing mucosa and submucosa, in a proximal-to-distal direction along a longitudinal axis

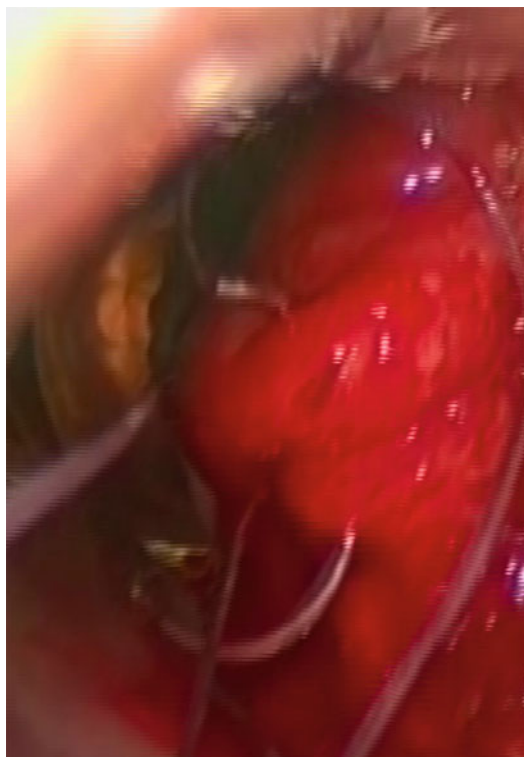


Fig. 13 During mucopexy, when the “marker point” is visualized, a passage of the running suture is done above (in this picture) and another below the “marker point,” in order to entrap the hemorrhoidal artery and accomplish the dearterialization according to the DDD principle

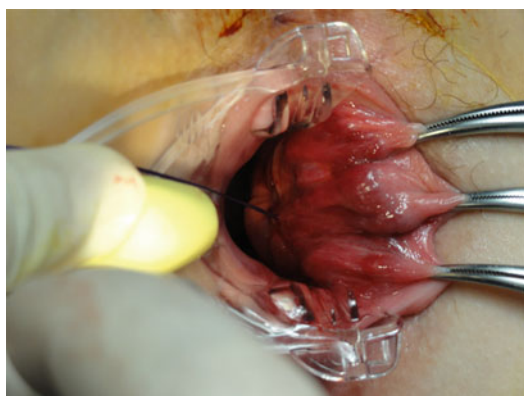


Fig. 14 The mucopexy running suture is stopped at the proximal apex of the internal hemorrhoid, avoiding its inclusion in the mucopexy; thereafter the suture is gently tied, finalizing the replacement of the prolapsing rectal mucosa/submucosa into the rectum. For this reason, the THD Doppler procedure can effectively be considered a hemorrhoid-sparing procedure

3.9 Postoperative Management

Diet rich in fluids (oral intake of at least 2 l of water per day) and fibers is established, eventually supplemented by oral assumption of stool softeners. Use of laxatives is advisable. In fact, especially in patients who underwent mucopexy, not only constipation but also diarrhea and increased frequency of bowel movements could cause an early disruption of the rectal sutures and, then, possible bleeding from the mucopexy suture(s) and early recurrence of prolapse. Scrupulous adherence to a dietary protocol is usually recommended during the first 2–3 postoperative months, and the patient is encouraged to continue a high residue diet after this time period. Patients with either chronic diarrhea or irritable bowel syndrome should be put on a very carefully controlled diet and pre-/probiotics. On the other hand, those with either chronic inflammatory bowel disease or chronic radiation proctitis must continue the specific therapy as prescribed; a sudden worsening of their condition should be diagnosed early and treated. Postoperative care should be strongly directed toward the control of pain and tenesmus. The source of these symptoms is the surgical site (not the hemorrhoidal cushions) and is related to the plication of the rectal mucosa/submucosa. This can cause an inflammatory response (with edema and inflammatory reaction) associated with relative ischemia of those tissues, which causes both pain and tenesmus. As a consequence of the inflammatory process, patients undergoing mucopexy can have a mucous, sometimes bloody, anal discharge for a few days. When both piles and the sensitive mucosa of the anal dentate line are spared during mucopexy (as described above), these are not the source of pain and tenesmus, unless a hemorrhoidal thrombosis has developed. The severity of pain and tenesmus could be dependent not only on the surgical procedure but also on the patient's tolerance level to pain; in that case, their management of these symptoms should be specially tailored. Patients who undergo dearterialization alone usually suffer minor pain and/or rectal discomfort, lasting from a few hours to a few days. In these patients, anti-inflammatory drugs and/or analgesics can be prescribed “as

needed.” Patients who had mucopexy more frequently report tenesmus and pain. In these patients, nonsteroidal anti-inflammatory drugs (NSAIDs) should be given around the clock for at least 3 days, and other analgesics when requested. With these measures, in the author's experience, both edema and related symptoms are reduced. Usually, patients can discontinue this postoperative regimen after a few days, and only a minority of them needs it for more than 7 days.

Urinary retention develops in about 10% of patients, especially those who undergo mucopexy and males. To prevent this, restriction of excessive intravenous infusion of fluids is advisable. Treatment should consist only in temporary bladder catheterization.

Tenesmus can be accompanied by a transient sensation of urge to defecate. This is usually transient, with resolution within 7–10 days and does not give rise to any form of persistent urgency, soiling, or fecal incontinence.

3.10 Follow-Up

The follow-up includes four different time points. At the first visit, 7–10 days after the procedure, a digital anorectal examination is never carried out, but only an external inspection to avoid the risk of pulling on the stitches. At this time, particular attention is also paid to normalizing defecation with diet and laxatives. Usually, bleeding is no longer present. In a minority of patients after mucopexy, some bloody mucus is referred, due to the early postoperative inflammatory process. Inflammation can also determine mild fever along the first 2–3 postoperative days, usually self-limited and responding to anti-inflammatory drugs. Tenesmus can be referred after mucopexy at this time and gradually improves. Only minority of patients still require analgesics. The second follow-up visit is made after 1 month. The patient's anorectum is digitally explored and assessed. Rectal pain, discomfort, and tenesmus should no longer be present. Persistence of these symptoms should be investigated. In case of some hemorrhoidal prolapse is preset or reported, this is suspicious of suture disruption, usually

secondary to defecatory dysfunction. Also intermittent, self-limited episodes of bleeding can be indicative to mucopexy disruption. Anal continence should be fully normal. At the 3 month follow-up visit, the patient is also evaluated with anoscopy. At that time, when the procedure is successful, all symptoms are resolved. Volume and appearance of hemorrhoidal cushions are that of patients without hemorrhoidal disease. Persistent or new bleeding or prolapse will require a closer follow-up. Thereafter, patients are contacted by telephone and examined 1 year after surgery. A long-term annual follow-up may be established. If any symptom related to a possible recurrence of hemorrhoidal disease is reported, the patient undergoes digital examination and anoscopy.

3.11 Complications and Management

The most common complication is tenesmus, which sometimes can turn into rectal discomfort or pain. It can be managed with analgesics and anti-inflammatory drugs as described above. However, these symptoms rapidly disappear. Rectal bleeding can occur in a very limited number of patients, usually within 2 weeks after the operation. It can be caused by trauma of the rectal mucosa involved in the surgical procedure (especially the mucopexy) during prolonged straining, passage of hard stool, or diarrhea. In fact, excessive suture traction can be generated and can lead to breakage. Moreover, the relative tissue ischemia at the level of the mucopexy suture line can result in a limited necrosis of the mucosa/submucosa and consequent bleeding. In both cases, the removal of clots by saline solution lavage (performed with a soft catheter) can usually stop the bleeding. If bleeding continues and increases in frequency and intensity, it is necessary to perform an endoscopic or surgical hemostasis (cauterization, endoclip, and suture). In the Authors' experience, THD, performed according to the principles outlined above, was never followed by fecal incontinence and chronic pain. Indeed, anorectal physiology parameters should be unaltered, and anal sphincters should not be injured by this procedure (Ratto et al. 2011b).

3.12 Recurrences and Their Management

In case of recurrence, the treatment decision-making is guided by the symptoms. Recurrence of rectal bleeding can occur in cases where the dearterialization was not successful in one or more rectal sectors. Severity of bleeding is usually less than in the initial presentation and can be easily managed with medical therapy, rubber band ligation, or new dearterialization under Doppler guidance. In the majority of cases of recurrent prolapse, the cause seems to be the disruption of mucopexy suture(s) with difficult defecation early in the postoperative period or later due to chronic straining. To prevent this occurrence, an optimal diet and fiber supplements are necessary in case of constipation, or prompt treatment for IBS and IBD symptoms. Patients with recurrent prolapse can be managed conservatively if the prolapse is minimal. Re-do mucopexy is technically possible although other strategies such as excisional hemorrhoidectomy can also be adopted.

4 Clinical Results of Application

Despite the high prevalence of hemorrhoidal disease, to date no surgical technique can be considered the "gold-standard" of treatment (Kaidar-Person et al. 2007). The most innovative approaches are stapled hemorrhoidopexy (Burch et al. 2009) and Doppler-guided dearterialization (mostly performed by either THD Doppler or Doppler-guided hemorrhoidal artery ligation (DG-HAL)); both are considered valid alternatives to conventional excision (Ratto 2014; Scheyer et al. 2006; Rivadeneira et al. 2011). However, recurrence is the most concerning issue. A large meta-analysis by Jayaraman et al. (2006) showed that stapled hemorrhoidopexy was associated with a higher risk of symptom recurrence and prolapse compared with hemorrhoidectomy; these two procedures were comparable in terms of pain, urgency, and pruritus ani.

In a recent systematic review, the pooled recurrence rate of Doppler-guided dearterialization was 17.5%, with a surprisingly wide range of 3–60%

Table 1 Intra- and postoperative results from cohort studies

Study	No. of patients	Operation time (min.)	No. of ligated arteries	Postoperative complications			
				Pain (%)	Bleeding (%)	Thrombosis (%)	Fissure (%)
Dal Monte et al. 2007	330 (grades 2-3-4)	n.a.	n.a.	19†	2	1.5	0.6
Festen et al. 2009	23 (grades 2–3)	34	n.a.	n.a.	n.a.	n.a.	n.a.
Ratto et al. 2010	170 (grades 2-3-4)	20 ± 5, 30 ± 10 (with RAR)	6	15.9	1.2	2.3	n.a.
Infantino et al. 2010	112 (grades 2–3)	33.9 ± 8.8	7.2 ± 1.5	28.6	0.9	2.7	n.a.
Ratto et al. 2011a	35 (grade 4)	33 ± 12	6	14.3	5.7	8.6	n.a.
Giordano et al. 2011	28 (grades 2–3)	30 (20–45)	n.a.	0	0	n.a.	n.a.
Schuurman et al. 2012	38 (grades 2–3)	n.a.	5.2 ± 0.71	0	2.6	2.6	n.a.
Infantino et al. 2012	85 (grade 3)	n.a.	n.a.		5.9	2.4	n.a.
Zampieri et al. 2012	46 (grades 3–4)	20 ± 5.1	n.a.	6.5	0	0	0
Denoya et al. 2013, 2014	20 (grades 3–4)	36.6 ± 12.7	6	10	10	0	0
Elmér et al. 2013	20 (grades 2–3)	36 (30–45)	6	5	0	5	0
De Nardi et al. 2014	25 (grade 3)	25 ± 10	6	0	0	0	0
Giordano et al. 2014	31 (grade 4)	32 (23–47)	6 (5–8)	71	0	3.2	0
Tempel et al. 2014	216 (grade n.a.)	n.a.	n.a.	10.4	0	0	0
Béliard et al. 2014	54 (grades 2–3)	n.a.	n.a.	0	0	0	0
Ratto et al. 2015	803 (grades: 2-3-4)	34.3 ± 5.9 (24–47)	6	13	2.2	0.5	0.1
LaBella et al. 2015	108 (grades 2-3-4)	n.a.	6	8	13	0	0
Rubbini and Tartari 2015	106 (grades 3–4)	25 (16–65)	n.a.	35	n.a.	n.a.	n.a.

(Pucher et al. 2013). However, in our opinion, an accurate literature review reveals that, to date, it is not trivial to produce a robust systematic review of the success rate of Doppler-guided dearterialization due to: (i) differences in the adopted device (DG-HAL or THD Doppler), (ii) techniques (dearterialization alone or with

mucopexy), (iii) length of FU, and (iv) the definition of “success” or “recurrence.” Also, Tiernan et al. (2013) suggested the need for “a standardized definition” of recurrence. Intra- and postoperative results reported in the published cohort studies have been summarized in Table 1, while those concerning the patients’ follow-up in Table 2.

Table 2 Follow-up results from cohort studies

Study	No. of patients	Follow-up (months)	Recurrence rate (%)	Symptoms at follow-up			Reoperation rate (%)
				Bleeding (%)	Prolapse (%)	Pain (%)	
Dal Monte et al. 2007	330 (grades 2-3-4)	46 (22–79)	7.5	3	2.7	n.a.	n.a.
Festen et al. 2009	23 (grades 2–3)	1.5	17	4.3	n.a.	n.a.	n.a.
Ratto et al. 2010	170 (grades 2-3-4)	11.5 ± 12 (1–41)	n.a.	6.5	10.5	0	4.1
Infantino et al. 2010	112 (grades 2–3)	15.6 ± 6.5 (6–32)	14.3	20	6.3	3.6	12.5
Ratto et al. 2011a	35 (grade 4)	10 (6–28)	n.a.	25.7	28.6	8.6	5.7
Giordano et al. 2011	28 (grades 2–3)	38 (33–48)	14	4	11	n.a.	n.a.
Schuurman et al. 2012	38 (grades 2–3)	6	n.a.	n.a.	n.a.	n.a.	13.2
Infantino et al. 2012	85 (grade 3)	17 ± 0.4 (15–20)	14	n.a.	n.a.	n.a.	11.3
Zampieri et al. 2012	46 (grades 3–4)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Denoya et al. 2013, 2014	20 (grades 3–4)	35 (27–43)	16.7	16.7	16.7	8.3	8.3
Elmér et al. 2013	20 (grades 2–3)	12	20.0	15.0	20.0	10–0	10.0
De Nardi et al. 2014	25 (grade 3)	24	12.5	4.2	0	16.6	4.2
Giordano et al. 2014	31 (grade 4)	32 (6–58)	3.2	n.a.	n.a.	n.a.	3.2
Tempel et al. 2014	216 (grade n.a.)	23 (1–42)	n.a.	n.a.	n.a.	n.a.	n.a.
Béliard et al. 2014	54 (grades 2–3)	24	9.3	n.a.	n.a.	n.a.	n.a.
Ratto et al. 2015	803 (grades: 2-3-4)	11.1 ± 9.2 (3–57)	9.3	3.0	6.9	0	5.6
LaBella et al. 2015	108 (grades 2-3-4)	12	10.3	0	10.3	0	10.3
Rubbini and Tartari 2015	106 (grades 3–4)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Results from studies comparing THD Doppler procedure and other approaches are reported and commented in Table 3.

In our recent multicenter study on 803 hemorrhoids patients treated with THD Doppler procedure (Ratto et al. 2015), “failure” was defined as the presence of recurrent bleeding or prolapse needing medical or surgical therapy; the overall success rate was 90.7%, with no significant differences between hemorrhoid grade (Tables 4 and 5). Other series

showed similar good results for advanced grades of hemorrhoids (Festen et al. 2009; Ratto et al. 2011a; Walega et al. 2010). In a randomized trial, patients affected by Grade III and IV hemorrhoids were assigned to THD Doppler or stapled hemorrhoidopexy; both techniques were equally effective at short-term FU, but it was concluded that THD should be the preferred option because of less postoperative pain (Festen et al. 2009). In our multicenter study (Ratto et al. 2015), at last FU the

Table 3 Results from comparative trials comparing THD Doppler procedure with other techniques

Study	No. of patients, grade	Compared procedure	Outcome
Festen et al. 2009	Total: 23 Grade 3: 19 Grade 4: 4	PPH	No significant difference for complications. However, significantly shorter operative time for DGHL (23 vs. 34 min, $p < 0.001$) and less pain (pain score at day 7: 1.6 vs. 3.2, $p < 0.01$)
Giordano et al. 2011	Total: 28 Grade 2: 16 Grade 2: 12	PPH	No significant difference for pain, operative time, complications or recurrence rate. Patients returned to normal activities faster after DGHL (3.2 vs. 6.3 days, $p < 0.01$)
Schuurman et al. 2012	Total: 38 (grades 2–3)	HL	No significant difference for patient reported severity of bleeding, pain, defecation problems, discomfort. Greater improvement of prolapse symptoms in non-Doppler group ($p = 0.047$). Higher rate of complications for DGHL ($p < 0.0005$)
Infantino et al. 2012	Total: 85 (grade 3)	PPH	No significant difference for pain, postoperative complications, recurrence or reoperation rates. Higher rate of late complications for PPH ($p = 0.028$). Shorter length of stay and lower equipment cost for DGHL
Zampieri et al. 2012	Total: 46 Grade 3: 21 Grade 4: 25	Ligasure hemorrhoidectomy	In DGHL group, lower length of procedure (20 ± 5.1 vs. 28 ± 4.2 min, $p < 0.05$), higher pain resolution rate (87% vs. 81%, $p < 0.05$), better QoL, lower number of constipation days.
Elmér et al. 2013	Total: 20 Grade 2: 3 Grade 3: 17	MMH	Postop peak pain lower in DGHL during first week ($p < 0.05$), but no difference in overall pain. More pts. normal well-being in DGHL ($p = 0.05$). Pain, bleeding, and manual reduction of prolapse improved in all DGHL pts. at 1-year follow-up, grade of hemorrhoids reduced for both methods (more pts. with remaining grade II for DGHL ($p = 0.06$)).
Denoya et al. 2013	Total: 20 Grade 3: 16 Grade 4: 4	Ferguson hemorrhoidectomy	In DGHL group, lower postop narcotics use (25% vs. 100%, $p < 0.001$), shorter postop analgesics use (0 vs. 7 days, $p = 0.001$), earlier first bowel movement (1.3 ± 0.9 vs. 4.6 ± 3.1 days, $p = 0.001$), lower pain intensity rate (2.9 ± 3.5 vs. 7.6 ± 2.9 , $p = 0.001$), less frequent urinary retention (0% vs. 23.5%, $p = 0.012$), less laxative use (8.3% vs. 23.5%, $p = 175$), less anal pain (8.3% vs. 64.7%, $p = 0.001$).
Denoya et al. 2014	Total: 12	Ferguson hemorrhoidectomy	In DGHL group, similar recurrence rate (16.7% vs. 6.7%, $p = 0.411$), reintervention rate (8.3% vs. 6.7%, $p = 809$), no chronic complications (0 vs. 13.3%, $p = 0.189$), similar rate of recurrent symptoms (50% vs. 26.7%, $p = 0.212$), similar pain severity, similar QoL, similar incontinence-related QoL.
De Nardi et al. 2014	Total: 25 (grade 3)	MMH	Similar pain level by 30th postop day. In DGH, shorter work resumption and higher patient satisfaction, but not significantly. Similar recurrence rates needing additional surgery (4.2% vs. 4.2%, $p = 0.55$) at 1-year follow-up.
Béliard et al. 2014	Total: 54 (grade 2)	PPH	In DGHL group, shorter disability for work (4.4 ± 6.6 vs. 18.6 ± 13.7 , $p < 0.001$), significantly more improved prolapse, similar improvement of bleeding, significant improvement of tenesmus at 3 months, similar incontinence score, lower pain level at 1 month, significantly higher patient satisfaction, higher recurrence rate, similar reoperation rate.

PPH procedure for prolapse and hemorrhoids (stapled hemorrhoidopexy), HL hemorrhoidal artery ligation (without Doppler guidance), DGHL Doppler-guided hemorrhoidal artery ligation, MMH Milligan–Morgan hemorrhoidectomy, QoL quality of life

most frequent findings were residual skin tags, needing excision in about two-thirds of cases because of pruritus ani or discomfort (Table 4).

However, a “skin tag-pxy” is not a target for the THD Doppler procedure; that should be made clear to patients in order to avoid false

Table 4 Perioperative and last follow-up results in the multicenter study published by Ratto et al. (2015)

<i>Perioperative results</i>	
	Patients n° (%)
Type of THD procedure	
Dearterialization	112 (13.9)
Dearterialization + partial mucopexy	52 (6.5)
Dearterialization + total mucopexy	639 (79.6)
Concomitant surgical procedure	
Skin tags removal	66 (8.2)
Internal lateral sphincterotomy	53 (6.6)
Single pile removal	42 (5.2)
Anorectal polyp excision	24 (3.0)
Fistulotomy	2 (0.3)
Other	12 (1.5)
Total	199 (24.8)
Mortality	0
Intraoperative complications	
Transient submucosal hematoma	2 (0.3)
Rectal mucosa tearing	1 (0.1)
Bleeding	1 (0.1)
Total	4 (0.5)
Early (≤ 24 h) morbidity	
Pain/tenesmus	96 (12.0)
Urinary retention	69 (8.6)
Bleeding	1 (0.1)
Total	166 (20.7)
Required therapy	
Analgesics	188 (23.4)
Catheterization	69 (8.6)
Other drugs	53 (6.6)
NSAIDs	27 (3.4)
Surgical hemostasis	1 (0.1)
Total	338 (42.1)
Late (≤ 30 days) morbidity	
Pain/tenesmus	104 (13.0)
Bleeding	18 (2.2)
Urinary retention	7 (0.9)
Hemorrhoidal thrombosis	4 (0.5)
Constipation	3 (0.4)
Anal abscess/infection	3 (0.4)
Anal fissure	1 (0.1)
Other	4 (0.5)
Total	144 (18.0)
Required therapy	
Analgesics	116 (14.4)
NSAIDs	37 (4.6)
Other drugs	28 (3.5)
Catheterization	7 (0.9)
Surgical hemostasis	7 (0.9)
Rectal washout	7 (0.9)
Anal abscess drainage	2 (0.3)
Fissurectomy	1 (0.1)
Other	1 (0.1)
Total	206 (25.7)

(continued)

Table 4 (continued)

<i>Last follow-up results</i>	
	Patients n° (%)
Failure	
Hemorrhoidal prolapse	51 (6.3)
Recurrent bleeding	19 (2.4)
Hemorrhoidal prolapse and bleeding	5 (0.6)
Total	75 (9.3)
Required therapy	
Drugs	28 (3.5)
Repeat-THD	18 (2.2)
Hemorrhoidectomy	16 (2.0)
Rubber band ligation	12 (1.5)
Other	1 (0.1)
Total	75 (9.3)
Condition or symptom referred	
Skin tags	67 (8.3)
Chronic rectal pain/discomfort	3 (0.4)
Post-defecation soiling	3 (0.4)
Anal fistula	1 (0.1)
Anal fissure	1 (0.1)
Recurrent hemorrhoidal thrombosis	1 (0.1)
Other	11 (1.4)
Total	87 (10.8)
Required therapy	
Skin tags removal	41 (5.1)
Analgesics	3 (0.4)
Biofeedback	2 (0.3)
Fistulectomy	1 (0.1)
Hemorrhoidal thrombosis	1 (0.1)
incision	1 (0.1)
NSAIDs	4 (0.5)
Other	
Total	53 (6.6)

expectations. The overall morbidity rate was 18.0%, mainly represented by pain or tenesmus (13.0%) (Table 4). This should be related to the fact that about 85% of patients were subjected to mucopexy, which inevitably creates edema and/or inflammation of the rectal mucosa/submucosa layers. Administration of NSAIDs and analgesics can easily control pain and tenesmus. Similarly, Theodoropoulos et al. (2010) found that these symptoms were more pronounced in patients undergoing DG-HAL plus hemorrhoidopexy or rectoanal repair. Data from our multicenter study (Ratto et al. 2015) were encouraging with regard to postoperative pain, confirming that THD Doppler resulted in less postoperative pain than stapled hemorrhoidopexy (Festen et al. 2009;

Sajid et al. 2012) or hemorrhoidectomy (Denoya et al. 2013). It is well known that stapled hemorrhoidopexy can be associated with some serious and life-threatening complications or disabling long-term conditions (Pescatori and Gagliardi 2008; Faucheron et al. 2012). In our multicenter study (Ratto et al. 2015), no serious event occurred. At last FU visit, only three patients (0.4%) complained of chronic rectal pain, while three (0.4%) reported post-defecation soiling (Table 4). The low incidence of these conditions is probably due to the absorbable nature of the suture: nerves or the smooth muscle layer are not trapped by the suture indefinitely and no anatomical changes are created in the rectum. Moreover, during the procedure, the needle penetrated the rectal wall at a maximum depth of 6 mm, avoiding perforation of the entire rectal wall; for this reason, perirectal sepsis after THD Doppler was not reported. Generally, postoperative bleeding is one of the most feared complications after surgery for hemorrhoids. Only one case of early postoperative bleeding (within 24 h) was registered in our multicenter study (Ratto et al. 2015), while the remaining 18 cases (2.2%) occurred within 30 days, but surgical hemostasis was needed only in seven patients (0.9%). These percentages were similar, or actually a little better, than other reports, from which emerged a pooled rate of 5% for postoperative bleeding (Pucher et al. 2013). An uni- and multivariate analysis performed in our study on potential predictive factors of failure found that the hemorrhoidal grade was not statistically significant. This finding probably has demonstrated that a tailored mucopexy is mandatory for successful treatment of patients with prolapse. Other studies seem to

confirm this interpretation. Pol et al. (2010) treated 244 patients with DG-HAL without mucopexy or rectoanal repair; patients with Grade III and IV hemorrhoids had a higher risk of recurrence at multivariate analysis. On the contrary, an another previous Italian multicenter study (Infantino et al. 2010), in which mucopexy was added to dearterialization to treat patients with grades II and III hemorrhoids, showed that hemorrhoid grade was not predictive of failure. In our study (Ratto et al. 2015), only the absence of morbidity and use of “high ligation” were statistically predictive of failure at multivariate analysis; other confounding variables (age, length of FU and type of device) lost significance at univariate analysis (Table 6). As previously described, the THD Doppler procedure has evolved over time; initially, the dearterialization was performed at 6–7 cm from the anal verge (“high ligation”). Recent studies have shown that hemorrhoidal arteries at 4–6 cm from the anorectal junction are located outside the rectal wall, while at 2 cm from the anorectal junction they are almost always detected in the submucosa (Schuurman et al. 2009; Ratto et al. 2012). Therefore, the technique has been modified to obtain a more effective dearterialization, introducing the DDD (Ratto 2014; Ratto et al. 2012). In this context it is not surprising that at multivariate analysis patients who underwent “high ligation” showed a three times higher risk of failure (Table 5). Analysis of patients with a minimum FU of 12 months gave a success rate of 86.9%; this percentage was slightly lower than the 92.9% observed in patients with a FU shorter than 12 months. This difference could be explained by the consideration that a greater proportion of patients with a 12-months minimum

Table 5 Failure rate by degree of disease and symptoms reported in the multicenter study published by Ratto et al. (2015)

Failure	Hemorrhoid grade ^a Patients n° (%)				<i>p</i> ^b
	II	III	IV	Overall	
Failure: Bleeding	2 (1.5)	16 (2.9)	1 (0.9)	19 (2.4)	0.302
Failure: Prolapse	7 (5.1)	33 (6.0)	11 (9.3)	51 (6.3)	0.332
Failure: bleeding + prolapse	1 (0.7)	4 (0.7)	0	5 (0.6)	0.648
Overall failure	10 (7.3)	53 (9.6)	12 (10.2)	75 (9.3)	0.657

^aGoligher classification⁽¹³⁾

^bChi-square test

Table 6 Predictive factors of failure at univariate and multivariate analysis as reported in the multicenter study published by Ratto et al. (2015)

FACTOR	Univariate analysis		Multivariate analysis	
	Relative Risk (CI 95%)	p-value	Relative Risk (CI 95%)	p-value
Age < 40 years	0.932 (0.879–0.988)	0.007	0.987 (0.963–1.012)	0.308
Male gender	0.806 (0.522–1.244)	0.330	–	–
Hemorrhoid grade	1.057 (0.546–2.047)	0.869	–	–
Recurrent disease	0.662 (0.364–1.203)	0.181	–	–
Type of THD procedure	1.198 (0.417–3.441)	0.737	–	–
No morbidity within 30 days	0.542 (0.328–0.894)	0.018	0.396 (0.158–0.992)	0.048
Need for therapy within 30 days	0.852 (0.499–1.456)	0.560	–	–
Follow-up < 12 months	0.541 (0.352–0.831)	0.005	1.021 (0.980–1.063)	0.322
Device: First device	2.222 (1.021–4.837)	0.044	0.779 (0.247–2.455)	0.670
Device: Second device	2.269 (1.231–5.613)	0.012	1.228 (0.492–3.065)	0.660
High ligation	3.091 (1.702–5.614)	0.000	2.846 (1.240–6.532)	0.014

FU underwent the operation with the old devices and “high ligation.” As stated above, these two variables were the only significant independent factors predictive of failure. On the other hand, a longer FU period increased the recurrence rates, but only very slightly. For this reason, a FU shorter than 12 months was significant only at univariate analysis, and it has lost its significance at multivariate analysis, when the two confounding variables (type of device and modality of artery ligation) were considered.

5 Conclusions

THD Doppler is a valid therapeutic option in patients affected by hemorrhoidal disease. An accurate distal Doppler-guided dearterialization and a tailored mucopexy are mandatory to control symptoms. This procedure is associated with a low morbidity rate. However, it is necessary to be very careful to avoid complications, as this could affect the long-term outcome.

6 Cross-References

- [Literature Review on Dearterialization of Hemorrhoids and Mucopexy](#)
- [Main Advantages of Dearterialization of Hemorrhoids and Mucopexy](#)
- [Main Disadvantages of Dearterialization of Hemorrhoids and Mucopexy](#)

- [Pros and Contras of Dearterialization of Hemorrhoids and Mucopexy](#)
- [Selection of Patients to the Surgical Treatment of Hemorrhoids](#)
- [Technical Tips and Tricks of Dearterialization of Hemorrhoids and Mucopexy](#)
- [Why and When I Do Prefer the Dearterialization of Hemorrhoids and Mucopexy](#)

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Hemorrhoidal Dearterialization with Laser: Techniques and Results

33

Paolo Giamundo

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Abstract

Hemorrhoidal dearterialization with laser (HeLP) is a novel form of dearterialization to treat patients with symptomatic hemorrhoids. Terminal branches of the superior hemorrhoidal artery localized 3 cm above the dentate line are sealed by means of diode laser. Due to the restricted area of shrinkage elicited by the laser beam and the variable anatomic distribution of the vessels, the Doppler signal is deemed mandatory in order to locate the arteries.

The laser energy causes minimal discomfort to patients, therefore no anesthesia is required. Patients can be discharged 2 hours after the operation and are allowed to resume normal activities with no restrictions.

Long-term results show high success and low morbidity rates. The HeLP is mainly indicated in patients suffering from symptomatic hemorrhoids with minimal or moderate

mucosal prolapse. In case of significant prolapse, a variation of the HeLP procedure has been proposed: the HeLPexx. In the HeLPexx, after sealing the hemorrhoidal arteries with laser, three to six running sutures are placed on the prolapsing mucosa causing lifting of hemorrhoidal plexus. The addition of mucosopexy to laser treatment has a clear advantage in terms of long-term resolution of mucosal prolapse.

1 Rationale, Review of the Literature and Personal Experience

Although the definition of the real pathophysiology of hemorrhoids remains controversial, the “vascular” theory has been gaining increased consensus in the last two decades.

According to this theory, arterial overflow in the superior rectal arteries represents the leading

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cause of distal dilatation of the hemorrhoidal plexus and its related symptoms.

Following the first papers published on hemorrhoidal dearterialization procedures (Morinaga et al. 1995), several other anatomic studies confirmed the presence of blood overflow, arteriovenous hemorrhoidal shunting system, and poor capillary interposition between arterial and venous hemorrhoidal plexus in patients suffering from hemorrhoids (Aigner et al. 2004; Schuurman et al. 2009). These findings explain the shrinkage of the hemorrhoidal piles and consequent symptomatic improvement in patients treated with hemorrhoidal dearterialization.

The terminal branches of superior hemorrhoidal artery represent the target for dearterialization as they are supposed to directly feed the hemorrhoidal plexus. Therefore, the correct identification and closure of these branches is deemed necessary in order to elicit the resolution of symptoms.

Several papers published in literature thoroughly described the common procedures of suture/ligation of the terminal branches of superior rectal artery after the proper identification of these vessels by means of a Doppler device (Scheyer et al. 2006; Tagariello et al. 2004; Bursics et al. 2004).

The results of many trials showed encouraging results also in the long term (Giordano et al. 2009). A systematic review of transanal hemorrhoidal dearterialization published in 2009 reported the analysis of 17 articles with a total of 1996 patients. The vast majority of patients reported good functional results, especially those suffering from second- and third-degree hemorrhoids, whereas recurrence or persistence of prolapse showed rates of up to 60% in case of fourth-degree hemorrhoids with a better outcome only when additional mucosopexy was performed (Giordano et al. 2009).

The NICE (National Institute for Health and Clinical Excellence) included Doppler-guided hemorrhoidal artery ligation (DGHAL) and transanal hemorrhoidal dearterialization (THD) in the list of efficacious alternatives to conventional hemorrhoidectomies or stapled hemorrhoidopexy for the treatment of II and III degree hemorrhoids

(National Institute for Health and Clinical Excellence).

Being a nonexcisional therapy, the real advantage of this procedure is quicker recovery and reduced postoperative pain due to minimal anodermal involvement.

Nevertheless, although the arterial suture/ligation has to be considered a minimally invasive procedure, in most cases, locoregional anesthesia, deep sedation, or even general anesthesia are necessary to perform these procedures and patients can rarely be discharged a few hours after surgery.

The “HeLP” (hemorrhoid laser procedure) is another procedure used for hemorrhoidal dearterialization. It follows the same rationale of DGHAL/THD techniques and consists of a Doppler-guided hemorrhoidal dearterialization performed by means of a diode laser. It has the potential advantage of being less invasive than common techniques of dearterialization and not requiring any anesthesia.

The procedure is performed by means of a diode laser operating at the wavelength of 980 nm (Fig. 1). At this particular wavelength the laser beam has its maximum absorption on blood due to selective action on the chromophores of hemoglobin. This causes high absorption of energy in the arterial blood with consequent shrinkage of the vessel and minimal damage to the surrounding mucosa crossed by the laser beam. The “shrinking effect” elicited on the submucosal arteries is the ultimate goal.

The laser beam is delivered through a conic tip optic fiber (Fig. 2) in a pulsed mode at the energy of 13 W. This causes shrinkage of underlying tissue, including the artery, to an average depth of 4 mm minimizing the burning and vaporization effects.

The terminal branches of the superior hemorrhoidal arteries are sealed about 3 cm above the dentate line.

Anatomic studies showed that, at that level, arterial vessels are located approximately 2 mm under the mucosa and have a caliber varying from 0.6 to 2 mm (Schuurman et al. 2009).

Due to high variability of arterial distribution in the anal canal and the small caliber of vessels,

Fig. 1 Diode Laser
“Leonardo”, Biolitec

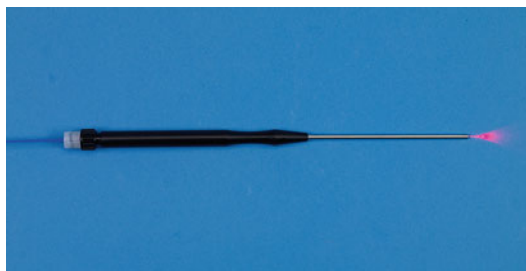


Fig. 2 Laser fiber



Fig. 3 Disposable Proctoscope

Doppler use is crucial in order to precisely locate and treat each arterial branch.

With this procedure, 12 arterial branches are usually located and sealed by means of the laser beam.

The laser energy causes minimal discomfort to patients, therefore no anesthesia is required for the HeLP. Light sedation can be administered intraoperatively only if requested by patients.

The procedure is performed with a disposable kit of instruments (Biolitec Biomedical Technology, Jena, Germany). This includes a specially designed proctoscope (Fig. 3) measuring 23 mm of diameter with a small window that holds a 3 mm Doppler transducer (Fig. 4). With the patient in the lithotomy position, the proctoscope is inserted into the anal canal. Once the arterial flow has been precisely located (Fig. 5), the



Fig. 4 Doppler probe



Fig. 5 Doppler probe inserted in the proctoscope in order to locate the terminal branches of superior hemorrhoidal arteries

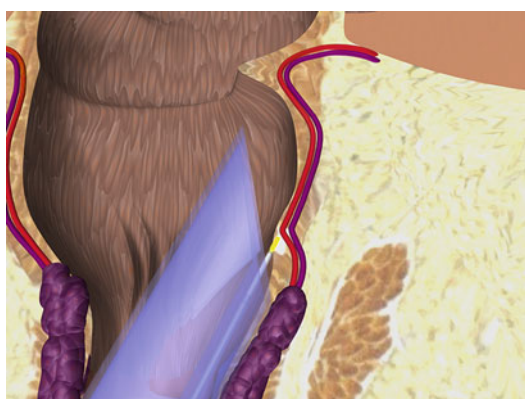


Fig. 6 Localization of hemorrhoidal arteries

Doppler probe is removed and replaced within the same built-in window with a 1000-micron laser optic fiber. The laser beam causes the shrinkage of the underlying artery (Fig. 6). Actual closure of the artery is checked by reintroducing the Doppler probe as it should be associated with disappearance of sound. Should the sound still be present, another sequence of three laser shots is delivered in the same point.

Hemorrhoidal dearterialization with laser has a few technical specific features that differ from previously described suture/ligation procedures.

Firstly, the Doppler transducers used by DGHAL and THD equipment operate at 7–8 MHz. On the contrary, the HeLP uses a 20 MHz Doppler transducer which seems more adequate in the detection of superficial arteries

closer to dentate line. Therefore, although the added value of Doppler-guidance has recently been challenged for other procedures, this method still plays a major role for the HeLP in localizing hemorrhoidal arteries and minimizing the effect of anatomic variation among patients (Giamundo 2016).

In addition, in DGHAL/THD the artery is usually sutured at variable distance from the point where the arterial pulse is located (Dal Monte et al. 2007; Ratto and Donisi 2012). In the HeLP, the laser fiber hits the mucosa and the underlying artery exactly at the same point where the Doppler signal locates the artery.

Finally, the laser treatment closes a larger number of arteries (12 instead of 6 or 8 closed with DGHAL/THD procedures).

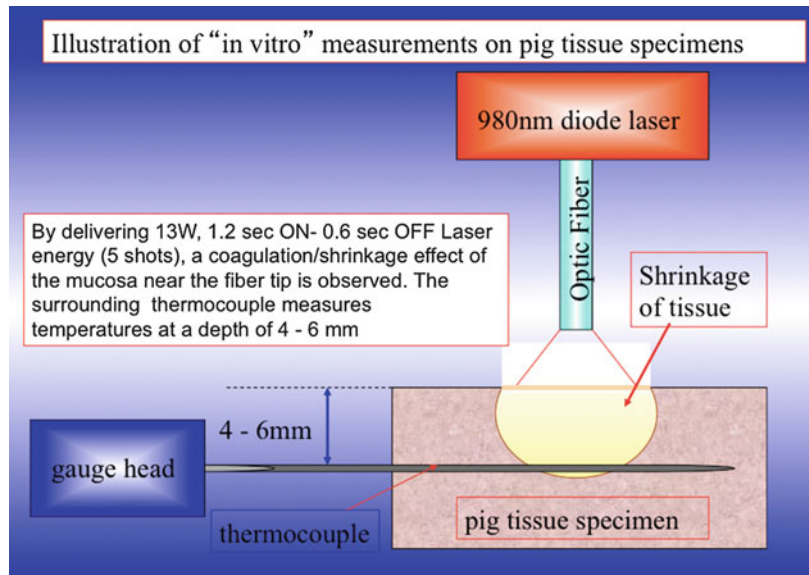
Before clinical laser application, “in vitro” studies on pig tissues have been conducted (Giamundo et al. 2011a). These studies helped in finding the optimal parameters for obtaining a satisfying absorption of energy by the arterial blood and minimal burning effect to the mucosa crossed by the laser beam. The thermal effect caused by laser shots is confined to the mucosa and submucosa avoiding risks of perforation of overheating of rectal tissue (Fig. 7).

The first prospective study published on the HeLP procedure reported the results on 30 consecutive patients suffering from symptomatic grade II and grade III hemorrhoids. Bleeding was the most frequent preoperative symptom in this series. Some patients had been previously treated with different surgical procedures. The operation was conducted without any kind of anesthesia in all cases and no associated procedures were performed.

The procedure was fast (mean operative time was 9.5 ± 2.3 min), and the vast majority of patients were discharged 2 h after the operation. Patients were allowed to resume normal activities with no restrictions. Intraoperative morbidity included only bleeding (in 4 cases) that was treated either by laser coagulation or by hemostatic suture.

Postoperative morbidity was negligible with no major complications reported. The efficacy of the procedure in terms of resolution of symptoms,

Fig. 7 Experimental studies on pig tissues: a thermocouple measures the temperature patterns in the tissues surrounding the area hit by laser beam



reduction of volume of hemorrhoidal piles (down-grading), and improvement of quality of life was evaluated by an independent observer.

At a mean follow-up of 6 months, the overall success rate was 93% with high satisfaction and compliance among the patients. In particular, the efficacy of the procedure, low morbidity, and the almost absence of pain during the procedure and in the postoperative course were the most appreciated features by patients (Giamundo et al. 2011a).

In another prospective study conducted on 97 patients with symptomatic II and III degree hemorrhoids, at a median follow-up of 15 months, no significant complications were reported. The procedure was judged safe, effective, and painless. Resolution of symptoms (frequency of bleeding, acute hemorrhoidal syndrome, pain, and itching) was reported in the vast majority of patients. Recurrence rate was 5% at 2 years (Crea et al. 2014).

In another recently published multicenter trial (De Nardi et al. 2016), 51 patients treated with HeLP were prospectively evaluated. Primary endpoint was bleeding rate and secondary endpoints were reduction in pain and prolapse, resolution of symptoms, and degree of patient's perception of improvement. At a 24-month follow-up, complete resolution of bleeding was observed in 28/29

patients (96.7%), resolution of pain in all patients, and resolution of the mucosal prolapse in 15/18 patients (76.9%). At 12-month follow-up, 86.3% of patients reported improvement with the PGI Scale indicating a high patient's perception of improvement and high compliance. The authors concluded that the hemorrhoids laser procedure is a safe and efficient technique to treat symptomatic II and III degree hemorrhoids.

In consideration of its minimally invasive characteristic and its feasibility in an ambulatory setting, the HeLP procedure has been compared with another commonly used minimally invasive technique, the RBL, in a randomized controlled multicenter clinical trial (Giamundo et al. 2011b). A total of 60 patients with symptomatic grade II or grade III hemorrhoids entered the trial with balanced allocation to HeLP or RBL, with stratification by study center. HeLP was performed according to the previously standardized procedure. RBL was performed by positioning rubber bands on the mucosa at the base of left lateral, right anterior, and right posterior piles. No anesthesia was given for either technique.

At 6 months, resolution of symptoms was observed in only 53% of patients with rubber ligation versus 90% of patients with laser procedure. Reduction of hemorrhoids of at least one grade was observed in 40% of patients with

Table 1 Baseline demographic, clinical features, and results of patients treated with “HeLP”

			No. of patients (%)
Sex			
Male			160 (59.7)
Female			108 (40.3)
Age (years) ^a			45 (18–78)
Hemorrhoid grade ^b			
I			0
II			140 (52.2)
III			128 (47.8)
IV			0
Previous failed surgical treatment:			34 (12.7)
Stapled hemorrhoidopexy			8
THD			8
Hemorrhoidectomy			7
Rubber band ligation			7
Other (infrared, sclerotherapy)			4
Preoperative symptoms:			
Bleeding			219 (82)
Pain			182 (68)
Recurrent acute hemorrhoidal symptoms(thrombosis, prolapse) > 2/year for at least 3 years			150 (56)
Overall success rate:			228 (85)
Patients with some persisting symptoms:			40 (14)
Patients reoperated after failure:			38
Type of reoperation:	Re-do HeLP	15	
	Milligan and Morgan	10	
	HeLPexx	9	
	RBL	4	

^aValues are median (range)^bGoligher classification

ligation versus 80% of patients with HeLP. Higher quality of life and less postoperative pain and discomfort was also seen in the laser procedure group. All these findings reached high statistical significance.

In our institution, 268 patients underwent the HeLP procedure from April 2009 to August 2016. There were 108 females and 160 males. Median age was 45 (range, 18–78) years. Preoperative diagnosis was II degree hemorrhoids in 140 cases and III degree hemorrhoids in 128 cases. In all cases hemorrhoidal symptoms had last more than 3 years and conservative treatment had failed. Mucosal prolapse at preoperative evaluation was judged moderate in most cases. In 34 cases (13%), previous surgery had failed. Main symptom was bleeding (82%) followed by pain

(68%) and frequent acute hemorrhoidal symptoms (> 2/year), including thrombosis (56%) (Table 1).

All patients were prospectively evaluated. All patients entered a database including a thorough description of comorbidities, symptoms, type of previous treatments, and personal perception of quality of life (Visual Analog Scale). Duration of the operation, pain, need for additional laser shots in order to obtain the disappearance of Doppler signal, and intraoperative complications were recorded.

Postoperative follow-up was planned at 1 month, 3 months, and 12 months after surgery in the outpatients clinic. Symptoms, degree of pain or discomfort, self-perception of quality of life, and possible adverse events were recorded.

A thorough evaluation of the anal canal by means of an anoscopy was always performed.

Extended follow-up (every year after the first year) was conducted by telephone interview.

Median follow-up was 48 months (range, 6–84).

Two hundred and twenty-two out of 268 patients (85%) reported overall resolution of their symptoms.

Thirty-eight patients (14%) underwent a second procedure because of persisting symptoms. Of these, 15 patients underwent a re-do HeLP, 4 underwent a rubber band ligation (RBL) and 19 underwent more invasive treatments (10 Milligan and Morgan, 9 HeLPexx).

There was a high satisfaction among patients (93%) and 97% of patients indicated their intention to advise this kind of treatment to friends or relatives.

Like for most techniques of hemorrhoidal dearterialization, bleeding, pain, itching, thrombosis, and acute hemorrhoidal syndrome are successfully controlled with the HeLP procedure.

Mucosal prolapse in high-grade hemorrhoids is caused by progressive destruction of submucosal connective tissue following enlargement of hemorrhoidal piles. The fibrosis caused by dearterialization procedures, due to minimal retraction of the mucosa, is often insufficient to completely solve significant prolapse. Therefore, it may require additional techniques.

Transanal hemorrhoidal dearterialization (THD) represented the “evolution” of the firstly described dearterialization techniques as it incorporates also a mucopexy to the suture/ligation of the terminal branches of the superior hemorrhoidal arteries (Dal Monte et al. 2007).

The mucosopexy has a clear advantage in terms of long-term resolution of mucosal prolapse (Ratto et al. 2014; Infantino et al. 2010).

Comparatively, in patients showing significant mucosal prolapse at preoperative evaluation, mucosopexy can be easily added to the HeLP procedure in the same operation. In this case, the procedure needs to be performed under locoregional or general anesthesia due to potential pain caused by the use of a larger

proctoscope and the placement of running sutures involving larger quantities of mucosal and submucosal tissues.

The procedure is called ‘HeLPexx’ and consists of the addition of mucopexy to the HeLP procedure.

The number of lifting sutures is generally variable, “a la demande,” i.e., depending on the type and morphology of the prolapse. Three to six running absorbable sutures are usually necessary to reduce the prolapse. Postoperative fibrosis elicited by the sutures allows the adhesion of the sliding mucosa to the underlying muscular layers, lifting the hemorrhoidal piles and restituting the normal anatomy of the anal canal.

As far as the technical aspect is concerned, the “HeLPexx” includes the laser dearterialization performed according to the standard procedure (HeLP). Once the laser procedure is completed, the proctoscope of the kit is replaced by a larger (3 cm diameter) disposable proctoscope (The Beak, Sapimed, Italy) which is open in part of the circumference (Fig. 8). This facilitates the placement of running sutures within the circumference of the anal canal by progressively rotating the proctoscope. The first stitch is placed about 4 cm above the dentate line. This represents the anchoring point of the suture to the underlying muscular layers. From this point a running suture descending caudally to include the prolapsing mucosa and submucosa is placed stopping approximately 5 mm above the dentate line. The



Fig. 8 Introduction of a disposable proctoscope for mucosopexy

knot is finally tied to the first stitch causing a lift of the redundant mucosa. Three to six sutures are placed in order to successfully treat the prolapse, usually at the odd number of the clock-hours (Fig. 9).

In our institution, from August 2010 to December 2015, 138 patients underwent the “HeLPexx” procedure. There were 65F and 73M. Preoperative

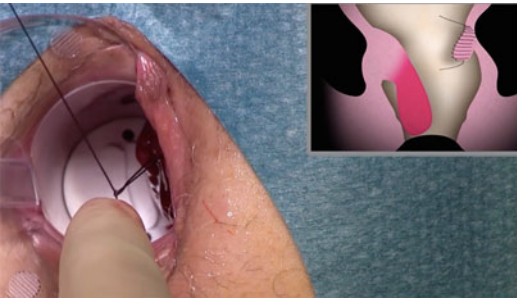


Fig. 9 Lifting of prolapsing mucosa during ‘HeLPexx’

diagnosis was III degree hemorrhoids in 134 cases and IV degree hemorrhoids in four cases.

Preoperative symptoms included: bleeding (72%), manually reducible hemorrhoidal prolapse (88%), pain (56%), recurrent thrombosis (34%), need for medications >3 times/year (42%) (Table 2).

Median duration of the operation was 26 min (range, 16–46). Median number of mucopexy sutures was 4.1 (range, 3–6).

Intraoperative complications included: bleeding (seven cases, 5%), submucosal hematoma (four cases, 3%).

At a median follow-up of 36 months (range, 12–70), overall resolution of symptoms was reported in 130 patients (94%). Recurrence of bleeding and partial prolapse was observed in eight patients at a follow-up ranging from 40 to 65 months. All of these patients underwent a second operation (two RBL, two HeLP, and four Milligan and Morgan).

Table 2 Baseline demographic, clinical features, and results of patients treated with “HeLPexx”

			No. of patients (%)
Sex			
Male			73 (52.9)
Female			65 (47.1)
Age (years) ^a			45 (18–78)
Hemorrhoid grade ^b			
I			0
II			0
III			134 (97.1)
IV			4 (2.9)
Preoperative symptoms:			
Prolapse			121 (88)
Bleeding			99 (72)
Pain			77 (56)
Recurrent acute hemorrhoidal symptoms (thrombosis, prolapse) > 2/year for at least 3 years			58 (42)
Duration of operation (min) ^a :			26 (16–46)
No. of mucopexy sutures			4.1 (3–6)
Overall success rate (median follow-up 36 months):			130 (94)
Patients with recurrence:			8 (5.8)
Patients reoperated after failure:			8
Type of reoperation:	HeLP	2	
	Milligan and Morgan	4	
	RBL	2	

^aValues are median (range)

^bGoligher classification

2 Conclusions

Doppler-guided hemorrhoidal dearterialization with laser (HeLP) has overcome the experimental phase and has proven to be a safe, reliable, painless, and easy to perform procedure for the treatment of symptomatic hemorrhoids.

If compared to other forms of dearterialization, the HeLP is less invasive as it can be performed without anesthesia in an outpatient setting.

Long-term follow-ups confirmed the initial encouraging results in terms of resolution of symptoms and improvement of quality of life.

The presence of severe mucosal prolapse may hamper the efficacy of the laser treatment. In these cases, the addition of mucosopexy (HeLPexx) can cure the prolapse, even in the long term.

Future randomized trials will clarify the pros and cons of HeLP and HeLPexx by comparing them with other common procedures used for the treatment of hemorrhoids.

However, on the basis of the available evidence, these minimally invasive forms of dearterialization with laser can be considered as an effective alternative to existing procedures and should be part of the armamentarium of colorectal surgeons to cure hemorrhoids.

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Why and When I Do Prefer the Dearterialization of Hemorrhoids and Mucopexy

34

Enrico Merolla, Bruno Scotto, and Micaela Piccoli

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Abstract

Transanal hemorrhoidal dearterialization represents a valid treatment for second- and third-degree hemorrhoids. Its introduction 20 years ago, followed by many technical adjustments and improvements, brought an important “non-excisional” option to resolve a frequent proctological problem. Starting from the anatomic, physiologic, and physiopathologic knowledges of the hemorrhoidal disease, associated with the evaluation of the encouraging results obtained, many surgeons have been starting to identify this technique as an optimal compromise because of the patient’s satisfaction and

the reduction of postoperative pain, associated with acceptable long-term recurrence rate when compared with other “milestones” techniques. An important step to obtain worldwide acceptance has been done when evaluating the efficacy of the technique in selected degrees of hemorrhoids: if at the beginning of the experience the data were obtained regardless of the degree of the disease, then many trials started to select specific patients to obtain more homogenous results to better clarify the efficacy of the technique. The aim of this chapter is to briefly summarize the correct indications for this technique to obtain good outcomes and reduce the failure of the treatment.

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1 Introduction

When Morinaga et al. (1995) first described the hemorrhoid artery ligation (HAL) procedure for internal hemorrhoids in 1995, many surgeons

focused their attention on this new technique for the treatment of the commonest anorectal benign disease. Since then, the cooperation between researchers and surgeons brought to the evolution of the procedure into the more recent transanal hemorrhoidal dearterialization (THD) in association or not with a mucopexy for treating the mucosal prolapse. Because of its “non-surgical” approach to the hemorrhoidal disease, this innovation brought many surgeons to start its comparison with others “milestones” procedures, such as rubber band ligation (RBL), conventional hemorrhoidectomy (CH), and the stapled hemorrhoidopexy (SH), showing different results in terms of postoperative outcomes and complication rates.

Nowadays, after almost 20 years of follow-up and debates, THD took its place within other techniques and is worldwide accepted as a valid option for hemorrhoids, with specific indications according to the degree of the problem.

2 When I Do Prefer THD: Correct Indications to Avoid Failure

The principle on which THD is based (i.e., the ligation of the terminal branches of the superior rectal artery causing to the reduction of the blood flow and the shrinkage of the hemorrhoidal cushions) lead surgeons to test its efficacy on any degrees of hemorrhoids, with both enthusiast and poor results creating several problems in evaluating its true benefit. To clarify this problem, first we need to ask ourselves when this option is appropriated for the disease, i.e., which type of hemorrhoids could benefit from THD treatment.

At the beginning of the experience (Sohn et al. 2001; Arnold et al. 2002; Bursics et al. 2004), the data collected by many surgeons showed encouraging results on relieving piles symptoms, but patient samples were inhomogeneous for two reasons: the presence of any hemorrhoids degrees and the lack of specification about the postoperative outcomes related to the degrees of the disease. After few years, two papers showed their results obtained after treating more than 300 patients, among them nearly 90% had second- or third-

degree hemorrhoids (according to Goligher's classification (Goligher et al. 1984)). After a mean follow-up of, respectively, 18 and 46 months on about 60% of the patients operated, both papers showed a relief of symptoms in the majority of patients (80% and 92%, respectively) (Scheyer et al. 2006; Dal Monte et al. 2007).

In 2009 Giordano et al. (2009) published a systematic review collecting data from 16 observational studies (11 prospective, 5 retrospective) and only 1 prospective randomized trial (Bursics et al. 2004), including 1996 patients. The data showed that after at least 1 year of follow-up, 10.8% of patients complained with prolapse, 9.7% with bleeding, and 8.7% with pain on defecation, but only one paper exactly showed the relationship between the hemorrhoids degree and the recurrence rate (expressed as hemorrhoidal prolapse or recurrent bleeding): in this study (Scheyer et al. 2006), 6.7% of patients affected by second-degree hemorrhoids, 13.5% of patients affected by third-degree hemorrhoids, and 59.3% of patients affected by fourth-degree hemorrhoids had a residual prolapse at the follow-up, while bleeding was present in 2.2% of patients with second-degree hemorrhoids, 6.8% of patients with third-degree hemorrhoids, and 3.7% of patients with fourth-degree hemorrhoids. Similar results were obtained by Dal Monte et al. (2007), who demonstrated that the relapse rate was 4.8% for third-degree hemorrhoids and 26.7% for third-degree hemorrhoids, but this higher rate of complication in advanced disease could be avoided by a mucosal plication of the cushions, although this data did not reach statistical significance. However, the paper demonstrated that, if properly applied, THD could lead to satisfying results in the short-term and long-term follow-up.

One of the largest series recently published, involving more than 800 patients consecutively enrolled, clearly confirms the strength of the technique for second- and third-degree hemorrhoids, with a 90.3% of success after at least 11-month follow-up (up to 57 months). Moreover, data shows that the recurrence rate raise up according to the degree of the disease, with 7.3% in second-degree hemorrhoids, 9.6% in third-degree hemorrhoids, and 10.2% in fourth-degree hemorrhoids.

Once again, it is demonstrated that the correct indication of THD has to be focused in selected cases (Ratto et al. 2015).

Those considerations, associated with further studies, brought the Italian Society of Colorectal Surgery (SICCR) to validate this technique as a potential treatment option for second- and third-degree hemorrhoids. In its recent consensus statement (Trompetto et al. 2015), discussants agreed that THD could be useful when the main complaint is not only bleeding but also hemorrhoidal or mucosal prolapse. In fact, after the dearterialization along the low rectal circumference, surgeon must evaluate the presence of residual mucosal prolapse, and, if confirmed, a mucopexy should be added, as an “on-demand” step of the procedure, depending on its location and severity (Ratto 2014). Moreover, it was generally agreed that THD is associated with significantly lesser postoperative pain if compared to stapled hemorrhoidopexy (SH); when compared to conventional hemorrhoidectomy (CH), dearterialization with mucopexy resulted in similar postoperative pain and morbidity and in similar 2-year cure rate.

Recently, some studies are trying to demonstrate the potential benefit of the THD procedure applied to advanced hemorrhoids (i.e., fourth-degree). Ratto et al. enrolled 35 patients with prolapsed and irreducible hemorrhoids but with soft external cushions. Patients with firm and fibrous external piles or thrombosed hemorrhoids were excluded. After 10 months the results were satisfying, confirming a 94% of success, with complete control of bleeding in three-quarters of cases, and only occasional in the others. On the other hand, a residual hemorrhoidal prolapse was observed in less than 30% of patients, requiring further surgery only in 5.7% (Ratto et al. 2011).

Similarly, in a small sample (31 patients), Giordano et al. demonstrated that THD could be effective for the treatment of advanced hemorrhoids, applying a technical modification of the technique, the “targeted mucopexy” (TM), consisting of adding the mucosal plication only if necessary and using a different type of needle (a 3/8 needle instead of a 5/8 needle); according to the author, this innovation allows the surgeon to

control precisely the amount of tissue taken with each bite, which will differ from patient to patient depending on the size of the hemorrhoids and any associated mucosal rectal prolapse (Giordano et al. 2014). After 12 months, the recurrence rate was only 3%, while compared to other studies where standard mucopexy was applied recurrence rate was 11% and 9%.

Although both studies obtained good results, they referred to small samples of selected patients, with relatively short follow-up. Trials with larger series, associated to comparison with other techniques, seem necessary to better evaluate the true efficacy of the technique on advanced disease.

3 Why I Do Prefer THD: An Anatomic and Physiological Issue

The decision to prefer a technique on another is usually based on surgeon’s habit and experience, conscious of the benefits and potential complications that could result from this choice. Innovations are usually well accepted with (more) criticism and (less) curiosity, above all if they bring little modifications to the “standard technique.” In this scenario, THD technique is in a disadvantaged position compared to others because of its different approach to the hemorrhoidal disease. If the main operations performed always tend to “destroy” hemorrhoidal tissues, THD aims to restore the correct physiology of the hemorrhoidal plexus by replacing the normal anatomy of hemorrhoidal cushions. The great novelty introduced is that surgeon doesn’t need to “remove” piles (like conventional hemorrhoidectomy) or part of the rectal mucosa (like stapled hemorrhoidopexy) but can obtain an optimal clinical result just with the “reconstruction” of the structures involved in the disease, reducing about to 0% the risk of complications usually related to anorectal surgery. As demonstrated, repositioning of the hemorrhoidal cushions as opposed to excising them also conveys the advantage of restoring the physiological role of these structures in the continence mechanism, because it has indeed been demonstrated that the

cushions contribute to approximately 15–20% of the anal resting pressure and may serve as a “plug” ensuring complete closure of the anal canal. A further advantage conveyed by THD is that the procedure allowed the accurate application of sutures in the area above the dentate line, thereby minimizing the risk of postoperative pain and complications (Giordano et al. 2009; Lestar et al. 1989). Also, it is of interest that neither fecal urgency nor fecal incontinence was reported, confirming that use of the THD method is reliable and not detrimental to continence mechanisms (Ratto et al. 2011). Those considerations have to be taken in account while choosing a treatment for hemorrhoid disease because of the potential complications related to anorectal surgery that could affect the quality of life of the patients.

For example, when compared to stapled hemorrhoidopexy, several studies demonstrated that there is no significative difference between the techniques in terms of postoperative pain and long-term recurrence rate, but patients receiving SH experienced a higher rate of late complications, such as anal pain, deep rectal abscess, fecal urge incontinence, obstructed defecation, and hematoma of the rectum-sigmoid with hemoperitoneum. All those rare but well-defined major complications could be mainly related to the “blind” excision of the rectal wall, while the “non-excisional” approach of the THD procedure could avoid those dangers. Moreover, THD device is relatively less expensive than the stapler used for SH procedure, and nowadays the cost evaluation is another issue that surgeon must take in account in his choices (Infantino et al. 2012; Giordano et al. 2011; Leardi et al. 2016; Cheetham et al. 2000; Molloy and Kingsmore 2000; Maw et al. 2002).

For the same anatomic-physiological reasons, the comparison with conventional hemorrhoidectomy (CH) showed that the excision of the prolapsing hemorrhoids potentially exposes the patients to anal incontinence, associated with a higher incidence of postoperative pain requiring painkiller administration, as demonstrated since the beginning of the experience (Sohn et al. 2001; Bursics et al. 2004) and in following studies (Giordano et al. 2009; Ratto et al. 2010; Zampieri et al. 2012).

Moreover, it is commonly accepted that CH could be useful in advanced hemorrhoids, while THD efficacy is still controversial (Trompetto et al. 2015).

4 Conclusions

Choosing THD with “targeted mucopexy” for the treatment of prolapsing hemorrhoids represents the attempt to restore the anorectal physiology without breaking up one of its component. After a 20-year experience, it is widely accepted as a valid treatment for second- and third-degree hemorrhoids, guaranteeing symptoms relief and little percentage of complications when compared to other surgical options.

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Technical Tips and Tricks of Dearterialization of Hemorrhoids and Mucopexy

35

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Abstract

Hemorrhoidal disease is a recurrent anorectal complaint in the surgeon's office, with a 5%

prevalence in general population. Several new techniques and devices have been developed, such as transanal hemorrhoidal dearterialization (THD). THD aims to reduce the hemorrhoidal blood flow through Doppler-guided ligation of the terminal branches of hemorrhoidal arteries and to provide application of the redundant rectal mucosa/submucosa (mucopexy). The surgery is fully performed in the distal rectum, avoiding the somatic innervation of the perianal

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skin, minimizing postoperative pain and thus providing faster recovery.

Transanal hemorrhoidal dearterialization, as any other surgical technique for hemorrhoids, should be offered to patients with symptomatic hemorrhoidal disease, despite clinical treatment. Patients who most benefit from THD are those with bleeding or prolapsed internal hemorrhoids. Patients whose symptoms are due to skin tags or external hemorrhoids will not benefit just because the technique is performed completely above the dentate line.

No enemas or bowel preparation are done before surgery because too soft or liquid stools can run through the anal canal making visualization difficult. Both general and spinal anesthesia are safe and effective for hemorrhoid surgery.

To perform the dearterialization, an “X-stitch” is performed at the place of the Doppler signal at the six main hemorrhoidal arteries branches.

To perform the mucopexy, using a conventional needle holder, it is performed a non-anchored continuous suture, involving mucosa and submucosa distally to the place where the dearterialization was performed.

1 Introduction

Hemorrhoidal disease is a recurrent anorectal complaint in the surgeon’s office, with a 5% prevalence in general population (Johanson and Sonnenberg 1990). Although excisional hemorrhoidectomy is the most traditional and effective treatment for third- and fourth-degrees hemorrhoids, several new techniques and devices have been developed in the last two decades in an attempt to minimize postoperative pain and complications (Similis et al. 2015). First described in 1995 by Morinaga et al. (1995), and adapted with mucopexy only in 2007 by Dal Monte et al. (2007), transanal hemorrhoidal dearterialization (THD) has become increasingly popular due to its application in different degrees of disease and

low postoperative bleeding and pain (Similis et al. 2015).

THD aims to reduce the hemorrhoidal blood flow through Doppler-guided ligation of the terminal branches of hemorrhoidal arteries and to provide application of the redundant rectal mucosa/submucosa (mucopexy), repositioning the prolapsing tissue to its anatomical site, thus treating the most frequent symptoms associated with internal hemorrhoids, which are bleeding and prolapsed. The surgery is fully performed in the distal rectum, avoiding the somatic innervation of the perianal skin, minimizing postoperative pain and thus, providing faster recovery.

2 Patient Selection

Transanal Hemorrhoidal Dearterialization, as any other surgical technique for hemorrhoids, should be offered to patients with symptomatic hemorrhoidal disease, despite clinical treatment. Patients who most benefit from THD are those with bleeding or prolapsed internal hemorrhoids. Thus, THD is indicated for internal second-, third-, or fourth-degree hemorrhoids. A recent study showed that disease grade did not independently affect success rate (Ratto et al. 2015).

Patients with only bleeding or second-degree hemorrhoids can have dearterialization alone. On the other hand, those who complaint from prolapse or have higher degree disease, should undergo both dearterialization and mucopexy. We routinely perform dearterialization and mucopexy in all patients amenable to THD technique.

Patients whose symptoms are due to skin tags or external hemorrhoids will not benefit just because the technique is performed completely above the dentate line. Good patient selection is the first tip for better results.

3 Preparation for Surgery

There are no evidence-based guidelines for this, so it is done according to the surgeon’s preferences. In our practice, patients stay NPO 8 h

before surgery, as they will have general anesthesia. No enemas or bowel preparation are done before surgery because too soft or liquid stools can run through the anal canal making visualization difficult. We only use mild laxatives 2 or 3 days before surgery to avoid fecal retention after the procedure what is very common if the stool is previously too tight.

Our patients routinely receive antibiotic prophylaxis with Cefoxitin 1 g at anesthesia induction. Recent studies showed no benefit in the use of prophylactic antibiotics for open or closed hemorrhoidectomies, with infection rates as low as 1.4% and no difference between studied groups (Nelson et al. 2014; Khan et al. 2014). As there are no specific studies for THD, it is our preference to continue with prophylaxis.

4 Anesthesia

Both general and spinal anesthesia are safe and effective for hemorrhoid surgery. In our initial experience, we operated under spinal anesthesia, but due to the high risk of urinary retention, now all our THD procedures are done with general anesthesia and endotracheal intubation or laryngeal mask, without neuromuscular blocking. There is yet no evidence for the best type of anesthesia for THD, but hemorrhoidectomy under spinal anesthesia has a 21.9% incidence of urinary retention, with increased risk associated

with female sex, presence of preoperative urinary symptoms, diabetes mellitus, and need for postoperative analgesics (Toyonaga et al. 2006).

5 Equipment

Since the very beginning of the technique, different devices were developed in order to allow accurate arterial positioning with Doppler and ligation at the same time. The latest proctoscope (Fig. 1) model and most used in recent studies is THD Slide (THD S.p.A., Correggio, Italy), which consists of an anoscope equipped with a Doppler probe and a light source, with the advantage of a sliding part comprising the operation window and the Doppler probe, so the surgeon can move them proximally or distally without repositioning the device.

Both probe and light source are connected to a single equipment that functions as a light generator and emits the Doppler signals that can be turned on or off through a pedal (Fig. 2). THD Slide has a window that allows the surgeon to perform sutures through the rectal wall, guided by the acoustic identification of the arteries (Fig. 3). The device has an elliptical section, with a maximum external diameter of 32–34 mm and a maximum internal diameter of 20–34 mm. The suture is 2-0 absorbable polyglycolic acid with a 5/8-in needle. The needle holder has a mark on the tip where the needle should be held.

Fig. 1 THD Slide with surgeon's right hand on the sliding part



Fig. 2 THD device with probe and light source



Fig. 3 Sliding device and operation window with needle in specific spot



6 Positioning

With patient in lithotomy position, surgeon and assistant operate between legs. It is important to check if the generator is securely connected to the electrical outlet and is not near any other electrical device that may cause interference. This is necessary because from the moment the generator is started it starts a 90-min countdown so that the procedure is performed, after which the Doppler stops working. If at any time the generator is turned off or disconnected, it will not start again unless a new Doppler probe is connected. We usually place the generator at the left side of the patient near the leg and the pedal near the right foot of the surgeon.

The surgeon remains seated during the whole procedure. Considering the hemorrhoidal arteries positions as the odd hours of a clock, from 1 to 11, the procedure can start at any point of rectal circumference. We prefer to start from the 1 h position, and move clockwise, so the surgical assistant stays at the left side of the main surgeon during the

treatment of the 1, 3, and 5 h arteries, and changes side to treat the other arteries, providing better ergonomics for the team. The scrub nurse stays at the opposite side of the assistant.

7 Surgical Technique

After proctologic physical examination and lubrication with ultrasound gel, the proctoscope is inserted through the anal canal, lightly tracing the skin of the anal margin preventing that tissue is unduly inserted into the canal. The device then reaches the distal rectum, about 6–7 cm from the anal margin.

7.1 Dearterialization

By moving the proctoscope, arteries are searched in the usual odd hours position with Doppler probe. The best Doppler signals correspond to the six main hemorrhoidal arteries branches. The

Fig. 4 Patient in lithotomy position with hemorrhoidal arteries position as odd hours of a clock

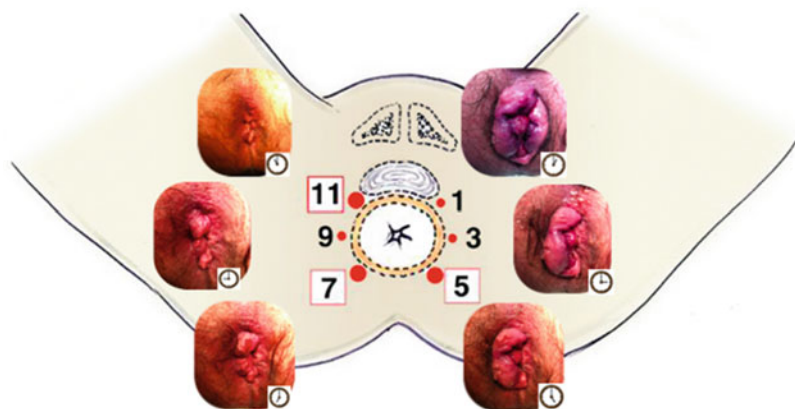
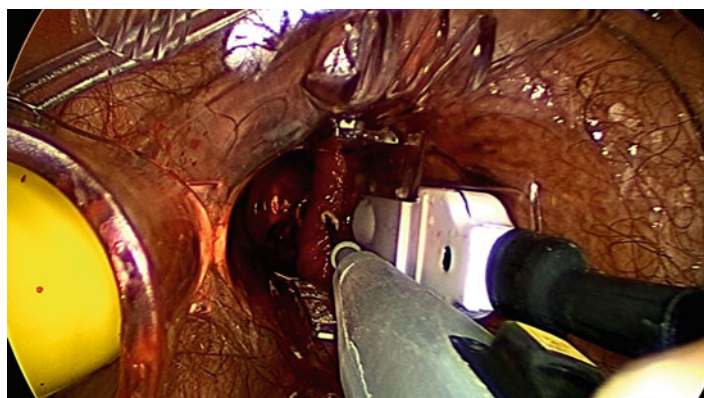


Fig. 5 Proximal mark at 5–6 cm from anal verge



six arterial branches, identified at 1, 3, 5, 7, 9, and 11 h, are almost invariably located in the distal rectum (Fig. 4). As shown in a pivotal study by Ratto et al. (2012), signal is quite clear at the proximal site (4–6 cm from the anorectal junction), absent at the intermediate site, and again clear at distal site (2–3 cm above dentate line).

After obtaining the signal, the rectal mucosa is marked with electric scalpel at 6 and 2 cm from the anal verge (Fig. 5). At the upper marking, the rectal and submucosal mucosa are then transfixed with an “X-stitch” of 2-0 absorbable polyglycolic acid for the artery ligation (Fig. 6). For the transfixing point, we use a modified needle holder that comes with the device, which has a marking for the correct needle. Insertion of its end into the pivot hole located in the anoscope center at the first passage of the “X” prevents the needle from penetrating to a depth greater than 6 mm (Fig. 7). Thus, only the mucosa and submucosa are

transfixed, avoiding full-thickness perforation of the rectum wall and adjacent tissues. The second passage of the “X” stitch can be performed without inserting the tip of the needle holder into the orifice, just by pulling the suture thread for the tissue presentation. By tying the suture, the dearterialization is completed.

7.2 Mucopexy

We then perform the mucopexy, using a conventional needle holder, in nonanchored continuous suture, involving mucosa and submucosa distally to the place where the dearterialization was performed, including the distal marking and interrupting it 1 cm above the dentate line (Fig. 8). At this step, it is crucial to tie it gently, promoting a lifting of the hemorrhoidal tissue slipped through the anal canal. In our experience,

Fig. 6 Distal rectal stitch with specific needle and needle holder

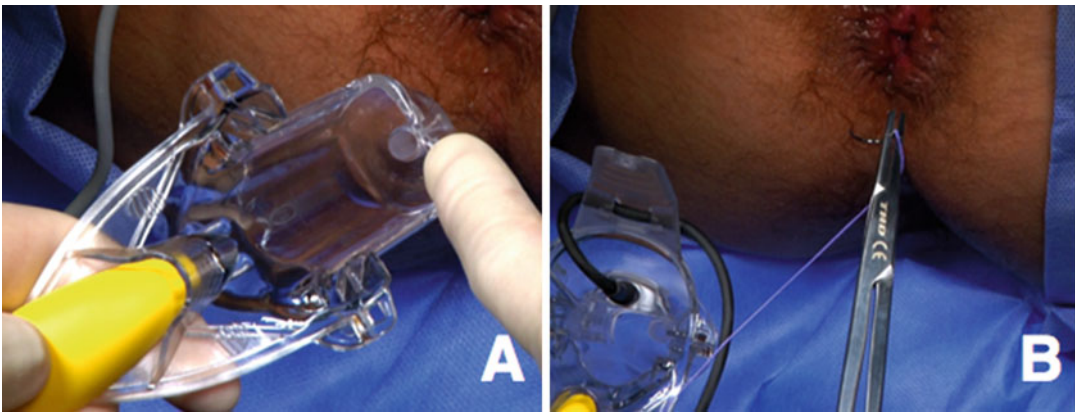
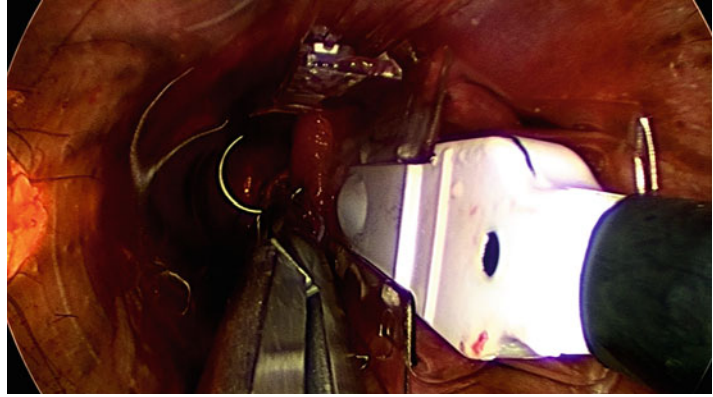
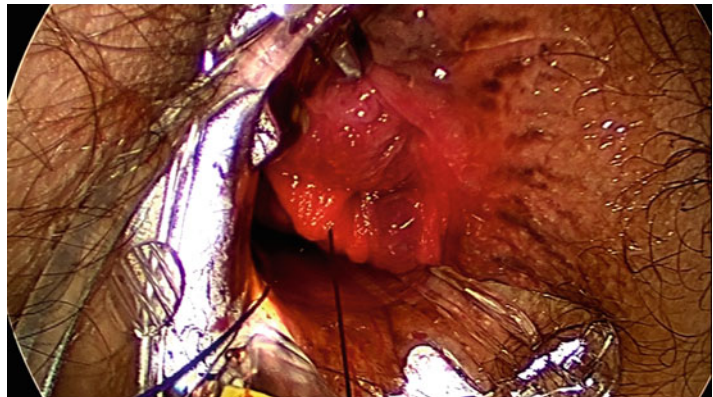


Fig. 7 THD proctoscope with pivot hole (a) and needle holder with marking point (b)

Fig. 8 Mucopexy ending at distal mark, 1 cm above dentate line



we abandoned the use of tissue forceps to perform this suture, keeping the suture thread with the nondominant hand, as the needle self-presents after rotation and passage through the mucosa (Fig. 9). If a hematoma is formed, we perform

gauze compression. It is essential that this suture is not anchored, in order to prevent mucosal lifts, and the anal canal mucosa should never be included, as this would imply in intense postoperative pain.

Fig. 9 Mucopexy with running nonanchored suture

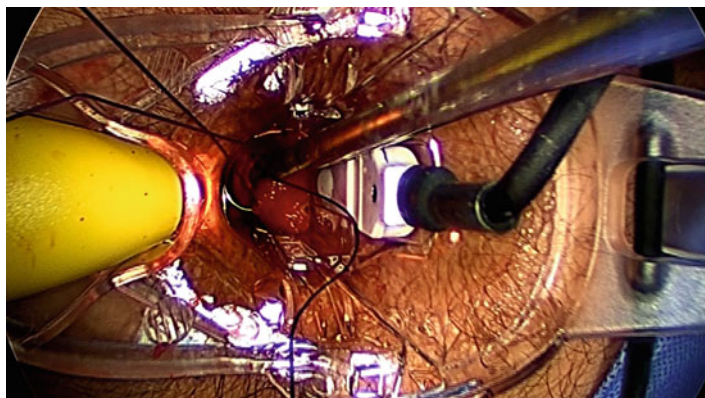


Fig. 10 Proctoscope careful removal, pushing sutured mucosa away from the device's working hole



After each hemorrhoidal suture, the proctoscope should be removed and cleaned. Care must be taken to remove it gently, with the opposite hand pushing the sutured mucosa against the rectal wall in order to remove it from the anoscope's working hole and prevent it from getting stuck, which can cause mucosal damage and bleeding (Fig. 10).

When all six sutures are finished, operation is completed. The THD anoscope is used to review sutures and control any bleeding that can occur. There is no need for internal tampons, dressings, or ointments. We routinely use only a few gauzes close to the anus to absorb secretions in the first postoperative hours.

8 Postoperative Management

After anesthesia recovery, the patient is returned to the room with prescription of analgesics; we routinely use nonhormonal anti-inflammatory

drugs, common analgesics, such as dipyron or paracetamol, and opioids if necessary, laxatives; usually polyethylene glycol and seat baths three times a day.

The main complaint in the postoperative period is tenesmus, which improves progressively with the passing of days. There may also have some bleeding when evacuating, but when small amounts and self-limited do not cause concern.

We usually keep patients hospitalized for one night for bleeding observation and urinary catheterization if there is urinary retention. On first postoperative day, patient is discharged with a prescription similar to that used during hospitalization and expected return in 1 week.

It is unnecessary to keep the patient hospitalized until the first evacuation, because it can take 2 or 3 days, and most patients feel more comfortable being at home.

We recommend that patient maintain relative rest for 1 week, avoid intense physical effort, or

remain seated for long periods. In cases of patients living outside the city, we ask them to stay nearby for 1 week, especially in cases where there is need for air transportation to the place of origin. Such care aims to provide rapid treatment in cases of major bleeding.

9 Complications

Rectal bleeding in our series was observed in 4% of the cases and occurred up to 2 weeks postoperatively. It can occur due to ulcer formation in the region of the suture of the procedure, probably secondary to ischemia. In most cases where this occurs, bleeding is self-limited and clinical measures for its control are sufficient. In case of persistent bleeding, reoperation may be necessary to remove clots from the rectum and inventory of possible bleeding site with its suture.

Another rare complication is external postoperative hemorrhoid thrombosis. They occurred in our series in 2.2% of the cases, and the clinical treatment with analgesics and anti-inflammatories was sufficient for remission of pain symptoms.

10 Follow-Up and Recurrence

The follow-up of these patients is done with a return 1 week after the surgery when we verify the immediate complaints. The most common are some bleeding due to evacuation and still some tenesmus that are expected at this time. One month after the operation, the patient returns to the clinic to assess any signs of early recurrence and if everything is good, patient is discharged and advised to return if they have new complaints.

Recurrence of hemorrhoidal disease can be divided into two groups: patients with recurrent hemorrhoidal bleeding and those with recurrent rectal prolapse. In our series, there was recurrence of bleeding in 3.1% of the cases, and it is usually accompanied by recurrence of prolapse. In these cases, we indicate conventional hemorrhoidectomy according to the patient's symptoms. We found recurrence of hemorrhoidal prolapse in 9.4% of

cases and what is observed is that the greater the preoperative prolapse, the greater the chance of recurrence. It is necessary to advise the patient that if we are facing internal hemorrhoids with large prolapse, there is a chance of recurrence of it, which in most cases are small and can be treated clinically.

11 Conclusions

Transanal hemorrhoidal dearterialization (THD) is a safe and good surgical option treating hemorrhoidal disease. It is important, though, to have a great expertise in understanding the patient's symptoms and have a precise proctological examination. If all these steps are followed by a good surgical technique, the outcomes are very favorable.

12 Cross-References

- ▶ [Dearterialization of Hemorrhoids and Mucopexy: Techniques and Results](#)
- ▶ [Literature Review on Dearterialization of Hemorrhoids and Mucopexy](#)
- ▶ [Pros and Contras of Dearterialization of Hemorrhoids and Mucopexy](#)
- ▶ [Why and When I Do Prefer the Dearterialization of Hemorrhoids and Mucopexy](#)

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Pros and Contrasts of Dearterialization of Hemorrhoids and Mucopexy

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Abstract

Management of hemorrhoidal disease is a tough task. First of all, because more than one surgical technique may be adequately indicated to manage different patients. Secondly, patients desire a good option associated with less postoperative pain, low morbidity, and

good long-term results. In this setting, conventional excision of hemorrhoids is highly effective, besides being associated with postoperative pain and discomfort. For this reason, nonexcisional alternatives have been developed in order to reduce complications and to provide better postoperative recovery. To accomplish this aim, the Doppler-guided hemorrhoidal dearterialization with anopexy was been introduced into clinical practice with high expectations. This hope has been maintained mainly for the encouraging early results, and despite the possibility of late prolapse recurrence, especially in grade IV disease. Anatomical and clinical studies have demonstrated the THD efficacy in controlling symptoms and ameliorating quality of life. As it preserves anatomy, it causes no detrimental effect on the anorectal physiology, making functional disturbances mainly transitory and

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rarely observed. Consequently, this technique may be an excellent option for patients with previous anal surgery and defecatory problems, when an additional procedure might increment this risk and affect quality of life. Furthermore, the THD technique has not been associated with frequent postoperative morbidity, life-threatening complications nor severe sequelae.

Keywords

Hemorrhoids · Transanal hemorrhoidal dearterialization · Surgical treatment · Recurrence · Stapled hemorrhoidopexy · Hemorrhoidectomy

1 Introduction

Hemorrhoidal disease (HD) is a very prevalent condition with multifactorial etiology and variable symptomatology. Complaints such as rectal mucosal prolapse, bleeding, pruritus, pain, soiling, and recurrent thrombosis may affect patient's quality of life and selection of the most appropriate surgical approach (LaBella et al. 2015).

Excisional surgical techniques (Milligan-Morgan and Ferguson) are still considered the gold standard surgical treatment, providing low rates of immediate complications and late recurrences. However, a major disadvantage regarding these techniques is the significant postoperative pain and discomfort. Moreover, severe complications like stenosis and incontinence may eventually occur (Khafagy et al. 2009).

The operative choice is still dependent on surgeon's experience and equipment availability. But preferably, an individualized surgical procedure should be tailored according to patient's complaints and anorectal parameters. During the last decades, a more profound knowledge of the pathophysiology of HD favored the development of new alternative treatments.

In this context, the introduction of less-invasive procedures (stapled hemorrhoidopexy (SH) and Doppler-guided hemorrhoidal artery ligation (DGHL), with or without pexy of prolapsing rectal mucosa) aimed to obtain symptoms

relief avoiding anatomical alterations, postoperative pain, and allowing a faster recovery (Figueiredo and Campos 2016).

It is well accepted that excisional procedures are associated with few recurrences, more postoperative complaints, and slower recovery. Otherwise, transanal hemorrhoidal dearterialization (THD) and SH may result in less pain, faster recovery, and higher recurrence rates. SH was designed to correct anal prolapse and reduce the vascular supply to the hemorrhoidal plexuses. However, persistent pain and severe complications have been rarely reported; moreover, increasing rates of long-term recurrence when compared to excisional techniques (Jayaraman et al. 2007). Thus, patients should be aware of these perspectives during the decision-making process before surgery (Simillis et al. 2015).

Morinaga et al. devised the procedure of dearterialization in 1995, using a proctoscope coupled with a Doppler transducer to identify and promote hemorrhoidal artery ligation (HAL) in 116 patients with hemorrhoidal internal hemorrhoids (Morinaga et al. 1995). The rationale for THD is centered on the fact that the arterial overflow leads to hemorrhoidal plexus dilatation within the anal canal, due to the existence of a great arteriovenous network. The arteries ligation disrupts the inflow to the venous plexuses, leading to shrinkage of the pathological tissue.

A Doppler-guided evaluation may confirm that the hemorrhoidal arteries become more superficial during their distal route, facilitating their surgical control (Aigner et al. 2010; Lucha 2009; Ratto et al. 2012). In a radiological evaluation, hemorrhoidal arteries were primarily extra rectal at 5–6 cm from the dentate line and submucosal within 2 cm from the anorectal junction (Ratto et al. 2012).

Although HAL was described more than two decades ago, only recently the technique became more popular and widely available and used. The development of a special proctoscope facilitated the combination of HAL and mucopexy, to promote the lifting of hemorrhoidal prolapse.

This chapter will address advantages and limits of THD with mucopexy by reviewing the available literature and exposing the author's perceptions with the application of this technique in the

management of HD. Pros and cons of THD are listed in Table 1. These features should be confronted with early and late outcomes observed after conventional and stapled procedures.

2 How Technical Variations May Affect Postoperative Outcomes?

The THD procedure for the management of HD involves ligation of hemorrhoidal arteries with the guidance of Doppler signals and mucopexy. The targeted arteries ligation (dearterialization) is performed to reduce overflow to hemorrhoidal piles, and in this setting, the Doppler is an important tool.

Dearterialization alone (artery ligation with a “Z-stich” at the site of the best Doppler signal) may be accepted as an alternative for grades I–II patients unresponsive to conservative treatment (Ratto 2014). However, the presence of hemorrhoidal prolapse should advise to incorporate mucopexy to the procedure. This is accomplished with the plication and lifting of prolapsing rectal mucosa, providing continuous running sutures that include redundant mucosa and submucosa (Fig. 1). After 2–4 months, these sutures are resorbed and give place to scar tissue where the hemorrhoidal plexuses used to stand.

Table 1 Pros and cons of transanal hemorrhoidal dearterialization (THD) technique

Pros	Cons
Procedure easy to teach and to learn	Absence of complete technical standardization
Less painful when compared with excision techniques	Absence of long-term results
Associated with to rare and minor early complications	Greater recurrence rates when compared to open hemorrhoidectomy
Allows early discharge from the hospital and return to work	More costly than excisional techniques
Fast procedure (30–60 min)	
May be performed as a outpatient	

The benefit of mucopexy turns to be more obvious when we analyze the treatment of advanced HD, as a 50% recurrence rate may be observed in grade IV patients not submitted to mucopexy, with better estimates after the introduction of mucosal plication (Khafagy et al. 2009; Ortiz et al. 2005). Consequently, correcting the prolapsing component was therefore introduced as part of THD (Dal Monte et al. 2007).

As stated before, if bleeding dominates patient’s complaints, ligation of the hemorrhoidal arteries should be performed at the low rectal circumference. Although not absolutely constant, the THD Doppler device may usually find at least six arteries. In the proximal part of the distal rectum, the Doppler signal is quite clear, the same occurring in the distal 2 cm of the lower rectum, where they are more superficial (Ratto et al. 2012).

The main technical variations regarding THD refer to the option of Doppler utilization to guide dearterialization, the number of HAL, the mucopexy modulation according to the site and severity of prolapse, and the association of other procedures.

Recently, the value of adding the Doppler to localize the terminal arteries branches has been questioned, based on the idea that an effective ligation in all six arteries positions is equally effective to the ligation guided by Doppler assistance (Gupta et al. 2011). However, a significant proportion of people may present an artery in an even-numbered clock position (Avital et al. 2012a). In this context, Doppler-assisted localization would be essential to correctly localize the vessels and thus reduce the consequences of not detecting an eventual anatomical variation.

However, so far there is not a conclusive answer for this issue. In a meta-analysis of 5 RCTs including 388 patients, DGH clinical outcomes were not superior to HAL without the aid of a Doppler (Liu et al. 2015). But this chapter displayed methodological limitations such as small sample-sized studies, differences in inclusion criteria, and definition of success.

Different grades of prolapse may be detected during investigation, with variable location, number, length, and softness. When performing a hemorrhoidectomy, this technique allows the

Fig. 1 Pre (*left*) and post (*right*) surgical aspect of a IV degree hemorrhoidal disease managed with THD



prolapse management in at most common positions (3–7–11 hours), even though a circular prolapse exists. In another situation, an SH aims to provide a circumferential prolapse correction, even if the prolapse is minor and localized.

In the case of THD, mucopexy should be added to the procedure when mucosal prolapse is reducible, in order to reposition the prolapsing tissue to its original anatomic site. When circumferential, the original technique advises to place six running sutures, although a smaller number has been accepted in cases presenting without circumferential involvement. In a review of the published series, Faucheron et al. (Faucheron et al. 2011) showed that the mean number of artery ligations and mucopexies per patient varied from 5–10 to 1–6, respectively.

For these reasons, some think that one of the advantages of the THD technique with mucopexy is the possibility to individualize the technique for each patient. Within this context, the number of arterial ligations would depend on the detection of blood pulsations, and the number of mucopexies would be related to the number of prolapses. These features would turn HAL with mucopexy the most suitable technique for a patient suffering from HD.

The idea of not performing all the sutures in less advanced cases HD aims to reduce tenesmus after surgery. However, it is intuitive that this option may influence recurrence rates, allowing a late manifestation of a disease left untreated. Thus, future studies are encouraged to respond if the possibility to modulate the technique is a real advantage and how it may affect long-term results.

But it is necessary to remember that, depending on the chronicity of HD, the addition of a fibrous

component to the piles may difficult their reduction into the rectal lumen, making these cases inappropriate to THD. In this situation, recurrence or a failed procedure may be the consequence. Another important issue is the eventual resection of skin tags when present. Once they are not treated with THD, removal of these lesions may improve the perception of a more radical treatment of HD without aiding postoperative pain.

3 The Pros: Advantages of THD

3.1 Anatomy and Function

As a nonexcisional technique, THD is thought to preserve the anatomy and physiology of the anal canal. This advantage is crucial, because other surgical procedures may occasionally lead to anal wounds and deformities that are associated with anal pain and impaired anal function (different grades of fecal incontinence, defecation disorders). Consequently, these complications may affect quality of life and determine devastating problems, inclusive to young patients.

When performed according to the technical principles already described, THD does not lead to fecal incontinence or chronic pain. Except for a minor sphincter stretching during the procedure, dearterialization does not present a major risk for sphincter damage. Also, since the mucopexy sutures are positioned above the pectinate line, pain should not be an important complication after THD. Although there is no damage to the sphincters, the hemorrhoids themselves are responsible for 15% of anal continence (Poylin

2016). However, transitory disturbances of fecal incontinence are rarely described after THD.

The first paper to look into functional results after THD was published in 2011 by Ratto et al. (Ratto et al. 2011a), who described a total of 20 patients followed on for 6 months, extracting solid data on functional results from this cohort. Although patients with any preoperative incontinence symptoms had been excluded, patients performed anal manometry before the procedure and 6 months afterwards, as well as endoanal ultrasound. All of them applied clinical continence scores. The authors reported no cases of continence disturbances, although they observed a drop in anal pressures on manometry (nonsignificantly).

In 2012, Walega et al. (Walega et al. 2012) reported their results regarding functional outcomes, already including ligation and anopexy. Their study included 40 patients with third and fourth degree hemorrhoids, of which 38 were operated on and 20 had a complete 1-year follow-up. Similarly to the previous study, this study also performed anal manometry and functional scores preoperatively and 3 and 12 months after surgery. They also found a drop in anal pressures after surgery ($p < 0.05$), but all pressures remained normal. Only one patient (5%) reported incontinence for gases and soiling in a 3-month follow-up, but not related with abnormal results on anal manometry. Mild gas incontinence continued until 12-month follow-up in this individual. After 1 year, no other cases of incontinence were reported.

Regardless of the technique implied, a higher anal pressure in patients with hemorrhoidal disease has been described, as well as a drop after the treatment (Chauhan et al. 2007; Hiltunen and Matikainen 1985; Patti et al. 2007). In an extensive systematic review and meta-analysis about current treatment options for hemorrhoids, Simillis et al. (2015) did not find difference regarding incontinence among modalities of surgical treatments.

In a comparison with SH, Giordano et al. (Giordano et al. 2009) found no cases of fecal incontinence after a 3-year follow-up after THD for patients with second and third degree HD. Other studies and case series have also reported a very low incidence of fecal incontinence after THD (Béliard et al. 2014; Elmér et al. 2013).

3.2 Postoperative Symptoms

Generally, symptoms and complications occurring right after THD are minor in nature. Tenesmus is rather commonly reported, occurring in about 10% (Giordano et al. 2014; Ratto et al. 2011b; Hussein 2001) to 24% (Ratto et al. 2010) of cases. Although sometimes it may turn into a real discomfort for the patient, this symptom is also usually transitory, disappearing during the first months.

At the same time, some studies (Faucheron et al. 2011) have found a very low incidence (around 1%) or even the absence of this complaint (Conaghan and Farouk 2009). In a comparative study between THD and SH, Béliard et al. (2014) found less tenesmus after THD in a 3 month follow-up. It may be managed with analgesics and anti-inflammatory drugs.

The premise of lower rates of postoperative pain after THD is probably the main reason why patients ask doctors about this technique. If we assume that mucopexy sutures should not advance distally to the pectinate line, pain should not be a real problem after surgery. Despite this, we actually see patients complaining about postoperative pain, a symptom usually reported together with tenesmus.

Differently from open hemorrhoidectomy (OH), pain is less intense, responds better to analgesics or anti-inflammatories, and has a shorter duration. Three comparative trials between THD and OH were published. In 2003, a randomized controlled trial of 60 patients showed less postoperative pain in the THD group, as well as a faster return to normal activities (Bursics et al. 2004). More recent trials (2013 and 2014) comparing the two techniques also report lower pain after THD (Elmér et al. 2013; Denoya et al. 2014a).

Compared to SH, results regarding postoperative pain are more discordant. While some report significant lower rates of pain after THD (Béliard et al. 2014; Avital et al. 2011; Tsang et al. 2014), others report less pain only immediately after surgery, but similar rates after 3 weeks (Festen et al. 2009). And there are studies that did not find any significant difference between results on both techniques (Verre et al. 2013; Lucarelli et al. 2013; Giordano et al. 2011). A systematic review comparing THD and SH included 3 trials and 150 patients,

80 submitted to THD (Sajid et al. 2012). Postoperative pain was found to be significantly lower ($p < 0.001$; 95% CI: $-2.06, -1.94$) after THD. This review points out several limitations regarding the included trials, such as different inclusion and exclusion criteria, different degrees of hemorrhoids, as well as measures of postoperative pain.

Other observational reports of THD show a wide range of pain scores, demonstrating rates from 5% (Faucheron et al. 2011; Wilkerson et al. 2009) up to 55–71% (Dal Monte et al. 2007; Giordano et al. 2014). But these studies exhibit different criteria to state postoperative pain, using visual analog scales, need of analgesics or anti-inflammatories, as well as duration of the use of these medications. Although the study from Giordano et al. (Giordano et al. 2014) showed a 71% rate of pain after THD included only patients with advanced hemorrhoids, another similar evaluation demonstrated only 14% pain rates (Ratto et al. 2011b).

Although intuitive, it is not clearly stated that higher degree of HD or the addition of mucopexy may directly influence pain scores (Ratto et al. 2015a; Theodoropoulos et al. 2010). Otherwise, other authors report similar postoperative pain with or without anopecty (Ratto et al. 2011b).

On summary, pain after THD seems to be lower than after other techniques, especially OH, and the grade of the disease might influence pain rates. Despite producing less pain, tenesmus is a very important complaint after THD. We have used vasoactive drugs (such as flavonoids) to lessen this postoperative discomfort.

Rectal bleeding may be rarely reported in patients presenting local trauma during prolonged straining or passage of hard stool. This is facilitated by tissue ischemia at the suture line. The meta-analysis by Simillis et al. (Simillis et al. 2015) has showed less postoperative bleeding after THD when compared to OH (OR = 0.29; IC 95% = 0,110,75) and SH (OR = 0.27; IC 95% = 0,090,75). Fortunately, this symptom usually disappears with simple modifications of intestinal habit and local application of saline solution; endoscopic or surgical control (cauterization, endoclip, and suture) is exceptionally necessary (Ratto 2014).

In a meta-analysis of RCT comparing THD and OH, the evaluation of 316 patients did not find

significant differences regarding total complications, postoperative bleeding, incontinence, recurrent prolapse, and reoperation rates (Xu et al. 2016).

Although there are no long-term results available, evaluation so far has demonstrated high success and patient satisfaction rates, mainly when compared to conventional techniques. Another great advantage is that THD has no serious life-threatening complications such as major bleeding, rectovaginal fistula, and perianal sepsis (Giamundo 2016). On the contrary, severe sepsis, rectal perforation, and peritonitis have been described after other surgical procedures for HD, leading to a high-risk mortality rate (Faucheron et al. 2012).

Interestingly, morbidity from postoperative bleeding is not increased in THD patients taking vitamin K antagonists, antiplatelet medication, or other drugs that affect coagulation. 80 of them submitted to THD without cessation of oral agents (Atallah et al. 2016). For sure, this fact represents another great advantage for THD, as the risk of postoperative bleeding usually dictates the suspension of such medication before performing excisional or stapled techniques (Faucheron et al. 2011).

4 The Contrasts of THD

Probably the most important *contra* of THD is the reported higher recurrence compared to OH, as showed in the meta-analysis by Simillis et al. (Simillis et al. 2015) (THD vs. OH; OR = 5.37; IC 95% = 2,4; 12,04). Compared to SH, recurrence rates do not seem to differ in this meta-analysis and other studies.

A randomized trial with a follow-up of 43 months compared THD with anopecty and SH and recurrent prolapse was the primary outcome analyzed (Lucarelli et al. 2013). The last follow-up was done by telephone interview, and prolapse recurrence was referred by 25% of THD patients versus 8.2% ($p = 0.021$) after SH. In spite of that, patient satisfaction was 73% in THD group versus 86.9% in the SH group. The recurrence rate in this study is somewhat dubious since it was an impression of the patient. Moreover, Ratto et al. have showed that patients misreported skin tags for prolapse, after a physical examination took place (Ratto et al. 2010).

Giordano et al. (Giordano et al. 2011) also compared THD with anopexy and SH for grades II and III, and reported symptoms recurrence in 14% versus 13%, while satisfaction was similar between groups (89% vs. 87%), respectively.

In the observational/cohort studies the recurrence rate has been reported from 3% (Giordano et al. 2014) after a 32-month follow-up to up to 26% after 18 months (Scheyer et al. 2006). Looking at the wide range of results, one must remember the absence of anopexy in many of the studies before 2010 (and even in studies after that), which may have influenced the results. Most studies report recurrence of hemorrhoids or symptoms around 10–15% after 1 year (Faucheron et al. 2011; Ratto et al. 2010; Ratto and de Parades 2015; Infantino et al. 2010; Satzinger et al. 2009) but the recurrence seems to rise in studies with longer follow-up (Conaghan and Farouk 2009; Avital et al. 2012b).

Some studies show a high recurrence rate related to higher grade (III or IV) hemorrhoids (Conaghan and Farouk 2009; Scheyer et al. 2006; Avital et al. 2012b), but they were done before the anopexy was associated with the arterial ligation and therefore it is expected that prolapse was not treated at first. The study with the longer follow-up showed a trend to higher recurrence rate for grade III hemorrhoids compared to grade II after 5 years, but the difference was not statistically significant (Avital et al. 2012b). Two studies involving patients only with grade IV hemorrhoidal disease showed a recurrence of 3–9% after a follow-up of almost 3 years. Thus, it seems that although THD seems to be more appropriate for grades II and III HD, it may be indicated for selected cases of grade IV disease (Faucheron et al. 2011; Denoya et al. 2014b).

In the largest series of the literature, Ratto et al. (2015b) performed THD in 803 patients with grade II (17.1%), III (68.2%), and IV (14.7%) HD. A 18% morbidity rate was represented mainly by pain or tenesmus (13%) and acute bleeding (0.9%). After 11.1 ± 9.2 months of follow-up, they reported recurrent prolapse (6.3%), bleeding (2.4%), both symptoms (0.6%) and reoperation in 5.8%.

When bleeding recurs, one may think that dearterialization was not effective in one or more

rectal sectors; if this symptom remains constant, therapeutic options involve oral-topical agents, rubber-band ligation, or a redo THD, necessarily performed under Doppler guidance (Ratto 2014). That is the reason we think that the technique should always be performed with the Doppler, although we recognize that many patients may have a good outcome without it.

On the other hand, the disruption of mucopexy suture associated or not with straining at defecation may cause the prolapse to recur. If minimal, a patient like this may be managed only with modification of diet and intestinal habits. In cases with a more advanced prolapse, we think that an excisional technique would be the best approach (mainly if it is not circumferential), although a redo mucopexy is possible.

5 Conclusions

THD is a valid therapeutic option for HD, demonstrating high effectiveness and many benefits such as less postoperative pain and bleeding, and a fast recovery. Bleeding control is achieved in the vast majority of patients, and complications are rare and minor. Anorectal physiological parameters are not affected, besides tenesmus being a common and transient early postoperative complaint.

Most patients return immediately to their normal activities and present long-term resolution of their symptoms. Most important, long-lasting pain or life-threatening complications have not been described so far.

Success rates seem to be closely related to accurate techniques of dearterialization and mucopexy. Moderation in physical activities and a better bowel function probably help to prevent recurrence.

Although grade IV HD may affect the final outcome, it should not be considered a contraindication for the procedure. Despite all these advantages, patients should be aware of the associated greater risk of long-term recurrence when compared to conventional hemorrhoidectomy. If prolapse recurs, it is usually not as severe as before operation. An OH might be an option to treat these cases.

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Main Advantages of Dearterialization of Hemorrhoids and Mucopexy

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If you don't like the way surgery is practised today, just wait a while – it will change.
(Campbell 2013)

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Abstract

Hemorrhoidal dearterialization with mucopexy is a minimally invasive method of treating hemorrhoidal disease which is effective for reducing the symptoms of hemorrhoids and improving quality of life. Moreover, it has the obvious advantages of preservation of the anatomy and physiology of the anal canal, absence of external wounds, better tolerance, and a less painful postoperative period, especially compared with hemorrhoidectomy, but also probably compared with stapled hemorrhoidopexy. It is therefore usually provided on a day sur-

gery basis and scores better in terms of general activity and ability to return to social and/or work activities. The procedure is also safe, with low postoperative morbidity and few complications, which are usually minor.

There is a probable higher long-term risk of recurrence of prolapse and/or bleeding after hemorrhoidal dearterialization with mucopexy, particularly in comparison with hemorrhoidectomy, but it is not a real problem in a time when patients often prefer a risk-free procedure and a short-term benefit to a potential long-term disadvantage.

1 Introduction

Hemorrhoidal dearterialization with mucopexy is a minimally invasive method of treating hemorrhoidal disease and has become a widely performed procedure. Indeed, the majority of randomized controlled studies have demonstrated that its short- and medium-term results seem equivalent to those of hemorrhoidectomy (Bursics et al. 2004; Zampieri et al. 2012; Denoya et al. 2013, 2014; Elmér et al. 2013; De Nardi et al. 2014; Elshazly et al. 2015) and stapled hemorrhoidopexy (Khafagy et al. 2009; Festen et al. 2009; Giordano et al. 2011; Infantino et al. 2012) in terms of efficacy regarding hemorrhoidal symptoms and quality of life. In addition, it has numerous advantages over these two procedures.

2 A Less Discomfortable and Better Tolerated Procedure

The first obvious advantage of hemorrhoidal dearterialization with mucopexy over hemorrhoidectomy is that it preserves the anatomy of the anal canal and does not need any specific postoperative care such as sitz baths and swelling control because there are no external wounds. For this reason, it is easy to understand why the postoperative period following hemorrhoidal dearterialization with mucopexy is more comfortable and better tolerated than hemorrhoidectomy.

3 A Less Painful Procedure

Secondly, the postoperative period following hemorrhoidal dearterialization with mucopexy is less painful, particularly compared with hemorrhoidectomy.

3.1 Comparison with Hemorrhoidectomy

Hemorrhoidal dearterialization with mucopexy has been compared with hemorrhoidectomy in at least eight randomized controlled studies (Table 1).

In most cases, the procedure was less painful during the postoperative period (Bursics et al. 2004; Khafagy et al. 2009; Zampieri et al. 2012; Denoya et al. 2013; Elmér et al. 2013; Elshazly et al. 2015). It required less use of analgesics and for a shorter length of time (Bursics et al. 2004; Khafagy et al. 2009; Denoya et al. 2013). Incidentally, we agree with Elmér et al. (2013) that severe pain was probably explained by sutures too close to the dentate line, but we also think that hemorrhoidal dearterialization with mucopexy is more effective in that case of “too low” suture. To finish, the first bowel movement was earlier (Zampieri et al. 2012; Denoya et al. 2013; Elshazly et al. 2015).

Hemorrhoidal dearterialization with mucopexy was usually provided on a day surgery basis (Denoya et al. 2013; Elmér et al. 2013; De Nardi et al. 2014; Denoya et al. 2014; Elshazly et al. 2015), and scored better in terms of general activity and ability to resume social and/or work activities (Bursics et al. 2004; Denoya et al. 2013; Elshazly et al. 2015).

3.2 Comparison with Stapled Hemorrhoidopexy

Hemorrhoidal dearterialization with mucopexy has also been compared with stapled hemorrhoidopexy in at least five randomized controlled studies (Table 2), and the differences between the two procedures were less evident.

Table 1 Main studies comparing hemorrhoidectomy (H) with hemorrhoidal dearterialization with mucopexy (HDM)

First author (year)	Year	Technique of H (number of patients)	Used device for HDM (number of patients)	Mean follow-up (months)	Median follow-up (months)
Bursics A ^a	2004	Closed H (<i>n</i> = 30)	MD (<i>n</i> = 30)	12	
Khafagy W ^a	2009	Open H (<i>n</i> = 15)	MD (<i>n</i> = 15)		
Zampieri N	2012	LigaSure™ H (<i>n</i> = 68)	THD kit (<i>n</i> = 46)	>12	
Denoya PI	2013	Closed H (<i>n</i> = 20)	THD kit (<i>n</i> = 20)	>3	
Elmér SE	2013	Open H (<i>n</i> = 20)	THD kit (<i>n</i> = 20)		12
De Nardi P	2014	Open (<i>n</i> = 25)	THD kit (<i>n</i> = 25)	>24	
Denoya P	2014	Closed H (<i>n</i> = 15)	THD kit (<i>n</i> = 12)		35
Elshazly WG ^b	2015	Open H (100)	Sim's speculum or PPH set (100)		26

MD missing data

^aDearterialization without mucopexy^bMucopexy without dearterialization**Table 2** Main studies comparing stapled hemorrhoidopexy (SH) with hemorrhoidal dearterialization with mucopexy (HDM)

First author (year)	Year	Used stapler for SH (number of patients)	Used device for HDM (number of patients)	Mean follow-up (months)
Khafagy W ^a	2009	PPH-03 set (<i>n</i> = 15)	MD (<i>n</i> = 15)	12
Festen S	2009	PPH-03 set (<i>n</i> = 18)	THD kit (<i>n</i> = 23)	>1.5
Giordano P	2011	PPH-03 set (<i>n</i> = 24)	THD kit (<i>n</i> = 28)	38
Infantino A	2012	PPH-01 or -03 set (<i>n</i> = 84)	THD kit (<i>n</i> = 85)	17
Lehur PA	2016	PPH-03 or HEM set (<i>n</i> = 196)	THD or AMI kit (<i>n</i> = 197)	>6

MD missing data

^aDearterialization without mucopexy

There was a significant difference in the pain score during the two first postoperative weeks in favor of hemorrhoidal dearterialization with mucopexy (Festen et al. 2009; Lehur et al. 2016), and the time required to return to normal activity and/or work was significantly shorter in some studies (Giordano et al. 2011; Lehur et al. 2016). However, in most studies, there was no significant difference between the stapled procedure and hemorrhoidal dearterialization with mucopexy regarding pain score (Khafagy et al. 2009; Giordano et al. 2011; Infantino et al. 2012), use of analgesics (Infantino et al. 2012; Lehur et al. 2016), or patient satisfaction (Giordano et al. 2011; Infantino et al. 2012; Lehur et al. 2016).

On a similar note, the hospital stay was significantly shorter (1.14 \pm 0.5 vs. 1.36 \pm 0.6 days) after hemorrhoidal dearterialization with mucopexy

than after stapled hemorrhoidopexy in one study (Infantino et al. 2012), but from a clinical standpoint, this difference was not relevant and, in most studies, hemorrhoidal dearterialization with mucopexy was also performed as a day-case procedure (Festen et al. 2009; Giordano et al. 2011; Lehur et al. 2016).

4 A Safer Procedure

Thirdly, the majority of studies did not find any difference between hemorrhoidal dearterialization with mucopexy and other procedures regarding postoperative morbidity (Festen et al. 2009; de Nardi et al. 2014; Elshazly et al. 2015; Lehur et al. 2016). However, one study demonstrated that complications were significantly fewer in a group treated using hemorrhoidal

dearterialization with mucopexy than in a group treated using stapled hemorrhoidopexy (Infantino et al. 2012). In addition, secondary hemorrhage after hemorrhoidal dearterialization with mucopexy usually resolved spontaneously and was rarely treated surgically (Festen et al. 2009; Infantino et al. 2012; Zampieri et al. 2012; De Nardi et al. 2014; Elshazly et al. 2015; Lehur et al. 2016). A recent meta-analysis demonstrated that fewer people had postoperative bleeding after hemorrhoidal dearterialization with mucopexy compared with hemorrhoidectomy or stapled hemorrhoidopexy, and that there were fewer emergency reoperations (Simillis et al. 2015).

Furthermore, most studies confirmed that morbidity after hemorrhoidal dearterialization with mucopexy was low, with many possible but infrequent complications, which were often minor and managed conservatively:

- Inconsequential submucosal haematoma (Giordano et al. 2011; Infantino et al. 2012)
- Urinary retention, rarely requiring catheterization (Giordano et al. 2011; Infantino et al. 2012; Elmér et al. 2013; Elshazly et al. 2015; Lehur et al. 2016)
- Thrombosed hemorrhoid (Infantino et al. 2012; Elmér et al. 2013; De Nardi et al. 2014; Elshazly et al. 2015; Lehur et al. 2016)
- Fecal urgency (Denoya et al. 2013)
- Constipation and occasional fecal impaction (Denoya et al. 2013; Elshazly et al. 2015)
- Discrete stenosis (Elmér et al. 2013)
- Local sepsis (Lehur et al. 2016)
- Anal fissure (unpublished observation)

One case of rectal perforation has been described (Gravié 2014), but there was not enough evidence available to explain the mechanics of the complication and allow relevant conclusions to be drawn. Apart from this debatable case report, there are no published cases of anorectovaginal fistula, severe pelvic sepsis, hemoperitoneum, retropneumoperitoneum, pneumomediastinum, ischemia, complete rectal obliteration, obstructed defecation, anal incontinence, persistent chronic pain, or mortality following hemorrhoidal

dearterialization with mucopexy, all major complications, sometimes life-threatening, that have been reported after stapled hemorrhoidopexy (Pescatori and Gagliardi 2008). Similarly, delayed external wound healing and severe stenosis have been described after hemorrhoidectomy but obviously cannot happen after hemorrhoidal dearterialization with mucopexy.

5 Specific Interest in Special Situations

Hemorrhoidal dearterialization with mucopexy may be of particular value in certain delicate situations. For example, where there is a risk of anal incontinence (sphincter damage, neuropathy, chronic diarrhea, older patient, etc.), it may be more prudent to avoid hemorrhoidectomy, or even stapled hemorrhoidopexy, in favor of hemorrhoidal dearterialization with mucopexy. Indeed, hemorrhoidal dearterialization with mucopexy preserves the physiology of the anal canal and rectum. A study evaluating patients before and after this procedure demonstrated that they remained able to distinguish gas from feces, and no significant variations in endosonographic sphincter structure or in the mean values of anal manometric and rectal volumetric parameters were recorded at 6 month follow-up compared with preoperative values (Ratto et al. 2011).

The literature is still poor and it is too early to draw formal conclusions, but hemorrhoidal dearterialization with mucopexy may be an interesting therapeutic alternative in Crohn's disease (Karin et al. 2012), severe hemorrhoidal bleeding with anemia (Cavazzoni et al. 2013) and anticoagulated patients who cannot stop taking oral agents, even during surgery (Atallah et al. 2016).

For those concerned, anal intercourse is still possible after hemorrhoidal dearterialization with mucopexy, whereas it may become difficult after hemorrhoidectomy because of anal sclerosis and/or stenosis, and the presence of staples after hemorrhoidopexy may result in condom damage and injury to the partner's penis.

6 Conclusion

Hemorrhoidal dearterialization with mucopexy is a minimally invasive method for treating hemorrhoidal disease that is effective for reducing hemorrhoidal symptoms and improving quality of life. It has the obvious advantages of preservation of the anatomy and physiology of the anal canal, absence of external wounds, better tolerance, and a less painful postoperative period, especially compared with hemorrhoidectomy but also probably compared with stapled hemorrhoidopexy. It is therefore usually provided on a day surgery basis and scores better in terms of general activity and ability to return to social and/or work activities. The procedure is also safe, with low postoperative morbidity and few complications, most often minor.

To finish, there is a probable higher long-term risk of recurrence of prolapse and/or bleeding after hemorrhoidal dearterialization with mucopexy (Khafagy et al. 2009; Infantino et al. 2012; Lehur et al. 2016; Simillis et al. 2015), particularly in comparison with hemorrhoidectomy, but we agree with Alexander Herold that today patients often prefer a short-term benefit to a potential long-term disadvantage (Herold 2012). It means that even if the surgeon advises a traditional hemorrhoidectomy, more and more patients will instead choose a minimally invasive procedure with few risks of complication and probably no risk of severe complication. Moreover, we are convinced that better patient selection will reduce hemorrhoid recurrence and improve long-term results. Having said this, we must admit that we have already experienced a paradigm shift in the surgical treatment of hemorrhoidal disease with the advent of hemorrhoidal dearterialization with mucopexy.

Conflict of Interest NF, AB, EC, JDZ, FP: none.

VdP, EP, PB: payment for travel to surgical meeting

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Main Disadvantages of Dearterialization of Hemorrhoids and Mucopexy

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Felix Aigner

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Abstract

Ligation techniques, such as Doppler-guided dearterialization of hemorrhoids (DH), were introduced to reduce the arterial inflow to the hemorrhoidal zone and thus preserve it as part of the continence system. Apart from inappropriate application of this surgical alternative for higher grade hemorrhoids, high recurrence rates of up to 30% after DH are due to technical failure of the ligation technique itself. Doppler-guided ligations can be set too high above

the hemorrhoidal zone, missing the targeted submucosal branches of the superior rectal artery. However, prolapsing hemorrhoids have been proposed to be insufficiently treated by solely interrupting the arterial inflow without repositioning the hemorrhoidal zone by mucopexy in DH. To overcome the shortcomings of the DG-HAL procedure, suture ligation modifications have been made, which address the pexy of the hemorrhoidal prolapse by fixing it above the dentate line.

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1 Introduction

Dearterialization of hemorrhoids (DH) and mucopexy are minimal-invasive techniques for treatment of hemorrhoidal disease and recommended for symptomatic hemorrhoids of any grade (Ratto and de Parades 2015). However, recent follow-up studies demonstrated a relatively high recurrence rate (>20%) in the long-term follow-up and the authors suggest that this procedure should not be used for advanced grades of hemorrhoids (Scheyer et al. 2015). Nonresection techniques for hemorrhoidal disease were developed to reduce the risk of complications and adverse events of conventional techniques such as pain and urgency (e.g., following conventional hemorrhoidectomy or stapled hemorrhoidopexy). Throughout this chapter the author tries to clearly separate both DH and mucopexy since mucopexy can be regarded as an “on-demand” step of the pure dearterialization procedure, depending also on the location and severity of mucosal prolapse (Trompetto et al. 2015). Mucopexy improves the clinical outcome for residual prolapse compared to pure DH due to the positive effects of additional pexy of the distal rectal mucosa. Both techniques should be separately analyzed regarding intra- and postoperative complications and outcome since DH aims at reducing arterial inflow to and shrinking of the hemorrhoidal piles, on the one hand, and mucopexy results in reconstruction of the anatomy of the hemorrhoidal zone at the anorectal junction. Certainly a selection bias can be observed in recent trials mixing or even subsuming both steps of this ligation technique (Simillis et al. 2015).

plication, of elongated and prolapsing rectal mucosa/submucosa to the rectal muscle). Basically, this procedure provided only the ligation of the hemorrhoidal arteries (Trompetto et al. 2015). This in fact was the major drawback with a quite high overall recurrence rate ranged between 3% and 24% (Trompetto et al. 2015). More recently, the addition of the “mucopexy” (also called “recto-anal repair”) has made possible to effectively treat the muco-hemorrhoidal prolapse, making the indications wider and significantly reducing the recurrence rate. Apart from inappropriate application of this surgical alternative for higher grade hemorrhoids, high recurrence rates of up to 38% after DG-HAL are due to technical failure of the ligation technique itself (Giordano et al. 2009). Doppler-guided ligations can be set too high above the transitional zone, missing the targeted submucosal branches of the superior rectal artery, as recently described by Ratto et al. and our own group (Aigner et al. 2004; Ratto et al. 2012). However, prolapsing hemorrhoids have been proposed to be insufficiently treated by solely interrupting the arterial inflow without repositioning the hemorrhoidal zone by mucopexy in solely Doppler-guided DH.

From an economic point of view it is questionable whether the additional use of a specifically designed proctoscope with an integrated ultrasound transducer is necessary for the success of ligation methods like mucopexy of hemorrhoidal cushions (Aigner et al. 2016; Gupta et al. 2011). Studies have shown that especially in higher grade hemorrhoids (III–IV°) the major benefit of ligation techniques is provided by pexy of the mucosa rather than targeted ligation following an ultrasound-guided detection of submucosal arterial signals (Gupta et al. 2011).

2 Main Disadvantages

2.1 Dearterialization of Hemorrhoids

Based on the technique described by Morinaga in 1995 (Morinaga et al. 1995), this approach aims to correct the hemorrhoidal engorgement and bleeding (by progressive shrinkage of piles) and the prolapse (by scarring fixation, following

2.2 Mucopexy

The mucopexy procedure, i.e., plication of the distal rectal mucosa and submucosa for reducing the prolapse of hemorrhoidal cushions as well as rectal mucosa, is a minimal-invasive, nonresection technique for hemorrhoidal disease (Aigner et al. 2016). It may be applied for

any Goligher grade (I–IV°) and in the context of tailored hemorrhoidectomy together with other hemorrhoidectomy techniques like segmental hemorrhoidectomy (open or closed procedure) since the number of mucopexy sutures is not basically fixed. The main disadvantage of the mucopexy alone is the recurrence of either hemorrhoidal bleeding or prolapse per se. Unfortunately studies include heterogenous endpoints regarding recurrence rate so far making direct comparisons difficult (Simillis et al. 2015). The major problem of reproducibility of mucopexy results in the different studies remains with the technique itself. Rarely, the length of plication is mentioned nor the depth of the suture (mucosa or submucosa or even muscularis) or how the mucopexy is performed: in anal to oral direction or vice versa. The use of a sliding proctoscope with or without integrated ultrasound transducer is not basically necessary or even associated with the treatment success (Aigner et al. 2016; Gupta and Kalaskar 2008; Gupta et al. 2011). Recurrence rates depend on the addition of mucopexy to DH and range between 3% and 60% (pooled recurrence rate 17.5%) (Pucher et al. 2013).

Pain is another disadvantage of mucopexy since this symptom mainly occurs or even persists in the short-term follow-up if the suturing is performed below the dentate line.

The question what is more effective: mucopexy or DH or a combination of both, remains unanswered since it is highly likely that the “mucopexy only” procedure includes an inadvertent ligation of the arteries with the mucopexy suture.

- Pain is often correlated to unnecessary distal ligation of the sensitive anoderm.
- Examination under anesthesia might be necessary in patients with persisting pain following mucopexy or DH.
- Regular use of a fixed analgesic regime is mandatory – at least recommended.

3.2 Postoperative Bleeding

- Hemorrhage within 48 h postoperatively, should be readmitted in case of persisting bleeding
- Rarely requires early surgical intervention

3.3 Urinary Retention

- Often correlated to postoperative pain or excessive intraoperative intravenous fluid consumption, anal tamponades, or preexisting urinary retention (e.g., in prostate hypertrophy).
- Perioperative urinary catheter might be useful.

3.4 Anorectal Sepsis

- Local septic complications are more common after stapled hemorrhoidopexy than mucopexy.
- Treatment is the same as for cryptoglandular abscesses and fistulae.
- Life-threatening Fournier gangrene is rare but associated with high mortality.

3.5 Anal Stenosis

- Rare for mucopexy or DH
- Can be treated with anal dilations or anoplastic interventions (e.g., house flap)

3 Complications and Management

3.1 Pain

- Often temporary, complicated if long-lasting or extraordinary heavy or occurring after painless interval.
- Conventional hemorrhoidectomy techniques are more frequently associated with pain.

3.6 Fecal Incontinence

- More common in resection techniques.
- Urge incontinence more common following stapled hemorrhoidopexy (due to reduction of capacity and compliance of the rectal ampulla).

- Caution must be paid to patients with preexisting fecal incontinence or weak sphincter tone.

3.7 Recurrence

- Must be differentiated from residual complaints due to incomplete resolution of the prolapse.
- Long-term cure is much less than appreciated (up to one third recurrent symptoms in the long run).
- More frequently following ligation techniques than resection techniques.

4 Conclusion

In conclusion repositioning of the anal transitional zone remains the key step in treating prolapsing hemorrhoids. Detecting submucosal arterial signals might be confusing for the operating surgeon because arterial signals could be derived at any position of the anal circumference. Several reports support the finding that the Doppler transducer does not contribute to the marked beneficial effect of improving drainage and filling of the hemorrhoidal zone. Asymptomatic hemorrhoidal prolapse should not be treated as on the patient's individual complaints.

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Literature Review on Dearterialization of Hemorrhoids and Mucopexy

39

Mark Lienert

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Abstract

Introduction This chapter gives a revision of the literature on dearterialization of hemorrhoids combined with mucopexy for treatment of hemorrhoidal disease, in order to present its evolution, safety, and efficacy of the technique,

to define its indications, as well as to show advantages, disadvantages, and modalities of surgical treatment.

Methods Performing a literature search in PubMed, Livivo, and Cochrane, one has to use multiple terms, including different combinations and variations of “transanal hemorrhoidal dearterialization (THD),” “Doppler-guided hemorrhoidal artery ligation (DGHAL),” “dearterialization of

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hemorrhoids,” “mucopexy,” “anopexy,” “suture mucosal pexy,” and “recto anal repair.”

In addition, references of selected articles were looked on to find more studies in this field.

Included were articles available in English or German.

Results An overall of 51 articles including 5315 patients were identified concerning dearterialization of hemorrhoids combined with mucopexy, beginning in the year 2007 up to today.

The overall quality was poor with recurrence rates ranging between 0% and 40%, highest in patients with fourth degree hemorrhoidal disease. The overall complication rate was low, nearly all minor complications, without life threatening or deadly complications.

One to 16 ligations were performed with a number of pexies from one up to nine.

Reintervention rates were stated between zero and 29%.

Operation times differ from 10 min up to 1 h.

The overall patient satisfaction, as far as specified, was 75% up to 99%, mainly around 90%.

Conclusion Doppler-guided hemorrhoid artery ligation combined with mucopexy is safe and especially in second and third degree hemorrhoidal disease efficacious, with a moderate complication rate and the absence of life-threatening incidents.

The learning curve seems to be flatter than expected with acceptable recurrence rates in experienced hands. The question whether Doppler guidance is needed or not cannot be answered with absolute certainty so far.

and Sonnenberg 1990; Loder et al. 1994; Kaidar-Person et al. 2007). On the other hand, a correct diagnosis of anal complaint set by the general practitioner is observed only in 52.4% of referred patients (Grucela et al. 2010).

For the United States, Johanson and Sonnenberg (1990) in 1990 showed that ten million people complained of hemorrhoids, corresponding to a prevalence rate of 4.4% (Johanson and Sonnenberg 1990).

Other reports showed prevalence in the United States up to a rate of 30–40% (Ganz 2013).

In Austria, Riss et al. (2012) found 39% of the patients presenting hemorrhoid knots during flexible colonoscopy and detailed examination in 976. But only 44.7% of the patients with hemorrhoid knots complained about symptoms, meaning a rate of 17.4% of all participants (Riss et al. 2012).

It has been stated that more than 50% of the population will experience symptomatic hemorrhoid disease at some point in their lives (Baker 2006; Zampieri et al. 2012; [Digestive Diseases Statistics for the United States](#)).

Open hemorrhoidectomy has been considered to be the gold standard for decades in treating especially third or fourth degree hemorrhoidal disease (Aigner et al. 2016; Figueiredo and Campos 2016; Gupta et al. 2011; Hoyuela et al. 2016; Nogueras et al. 2015; Pucher et al. 2013; Xu et al. 2016; Yeo and Tan 2014).

But these procedures are frequently associated with postoperative complications, like severe pain, sepsis, anal stenosis, bleeding, and incontinence (Figueiredo and Campos 2016; Madoff et al. 2004).

For this reason there has been a search in techniques with comparable outcome and fewer complications, leading among others to Doppler-guided ligation procedures.

1 Introduction

Hemorrhoidal disease is recognized as one of the most common diseases around the globe, but the true prevalence is unknown due to the fact that patients ignore symptoms or use self-treatment (Lohsiriwat 2012). In a proctologic unit, hemorrhoid disease is the most common disease with a prevalence ranking from 35% to 55% (Johanson

2 Material and Methods

Performing a literature search in PubMed, Livivo, and Cochrane, one has to use multiple terms, including different combinations and variations of “transanal hemorrhoidal dearterialization (THD),” “Doppler-guided hemorrhoidal artery ligation (DGHAL),” “dearterialization of

hemorrhoids,” “mucopexy,” “anopexy,” “suture mucosal pexy,” and “recto-anal repair.”

In addition references of selected articles were looked on, to find more studies in this field.

3 Results

3.1 Technical Evolution

In 1995, Morinaga et al. (1995) were the first to describe ligation of the hemorrhoidal artery with a new device – called Moricor – in conjunction with a Doppler flowmeter in order to detect and block distal branches of the superior rectal artery leading to the hemorrhoidal area. The idea was to achieve shrinkage of hemorrhoidal knots by reducing the blood supply.

In the following years, different devices were developed. Nowadays, the HAL-RAR device (A.M.I., Feldkirch, Austria), the HAL-Doppler (AMI Dufour MedicalTM, Maurepas, France), the THD device (G.F. Medical Division, Correggio, Italy) by THD SPA and the KM-25 device (VaiDan Medical Corporation, St. Petersburg, FL), and the KM-25 Moricor (Hayashi Denki Co., Tokyo, Japan) are commonly used (Figueiredo and Campos 2016; Giordano et al. 2009). The main principle is the same as described by Morinaga, but shape of the instruments differs and there are distinct variations in the performed technique.

3.2 Number of Ligations

Morinaga et al. (1995) have given no clear advice how many ligations have to be performed to achieve the best results.

On the one hand, a higher number of ligations may produce more pain or complications; on the other hand, a limited number of ligations may lead to a higher recurrence rate.

One strategy could be only to ligate the arteries where piles are found. In this scenario, may piles occur after a while, where no ligation was done and the patient is not satisfied.

The oppositional strategy is to ligate every detected artery. This may produce a number of

ten or more ligations in one patient. Here the risk to constrict the lower rectum or upper anal canal seems to be higher, which tends to result in more defecation problems like tenesmus or postoperative pain.

So, how many arteries are described in literature? Thomson (1975) found an average of five branches of the superior rectal artery reaching the hemorrhoidal zone in his studies.

But Schuurman et al. (2009) in their anatomical studies detected an average of about eight arteries in the distal rectum originating from the superior rectal artery leading to the corpus cavernosum recti.

Regarding transanal hemorrhoidal dearterialization, Toh et al. (2010) described a fourth branch of the superior rectal artery and its implications for adequate treatment.

And furthermore Giamundo (2016) reports a finding of 12 arteries with a 20 MHz Doppler, while with a 7–8 MHz Doppler, like commonly used performing ligations with mucopexy, normally a lower number could be detected.

Therefore, the answer to the question how many relevant arteries are responsible for the blood supply of the hemorrhoidal area and may for the development of hemorrhoidal disease is not quite clear so far.

This uncertainty could be the reason for different recommendations in performing Doppler-guided hemorrhoid artery ligations.

Basically there are two types of performing ligations.

The aim of one type is to perform a total amount of six ligations by searching for the best Doppler signal in sectors. Starting for example at 12 o'clock in the sector from 12 o'clock to 2 o'clock the best Doppler signal is used to close the artery at that point in this sector. Then in the next sector from 2 o'clock to 4 o'clock the best signal is searched for and so on, resulting in six ligations at 1, 3, 5, 7, 9, and 11 o'clock (Ratto 2014; Ratto and de Parades 2015).

In the other type of performing ligations first every signal at one level above the dentate line searched for, ligating every artery where a signal is found. This is repeated at a slightly lower level, closer to the dentate line. Some authors advise even to do a third circle to catch every artery. In

this technique up to ten or more ligations are done (Scheyer et al. 2008).

In this regard, Infantino et al. (2010) stated a significantly higher failure rate with a number of seven or more ligations.

Today a number of around six to eight ligations is normally used but still with a wide variation from one to 16 ligations in literature (Giordano et al. 2009; Schuurman et al. 2012; Wilkerson et al. 2009) (Table 3).

3.3 Level of Ligations

Morinaga et al. (1995) recommended to perform ligation 2–3 cm above the dentate line. This advice was followed more or less for 15 years (Giordano et al. 2009).

Aigner et al. (2004) showed beside the submucosal branches of the superior rectal artery additional transmural vessels piercing the muscular layers of the rectum to supply the corpus cavernosum recti, which might explain the remaining of hemorrhoids after ligation. On the other hand, even a higher number of ligations reduce but never totally block the blood inflow to the hemorrhoidal cushions. Therefore, necrosis of the hemorrhoidal tissue is extremely rarely reported (Faucheron et al. 2011).

To optimize the results, Ratto et al. (2012b) assessed the topography of hemorrhoidal arteries, showing that most arteries were external to the rectal wall 5–6 cm above the dentate line, but at 1–2 cm above nearly all arteries are localized in the submucosa. Therefore, he advised to perform a distal ligation 1–2 cm above the dentate line called “Distal Doppler-guided dearterialization” (Ratto et al. 2012b). In 2015, they reported a three times greater failure risk for patients treated with ligation in the area Morinaga advised than using Distal Doppler-guided dearterialization (Ratto et al. 2015).

3.4 Results with Ligation Alone

In the 12 years following Morinaga’s publication until the first reported technical modification by

Dal Monte et al. (2007), ligation alone was performed (Dal Monte et al. 2007).

In his first series with 112 patients, Morinaga et al. (1995) reported satisfactory results in 78% of patients with prolapse, resolution of pain in 96% of patients and bleeding in 95% in a short-term follow-up.

In 2001, Sohn et al. (2001) were the first to prove this results in 60 patients reporting bleeding corrected in 88%, protrusion in 92%, and pain in 71%.

In the following years, a number of reports showed good results in treating hemorrhoidal disease by Doppler-guided artery ligation (Arnold et al. 2002; Shelgyin et al. 2003; Bursics et al. 2004; Charúa Guindic et al. 2004; Lienert and Ulrich 2004; Narro 2004; Vávra et al. 2004; Felice et al. 2005; Ramírez et al. 2005; Greenberg et al. 2006; Scheyer et al. 2006; Abdeldaim et al. 2007; Wallis de Vries et al. 2007).

In 2009, Giordano et al. (2009) gave us the first systematic review of 17 papers from 1995 to 2008, with or without pexy. Two papers with additional pexy were included (Cantero et al. 2008; Dal Monte et al. 2007). A total of 1996 patients were analyzed. Early postoperative pain was reported in 18.5% of patients. The recurrence rate at 1 year or more was 10.8% for prolapse, 9.7% for bleeding, and 8.7% for pain at defecation. When reported as a function of the hemorrhoidal grade, the recurrence rate was higher for fourth-degree hemorrhoids (range 11.1–59.3%).

3.5 Additional Pexy

Especially in patients suffering from hemorrhoids with higher grades, the results of hemorrhoid artery ligation alone were not satisfying regarding recurrence and prolapse with recurrence rates up to 50% or more (Dal Monte et al. 2007; Giordano et al. 2009; Pol et al. 2010; Scheyer et al. 2006).

It has been suggested that mucosal prolapse is an important factor for predicting recurrence (Pol et al. 2011). So the combination of hemorrhoid artery ligation with some sort of pexy in order to treat prolapse during the same procedure was an obvious idea.

Pexies of hemorrhoid cushions were described in varying ways in literature over the years for example by El-Megiud Farag (1978) and Awojobi (1983) called anopexy. Especially for treatment of advanced hemorrhoidal disease a procedure was described by Hussein (2001) using a Sims' speculum to reduce prolapse, suturing about 1.5 cm above the dentate line.

Dal Monte et al. (2007) were the first to describe a modification of transanal hemorrhoidal dearterialization (THD) in 2007, adding anopexy of cushions where prolapse was found. After ligation was done, about three centimeters above the dentate line in those places where prolapsed piles are found, they performed a running suture with three to five stitches, in order to surround the cushions. They then tied the knot at the level of the most cranial stitch, in order to lift the prolapse up. They also advised to respect the dentate in order to prevent patients from pain.

In 2008, Scheyer et al. (2008) added the so-called transanal rectal mucopexy to hemorrhoidal artery ligation (HAL), and named the method "recto-anal repair" (RAR). Especially in patients with third or fourth degree hemorrhoids in places where the mucopexy has to be done, a continuous running suture, starting about 5 cm above the dentate line, with a special shaped proctoscope is performed.

The rationale of these new procedures was to treat prolapse at the same time. In addition to hemorrhoid artery ligation, the mucosa is lifted up the anal canal using running continuous helical stitches until above the dentate line. So the main indications for additional pexies are grade III and IV hemorrhoids.

Additional pexies could be done either as a combined procedure using the same suture to ligate the distal branches of the superior rectal artery and perform the mucopexy (Dal Monte et al. 2007; Ratto et al. 2012a) or as a two-step operation. Here the first step is finishing the ligation at all localizations, then, with a different needle and suture, performing the mucopexy as a second step where prolapse is found (Faucheron et al. 2011; Satzinger et al. 2009; Theodoropoulos et al. 2010).

Combined procedures were described by Dal Monte et al. (2007) in their first technical modification of THD by adding anopexy and Ratto et al. (2012a) in their "Distal Doppler-guided dearterialization" recommending a different place of ligation in order to close the distal branches of the superior rectal artery.

Two step procedures separating ligation from pexy are, e.g., described by Scheyer et al. (2008) introducing HAL-RAR technique, Satzinger et al. (2009), Theodoropoulos et al. (2010), and Faucheron et al. (2011) giving first additional reports about the outcome.

Giordano et al. (2014) described a technical modification of THD, which includes targeted mucopexy (THD TM), using a different needle from that recommended for the original operation for a better treatment of prolapse in patients with higher degree of hemorrhoids.

With these additional pexies the recurrence rates could be reduced (Faucheron et al. 2011; Giordano et al. 2014; Ratto et al. 2012a; Satzinger et al. 2009; Scheyer et al. 2008; Sherif and Sarhan 2016; Theodoropoulos et al. 2010; Tsunoda et al. 2015; Zagryadskiy and Gorelov 2008).

3.6 Number of Pexies

In their first description of additional anopexy, Dal Monte et al. (2007) only performed a running suture on prolapsed cushions and not routinely in all six terminal branches.

Scheyer et al. (2008) as well only performed the mucopexy in the case of existing prolapses in grade III and IV patients, with a number of one up to five mucopexies.

But in the following years it was shown that pexies lead to a much higher number of postoperative pain and discomfort compared to ligation alone (De Nardi et al. 2014; Elmér et al. 2013; Figueiredo and Campos 2016; Forrest et al. 2010; Testa et al. 2010; Theodoropoulos et al. 2010, 2012).

Rubbini and Tartari (2015) reported a higher number of mucopexies leading to a higher rate of postoperative pain (Rubbini and Tartari 2015). He

advised to do a proper indication to limit the number of pexies best to a number of four or less. Beside that advice straight running mucopexies with enough mucosal space between two nearby lines of mucopexies while respecting the dentate line with stopping the running suture at least 0.5 cm above it can lead to a lower rate of postoperative pain.

3.7 Results of Ligation Combined with Pexy

With these additional pexies recurrence rates in grade IV patients were reduced from around 50% to more or less 10% in short-term follow-up (Aigner et al. 2004; Faucheron et al. 2011; Giordano et al. 2009, 2014; Ratto et al. 2012a; Scheyer et al. 2008; Sherif and Sarhan 2016). In long-term follow-up, there are still remarkable prolapse recurrence rates. A summary of all reviewed studies is shown in Table 3.

Scheyer et al. (2008) reported in a subgroup of their results using DGHAL in 623 patients about 72 patients treated with additional pexy called RAR (53 patients with third and 19 patients with fourth degree hemorrhoids) a residual protrusion of 6.9% after a very short-term follow-up of 6–8 weeks. In 2015, they reported long-term data with a medium follow-up of 6.5 years (range 6–12 years) of these 623 patients, but loss in follow-up was 35% (Scheyer et al. 2015). In the remaining 408 patients with grade I to IV hemorrhoids, an early postoperative overall residual protrusion rate of 16% with a high residual protrusion rate of 59% in patients with fourth degree hemorrhoids was found. However, this residual protrusion was defined as tissue edema after surgical trauma, which resolved later on. In long term in a mailed questionnaire a patient reported pile recurrence rate of 24%. It has to be noticed that here patients without additional pexy were included.

Zagryadskiy and Gorelov (2008) with 6-months follow-up reported recurrent piles in 8.2% of their 85 patients with stage III–IV hemorrhoids in a noncontrolled prospective study after Doppler-guided hemorrhoid artery ligation

with anopexy (Zagryadskiy and Gorelov 2008). In 2011, they provided a randomized trial comparing Doppler-guided artery ligation and recto-anal repair with hemorrhoidectomy in 150 patients with third or fourth degree hemorrhoids, proving their initial results with even a lower recurrence rate regarding piles of 4.6% in the Doppler group after 12 months (Zagryadskiy and Gorelov 2011).

Satzinger et al. (2009) reported the first data of a 1-year follow-up in 83 patients with third (75 patients) or fourth (8 patients) degree hemorrhoids treated by DGHAL with RAR. They found a rate of 11.4% persisting prolapse.

Ratto et al. (2012a) in 100 patients treated with THD and mucopexy and a short follow-up of 7.3 (3–17) months reported recurrence in 8%. The Danish experience in a single center non-controlled retrospective study found an unacceptably low success rate of 64% treating patients with third and fourth degree hemorrhoid knots and a follow-up on average 9 months postoperatively (3–24 months) (Kjær et al. 2014). But here nearly 80% of the 73 patients were treated with THD alone without additional mucopexy. Having in mind the definition of hemorrhoid degree there may not in all cases a mucopexy was done, where protruded knots were found.

Tsunoda et al. (2015) reported a recurrence rate of 5.5% in a medium-term follow-up of 8.5 months in 36 patients with third degree hemorrhoids treated by THD and mucopexy (Tsunoda et al. 2015). Nogueras et al. (2015) in a multicenter observational study with prospective data collection with a total of 475 patients treated by THD and mucopexy in five public hospitals in Spain reported a postoperative bleeding rate of 4%, pain in 7%, and a recurrence rate of 7% in a follow-up of about 24 months. There were mainly (84.4%) patients with grade III and IV hemorrhoidal disease included, but also some with grade I (0.4%). They pointed out the short hospital stay, early return to work (less than 12 days on average), and a minimum rate of complications and recurrences, but complications were not reported in detail.

Ratto et al. (2015) in a multicenter observational study with prospective data collection with the largest ever published series reported about

803 patients with second to fourth degree hemorrhoidal disease and a median follow-up of 7 (3–57) months treated by THD. No loss in follow-up was reported. They found an early morbidity rate of 18% mainly caused by tenesmus (13%), acute bleeding requiring surgical intervention in 0.9%, and no serious or life-threatening complications. Recurrence was reported in 6.3% while bleeding occurred in 2.4%. The overall success rate was 90.7%.

3.8 Treatment of Fourth Degree Hemorrhoidal Disease

There are four papers presenting results of Doppler-guided hemorrhoid artery ligation only in patients with fourth degree hemorrhoidal disease.

In the biggest series so far, Faucheron et al. (2011) reported long-term results in 100 consecutive patients for the treatment of grade IV hemorrhoids with recurrence rates of 9% with a mean follow-up of 34 months.

Ratto et al. (2011) reported about 35 patients with fourth degree hemorrhoid knots, medium follow-up of 10 months with ten patients experiencing some degree of residual prolapse, significantly only two (5.7%) requiring further surgery.

Giordano et al. (2014) reported in 31 patients with fourth degree hemorrhoids and a follow-up of 32 months a recurrence rate of 4%, but loss in follow-up was more than 15%.

Sherif and Sarhan (2016) in 63 patients with fourth degree hemorrhoids and a follow-up of 12 months published a 3% recurrence rate and no loss in follow-up (Sherif and Sarhan 2016).

In addition to the above named papers, Roka et al. (2013) in a subgroup of patients with fourth degree hemorrhoids found a recurrence rate of 18% after a 12 months follow-up.

Furthermore, Venturi et al. (2016) reported in their comparison of SH versus THD about a subgroup of patients with fourth degree hemorrhoid disease. Here prolapse recurrence was higher in patients with fourth-degree hemorrhoids, while SH was more effective than THD in reducing the risk of recurrence at 36 ± 6 months follow-up

($p = 0.049$). Residual prolapse was found in 5% of patients with third degree hemorrhoid disease and 33.3% with fourth degree hemorrhoids meaning a total prolapse recurrence rate of 17.1% (Tables 1, 2, and 3).

3.9 Complications

In all reviewed studies major complications (Clavien-Dindo Classification grade IV and V) (Clavien et al. 2009) are not reported. Up to 1st of October 2010 the National Institute for Health and clinical Experience (NICE) reviewed all papers so far published including 3061 patients, not finding any life-threatening complication despite of three cases of significant postoperative hemorrhaging requiring blood transfusion (NICE 2010). Blood transfusion is classified as Clavien-Dindo grade II.

Only case reports could be found about severe complications. Berkel et al. (2013) gave a case report about a brain abscess 2 weeks after performing transanal hemorrhoid dearterialization without mucopexy. Due to unsuccessful initial nonsurgical treatment after 3 weeks the abscess was drained by ventriculocopy (Clavien-Dindo grade IIIb).

Intraoperative complications are seldom and inconsistently reported. Infantino et al. (2010) reported during the procedure a breakage of the needle in three cases without consequences.

Satzinger et al. (2009) noticed five partial or full mucosal ruptures in 276 performed mucopexy sutures, meaning a rate of 1.8%, leading to one reoperation after 3 months, while Tsunoda et al. (2015) found intraoperative transient submucosal hematomas in 28% of their patients.

Hoyuela et al. (2016) reported one out of 30 treated patients presenting necrosis of a hemorrhoidal cushion in the early post-operative period that required reoperation (Clavien-Dindo Grade IIIa). In this case a hemorrhoidectomy was performed.

Loganathan et al. (2016) reported five patients of 85 patients with early postoperative septic complications, the majority presented with either perianal swelling or pain or both and one patient

Table 1 Comparative trials data

Author/year	DGHL patients (n)	DGHL grade hemorrhoid/ number of patients	Op time (min)	Compared to	Patients comparison (n)	Grade comparison	Op time comparison (min)	Follow-up (months)	Recurrent prolapse (n (%))	Recurrent prolapse comparison (n (%))
Elmér et al. (2013)	20	II: 3 (15%), III: 17 (85%)	36 (30–45)	CH	20	II: 3 (15%), III: 17 (85%)	20 (10–34)	12	II: 7 (35%), III: 2 (10%)	II: 3 (15%), III: 1 (5%)
De Nardi et al. (2014)	25	III: 25 (100%)	35 ± 20	CH	25	III: 25 (100%)	25 ± 10	24	0	0
Tsunoda et al. (2015)	36	III: 36 (100%)	33 (32.8–36.6)	CH	30	III: 19 (63%), IV: 11 (37%)	31 (28.1–35.3)	8.5 (3–12)	2 (5.5%)	1 (3.3%)
Sherif and Sarhan (2016)	63	IV: 63 (100%)	32 ± 10.3	CH	63	IV: 63 (100%)	18 ± 9.1	12	2 (3.2%)	0
Zagryadskiy and Gorelov (2011)	65	III: 41 (63%), IV: 24 (37%)	36 ± 2.3	CH (closed hemorrhoidectomy)	70	III: 39 (56%), IV: 31 (44%)	35.3 ± 3.1	15	3 (4.6%)	0
Denoya et al. (2014)	12	III–IV: 12 (100%)	na	CH (closed hemorrhoidectomy)	15	III–IV: 15 (100%)	na	36 (27–43)	2 (16.7%)	1 (6.7%)
Zampieri et al. (2012)	46	III: 21 (46%), IV: 25 (54%)	20 ± 5.1	CH LigaSure™	68	III: 32 (47%), IV: 36 (53%)	28 ± 4.2	6	4%	4%
Gupta et al. (2011)	24	III: 24 (100%)	31 (5.4)	HL	24	III: 24 (100%)	9 (6.3)	12	3 (12.5%)	4 (16.6%)
Schuurman et al. (2012)	38	II: 7 (18%), II/III: 19 (50%), III: 12 (%)	na	HL	35	II: 12 (34%), II/III: 14 (40%), III: 9 (26%)	na	6	12.40%	0

Aigner et al. (2016)	20	III: 20 (100%)	na	HL	20	III: 20 (100%)	na	12	2 (10.0%)	1 (5.0%)
Brown et al. (2016)	161	II: 115 (65%); III: 60 (34%)	na	RBL	176	II: 92 (57%); III: 68 (42%)	na	12.1 (12–12.3)	48 (29.8%)	87 (49.4%)
Festen et al. (2009)	23	III: 19 (84%); IV: 4 (16%)	34	SH	18	III: 17 (94%); IV: 1 (6%)	23	1.5	5 (21.7%)	2 (11.1%)
Giordano et al. (2011)	28	II: 16 (57%); III: 12 (43%)	30 (20–45)	SH	24	II: 15 (62%); III: 9 (38%)	33 (18–100)	38 (33–48)	3 (10.7%)	2 (8.6%)
Infantino et al. (2012)	85	III: 85 (100%)	26.6 ± 8.4 (14–50)	SH	84	III: 84 (100%)	25.7 ± 7.8 (15–55)	17 (15–20)	12 (14.1%)	6 (7.1%)
Verre et al. (2013)	59	III: 27 (46%); IV: 35 (59%)	27 ± 5.6	SH	63	III: 25 (40%); IV: 38 (60%)	31 ± 8.7	3 (1–3)	na	na
Béliard et al. (2014)	54	II: 24 (44%); III: 30 (56%)	na	SH	27	II: 15 (56%); III: 12 (44%)	na	24	5 (9.2%)	1 (3.7%)
Tsang et al. (2014)	40	3 (2–4)	39.03 ± 14.18	SH	37	3 (1–4)	33.84 ± 18.45	8 (4–15)	4 (10.3%)	9 (24.3%)
Leardi et al. (2016)	50	III: 50 (100%)	na	SH	50	III: 50 (100%)	na	84 (60–132)	10%	14%
Lehur et al. (2016)	197	II: 45 (23%); III: 152 (77%)	44 ± 16	SH	196	II: 46 (23%); III: 150 (77%)	30 ± 14	13	15%	5%
Venturi et al. (2016)	35	III: 20 (57%); IV: 15 (43%)	37.8	SH	35	III: 20 (57%); IV: 15 (43%)	37.9	36 ± 6	6 (17.1%), III: 1 (5%), IV: 5 (33.3%)	3 (8.6%)

Table 2 Comparative trials outcome

Elmér et al. (2013)	CH	Early postoperative pain was lower in THD ($p < 0.05$), THD longer duration of surgery ($p < 0.001$), trend to more recurrences in THD after 1 year ($p = 0.06$)
De Nardi et al. (2014)	CH	DGHAL less pain ($p > 0.05$), return to work better in DGHAL ($p = 0.09$)
Tsunoda et al. (2015)	CH	Pain lower in THD ($p = 0.04$), blood loss greater in THD ($p = 0.001$), length of stay ($p = 0.006$) and time to first defecation shorter in THD ($p = 0.008$), postoperative complications comparable
Sherif and Sarhan (2016)	CH	Longer operative time for DGHAL ($p > 0.001$), first defecation sooner in DGHAL ($p = 0.006$), shorter hospital stay in DGHAL ($p > 0.001$), return to work earlier in DGHAL ($p > 0.001$), less pain in DGHAL ($p > 0.001$), no differences in outcome after 1 year
Zagryadskiy and Gorelov (2011)	CH (closed hemorrhoidectomy)	No difference in operation time and time to first bowel movement, lower pain for THD ($p < 0.05$), shorter hospital stay in THD ($p = 0.001$), THD earlier return to daily activities (2.8 vs. 21.1 days, $p < 0.001$), no difference in follow-up regarding recurrence of prolapse, bleeding, or pain. More residual skin tags ($p = 0.047$)
Denoya et al. (2014)	CH (closed hemorrhoidectomy)	No significant difference in persisting symptoms, recurrence and reoperation rates but with chronic complications only after hemorrhoidectomy ($p = 0.189$), trend toward more patient reported than actual recurrence on proctoscopy
Zampieri et al. (2012)	CH LigaSure™	No differences in postoperative complications or readmissions, in short- and medium-term higher rate of pain resolution in THD ($p < 0.05$) and less postoperative constipation ($p < 0.05$)
Gupta et al. (2011)	HL	Operative time shorter for HL (9 vs. 31 min, $P < 0.003$) and lower pain score (2.2 vs. 4.4, $P < 0.002$). No difference for complication or recurrence rates
Schuurman et al. (2012)	HL	No significant difference for patient reported severity of bleeding, pain, and dyschezia. Greater improvement of prolapse symptoms in HL group ($p = 0.047$). Higher rate of complications for DGHAL ($p < 0.0005$)
Aigner et al. (2016)	HL	DGHAL less pain first 2 weeks (not significant), more recurrences 10% versus 5%, not significant ($p = 0.274$), no morphological changes, more early mucus discharge in suture mucopexy ($p = 0.035$), DGHAL add nothing significantly to results achieved by mucopexy alone
Brown et al. (2016)	RBL	Early pain higher in HAL ($p < 0.0001$), readmission rate higher in HAL (7% vs. 1%), high overall recurrence rate, recurrence after HAL was lower than a single RBL ($p = 0.0005$)
Festen et al. (2009)	SH	No difference for complications. Shorter operative time for DGHAL (23 vs. 34 min, $p < 0.001$) and less pain (pain score at day 7: 1.6 vs. 3.2, $p < 0.01$)
Giordano et al. (2011)	SH	No significant difference for pain, operative time, complications, or recurrence rate. Patients returned to normal activities faster after THD (3.2 vs. 6.3 days, $p < 0.01$). Patients return to work earlier after THD (12 vs. 25 days, $p < 0.05$)
Infantino et al. (2012)	SH	No difference for pain, postoperative complications, recurrence, or reoperation rates. Higher rate of late complications for SH ($p = 0.028$). Shorter length of stay and lower equipment cost for DGHAL
Verre et al. (2013)	SH	More postoperative bleeding in SH and lower pain for THD (both not significant), return to work earlier in THD group (3.5 vs. 5.5 days), in follow-up SH higher pain at rest and during defecation and more blood loss, while THD group no pain or blood loss at all
Béliard et al. (2014)	SH	Short-term outcome better in THD regarding prolapse, bleeding, pain, and tenesmus. Mean duration of disability for work was lower in THD ($p < 0.001$), long-term results were similar, one recto-vaginal fistula in SH

(continued)

Table 2 (continued)

Tsang et al. (2014)	SH	Length of stay, time to first bowel movement and complications similar, less pain in THD ($p = 0.000$), THD earlier return to daily activities (3.13 vs. 6.78 days, $p = 0.001$), in follow-up similar satisfaction, complication, and recurrence rates
Leardi et al. (2016)	SH	In short-term pain lower in DG-THD ($p < 0.01$), morbidity rate and return to normal life similar. At long-term follow-up incidence of piles not statistically different (DG-THD 10.0%; SH 14.0%), no differences in terms of satisfaction
Lehur et al. (2016)	SH	Operative-related adverse events similar, DGHAL longer operation time than SH ($p < 0.001$), less pain ($p < 0.013$), DGHAL led to more residual grade III HD (15% vs. 5%) and a higher reoperation rate (8% vs. 4%). Patient satisfaction was >90% for both
Venturi et al. (2016)	SH	Frequencies of preoperative obstructed defecation symptoms and prolapse recurrence higher in patients with fourth-degree hemorrhoids, SH was more effective than THD in reducing the risk of recurrence at 36 ± 6 months follow-up ($p = 0.049$), operative time, complications, pain, and time of return to normal activity were similar, costs higher for SH in patients with fourth-degree hemorrhoids ($p > 0.01$), no difference in overall patient satisfaction

which developed localized ulceration. All were cured by antibiotics without reoperation (Clavien-Dindo grade II). Perianal abscesses and proctitis are reported in some papers up to 1% (Bjelanovic et al. 2016; Roka et al. 2013), while fever was found in one paper up to 3% (Zagryadskiy and Gorelov 2011).

Apart from the above listed reports there are some more or less common minor complications one can expect after Doppler-guided hemorrhoid artery ligation with mucopexy (Table 3).

The most common postoperative complication is acute urinary retention (AUR) with rates up to 20% (Elmér et al. 2013; Giordano et al. 2014; Rotta et al. 2012).

Urinary infections are very seldom reported, while one paper reports about dysuria up to 5% (Infantino et al. 2010).

Thrombosis seems to be the second common postoperative complication with occurrence rates up to 8% (Ratto et al. 2011; Zagryadskiy and Gorelov 2008).

Perianal fistulas (up to 1%) and fissures (up to 3.5%) were not so often reported (Bjelanovic et al. 2016). Roka et al. (2013) reported one late anal stenosis, which required anal dilatation.

Complications regarding defecation are often named and mainly transitory. Tenesmus rates vary from 9% up to 20% (Giordano et al. 2014; Jeong

et al. 2011), while one report describes mild transient tenesmus up to 30% (Hoyuela et al. 2016).

Fecal incontinence is a rare complication, mainly transitory, with rates up to 2% (Forrest et al. 2010; Rotta et al. 2012). On the other hand, constipation is reported up to 13% (Giordano et al. 2014), one paper named urgency up to 15% (Aigner et al. 2016).

In this respect, Bjelanovic et al. (2016) recently stated a decreasing number of complications with increasing surgeon experience.

Late complications at the end of follow-up are mainly related to recurrent disease or caused by skin tags.

Reoperation rates vary from 0% to 29% often due to resolving symptoms associated with skin tags.

Patient satisfaction, as far as reported, reaches from 40% (subgroup of patients with fourth degree hemorrhoids) to 98.8% and is mainly around 90% (Table 3).

3.10 Systematic Reviews

As mentioned above in 2009 Giordano et al. (2009) gave us the first systematic review of 17 papers from 1995 to 2008, but here 15 reports without pexy were included.

Table 3 All studies

Author/year	DGHL patients (n)	DGHL age (years)	DGHL sex (female/male)	DGHL grade hemorrhoid/number of patients	Op time (min)	Ligations (n)	Pexies (n)	Early complications	Follow-up (months)	Late complications	Recurrent prolapse (n (%))	Reoperation (n (%))	Satisfaction (Good/Excellent) (%)
Dal Monte et al. (2007)	63	na	na	III: 54 (85.7%); IV: 9 (14.3%)	na	6	na	na	na	na	3 (4.7%); III: 2 (3.7%); IV: 1 (1.1%)	na	na
Scheyer et al. (2008)	72	na	na	III: 53, IV: 19	na	3–12	1–5	Bleeding: 4 (5.6%), thrombosis: 2 (2.8%), defecation pain: 3 (4.2%), fissure: 1 (1.4%), AUR: 2 (2.8%), urinary infection: 1 (1.4%), fistula: 1 (1.4%), proctitis: 1 (1.4%)	1.5	na	5 (6.9%)	na	93%
Zagryadskiy and Gorelov (2008)	85	44	28/57	III: 61 (71.8%); IV: 24 (28.2%)	32 ± 5.2 (24–45)	(6)	(3–4)	10 (11.7%), thrombosis: 7 (8.2%), fever: 3 (3.5%)	10 (6–12)	na	7 (8.2%)	13 (15.3%); prolapse/sclerotherapy: 7 (8.2%), skin tags: 6 (7.1%)	>91%
Festen et al. (2009)	23	39	7/16	III: 19 (84%); IV: 4 (16%)	34	na	na	1 (4.32%); bleeding/reoperation	1.5		5 (21.7%)	na	na
Satzinger et al. (2009)	83	56 (20–83)	36/47	III: 75 (90%); IV: 8 (10%)	26.5	6 (3–11)	1–6	7 (8.4%); pain: 1 (1.2%), thrombosis: 2 (2.4%), AUR: 3 (3.6%), abscess: 1 (1.2%), fissure: 1 (1.2%), bleeding: 1 (1.2%)	12	2 (2.4%); abscess: 1 (1.2%), reoperation due to mucosal rupture: 1 (1.2%)	5/44 (11.4%)	1/44 (2.3%)	>90%
Cho et al. (2010)	34	50.2 ± 15 (20–86)	16/18	II: 13 (38.2%); III: 16 (47.0%); IV: 5 (14.7%)	35	na	na	2 (5.8%); AUR: 1 (2.9%); bleeding: 1 (2.9%)	13.6 ± 2.5	na	2 (5.8%)	na	91%

Forrest et al. (2010)	77	50	28/49	II: 12, III: 65	n/a	6 (1–9)	2 (1–5)	3 (3.9%): AUR: 1 (1.3%), transient fecal incontinence: 1 (1.3%), postdefecation hemorrhage: 1 (1.3%)	13 (6–21)	17 (22.1%): bleeding: 4 (5.1%), pruritus: 2 (2.6%), fissure: 8 (10.3%), skin tag: 3 (3.9%)	5 (6.5%)	2 (2.6%): repeat DGHAL 1 (1.3%), stapled hemorrhoidopexy 1 (1.3%)	84%
Infantino et al. (2010)	112	48 ± 13 (21–85)	32/80	II: 39 (35), III: 73 (65)	33.9 ± 8.8 (15–60)	7.2 ± 1.5	3–5	11 (9.8%): thrombosis: 3 (2.6%), bleeding: 1 (0.8%), AUR: 1 (0.8%), dysuria: 6 (5.3%), 6 (15%): rectal impaction: 2 (5%); hemorrhoidal thrombosis: 2 (5%); AUR: 2 (5%)	15.6 ± 6.5 (6–32)	na	7 (6.25%)	14 (12.5%): RBL: 9 (8.0%), OH: 5 (4.5%)	85.7%
Testa et al. (2010)	40	20–65		III: 16 (40%); IV: 24 (60%)	30–45	4–9	2–3		16 (5–37)	na	2 (5%)	na	90%
Theodoropoulos et al. (2010)	74	na	na	III: 32 (43.3%); IV: 42 (56.7%)	n/a	9 (4–15)	1–4		15	4 (5.4%): bleeding: 2 (2.7%), prolapse: 2 (2.7%)	2 (2.7%)	2 (2.7%): OH: 1 (1.3%), RAR: 1 (1.3%)	97.3%
Faucheron et al. (2011)	100	50 (21–85)	64/36	IV: 100	35 (17–60)	9 (4–14)	1–4	9 (9%): pain 6 (6%), bleeding: 4 (4%), dyschezia: 1 (1%), thrombosis 3 (3%)	34 (14–42)	4 (4%): dyschezia: 1 (1%), anal urgency: 1 (1%), thrombosis of residual piles: 1 (1%), anal fissure	9 (9%)	6 (6%): reoperation: 3 (3%), OH: 3 (3%)	na
Giordano et al. (2011)	28	54 (23–73)	8/20	II: 16 (57%); III: 12 (43%)	30 (20–45)	na	na	4 (14%): AUR: 1 (4%), submucosal hematoma: 1 (4%), technical problems: 2 (7%)	38 (33–48)	Bleeding: 1 (4%)	3 (10.7%)	na	86%
Gupta et al. (2011)	24	44 (11.2)	11/13	III: 24 (100%)	31 (5.4)	6–11	3	4 (16.6%): AUR: 3; bleeding: 1	12	na	3 (12.5%)	na	na

(continued)

Table 3 (continued)

Author/year	DGHL patients (n)	DGHL age (years)	DGHL sex (female/male)	DGHL grade hemorrhoid/ number of patients	Op time (min)	Ligations (n)	Pexies (n)	Early complications	Follow-up (months)	Late complications	Recurrent prolapse (n (%))	Reoperation (n (%))	Satisfaction (Good/Excellent) (%)
Jeong et al. (2011)	97	51.7 ± 13.2 (22–87)	35/62	II: 13 (13.4%), III: 68 (70.1%), IV: 16 (16.5%)	34 (27–41)	5.9 ± 0.5	5.8 ± 0.5	36 (37.1%): tenesmus: 19 (19.6%), bleeding: 8 (8.2%), dyschezia: 7 (7.2%), prolapse: 2 (2.1%)	12	14 (14.4%): bleeding: 4 (4.1%), prolapse: 10 (10.3%)	10 (10.3%)	na	78.3%
Ratto et al. (2011)	35	50.4 ± 13.8	16/19	IV: 35 (100%)	33 ± 12	6	na	10 (28.5%), thrombosis: 3 (8.6%), bleeding: 2 (5.7%); AUR: 5	10 (2–28)	Bleeding: 9 (25.7%), mild anal pain: 3 (8.6%), transient anal burning: 4 (11.4%), tenesmus: 4 (11.4%)	10 (28.6%)	2 (5.7%)	na
Szmulowicz et al. (2011)	96	63.5 (21–81)	57/39	II/III: 40%	64 (45–150) including concurrent procedures	7–13	na	9 (9%): bleeding: 3 (3%), anal pain: 2 (2%), fissure: 2 (2%), AUR: 2 (2%)	15 (3–35)	na	20 (21%) all, 11.5% after mucopexy	13 (13%): RBL: 6, DGHAL: 5, excisional hemorrhoidectomy: 2	na
Zagryadskiy and Gorelov (2011)	65	43 (28–63)	11/54	III: 41 (63%), IV: 24 (37%)	36 ± 2.3	na	na	3 (4.6%): thrombosis: 1 (1.5%), fever: 2 (3.1%), fever: 2 (3.1%) thrombosis: 1 (1.5%), fever: 2 (3.1%)	15	Bleeding: 2 (3.1%)	3 (4.6%)	9 (13.8%): sclerosis: 3 (4.6%), skin tags: 6 (9.2%)	100%
Deutsch et al. (2012)	58	na	15/43	I: 6 (10.3%); II: 12 (20.6%); III: 32 (55.1%); IV: 8 (13.8%)		7 (4–9)	3 (1–3)	2 (3.4%): fissure: 2 (3.4%)	2.6 (0.25–12)	na	na	2 (3.4%)	91%
Infantino et al. (2012)	85	47.6 ± 11.9 (24–70)	27/58	III: 85 (100%)	26.6 ± 8.4 (14–50)	na	na	26 (30.6%): AUR: 5 (5.9%), dysuria: 5 (5.9%), bleeding: 5	17 (15–20)	0	12 (14.1%)	10 (11.7%) RBL: 7 (8.2%), MM: 3 (3.5%)	na

Ratto et al. (2012a)	100	na	na	na	30 ± 10	na	na	na	(5.9%), thrombosis: 2 (2.4%), hematoma: 5 (5.9%), others: 6 (7.1%)	7.3 (3–17)	na	8 (8%)	6 (6%); RBL: 1; mucopexy: 5	na
Rotta et al. (2012)	42	42.3 (31–64)	13/29	II: 11 (26%), III: 21 (50%), VI: 10 (24%)	35 ± 10	(6)	na	na	18 (18%); thrombosis: 2 (2%), AUR: 5 (5%), pain during defecation: 10 (10%), submucosal abscess: 1 (1%)	4 (1–9)	na	0	0	95%
Schuurman et al. (2012)	38	50 ± 13.0	14/22	II: 7 (18%), II/III: 19 (50%) III: 12 (%)	na	5.2	na	na	3 (7.8%), thrombosis: 1 (2.6%), AUR: 1 (2.6%), hemorrhage/ blood transfusion: 1 (2.6%)	6	na	12.4%	5 (13.1%), hemorrhoidectomy: 2 (5.2%), RBL: 3 (7.9%)	75%
Theodoropoulos et al. (2012)	57	55	17/40	III: 22 (38.6%), IV: 35 (61.4%)	na	10 (4–15)	na	na	Tenesmus/dyschezia/fullness: 7 (12.3%)	20 (6–48)	16 (28.1%); re-intervention: 1 (1.7%), skin tags: 7 (8.8%), minor bleeding: 7 (12.3%), persistent bleeding: 1 (1.7%)	3 (5.2%)	0	94.7%
Walega et al. (2012)	20	54.8	8/12	III–IV: 20 (46%), IV: 25 (54%)	32 (25–75)	5.6 (4–8)	2.5 (1–4)	1 (5%) bleeding		12	Bleeding: 0%	8 (40%)	Bleeding: 1 (5)	95%
Zampieri et al. (2012)	46	(18–60)	18/28	III: 21 (46%), IV: 25 (54%)	20 ± 5.1	na	na	Readmission: 3 (6.5%)		6	na	4%	4%	na

(continued)

Table 3 (continued)

Author/year	DGHL patients (n)	DGHL age (years)	DGHL sex (female/male)	DGHL grade hemorrhoid/number of patients	Op time (min)	Ligations (n)	Pexies (n)	Early complications	Follow-up (months)	Late complications	Recurrent prolapse (n (%))	Reoperation (n (%))	Satisfaction (Good/Excellent) (%)
Elmér et al. (2013)	20	na	12/8	II: 3 (15%), III: 17 (85%)	36 (30–45)	6 (6–8)	2–4	8 (40%); AUR: 4 (20%); thrombosis: 1 (5%); re-prolapse 3 (15%); reoperation: 1 (5%)	12	1 (5.0%); discrete anal stricture: 1 (5.0%)	II: 7 (35%); III: 2 (10%)	4 (20%); reoperation: 2 (10%); RBL: 2 (10%)	
Roka et al. (2013)	184	46.8 (23–76)	60/124	III: 107 (58.1%), IV: 77 (41.8%)	35 (13–75)	6 (2–11)	3 (1–9)	14 (7.6%); reoperation for bleeding: 2 (1.0%); thrombosis: 11 (6.0%); proctitis: 1 (0.5%)	12	3 (1.6%); anal stenosis: 1 (0.5%); AUR: 1 (0.5%); fecal incontinence: 1 (0.5%)	21 (11.4%); III: 8/99 (8%); IV: 13/70 (18%)	32 (19%); OH: 2 (1); skin tags: 12 (6); sclerotherapy: 5 (3); RBL: 4 (2); drugs/others: 13 (7)	87.6% (III: 87.0%, IV: 88.4%)
Verre et al. (2013)	59	48.9	37/22	III: 27 (46%), IV: 35 (59%)	27 ± 5.6	na	na	12 (20.3%); AUR: 5 (8.4%); thrombosis: 3 (5.1%); pain: 4 (6.7%)	3 (1–3)	Tenesmus: 1.8%; soiling: 3.6%; constipation: 3.6%	na	na	na
Yannoul et al. (2013)	120	51 (21–76)	32/88	I: 3 (2.5%), II: 20 (16.6%), III: 52 (35.0%), IV: 55 (45.8%)	28 (9–76)	8 (2–14)	na	16 (13.3%); pain: 12 (10%); bleeding: 4 (3.3%)	12	6 (5%); fissure: 5 (4.1%); thrombosis: 1 (0.8%)	16 (13.3%)	16 (13.3%)	86.5%
Béliard et al. (2014)	54	51.2 ± 12.6	55.6%/44.4%	II: 24 (44%); III: 30 (56%)	na	na	na	0	24	na	5 (9.2%)	2 (3.7%)	na
De Nardi et al. (2014)	25	48	9/16	III: 25 (100%)	35 ± 20	6		2 (8%); thrombosis: 1 (4); re-prolapse: 1 (4)	24	na	0	3 (12.0%); incision thrombosis: 1 (4.0%); RBL: 1 (4.0%); skin tag removal: 1 (4.0%)	75.0%
Denoya et al. (2014)	12	53.8 ± 8.8	7/5	III–IV: 12 (100%)	na	6	6?	0	36 (27–43)	0	2 (16.7%)	THD: 1 (8.3%)	na
Giordano et al. (2014)	31	58 (18–75)	10/21	IV: 31 (100%)	32 (23–47)	6 (5–8)	3–4	Pain: 5 (16.1%); AUR: 6 (19.3%); tenesmus: 3 (9.6%)	32	1 (3.2%); fibroepithelial polyp, excised	1 (3.2%)	2 (6%); OH: 1 (3%); skin tags: 1 (3%) removal	na

Kjær et al. (2014)	73	47 (22–82)	33/40	II: 24 (33%), III: 39 (53%), IV: 10 (0%)	na	na	na	na	constipation: 4 (12.9%), thrombosis: 1 (3.2%)	9 (3–24)	na	36%	21 (29%) all THD reoperation	na
Tempel et al. (2014)	216	52.2 ± 14.2	61/165	III: IV:	na	na	na	na	62 (28.7%); AUR: 37 (17.1%); transitory bleeding: 38 (18%), transitory incontinence to stool: 18 (9%) to flatus: 16 (8%), pelvic muscle spasm: 21 (10%)	23 (1–42)	na	na	na	91.5%
Tsang et al. (2014)	40	54.3 ± 10.9	15/25	3 (2–4)	na	39.03 ± 14.18	na	na	2 (5%); thrombosis: 1 (2.5%), AUR: 1 (2.5%)	8 (4–15)	0	4 (10.3%)	1 (2.5%)	na
LaBella et al. (2015)	106	51 ± 15	65/41	II: 4 (4%); III: 69 (64%); IV: 33 (32%)	na	6	na	na	no	12	na	10.3%	na	92%
Noguerales et al. (2015)	475	50 ± 1.2	621/254	I: 2 (0.4%), II: 72 (15.2%), III: 267 (56.2%), IV: 134 (28.2%)	47 ± 13.3	6	6	6	60 (12.6%); bleeding: 19 (4.0%), pruritus: 7 (1.5%), pain: 34 (7.1%)	23.7 ± 12.9	na	35 (7.4%)	na	na
Ratto et al. (2015)	803	49.4 ± 13.0	301/502	II: 137 (17.1%), III: 548 (68.2%), IV: 118 (14.7%), 112 non mucopexy included (grade II)	34.3 ± 5.9 (24–47)	6–7	>=6	166 (20.7%), bleeding (reop): 1 (0.1%), AUR: 69 (8.6%), pain/tenesmus: 96 (11.2%)	144 (18%); pain/tenesmus: 104 (13.0%), bleeding: 18 (2.2%), AUR: 7 (0.9%), thrombosis: 4 (0.5%), constipation: 3 (0.4%), abscess/infection: 3 (0.4%), fissure: 1	11.1 ± 9.2	56 (6.9%)	Reoperation: 46 (5.7%), Re-THD: 18 (2.2), OH: 16 (2), RBL: 12 (1.5),	90.7%	

(continued)

(continued)

Table 3 (continued)

Author/year	DGHL patients (n)	DGHL age (years)	DGHL sex (female/male)	DGHL grade hemorrhoid/ number of patients	Op time (min)	Ligations (n)	Pexies (n)	Early complications	Follow-up (months)	Late complications	Recurrent prolapse (n (%))	Reoperation (n (%))	Satisfaction (Good/Excellent) (%)
Schever et al. (2015)	408	50 (22–84)	175/233	II: 69 (17%), III: 302 (74%), IV: 37 (9%)	na	6.5 (2–16)	na	118 (29%): residual protrusion: 65 (16%), bleeding: 25 (3%), perianal thrombosis: 13 (3%), painful defecation: 7 (2%), fissure: 5 (1%), AUR: 7 (1%), urinary infection: 3 (0.6%), stool retention: 1 (0.3%), fistula: 2 (0.3%), proctitis: 2 (0.3%)	78 (72–144)	Bleeding: 3%, pruritus: 2%, anal pain: 2%, mixed symptoms: 20% (0.1%), other: 4 (0.5%) included reoperations: hemostasis: 7 (0.9%), abscess drainage: 1 (0.1%), fissurectomy: 1 (0.1%)	98 (24%)	na	86%
Tsunoda et al. (2015)	36	64 (21–81)	9/27	III: 36 (100%)	33 (32.8–36.6)	6 (5–6)	2 (1–4)	AUR: 2 (5.5%)	8.5 (3–12)	na	2 (5.5%)	2 (5.5%); RBL: 2	na
Aigner et al. (2016)	20	49.2 ± 12.6	8/12	III: 20 (100%)	na	na	3 (1–6)	Bleeding: 2 (10%), urgency: 3 (15%), pruritus: 3 (15%)	12	Bleeding: 5 (10%), urgency: 4 (20%), pruritus: 2 (15%)	2 (10.0%)	na	na
Bjelanovic et al. (2016)	402	46.4 (20–85)	134/268	II: 16 (4%); III: 210 (52.2%); IV: 176 (43.8%)	23 (17–34)	6	na	67 (16.7%); bleeding: 10 (2.5%), hemorrhoidal thrombosis: 10 (2.5%), perianal fistulas: 5 (1.2%), fissures: 14 (3.5%); AUR: 3 (0.7%)	12	25 (6.2%): not specified	30 (7.4%); II: 1/16 (6.3%); III: 121/210 (5.8%); IV: 17/176 (9.7%)	30 (7.4%); II: 1/16 (6.3%); III: 121/210 (5.8%); IV: 17/176 (9.7%)	Bleeding: 90.5%; prolapse: 97.3%; pain: 97%

[illegible]

(continued)

Table 3 (continued)

Author/year	DGHL patients (n)	DGHL age (years)	DGHL sex (female/male)	DGHL grade hemorrhoid/ number of patients	Op time (min)	Ligations (n)	Pexies (n)	Early complications	Follow-up (months)	Late complications	Recurrent prolapse (n (%))	Reoperation (n (%))	Satisfaction (Good/Excellent) (%)
Loganathan et al. (2016)	85	55 ± 14 (30–85)	21/64	III: 72 (84.7%); IV: 13 (15.3%)	25 ± 12	6 (3–11)	3 (1–7)	urgency: 4 (2.0%), exteriorized bleeding: 12 (6.0%), severe septic complications: 1 (0.5%), severe pain: 8 (4.0%), reoperation: 3 (1.5%)	26.4 (5.7–41.6)	na	16 (19%); III: 15/72 (17.6%); IV: 1/13 (7.7%)	12 (14.1%); RBL: 4 (4.7%), open hemorrhoidectomy: 3 (3.5%), injection: 2 (2.3%), re-THD: 2 (2.3%), sphincterotomy: 1 (1.2%)	98.8%
Piccinini (2016)	56	50.46 (31–70)	20/36	III: 36 (64.3%); IV: 20 (35.7%)	40 (19–120)	4.57 (2–7)	2.2 (1–4)	19 (33.4%); bleeding: 8; pain: 11, prolapse: 10; AUR: 1 (1.6%)	4.7 (0.2–15.6)	na	7 (12.5%)	1 (1.7%) Re-THD	82.1%
Sherif and Sarhan (2016)	63	51.2 ± 14.97	10/53	IV: 63 (100%)	32 ± 10.3	na	na	12 (19%); urgency: 7 (11.1%), flatus incontinence: 2 (3.2%), tenesmus: 1 (1.6%), discrimination problems: 2 (3.2%). All vanished at last FU	12	12 (19%); urgency: 7 (11.1%), flatus incontinence: 2 (3.2%), tenesmus: 1 (1.6%), discrimination problems: 2 (3.2%). All vanished at last FU	2 (3.2%)	na	na
Venturi et al. (2016)	35	48.6	17/18	III: 20 (57%); IV: 15 (43%)	37.8	na	na	3 (8.6%); AUR: 1 (2.8%), bleeding: 1 (2.8%), thrombosis: 1 (2.8%)	36 ± 6	0	6 (17.1%); III: 1 (5%); IV: 5 (33.3%)	5 (14.3%)	III: 75%; IV: 40%

In 2010, the National Institute for Health and Clinical Excellence (NICE) analyzed all so far published reports about Doppler-guided hemorrhoid artery ligation including mainly reports without pexy finding “Current evidence on hemorrhoidal artery ligation shows that this procedure is an efficacious alternative to conventional hemorrhoidectomy or stapled hemorrhoidopexy in the short and medium term, and there are no major safety concerns” (NICE 2010).

Sajid et al. (2012) published a systematic review comparing hemorrhoidal dearterialization to stapled hemorrhoidopexy with three papers and 150 patients, finding no difference in primary outcome, but here as well were ligation procedures without pexy included.

Pucher et al. (2013) reviewed systematically the clinical outcome following Doppler-guided hemorrhoidal artery ligation analyzing 28 studies with 2904 patients. Here several studies without added mucopexy were included, while the overall quality was poor. They found recurrence rates from 3% to 60%, a pooled rate of 17.5%, with the highest rates for patients with fourth degree hemorrhoids. The overall complication rates were low with a reintervention rate of 6.4%.

In another systematic 2014 updated overview, von Roon et al. (2009) analyzed one systematic review and seven randomized controlled trials with the question what the effects of hemorrhoid artery ligation for hemorrhoidal disease are (von Roon et al. 2009).

Due to low quality of the analyzed studies they found insufficient evidence to judge the effectiveness of hemorrhoidal artery ligation compared with injection sclerotherapy, infrared coagulation, rubber band ligation, or radiofrequency ablation. For hemorrhoidal artery ligation compared with stapled hemorrhoidectomy, closed hemorrhoidectomy, and open excisional (Milligan-Morgan) hemorrhoidectomy, the RCT evidence showed that there was a balance between the benefits (e.g., symptom and quality of life improvement, shortened length of hospital stay) and harms (e.g., postoperative pain, overall complications) associated with each procedure.

As mentioned above, in 2015 Liu et al. (2015) in their systematic review analyzed five

randomized control trials (Bursics et al. 2004; Festen et al. 2009; Gupta et al. 2011; Infantino et al. 2012; Schuurman et al. 2012) on the effectiveness of DGHL and HL without Doppler guidance or other procedures for hemorrhoidal disease. In spite of the fact that Doppler-guided hemorrhoid artery ligation is associated with lower treatment success, longer operation time, less postoperative pain, less postoperative complications, and higher recurrence rate, they found that the differences were not significant.

3.11 Comparative Studies

Twenty direct comparative studies were identified, nine of them are comparisons to stapled hemorrhoidopexy (Tables 1 and 2).

3.11.1 Comparison of All Techniques

In the biggest review so far, Simillis et al. (2015) reported a systematic review and network meta-analysis comparing clinical outcome and effectiveness of 11 surgical treatments for grade III and IV hemorrhoids by analyzing 98 randomized controlled trials with 7827 participants. Regarding THD seven trials were included, part of them without using mucopexy (De Nardi et al. 2014; Denoya et al. 2013; Festen et al. 2009; Infantino et al. 2012; Khafagy et al. 2009; Verre et al. 2013; Zampieri et al. 2012). In detail they found “... open, closed and radiofrequency hemorrhoidectomies resulted in significantly more postoperative complications than transanal hemorrhoidal dearterialization (THD). THD had significantly less postoperative bleeding than open and stapled procedures, and resulted in significantly fewer emergency reoperations than open, closed, stapled and LigaSure™ hemorrhoidectomies. Open and closed hemorrhoidectomies resulted in more pain on postoperative day one than stapled, THD, LigaSure™ and Harmonic® Procedures. THD provided the earliest time to first bowel movement. The stapled and THD groups had significantly higher hemorrhoid recurrence rates than the open, closed and LigaSure™ groups.” To summarize, in open and closed hemorrhoidectomies more postoperative complications and slower

recovery but fewer hemorrhoid recurrences were found. THD and stapled hemorrhoidectomies were reported with decreased postoperative pain and faster recovery.

Freitas et al. (2016) in their “Analysis of the main surgical techniques for hemorrhoids” presented an exploratory study with an integrative review of scientific literature on current surgical techniques looking at 19 papers. The aim was to outline the techniques used in the treatment of grades III and IV hemorrhoidal disease. They pointed out that conventional techniques are still most practiced, with good acceptance as to the long-term resolution and to the low recurrence rate, despite a period of slower recovery and more intense pain. For THD they found good results in grade III diseases, with shorter surgical times and less pain, but with unsatisfactory long-term results. In this paper only two of 19 articles regarding hemorrhoid artery ligations were analyzed, one without mucopexy.

3.11.2 Comparison with Rubber Band Ligation

Brown et al. (2016) in a multicenter, open-label, randomized controlled trial (HubBLE trial) compared recurrence after hemorrhoid artery ligation (HAL) versus rubber band ligation (RBL) in patients with grade II–III hemorrhoids in the United Kingdom. The primary outcome was recurrence at 1 year. A total of 185 patients were randomly assigned to the HAL group and 187 patients to the RBL group. Of these 372 patients 35 (9.4%) were lost until the primary endpoint. At 1 year postprocedure 49% of the RBL group and 30% of patients in the HAL group had hemorrhoid recurrence. Due to the need for repeat bandings in the RBL group the higher recurrence rate was explained. Additionally they found HAL was more painful than RBL. The study was performed in 18 different centers.

Experience for THD was defined by performing five THD mentored and another five procedures without supervision. This may lead to the astonishingly high recurrence rate of 30% after 1 year, compared to other reports of experienced centers and results in the question if the learning curve is flatter than advised by the manufactures.

In this regard, Szmulowicz et al. (2011) reported 50% and 70% of the recurrences necessitating further treatment occurring during the first 20 procedures of each of two surgeons. Scheyer et al. (2015) described a learning curve of about 20 patients, which explained their initial high number of ligations (up to 16 ligations in one patient).

3.11.3 Comparison with HL

There are some reports indicating that a Doppler is not necessary to perform a ligation with pexy (Aigner et al. 2016; Gupta et al. 2011; Xu et al. 2016; Yeo and Tan 2014).

Three papers were identified with a direct comparison of patient groups treated with Doppler guidance versus high ligation (HL) without Doppler guidance.

Gupta et al. (2011) reported a significantly higher postoperative pain score and a prolonged operation time in Doppler-guided hemorrhoidal artery ligation and mucopexy compared to ligation and mucopexy without use of a Doppler for treatment of third degree hemorrhoids. In this single institution report with a low number of participants in each group 24 patients were included. It is not quite clear, why the use of a Doppler should increase the severity of pain (Rubbini and Tartari 2015).

On the opposite, Schuurman et al. (2012) found an insignificantly lower pain score in the first week postoperative and an earlier return to work in the Doppler group in their comparison of Doppler and non-Doppler hemorrhoid artery ligation. Their single-center single-blinded randomized controlled trial compared hemorrhoidal artery ligation with and without Doppler transducer in 82 patients with grade II and III hemorrhoidal disease in a short-term follow-up of 6 months. They confirmed that hemorrhoidal artery ligation significantly reduces signs and symptoms of hemorrhoidal disease but found that the Doppler transducer does not contribute to this beneficial effect. In this study, a maximum of six ligations was performed with no additional pexy procedures. After 6 months, they reported 23.5% less patients who suffered from mild or severe prolapse in the non-Doppler group. Regarding complications and additional treatments, the non-Doppler group scored better. One

weakness of this study is the small sample size, not having included grade IV hemorrhoidal diseases and loss of nine patients (10.9%).

In the most recent trial, Aigner et al. (2016) compared in a randomized control study 20 patients operated with Doppler-guided hemorrhoidal artery ligation with mucopexy with 20 patients treated by suture mucopexy alone for the treatment of third degree hemorrhoidal disease with a follow-up of 12 months. In opposite to Gupta et al. (2011) they found less pain in the Doppler-guided group compared to the procedure without Doppler in the first 2 weeks after operation. In regards of recurrence of piles no significant differences were found. So they concluded Doppler guidance does not add significantly to the results achieved by mucopexy. Here also a small sample size is used which gives the results some uncertainty.

Recently, two literature reviews were published regarding the question whether Doppler guidance is necessary or not (Liu et al. 2015; Xu et al. 2016).

In 2015, Liu et al. (2015) in their systematic review analyzed five randomized control trials (Bursics et al. 2004; Festen et al. 2009; Gupta et al. 2011; Infantino et al. 2012; Schuurman et al. 2012) on the effectiveness of DGHL and HL without Doppler guidance or other procedures for HD, including the papers of Gupta et al. (2011) and Schuurman et al. (2012) mentioned above. In these five trials a total of 198 patients who underwent Doppler-guided procedures were compared to 190 patients having ligation without Doppler guidance or other procedures for hemorrhoidal disease. They found that the differences were not significant in spite of the fact that Doppler-guided hemorrhoid artery ligation is associated with lower treatment success, longer operation time, less postoperative pain, less postoperative complications, and higher recurrence rate. But they also suggested that Doppler-guided hemorrhoid artery ligation may not have evident superiority for the management of hemorrhoidal disease in terms of treatment success rate, operation time, postoperative complications, postoperative pain, and incidence of hemorrhoidal disease recurrence.

In the most recent paper, Xu et al. (2016) with their meta-analysis of four randomized control trials (De Nardi et al. 2014; Denoya et al. 2014; Elmér et al. 2013; Elshazly et al. 2015) explored transanal hemorrhoidal dearterialization with mucopexy versus open hemorrhoidectomy in the treatment of hemorrhoids, one of them without use of Doppler guidance (Elshazly et al. 2015). They found a longer operation time with the use of Doppler guidance. There were no significant differences regarding total complications, bleeding, incontinence, recurrent prolapse, and urinary retention rate. After excluding the trial without Doppler guidance, no change was detected in these results. They therefore asked for further trials to answer the question whether Doppler guidance is truly necessary or not.

3.11.4 Comparative Studies with Closed Hemorrhoidectomy

Denoya et al. (2014) in their 3 year follow-up of a randomized controlled trial compared hemorrhoidal dearterialization with mucopexy versus closed hemorrhoidectomy in 40 patients (20 in each group) with third or fourth degree hemorrhoids. They found no significant difference in persisting symptoms and recurrence rates but with chronic complications only after hemorrhoidectomy. Thirteen patients (32.5%) were lost in follow-up.

3.11.5 Comparative Studies with LigaSure™

Zampieri et al. (2012) looked at the long-term results and quality of life using THD (46 patients) versus LigaSure™ (68 patients). They observed no differences in postoperative surgical complications in a follow-up of 1 year, while LigaSure™ showed more postoperative constipation. In short- and mid-term follow-up, pain resolution was better in the THD group (87% vs. 81% in the LigaSure™ group).

3.11.6 Comparative Studies with SH

There were nine reports found comparing Doppler-guided artery ligation with anopexy (DGHAL or THD) compared to circular stapled hemorrhoidopexy (SH) (Tables 1 and 2).

Giordano et al. (2011) reported first results in a prospective trial evaluating 3 year outcome of SH versus THD with mucopexy in a total of 52 participants with a follow-up of 38 (range 33–48) months. In this trial, there was no formal randomization. While operation time was nearly the same, in short term there also were no significant differences regarding pain, but THD patients returned to work sooner. Complication rate was THD 14% and SH 25% but not significant. Patient satisfaction (good/excellent THD 89% vs. SH 87%) and recurrence rate (THD 14% vs. SH 13%) were reported to be similar.

As mentioned above Sajid et al. (2012) published a systematic review comparing hemorrhoidal dearterialization to stapled hemorrhoidopexy with three papers finding no difference in primary outcome, but here were ligation procedures without pexy included.

Infantino et al. (2012) gave the first randomized controlled trial about stapled hemorrhoidopexy compared to Doppler-guided transanal dearterialization with additional mucopexy including 169 patients suffering from third degree hemorrhoids with 85 participants in the THD group and 84 in the SH group and a follow-up of 17 (15–20) months. Early minor postoperative complications were reported in around 31% in both groups, while late complications were significantly higher in the SH group (0% THD, 7.1% SH). Quality of life improved in both groups equally. Postoperative pain and recurrence did not differ significantly between the two groups, but with a tendency of more recurrences in THD (14% vs. 7.1% SH group).

Verre et al. (2013) in their trial with 122 patients suffering from third or fourth degree hemorrhoids compared THD versus SH in a short-term follow-up of 3 months. They found more postoperative bleeding in SH group and lower pain for THD group, but both not significant. The return to work was earlier in THD group (3.5 vs. 5.5 days). In follow-up SH had a higher pain at rest and during defecation and more blood loss, while in the THD group there was no pain or blood loss at all.

Tsang et al. (2014) in their retrospective study compared 40 patients treated with THD and additional mucopexy if needed, compared to 37

patients treated with PPH picked from a data base finding THD patients with an earlier return to work and no difference in satisfaction score, complications and recurrence rates found a mucopexy was done.

Béliard et al. (2014) found short-term outcomes after THD with mucopexy (THDm) were better than after Longo but long-term results seemed to be similar in 27 patients treated with PPH and 54 THDm in short-term follow-up. They observed one severe complication in the PPH group with one patient presenting a recto-vaginal fistula.

Leardi et al. (2016) with the longest follow-up of 7 years (range 5–11 years) found in this review compared DGHAL with stapled hemorrhoidopexy (SH) in 100 patients with third degree hemorrhoids (50 each group). In short term pain score was significantly lower in the DGHAL group. At long-term follow-up they found no statistically difference in incidence of piles or patient reported satisfaction for surgery. Astonishingly no loss in follow-up was reported, this was explained by all patients coming from a small town.

In the most recent larger trial, Lehur et al. (2016) recruited 393 patients (DGHAL: $n = 197$; SH $n = 196$) with second or third degree hemorrhoids in a multicenter randomized prospective study. After 3 months, nearly the same number of operative related adverse events occurred (DGHAL 24%, SH 26%). DGHAL resulted in a longer mean operating time, less pain, and shorter sick leave. After 1 year DGHAL led to more residual grade III hemorrhoid knots (15% vs. 5%) and a higher reoperation rate (8% vs. 4%). Patient satisfaction was >90% for both procedures. Total cost at 1 year was greater for DGHAL.

Regarding costs Venturi et al. (2016) found a significantly higher amount in SA patient group with four degree hemorrhoids in their comparison of four subgroups THD versus SH in patients with third ($n = 40$) respectively fourth degree ($n = 30$) hemorrhoid knots. In these four subgroups, frequencies of postoperative obstructed defecation symptoms and prolapse recurrence were higher in patients with fourth-degree hemorrhoids, and SA was more effective than THD in reducing the risk of recurrence at 36 ± 6 months follow-up. In

terms of operation time, complications, pain, and time of return to normal activity results were similar in the four groups. There was no significant difference in overall patient satisfaction, with a significant improvement of quality of life in all groups.

3.11.7 Comparison with CH

Elmér et al. (2013) in their 12 months follow-up of 40 patients treated by OH versus THD (20 patients each group) found early postoperative pain was lower in THD ($p < 0.05$), while THD had a longer duration of surgery ($p < 0.001$). After 1 year, there was a trend to more recurrences in THD ($p = 0.06$).

De Nardi et al. (2014) presented long-term results in their prospective, randomized trial with 50 patients (25 each group) suffering from third degree hemorrhoids comparing THD with mucopexy and excision hemorrhoidectomy with a follow-up of 24 months and loss in follow-up of 6%. Operation time was significantly higher in THD group (Table 2). In short term, there was no significant difference regarding pain, but in the THD group patient returned to work significantly earlier (THD 10 days vs. excision hemorrhoidectomy 22 days). At the last follow-up no difference in the recurrence rate was found.

Tsunoda et al. (2015) reported in a medium-term follow-up of 8.5 months in 36 patients with third degree hemorrhoids after transanal hemorrhoidal dearterialization (THD) a recurrence rate of 5.5% regarding recurrent prolapse (Tsunoda et al. 2015). Compared to 30 patients undergoing hemorrhoidectomy using an ultrasonic scalpel (US) for third or fourth degree hemorrhoids the blood loss was greater in THD patients, hospital stay and time until first defecation were shorter with no significant difference in operation time. Early postoperative pain was significantly less in THD patients.

Sherif and Sarhan (2016) compared in a prospective randomized study with 126 patients the outcome of Doppler-guided hemorrhoid artery ligation versus open hemorrhoidectomy by Milligan-Morgan (63 in the DGHAL group and 63 in the Milligan-Morgan group) (Sherif and Sarhan 2016). In short term, they found in the DGHAL

group operative time was significantly longer, first defecation occurred sooner, mean hospital stay was significantly shorter, return to work was achieved significantly earlier, and postoperative pain score was significantly less, especially during defecation. After 1 year of follow-up, there were no significant differences between the two groups as regards postoperative complications, recurrent prolapse (3%), anorectal function, and fecal continence.

Titov et al. (2016) in their prospective randomized study with 240 patients (156 with third degree hemorrhoids, 84 with fourth degree hemorrhoids) compared Doppler-guided hemorrhoid artery ligation including mucopexy with hemorrhoidectomy by using harmonic scalpel. They found a shorter operation time, less early postoperative pain and complication rate plus earlier return to work in the ligation group. Recurrent prolapse in the ligation group was higher with 1.7% in a very short-term follow-up of 45 days. This article is not shown in the table because it is written in Russian.

In the most recent study, Xu et al. (2016) presented a meta-analysis of four randomized control trials comparing the outcomes of transanal hemorrhoidal dearterialization with mucopexy versus open hemorrhoidectomy in the management of hemorrhoids. In four trials (but one without Doppler guidance) with 316 patients, there were no statistically significant differences in either total complications or postoperative bleeding, incontinence, recurrent prolapse, and urinary retention rate. Operative time was significantly longer for Doppler-guided operation versus ligation without Doppler guidance. Patients returned to normal activities earlier after ligation with mucopexy than after open hemorrhoidectomy. No statistically significant differences between both operation procedures were noted in regards to recurrence and reoperation rates.

3.12 Doppler-Guided Ligation in Crohn's Disease

Karin et al. (2012) in a retrospective study with 13 patients report good results in patients with Crohn's disease treated by DGHAL, but all without perianal infestation.

3.13 Hemorrhoids in Patients Having Anticoagulant or Antiplatelet Drugs

Nowadays in Europe and Northern America up to a quarter of the adult population is taking anticoagulants as a monotherapy or multidrug regimen (Ajani et al. 2006; Williams et al. 2015). So the question how to treat bleeding hemorrhoids in these is an important question.

Cavazzoni et al. (2013) in their “Emergency transanal hemorrhoidal Doppler guided dearterialization for acute and persistent hemorrhoidal bleeding” found a high amount of seven patients with anticoagulants in emergency situation in a total number of 11 patients with severe anal bleeding. Treating them with THD, the intraoperative blood loss was nil and bleeding was well-controlled in all patients. Using THD, all patients were able to continue their antiplatelet or anticoagulant therapy with the advantage that the risk of coronary and circulatory events was reduced.

While in early papers only small subgroups of anticoagulated patients were reported (Faucheron et al. 2011). Atallah et al. (2016) investigated the question if THD is a safe procedure for the anticoagulated patient. With a 6-months medium follow-up period in 36 patients who continued taking anticoagulants compared to 70 patients without, they found no significant postoperative difference in morbidity especially in the rate of postoperative hemorrhage. But most of the patients (55.6%) in the anticoagulant group had only a low dose ASA. Nevertheless, no patient required reintervention, while patients who underwent THD while on anticoagulation were less likely to have recurrent hemorrhoidal disease.

definitions in nearly every respect, comparison and analysis of papers is difficult and in some regards impossible. Surprisingly even a retraction of an unreliable publication was found (Johnson et al. 2014; Lucarelli et al. 2013).

What does recurrence of piles mean? Having the same degree of prolapsed piles at all sites of the anus, at one site or a minor degree in the same patient? How is it stated in follow-up? By patient report taken by phone call, mailed questionnaire, or clinical examination including proctoscopy?

How is it defined where a mucopexy has to be done? In all papers, there was no clear definition, it was mainly said “... where protrusion was found.” It could be a good idea to test it by using a bigger piece of gauze, introducing it through a proctoscope. After removing the proctoscope one pulls out the gauze identifying the areas, where a pile or mucosa prolapses. Here too, second degree hemorrhoids or just mucosal prolapse can easily be shown and treated, because this maneuver imitates part of the normal defecation process. Following this, a tailored approach to the amount of prolapse is possible by defining places, where a mucopexy has to be done.

Unfortunately, even in registered surgical randomized trials intraoperative complications are frequently pooled with postoperative complications, are ill-defined, or not reported at all (Rosenthal et al. 2015). For example, the cutoff between early and late complications was either not defined at all or not in the same way. Some authors use 1 week, some 1 month or 2 months.

On the other hand, a wide variation of subtle technical distinctions in the described procedures for Doppler-guided hemorrhoid artery ligation combined with mucopexy can be found in literature. So far it is not totally clear, which is the best number or place of ligations or pexies. There is some evidence for the best level of ligations, but it still has not been validated in bigger comparative trials.

A major advance of dearterialization of hemorrhoids and mucopexy is the lack of severe complications, especially compared to more aggressive procedures like stapled hemorrhoidopexy and open hemorrhoidectomy. In addition to that mild pain and an early return to normal daily activities

4 Discussion

The exact pathophysiology of hemorrhoids is still poorly understood and likely to be multifactorial (Lohsiriwat 2015). Nowadays, the theory of sliding anal canal lining has a wide acceptance (Thomson 1975).

In preparation for this chapter, more than 100 full articles were read by the author. Due to lack of

can be expected. Therefore, it may be useful to treat immune suppressed patients by Doppler-guided hemorrhoid artery ligation combined with anopexy and perioperative antibiotics, rather than employing a more aggressive method.

Looking at pain scores after hemorrhoid artery ligation combined with mucopexy, it was pointed out that compared to open hemorrhoidectomy as the gold standard for decades, less pain can be expected. Compared to stapled hemorrhoidectomy nearly the same or less pain was found, but absence of life-threatening complications. As stated above, the amount of pain can be reduced by technical modification of the ligation and pexy procedure.

Overall recurrence rates of between 0% and 40% are reported in the reviewed articles, while mainly 5–15% is stated. Recurrence rates were reported for 48 studies including 4982 patients with a pooled recurrence rate of 11.48%.

Walega et al. (2012) found a recurrence rate of 40% but with a patient satisfaction rate of 95%. Here is also shown that patient satisfaction is poorly correlated with recurrence of piles, like Gerjy et al. (2008) proved in their paper.

It has to be stated that a longer follow-up period leads to higher recurrence rates, like demonstrated by Scheyer et al. (2015) and Venturi et al. (2016).

Reoperation rates vary from 0% to 19% in this overview, partly caused by counting sclerotherapy to reoperation procedures and correction of skin tags (Roka et al. 2013; Zagryadskiy and Gorelov 2008). It has to be pointed out that even added pexies could not resolve every problem associated with skin tags (Khafagy et al. 2009; Theodoropoulos et al. 2012). Zagryadskiy and Gorelov (2011) reported significantly more residual skin tags after HAL-RAR compared to closed hemorrhoidectomy (Zagryadskiy and Gorelov 2011). So this problem should be discussed with the patient in advance of surgical treatment (Ratto et al. 2010, 2015).

Regarding long-term results more recurrences could be found compared to conventional or stapled hemorrhoidectomy.

Due to possible revascularization, there is maybe more recurrent prolapse especially in long-term results. On the other hand, anal

physiology is not so massively disturbed compared to resection procedures with postoperative scar formation. Therefore, reported rates of tenesmus and defecation problems early and late postoperative are lower while using Doppler-guided procedure with mucopexy compared to more aggressive procedures.

Especially fourth degree hemorrhoids are a challenging disease in order to cure patients without harming them. Open hemorrhoidectomy leads to good long-term results, but with an increased number of late long-lasting complications like incontinence, anal canal stenosis, and severe pain at defecation (Avital et al. 2011; LaBella et al. 2015). So, may minimal invasive treatment options like Doppler-guided hemorrhoid artery ligation should be chosen, knowing that long-term recurrence is higher.

There are some papers indicating Doppler guidance is not needed, therefore future studies should clarify this point (Aigner et al. 2016; Gupta et al. 2011; Liu et al. 2015; Schuurman et al. 2012; Xu et al. 2016).

Doppler-guided hemorrhoid artery ligation eventually with mucopexy seems to be a good technique for the treatment of acute bleeding hemorrhoids especially in anticoagulated patients (Atallah et al. 2016; Cavazzoni et al. 2013).

Despite of the possible weakness of all papers, one point is very clear: there are no life-threatening complications reported, the overall complication rate is low, and normally complication-related symptoms vanish within a few weeks.

In the absence of a validated symptom scoring system, having in mind, that the posttreatment appearance of the anal cushions correlates poorly with patients' symptoms, an anorectal visualization alone is not a reliable parameter of success (Brown et al. 2016; Gerjy et al. 2008).

To cover this problem Giordano et al. (2014) presented a scoring system to measure the severity of hemorrhoidal symptoms using a specifically designed questionnaire assessing five different parameters: bleeding, prolapse, manual reduction, discomfort/pain/discharge, and impact on quality of life. However, this system has not been validated.

The only so far validated scoring system was presented by Pucher et al. (2015) from a single

center with a small number of patients. They developed a symptom and quality-of-life questionnaire from the literature in conjunction with expert surgical opinion. After circulation of this questionnaire to patients with confirmed hemorrhoids, a statistical model was used to derive a weighted score of symptoms most affecting patients' quality of life. Unfortunately, this system is not used in the following trials.

Therefore, a global standardized, validated symptom severity scoring system regarding hemorrhoidal disease should be defined, in order to improve comparability of future trials.

5 Conclusion

Doppler-guided hemorrhoid artery ligation combined with mucopexy is safe and especially in second and third degree hemorrhoidal disease efficacious, with a moderate complication rate and the absence of life-threatening incidents. Compared to other procedures the more aggressive a procedure is, the more pain and lower recurrence rates can be expected, and vice versa (Altomare and Giuratrabocchetta 2013).

The learning curve seems to be flatter than expected with acceptable recurrence rates in experienced hands.

The question whether Doppler guidance is needed or not has not been answered with absolute certainty so far.

Some efforts should be made using a validated scoring system for the severity of hemorrhoidal disease with a standardized procedure for Doppler-guided hemorrhoidal artery ligation with well-defined instruction for mucopexy in bigger long-term trials in the future to eliminate uncertainties about this procedure.

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Part VII

Perioperative Management and Outcome

Intra- and Postoperative Management in Patients Submitted to Operation for Hemorrhoids

40

M. Margarita Murphy

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Abstract

In the current healthcare environment, it has become increasingly important to reduce hospital length of stay and to perform as many procedures as possible in the ambulatory setting. Outpatient surgery can not only cut costs by improving efficiency but may also prevent nosocomial infections associated with inpatient care while maintaining excellent safety standards and high levels of patient satisfaction

despite its ambulatory nature. Hemorrhoid surgery can be seen as the perfect example of how excellent perioperative care as implemented by the entire surgical team can make ambulatory surgery possible in cases that used to require hospital stays as long as 8 days. In this chapter, a description of the technique and protocols to make this possible will be described, including multimodal pain management.

Data have shown that enhanced recovery after surgery (ERAS) protocols implemented in the inpatient setting reduce length of stay and improve quality outcomes (Francis 2012). These benefits to the patients and the healthcare system are amplified when used in ambulatory surgery centers particularly when applied to high volume

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ambulatory surgeries such as hemorrhoidectomies (Chukmaitov et al. 2011). These protocols must be evidence based and should be strictly adhered to, during the preoperative, intraoperative, and postoperative settings (Merrill and Laur 2010).

1 Prophylactic Antibiotics

Rates of surgical site infection (SSI) after hemorrhoidectomy have been reported to be as low as 1.4% (Nelson et al. 2014). In a randomized controlled trial comparing a group of patients receiving 500 mg of metronidazole and 1 gm of ceftriaxone to a group receiving no antibiotics prior to a Milligan Morgan hemorrhoidectomy, the primary objective was to evaluate the difference in the rate of wound or systemic infections between the two groups. None of these were identified on either group. The authors concluded that there was no role for prophylactic antibiotics (Khan et al. 2014). Furthermore, in a retrospective data review that included 852 patients, antibiotic prophylaxis did not reduce the incidence of postoperative surgical site infection (Nelson et al. 2014). Therefore, based on the available data, the routine use of prophylactic antibiotics in hemorrhoid surgery is not supported.

2 Preemptive Analgesia

Preemptive analgesia is provided to minimize postoperative pain by preventing sensitization at the central nervous system level before surgery commences. The aim is to prevent postoperative hyperesthesia from developing (Heck 2005). The one medication that has clearly demonstrated a difference in this setting is gabapentin (Poylin et al. 2014; Penprase et al. 2015). In a prospective open label study, a group of patients received 1000 mg of gabapentin starting the day before surgery and continued for 9 days after. The levels of postoperative pain were significantly lower not only on day 1 after surgery but also on days 7 and 14 when compared with the group that did not receive gabapentin (Poylin et al. 2014).

In our center, prior to starting the hemorrhoid procedure, the patient receives:

Tylenol 650 mg PO with a sip of water
Gabapentin 100 mg PO with a sip of water
Cyclobenzaprine 5 mg PO with a sip of water

3 Anesthesia and Intraoperative Care

There is ample evidence that for the vast majority of patients, there is no need for general anesthesia and endotracheal intubation for hemorrhoid procedures. These surgeries can be safely done with total IV sedation (propofol) and local anesthetic (Argov et al. 2012; Bansal et al. 2012; Gerjy et al. 2008). This approach has proven to be safe, effective, and with a decreased cost (Read et al. 2002). A study by the University of Texas Southwestern Medical Center randomized 93 patients undergoing anorectal surgery to one of three forms of anesthesia: group 1 received local infiltration with a 30 ml mixture containing 15 ml lidocaine 2% and 15 ml bupivacaine 0.5%, with epinephrine (1:200,000) in combination with intravenous sedation using a propofol infusion, 25–100 mcg/kg/min; group 2 received a spinal subarachnoid block with a combination of 30 mg lidocaine and 20 mcg fentanyl with midazolam, 1–2 mg intravenous bolus doses; and group 3 received general anesthesia with 2.5 mg/kg propofol administered intravenously and 0.5–2% sevoflurane in combination with 65% nitrous oxide. In groups 2 and 3, the surgeon also administered 10 ml of the previously described local anesthetic mixture at the surgical site before the skin incision. Group 1, using IV propofol and local anesthetic alone, had higher patient satisfaction, and the patients in this group had no nausea, while those in the other 2 groups did (3% and 26% in groups 2 and 3, respectively). The anesthesia times and the time to oral intake and discharge readiness were significantly shorter in group 1. Additionally, the analgesic requirements were less in groups 1 and 2 than those in group 3, which received general anesthesia (Li et al. 2000).

Neuraxial techniques of regional anesthesia, such as spinal and epidural anesthesia, are well recognized as advantageous for lower abdominal, pelvic, perineal, and lower extremity surgeries.

One of the main advantages is that they are easy to perform as compared to peripheral nerve blocks for these regions, which may be difficult and time consuming to implement (Mulroy and Salinas 2005). An exception to this statement is anorectal surgery. A pudendal nerve block is a very simple, quick, and effective technique that should be employed by every surgeon that performs anorectal surgery. This easy to perform peripheral nerve block has been shown to significantly decrease postoperative pain, decrease the intake of analgesics, and decrease pain during the first bowel movement. Furthermore, all of these advantages are present for up to 24 h when bupivacaine is used (Imbelloni et al. 2007). A 24-gauge spinal needle is used to infiltrate a mixture of 30 ml of 1% lidocaine with 30 ml of 0.25% bupivacaine with 1:200,000 epinephrine. The author does avoid epinephrine when performing a Doppler-guided dearterialization technique to prevent spasm of the hemorrhoidal arteries and loss of Doppler signal. The use of the lidocaine in our center is mainly used to obtain immediate nerve block to allow for the operation to be performed with IV sedation only, specifically propofol. Other authors use only bupivacaine 0.5% when it is used for postoperative pain only (Imbelloni et al. 2007).

To perform the block, the 24G needle is introduced on both right and left lateral perianal areas at a location halfway between the external sphincter and the ischial spine. Three to 4 ml of anesthetic is injected as the needle is withdrawn to almost the skin. Then, the needle is reinserted at a different angle with a single skin puncture on each side, and the process is repeated multiple times to “fan out” the anesthetic until the total amount is completely injected, 30 ml on either side. This block is the key to performing outpatient hemorrhoidectomies without a general or spinal anesthetic.

Postoperative urinary retention (POUR) is a common complication of anorectal surgery. The surgeon must understand the physiology of bladder function to attempt avoidance of this complication. The process of voiding involves a complex interaction of sympathetic and parasympathetic nerves and the bladder muscle (detrusor) itself. Voiding requires inhibition of the sympathetic nerves which in turn induce urinary sphincter contraction and detrusor relaxation. Concomitantly, there must be

a stimulation of the parasympathetic nerves that cause detrusor contraction and bladder neck relaxation. An important relationship is that of the contraction of the muscle and its degree of stretch, or distention, overdistention, defined as volumes larger than 600 ml, is most often associated with inability to void spontaneously. Thus, there are several factors which can contribute to POUR in the perioperative period. Blockade of the parasympathetic nerves by the use of anticholinergic drugs, such as glycopyrrolate used in the reversal of muscle relaxants, has been reported to produce POUR. Also, generous use of intravenous fluid or a long surgery with continuous fluid administration will cause large volumes of urine with subsequent bladder overdistension resulting in urinary retention. The resultant inability to void usually necessitates artificial emptying of the bladder by a single catheterization or placement of an indwelling Foley catheter. Once decompressed, the normal bladder will return to its usual level of function, although overdistention for more than 2 h has been associated with prolonged bladder dysfunction which may require a Foley catheter for at least 24 h.

Another frequent source of bladder dysfunction is perineal pain secondary to the hemorrhoidal surgery itself. This creates a reflex inhibition of the normal micturition process by sympathetic stimulation. This issue can be further aggravated by an underlying prostate dysfunction in older male patients. Thus, the standard risk factors for POUR include age, male sex, pelvic surgery, prolonged surgery, and history of previous urologic dysfunction.

Regional anesthesia, as in the case of spinal or epidural techniques, inhibit the parasympathetic pathways of the S2–4 nerve roots, causing sensory blockade and detrusor dysfunction, thereby causing urinary retention (Mulroy and Alley 2012). It has been reported that urinary retention and length of stay are higher in patients who undergo spinal anesthesia when compared to local anesthesia alone during anorectal surgeries (Kulkarni et al. 2014; Kim et al. 2005).

From this, we may summarize that the avoidance of bladder dysfunction after hemorrhoidal surgery should focus on three strategies:

(1) local anesthesia (bilateral pudendal nerve block), (2) strict control of fluid administration, and (3) aggressive pain management.

In my center, the patient receives only propofol during the surgical intervention. A pudendal nerve block is performed as described above. No IV fluids are given to the patient, and the anesthesiologist injects the propofol directly into the IV. The operation is short and the patient recovers from anesthesia very rapidly, so he/she may start drinking soon after the procedure is completed.

4 Postoperative Pain Management

The goal after hemorrhoid surgery is to provide adequate pain relief while allowing the patient to be as comfortable as possible, all while keeping side effects to a minimum. It is clear that a multimodal analgesia approach is the best option for pain management of the surgical patient and even more important in the ambulatory setting (Prabhakar et al. 2017; Gritsenko et al. 2014). This approach allows for better pain control because some of these analgesics have a synergistic/additive effect. As a result, there is reduction in the amount of opioids the patient requires. By combining different types of analgesics, lower doses of each individual one can be used and, thereby, less adverse events from each medication. The current armamentarium of analgesic medications allows us to improve the difficult and painful recovery from hemorrhoidectomy.

4.1 Nonsteroidal Anti-inflammatory Drugs

Nonsteroidal anti-inflammatory drugs (NSAIDs) are commonly used in postoperative pain. A prospective, randomized, double-blinded study demonstrated that 60 mg of Ketorolac given intravenously or injected locally at the time of the hemorrhoid procedure significantly reduced postoperative pain with subsequent lower analgesic requirements after anorectal surgery (Place et al. 2000).

In another study, Rahimi et al. evaluated the efficacy of a 100 mg diclofenac suppository compared to the local application of EMLA cream at the end of the hemorrhoidectomy. Although the later was better at controlling the pain in the immediate postoperative period and the subsequent 2 h, the suppository group fared better on the evening of the procedure and on the following day (Rahimi et al. 2012).

Nonsteroidal anti-inflammatory drugs (NSAIDs) are an effective adjunct in post-hemorrhoidectomy pain control. NSAIDs are well tolerated and inexpensive.

4.2 Liposomal Bupivacaine

As previously discussed, local injection of lidocaine and bupivacaine decreases postoperative pain, but unfortunately these effects are short lived. A formulation of liposomal bupivacaine (Exparel[®], Pacira Pharmaceuticals, Parsippany, NJ) is now available, which can provide analgesia for up to 72 h when injected locally. In a study, 189 patients were randomly assigned to receive liposomal bupivacaine or normal saline injected at the completion of the hemorrhoidectomy into the perianal tissues. The patients were then followed at multiple time intervals up to 72 h after surgery. They showed significant reduction in pain throughout the whole observed time, with marked decrease in opioid requirements in the liposomal bupivacaine group. Fifty-nine percentage of the patients were opioid-free for 12 h after the surgery in the liposomal bupivacaine group. This dropped to 36% at 24 h, albeit much higher than those patients who received placebo (Gorfine et al. 2011; Schmidt et al. 2012). When compared to injection of bupivacaine HCL, the efficacy of liposomal Bupivacaine in reducing cumulative pain scores up to 72 h and lowering requirements of opioids was once again superior. Furthermore, the opioid-related adverse events (nausea, constipation, vomiting, pyrexia, pruritus, and dizziness) were statistically lower in the liposomal bupivacaine group (Dasta et al. 2012; Haas et al. 2012). Unfortunately, this promising option for postoperative

pain control remains expensive and not widely available.

4.3 Gabapentin

The use of gabapentin in post-hemorrhoidectomy pain control has only been evaluated in the open labeled study by Poylin and colleagues, discussed previously in this chapter. Although the authors were able to demonstrate an improvement in postoperative pain on days 1, 7, and 14 in the patients who received gabapentin compared to placebo, the study design allows the possibility of bias effect. While further studies are needed, given its low side effect profile and mechanism of action, in my center gabapentin is used in the multimodal pain control regimen.

4.4 Metronidazole

Multiple studies have sought to prove the efficacy of oral metronidazole as an adjunct in the pain management of the patient who has undergone a hemorrhoidectomy. One such study compared the administration of metronidazole 500 mg every 8 h against placebo administration over 7 days following surgery. In this study, by Solorio-Lopez et al., 22 patients were included in each group. The authors found that the study (metronidazole) group had statistically significant less pain than the control group at 6 h, 12 h, 24 h, 4 days, 7 days, and 14 days. Daily activities were also resumed earlier in the metronidazole group (Solorio-Lopez et al. 2015). In contrast, in 2002, a similar study by Balfour et al. (2002) randomized 18 patients to receive metronidazole post-hemorrhoidectomy and compared them to 20 patients receiving placebo. They found no difference in pain experienced or time to return to normal activities between the two groups. A recent meta-analysis of randomized clinical trials failed to answer the question definitively (Wanis et al. 2017). The authors found there was no postoperative pain improvement in most days except for perhaps on days 1 and 4 after hemorrhoidectomy. Unfortunately, this apparent advantage disappeared once a sensitivity analysis

was performed that excluded the study with the greatest risk of bias. The authors concluded that the wide use of metronidazole after hemorrhoidectomy may not be warranted.

The PROSPECT working group is a collaboration of surgeons and anesthesiologists that seeks to formulate evidence-based recommendations for pain management. They recommended on their 2010 review of pain management after hemorrhoidectomy the use of oral metronidazole postoperatively. They based this decision on the study by Dr. Solorio-Lopez et al. previously described. The same recommendation is still included in the PROSPECT 2017 review (Sammour et al. 2017). To further determine if using oral metronidazole in this setting is beneficial, a larger study needs to be performed.

4.5 Other Oral Analgesics

The use of acetaminophen alone or combined with an opioid can be used as part of the armamentarium to treat post-hemorrhoidectomy pain. The mechanism of action of acetaminophen to produce analgesia is not fully understood, but it likely involves actions in the central nervous system and interaction between the brain and spinal cord. Although overall it may have less side effects than NSAID's, it does cause severe liver damage when taken in excess or if combined with alcohol or with other drugs metabolized by the liver (Albert-Vartanian et al. 2016).

Physicians have been pressured to treat pain in a more aggressive way following an international effort to better recognize and manage what has been labeled as "the fifth vital sign." Opioids have high clinical efficacy for pain control making them a popular choice among prescribers. Unfortunately, these medications have many adverse effects that can be very severe including respiratory depression and sedation. Opioids can cause very significant constipation which can lead to rectal impaction. Either of these complications are particularly difficult in the post-hemorrhoidectomy patient making opioids a less attractive option in this group. Nausea, vomiting, itching, and dizziness are adverse effects of these analgesics that can

also deter recovery (Dasta et al. 2012). Opioids are associated with misuse or abuse, which has become a serious global problem affecting almost 36 million people across the world according to the United Nations Office on Drugs and Crime (UNODC) (Gasior et al. 2016). It is possible for some patients to become addicted to these medications even when taking them over a short period of time and as prescribed. A recently published cohort study reported that, of those patients who are introduced to opioids for the first time after surgical procedures, 6% will have persistent opioid use. Based on these findings, in the United States alone, more than two million individuals will start overusing opioids after ambulatory surgeries each year (Brummett et al. 2017). For all these reasons, opioids should be reserved as rescue medications when the other components of the multimodal regimen fail.

Spasm of the pelvic muscles maybe a component of the post-hemorrhoidectomy pain. Although not widely studied, there is some evidence that cyclobenzaprine, a muscle relaxant, may be beneficial in the treatment of pelvic floor pain (Sheikh et al. 2012; Kunitake 2016). Benzodiazepines have an anxiolytic and centrally mediated muscle relaxation activity that can also be helpful in the immediate postoperative care of the hemorrhoidectomy patient. I favor hemorrhoidal dearterialization and mucopexy for management of my patients with hemorrhoidal disease. In my personal experience, this surgery is overall very well tolerated, but I find that in the immediate postoperative period, when the patient is waking up from anesthesia, they may experience significant pelvic pressure and the sensation of needing to evacuate their rectum and/or bladder. This feeling, although transient, may produce significant anxiety and increased spasm of the pelvic floor musculature. I find that in this setting, a dose of 2.5–5 mg of intravenous diazepam is very effective in alleviating the discomfort.

4.6 Topical Agents

Topical anesthetics have been used to aid in pain control after hemorrhoid surgery. As discussed

earlier, a combination of lidocaine and prilocaine ointment (EMLA, AstraZeneca, Wilmington, DE) is very efficient for immediate pain control and up to 2 h after surgery (Rahimi et al. 2012). A randomized trial comparing application of EMLA cream to the perianal area at the end of surgery against neomycin ointment demonstrated not only reduced pain on arrival to the recovery room but during the following 24 h in the EMLA group. There was also less opioid requirement and less need for catheterization (Shiau et al. 2008). The same author also concluded that EMLA with the local injection of lidocaine provides excellent pain control after hemorrhoidectomy (Shiau et al. 2007).

Spasm of the internal sphincter has been theorized to contribute to the pain that follows anal surgery. For this reason, medications used for the medical management of anal fissures have been studied for post-hemorrhoidectomy pain. Small studies (Amoli et al. 2011; Sugimoto et al. 2013; Silverman et al. 2005) have been performed comparing the use of topical diltiazem 2% and placebo with mixed results. Despite the PROSPECT group recommendation against the use of diltiazem in this setting (Sammour et al. 2017), there is opportunity for larger studies to be performed before completely setting this potential adjunct aside. Nitroglycerine has been shown to be effective in decreasing the pain after hemorrhoidectomy and even in expediting wound healing (Liu et al. 2016). Furthermore, those patients treated with nitroglycerine postoperatively were able to resume daily activities sooner when compared to those using placebo. Nevertheless, severe headaches remain a limitation in the use of this treatment (Liu et al. 2016).

A study by Ala et al. (2008) evaluated the efficacy of topical metronidazole 10% as an adjunct in pain control after hemorrhoidectomy. In this double blind, placebo controlled study, 47 patients were randomized to receive 10% metronidazole or placebo ointments to the surgical area three times a day. The patients in the metronidazole group experienced significantly less pain at 6 and at 12 h after surgery and at postoperative days 1, 2, 7, and 14 with subsequent decrease in the requirement of other analgesics for pain

control. Further, Nicholson and Armstrong (2004) not only confirmed decreased pain in the patients receiving the 10% metronidazole ointment, but also the patients had markedly less edema, less induration, and were found to have tissue margins that appeared flat with decreased formation of skin tags when compared to the placebo group.

Sucralfate has angiogenic, antibacterial, and wound healing properties. Its application in the post-hemorrhoidectomy setting was evaluated by Gupta and colleagues (2008). In this double blind randomized study, 116 patients were randomized to use sucralfate 7% three times per day or placebo. Significantly less pain was present in the medication group at 7 and 14 days, with less wound edema and less skin tags and overall faster wound healing.

Various other compounds like cholestyramine 15% or even vitamin E have also been proven advantageous in decreasing postoperative pain after hemorrhoidectomy (Ala et al. 2013; Ruiz-Tovar et al. 2016). More studies are needed to evaluate these results.

4.7 Sitz Baths

Sitz baths have been a traditional recommendation for postoperative pain relief and other anorectal ailments dating back to the 1800s. Unfortunately, there is little evidence that they actually decrease pain (Siew Ping et al. 2010; Lang et al. 2011; Tejjirian and Abbas 2005). They do, however, seem to decrease the urethral pressure and thereby help in obtaining spontaneous micturition in patients with urinary retention post-hemorrhoidectomy (Shafik 1993).

4.8 Bowel Regimens

The prevention of constipation, straining, and fecal impaction is of paramount importance in the postoperative care of these patients. This becomes especially important in the case of patients receiving opioids. Usually, a postoperative regimen should include stool softeners around the clock and stronger “rescue” laxatives as needed.

In my practice, the patient receives an intravenous dose of ketorolac (30 mg) if there are no contraindications, at the end of the procedure.

The patient is discharged promptly after surgery with the following medications:

- Gabapentin 100 mg, 1 to 2 capsules by mouth every 8 h as needed
- Cyclobenzaprine 5 mg, 1 tablet by mouth every 8 h as needed
- Oxycodone/acetaminophen 5/325, 1 to 2 tablets by mouth every 6 h as needed if all other measures have failed
- Compounded ointment containing metronidazole 10%, nifedipine 0.5%, lidocaine 1.5%, and diclofenac 3% to be applied three times per day in the anal canal
- Colace 100 mg, 1 tablet by mouth every 8 h
- Milk of magnesia 2400 mg by mouth if no bowel movement by postoperative day 3 and if that fails,
- Magnesium Citrate 150 ml by mouth every 12 h as needed
- Patients are also directed to take tub baths several times per day
- Patients are seen back in the office at 3 weeks

In today's practice, when hemorrhoidectomy must be exclusively an ambulatory procedure, it is imperative to optimize these patients' management. This can be successfully achieved by a combination of evidenced-based preemptive analgesia, intraoperative techniques, and a multimodal postoperative analgesic regimen.

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Postoperative Complications Following Surgical Procedures for Hemorrhoids and Their Management

41

Steen Buntzen

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Abstract

Minor complications following surgical procedures for hemorrhoidal disease are quite common and include pain, rectal bleeding, vasovagal reaction, micturition disturbances, anal fissures, and ulcers in the anal canal. Analgesics of the

NSAID group and others are used to treat mild pain. Observation and/or surgical hemostasis are relevant in case of minor rectal bleeding. Micturition disturbances should be monitored with bladder scans and catheterization if necessary.

Massive rectal bleeding, severe pain, urinary retention, pelvic sepsis, and even death are considered as *major complications*. They are uncommon with an estimate between 1% and 2.5%.

Severe rectal bleeding is usually treated with surgical hemostasis and blood transfusions. The

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septic complication is the most feared complication with a significant risk of major morbidity and even of death. It may be in progress if a patient presents with unexpected severe perianal/abdominal pain in combination with urinary retention and fever. Objective findings may be sparse, and it is not uncommon that the patient has attended the hospital more than once before the condition is recognized. Cases presenting early with tissue edema and sepsis in the absence of necrosis may be treated only with antibiotics and supportive care. In the presence of necrosis, debridement should be undertaken urgently with or without laparotomy and fecal diversion in addition to antibiotics and supportive care.

Early recognition and immediate treatment of septic complications are crucial for a successful outcome.

1 Complications After Chirurgia Minor for Hemorrhoids

Minimal invasive surgical procedures including rubber band ligation, injection sclerotherapy, infrared coagulation, and radio frequency ablation are common procedures in the outpatient clinic because of their simplicity, efficacy, and low rate of major complications.

They are all designed to induce inflammation around the vessels to the hemorrhoidal columns and thereby creating obliteration of the vessels to the hemorrhoidal cushions. This process will lead to fibrosis and fixation of the hemorrhoidal cushions in the upper part of the anal canal.

Minor complications are quite frequent and although serious complications are rare, they can be devastating and may be fatal. Therefore, early recognition and treatment of major complications are essential to avoid serious morbidity and even death.

1.1 Rubber Band Ligation

Rubber band ligation (RBL) was introduced in the 1950s and later modified by Barron in the 1960s (Barron 1963). The technique is now very

common as an office procedure, because it is a very simple procedure with limited preoperative preparations, no anesthetics, no preoperative antibiotics, no major bowel preparations, equipment easy to handle, acceptable complications rates, and high success rates between 69% and 97% (Iyer et al. 2004).

However, complications will occur, and they are classified as minor or major complications (Bat et al. 1993). Mild pain and rectal bleeding, vasovagal reaction, extrusion of rubber bands, voiding disturbances, anal fissures, and band related ulcers in the anal canal are common minor complications, whereas massive rectal bleeding, severe pain, urinary retention, pelvic sepsis, and even death are considered as a major complication although they are uncommon (Albuquerque 2016).

Complication rates vary in the literature from 1.1% severe adverse events (Brown et al. 2016) to 18.8% minor complications which require no hospitalization (Komborozos et al. 2000).

Bat et al. (1993) reported a complication rate of 7.1% in a prospective study including 512 patients treated with RBL. Minor complications were seen in 4.6%; pain, slippage of bands, mild rectal bleeding, and micturition disturbances and 2.5% with major complications: delayed massive rectal bleeding, urinary retention, pain, prolapsed thrombotic hemorrhoids, and a perianal abscess followed by a perianal fistula.

Mild pain, bleeding, and vasovagal reactions occur frequently in the first few days after the procedure. In a prospective study by Watson et al. (2006) where 183 consecutive patients were included, 90% experienced mild pain 4 h after the procedure, but after 1 week 75% reported to be free of pain. Mild rectal bleeding was seen in 65% the day after the procedure and after 1 week 30% still reported mild rectal bleeding. Vasovagal reactions were seen in 30% postoperatively.

Delayed mild bleeding after 10–14 days is quite common and caused by sloughing from the ligated hemorrhoids. Even severe delayed rectal bleeding may occur after 10–14 days, but is uncommon. Marshman et al. (1989) reported 1.2% of severe delayed rectal bleeding requiring hospitalization in a study including 241 patients.

Patients under antiplatelet and or anticoagulant treatment are at risk for developing severe delayed rectal bleeding (Bat et al. 1993). Prevention is essential to avoid this complication. A thorough medical history including comorbidity and medication should be obtained to identify patients at risk.

Infectious complications, pelvic sepsis, Fourniers gangrene, liver abscesses, tetanus, and bacterial endocarditis have been reported after RBL. Albuquerque (2016) reported six liver abscesses due to treatment with RBL, five resolved with drainage and antibiotics and one patient had additional right hepatectomy. Furthermore, seven deaths in relation to RBL were identified. Recently death number eight after RBL was reported by Poulsen et al. (2014). The majority of the patients were healthy prior to the procedure (McCloud et al. 2006).

The time between the procedure and the onset of symptoms was typically between 3 and 10 days (Albuquerque 2016; McCloud et al. 2006) and seven out of 17 patients described in a review by McCloud et al. (2006) had attended the hospital once or more before the condition was recognized. Furthermore, common symptoms were severe perineal and/or abdominal pain, urinary retention, and fever (McCloud et al. 2006). Objective findings on examination may be sparse.

1.2 Injection Sclerotherapy

Injection sclerotherapy (IS) in the treatment of hemorrhoids has been an option for more than a century (Goligher 1984). The injected agent has varied over the years, but presently 5% phenol in almond oil is the most common agent. RBL is superior to IS in terms of efficacy (Cheng et al. 1981; Sim et al. 1981; Gartell et al. 1985; MacRae and McLeod 1995), but complications and discomfort are less after IS compared to RBL.

Nevertheless, both minor and major complications after IS have been reported. Complications were mainly local, urological, and septic. Local complications included pain, bleeding from the injection site, and ulcerations (Wright 1950). Al-Ghnam et al. (2001) published in a survey

among surgeons in the South East Thames Region that nearly one third of the surgeons reported complications mostly of urological nature, including prostatitis, hematuria, septicemia, hematospermia, urinary retention, urethral stenosis, epididymitis, and injection site ulcer. Even impotence has been reported by Bullock (1997). Based on the survey, the authors recommended to select other methods than IS if symptomatic anterior hemorrhoids required treatment (Al-Ghnam et al. 2001).

Bacteremia proven by positive blood culture in 8% after proctoscopy and IS without any clinical adverse events has been documented (Adami et al. 1981). Two patients with retroperitoneal abscesses (Ribbens and Radcliffe 1985; Barwell et al. 1999), one patient with a life-threatening rectal necrosis (Schulte et al. 2008), and one patient with necrotizing fasciitis (Kaman et al. 1999) after IS have been described. Fatal cases have not been documented.

Correct injection technique is essential to prevent complications (Goligher 1984).

1.3 Infrared Coagulation

Infrared coagulation (IRC) has been an option in the treatment of first and second degree hemorrhoidal disease since late 1970s (Neiger 1979). In general, the technique is less effective compared to RBL (MacRae and McLeod 1995; Walker et al. 1990), on the other hand IRC causes lesser discomfort during the procedure and during the first week postoperatively (Ricci et al. 2008; Marques et al. 2006; MacRae and McLeod 1995; Walker et al. 1990; Templeton et al. 1983), except in one study by Ahmad et al. (2013) where Doppler-guided hemorrhoidal artery ligation (DG-HAL) was compared with IRC including 296 patients. Postoperative complication rate in the DG-HAL group was 2% versus 13% in the IRC group. There was no further specification of the complications.

In a small randomized study by Ricci et al. (2008) comparing RBL with IRC where 48 patients were included (25 patients in the IRC group), bleeding occurred in 34.7%, pain was experienced in 52%, and one patient (4%) needed medication for pain after IRC. Templeton et al.

(1983) showed in a study including 137 patients comparing IRC with RBL that major discomfort was found in 5% versus 24% in favor of IRC. Major complication with IRC has not been described so far.

1.4 Radiofrequency Coagulation, Laser Therapy, and Others

Outpatient treatment of hemorrhoids with radiofrequency coagulation (RFC) has been adopted in the treatment of early grade hemorrhoids during the last 15 years (Gupta 2002). The main bulk of publications have originated from one center (Gupta 2002). In a retrospective study by Gupta (2005) from 2005 including 240 patients, 10% complained of rectal bleeding in the first 2 weeks and 1.6% was readmitted with massive rectal bleeding, one patient required reoperation. Twelve per cent complained of pain postoperatively and was prescribed analgesics; 1.6% complained of discharge from the anus and it ceased spontaneously within a week. Itching around the anus was reported in 3.7%. No infectious complications were seen. In the same study, RFC was compared with RBL. RFC was less effective, but with lesser pain and discomfort compared with RBL (Gupta 2005). A more recent paper confirmed the absence of major complications with RFC (Filingeri et al. 2013).

Giamundo et al. (2011a) reported their experience with a new nonexcisional method the *Hemorrhoidal Laser Procedure* (HeLP). It is an office procedure based on a Doppler-guided laser procedure for second- and third-degree hemorrhoids. The procedure has been compared with RBL in a small randomized study. Overall success rate at 6 months postoperatively was 53% versus 90% in favor of the HeLP technique. No major complication was reported, and the postoperative pain score was significantly lower compared to the RBL group (Giamundo et al. 2011b). The absence of major complications was confirmed in a more recent study by Crea et al. (2014).

Studies on cryotherapy in hemorrhoids were mainly published in the late 1960s (Lewis et al. 1969), but the clinical use of the technique has

been reduced because of a high rate of complications and low patient satisfaction (Yamamoto and Sano 1982). Major complications have been reporting including severe pain, massive rectal bleeding, and a fatal case caused by meningitis (Anderson and Steger 1984) (Table 1).

2 Complications After Excisional Surgery for Hemorrhoids

2.1 Hemorrhoidectomy

Hemorrhoidectomy is usually performed in patients with grade III and IV hemorrhoids. Three techniques are available: open, closed, and submucosal hemorrhoidectomies employing several different techniques: scissors, conventional scalpel, conventional diathermia, LigaSure™ hemorrhoidectomies, Harmonic hemorrhoidectomies, laser hemorrhoidectomies, Starion hemorrhoidectomies, radiofrequency hemorrhoidectomies, and bipolar scissors hemorrhoidectomies (Simillis et al. 2015).

A systematic review of the clinical outcome on surgical treatment in third and fourth grade hemorrhoids based on 98 trials with 7827 patients and 11 surgical treatments was published in 2015 by Simillis et al. (2015). They showed in general that the closed and radiofrequency groups had significantly more postoperative complications than open, stapled, LigaSure™, Harmonic, and trans anal hemorrhoidal dearterialization (THD, a nonexcisional principle) groups. Open hemorrhoidectomy had significantly more postoperative complications than the LigaSure™, Harmonic, and THD groups.

Specifically, they found that the incidence of postoperative urinary retention was significantly more frequent in closed hemorrhoidectomy group compared with the LigaSure™ and Harmonic groups. Postoperative bleeding studied among 6191 patients was observed in 65 patients (2%), and in 57 patients (88%) reoperation was necessary to achieve hemostasis. The risk of postoperative bleeding requiring reoperation was significantly higher in the open and stapled groups compared to the THD group.

Postoperative pain was evaluated on day 1, 7, and 14. On day 1, 4184 patients participated; open

Table 1 Schematic overview of documented procedure related major complications and deaths after office procedures for hemorrhoids

Procedure	Minor complications	Major complications documented	Deaths documented
Rubber band ligation	Common	Yes	Yes
Injection sclerotherapy	Common	Yes	Yes
Infrared coagulation	Common	No	No
Radiofrequency coagulation	Common	No	No
Hemorrhoidal laser procedure (HeLP)	Common	No	No
Cryotherapy	Common	Yes	Yes

and closed hemorrhoidectomies had significantly more pain compared to LigaSure™, Harmonic, Starion, stapled hemorrhoidectomies, and THD procedure. Still, on day 7 (2856 patients) the open group had significantly more pain compared to the stapled group. On postoperative day 14, it was shown that the open and closed group had significantly more pain than the LigaSure™ and stapled groups. Anal stenosis (4793 patients), incontinence (3856 patients), and skin tags (1766 patients) did not show any significant differences among procedures concerning these three outcomes.

Postoperative complications in recent papers published after 2005 were analyzed separately and showed that closed hemorrhoidectomy had significantly more complications than the open, stapled, LigaSure™, Harmonic, and THD groups. Radiofrequency hemorrhoidectomy was associated with significantly more postoperative complications than open, stapled, LigaSure™, Harmonic, and THD procedures.

Likewise larger studies were analyzed separately and showed that closed hemorrhoidectomy had significantly more postoperative complications compared with open, stapled, LigaSure™, and THD procedures. Open hemorrhoidectomy had significantly more complications than the LigaSure™ hemorrhoidectomy (Simillis et al. 2015).

Sayfan (2001) reported in a single center study including 500 patients operated with a modified Milligan-Morgan technique (diathermia dissection) an overall complication rate of 22%: 16% with urinary retention, 3.4% with a circular mucosal stricture above the dentate line, 1.6% with

delayed bleeding, and three patients (0.6%) with prolonged convalescence periods due to anal ulcers. Postoperative pain and fecal incontinence was not documented. This is in contrast to Johannsson et al. (2002); they reported in a study including 418 patients impaired anal continence in 139 patients where 40 patients (29%) claimed a direct association with the surgical procedure. Eu et al. (1994) reported impaired anal continence in 5.2% after elective hemorrhoidectomy.

The risk of major complications is very low, but they do occur and can be devastating and even fatal. In a systematic review by McCloud et al. (2006), ten major septic complications with two fatal outcomes were identified: pelvic sepsis ($n = 3$), retroperitoneal and mediastinal air ($n = 1$), liver abscesses ($n = 5$), and one patient with a septic pulmonary embolus. Compromised immunological competence was described in three cases (diabetes, agranulocytosis, and steroid-dependent rheumatoid arthritis).

2.2 Stapled Hemorrhoidopexy

Longo introduced the stapled hemorrhoidopexy or procedure for prolapsing hemorrhoids (PPH) in 1998 as an alternative to conventional excisional surgery for hemorrhoids. The procedure gained quickly popularity because of less postoperative pain and a quick return to daily activities. Postoperative complications are quite common with an overall complication rate ranging from 3.3% to 77% (Porrett et al. 2015). In the same study, early postoperative complications within 7 days had a median rate of 16.1% and a late

postoperative complication rate after 7 days a median value of 23.7% (Porrett et al. 2015). Ng et al. (2006) published in 2006 their experience with 3711 procedures, and they reported minor complications in 12.3% of the patients; bleeding 4.3%, urinary retention 4.9%, pain requiring admission 1.6%, anorectal stricture 1.4%, less frequent were perianal hematoma, one patient developed a perianal abscess, and anastomotic dehiscence was seen in three patients. Another large series by Kam et al. (2011) including 7302 procedures reported a similar frequency of minor complications and seven major complications were seen; ischioanal abscesses in four patients and anastomotic dehiscence ($n = 3$). Neither Ng et al. (2006) nor Kam et al. (Kam et al. 2011) did report on fecal urgency as a complication; however, in a systematic review by Porrett et al. (2015) early fecal urgency was reported in the range from 0% to 25% with a medium value of 8.3%.

Although uncommon, a number of serious complications have been described in a systematic review by McCloud et al. (2006). Six cases were identified in the literature, one with a fatal outcome. The patients presented with perineal necrosis ($n = 3$), retroperitoneal air ($n = 2$), and fecal peritonitis in one patient. Four of the patients had a defect in the stapler line. In a recent study, multiple cases of sepsis and additional four deaths have been documented (Porrett et al. 2015).

3 Complications After Nonexcisional Surgery for Hemorrhoids

3.1 Hemorrhoidal Dearterialization and Mucopexy (Suture/Laser)

Trans anal hemorrhoidal dearterialization (THD) is a relatively new technique. THD has evolved during the last two decades from a simple ligation of the hemorrhoidal arteries in the distal part of the ampulla recti (Morinaga et al. 1995) to the distal Doppler-guided dearterialization with tailored mucopexy described by Ratto et al. (2012).

The complication profile is quite favorable compared to excisional surgery for hemorrhoids,

but the few major complication reported might partly be explained by the fact that it is a relatively new technique. Open and closed hemorrhoidectomies have significant more postoperative complications than THD, especially less postoperative bleeding, pain and emergency reoperations are in favor of THD (Simillis et al. 2015).

In a systematic review from 2009 based on 1996 patients, postoperative pain day one was 18.5% and bleeding 4.3%, three patient with severe postoperative bleeding required blood transfusions, and no major septic complications were described (Giordano et al. 2009). In a more recent systematic review published by Pucher et al. (2013) including 2904 patients, postoperative pain ranged from 0% to 38% and a calculated pooled value of 15% and for postoperative bleeding a pooled value of 5%, quite similar to findings published by Giordano et al. (2009).

In 2015, Ratto et al. (2015) published a multicenter study including 803 patients treated for symptomatic hemorrhoids grade II–IV. In 65.1%, dearterialization was performed with the high ligation technique and in 34.9% the distal Doppler-guided dearterialization principle was used. The rate of intraoperative complications was 0.5%, overall early complication rate was 20.7%; Pain 12%, urinary retention 8.6%, and bleeding 0.1%. Overall late (≤ 30 days) complication rate was 18%; pain 13.0%, bleeding 2.2%, urinary retention 0.9%, and other 1.9%.

One major septic complication, a brain abscess, has been reported in 2013 (Berkel et al. 2013) (Table 2).

4 Complications After Emergency Surgery for Hemorrhoids

4.1 Acute Thrombosis and Strangulation of Internal Hemorrhoids

The acute thrombosis and strangulation of hemorrhoids is painful and cause major impact on quality of life. The terminology in the literature is not

Table 2 Schematic overview of documented major complications and deaths after excisional and nonexcisional surgery for hemorrhoids

Procedure	Minor complications	Major complications documented	Deaths documented
Hemorrhoidectomy	Common	Yes	Yes
Hemorrhoidopexy (PPH)	Common	Yes	Yes
Trans anal hemorrhoidal dearterialization (THD)	Common	Yes	No

uniform. Hardy and Cohen (2014) suggested the term “strangulated hemorrhoids” for internal hemorrhoids. Conservative approach has been advocated because of fear of surgical complications such as bleeding, anal stenosis, fecal incontinence, and septic complications. However, evidence is accumulating that emergency/early surgical treatment is safe and will reduce the length of incapacity compared to conservative treatment (Hardy and Cohen 2014).

Eu et al. (1994) included 704 patients; they compared 500 patients operated with elective hemorrhoidectomy for prolapsed hemorrhoids to 204 patients who underwent emergency hemorrhoidectomy for acutely prolapsed hemorrhoids. In the elective group, postoperative bleeding was seen in 5.4%, anal stenosis 3.0%, degrees of fecal incontinence 5.2%, no septic complications compared to postoperative bleeding in 4.9%, anal stenosis 5.9%, degrees of fecal incontinence 4.4%, and no septic complication in the group subjected to emergency surgery. Ceulemans et al. (2000) included 104 patients for emergency hemorrhoidectomy and 545 for elective hemorrhoidectomy. In the emergency group, early complications were 25%, reoperations 7%, and late anal stenosis 7% and the corresponding figures in the elective group were 13.6%, 1.7%, and 0.2%, respectively. The early complication rate seemed higher in the emergency group, but the difference was not significant and the rate of septic complications was not increased.

Stapled hemorrhoidopexy has been compared to conventional hemorrhoidectomy as emergency surgery in a randomized study (Brown et al. 2001). They concluded that stapled hemorrhoidopexy was feasible and resulted in less postoperative pain at 2 and 6 weeks postoperatively.

4.2 Acute Thrombosis of the Inferior Hemorrhoidal Plexus

An acute painful perianal swelling, bluish in color, is characteristic for an acute thrombosis in the external hemorrhoidal plexus or perianal varices. It will resolve within 8–10 days if left without treatment. If seen within 24–48 h after debut of the painful swelling, incision and evacuation of the blood clot is recommended.

Jongen et al. (2003) reported the outcome of 340 patients operated with excision of thrombosed external hemorrhoids in a retrospective study. The indications were severe pain, necrosis, and perforation of the skin. They described bleeding in one patient (0.3%) and anal abscesses/fistula in 2.1%. Patient satisfaction was high. They concluded that the procedure was safe with high rate of satisfaction and with low rate of complication and recurrence.

5 Treatment of Postoperative Complications After Hemorrhoidal Surgery

Minor postoperative complications following surgical procedures for hemorrhoidal disease are quite common and include minor pain and rectal bleeding, vasovagal reaction, micturition disturbances, anal fissures, and ulcers in the anal canal with or without discharge. Symptomatic treatment will in most cases solve the problem. Analgesics of the NSAID group and others can be used for mild pain. Observation and/or surgical hemostasis are relevant to treat minor rectal bleeding. Micturition disturbances should be monitored with bladder scans and catheterization if

necessary. An anal fissure will add to the common mild pain postoperatively and may be treated with tailored lateral sphincterotomy. Persisting anal ulcers may warrant an examination under general anesthesia with endoanal ultrasonography to exclude an intersphincteric infectious focus.

Major postoperative complications following surgical procedures for hemorrhoidal disease are uncommon, but the exact risk is impossible to estimate because we do not know the exact figures of procedures performed. Severe rectal bleeding is usually treated with surgical hemostasis and blood transfusions. A low anterior rectal resection has been described in order to control an intraabdominal bleeding after a stapled hemorrhoidopexy (Blouhos et al. 2007). A postoperative septic complication may be in progress if a patient presents with unexpected severe perineal/abdominal pain in combination with urinary retention and fever. Objective findings may be sparse and it is not uncommon that the patient has attended the hospital more than once (McCloud et al. 2006). Early recognition and immediate treatment of septic complications are crucial for a successful outcome. Treatment algorithms on postoperative septic complications after surgery for hemorrhoids do not exist. McCloud et al. (2006) suggested that cases presenting early with tissue edema and sepsis and the absence of necrosis could be treated with antibiotics and supportive care. In the presence of necrosis, debridement should be undertaken urgently with or without fecal diversion in addition to antibiotics and supportive care. Major septic complications in stapled hemorrhoidopexy are often associated with rectal perforation. This complication will lead to a septic condition above the levator ani in the retroperitoneum or intra abdominally and they will often undergo laparotomy with debridement, washout, drainage, and fecal diversion (McCloud et al. 2006).

- Pros and Contrasts of Outpatient Treatments for Hemorrhoids
- Pros and Contrasts of Stapled Hemorrhoidopexy

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Literature Data on the Hemorrhoidal Disease Management

42

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Abstract

Hemorrhoids are very common, with large proportion being asymptomatic and not requiring treatment. Wide variety of management options is available for those requiring or

seeking treatment for symptom control. Comprehensive evidence relating to efficacies of multitude of treatment modalities are varied and can be lacking at times, and long-term results are limited. However, results from several meta-analysis and large multicenter randomized controlled trials in recent past could help as a guide in providing a pragmatic management algorithm for various stages of hemorrhoidal disease. The aim of this chapter is to present a comprehensive review of various treatment interventions and related evidence for management of hemorrhoidal disease.

In general, conservative management can be offered to all patients and may be adequate enough for grade I hemorrhoids. Grade II

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would likely benefit from a course of rubber band ligation (RBL) with the provision for a repeat RBL if required. Failure of treatment/refractory symptoms may justify interventions with hemorrhoidal dearterialization techniques. Grade III and IV hemorrhoids will most likely benefit from conventional excisional hemorrhoidectomy, which despite its main drawback of postoperative pain, has benefits from proven long-term effectiveness and low recurrence rates. Stapled hemorrhoidectomy (SH) may be considered as a possible option in select cases of circumferential prolapsed hemorrhoids. The main benefit of SH is lower postoperative pain but is a less preferred approach due to higher long-term recurrence rate. The newer energy-based excision hemorrhoidal techniques using bipolar and ultrasonic scalpel has equivalent efficacy compared to conventional excisional hemorrhoidectomy; however, increased equipment costs and lack of long-term efficacy data limits their recommendation and widespread adoption.

1 Introduction

Hemorrhoids are cushions of highly vascular tissue within the submucosal space and represent pathological changes in the anal cushions, a normal component of the anal canal. There are three main cushions found in the anal canal and are located in the left lateral, right anterior, and right posterior positions. They are rich in blood vessels and muscular fibers which arise from the internal sphincter and the conjoined longitudinal muscle and surround the anastomoses between the terminal branches of the superior rectal and middle rectal arteries and the superior, middle, and inferior rectal veins. These cushions fill with blood during defecation and protect the anal canal from injury (Shafik 2009).

The exact pathophysiology of symptomatic hemorrhoid disease is poorly understood. Currently, it is proposed that hemorrhoids occur when the supporting tissues of the anal cushions deteriorate, and this can be contributed by advanced age and activities such as strenuous lifting, straining

with defecation, and prolonged sitting. Hence, hemorrhoids are defined as the abnormal downward displacement of the anal cushions causing venous dilatations (Thomson 1975).

Hemorrhoids can be classified by their location with external hemorrhoids lying below the dentate line and is covered by squamous epithelium and innervated by somatic nerves supplying the perianal skin. Internal hemorrhoids lie above the dentate line and is covered by columnar epithelium and innervated by visceral nerve fibers (Thomson 1975).

Internal hemorrhoids are traditionally further classified by their severity of the prolapse. First-degree internal hemorrhoids do not prolapse out of the canal. Second-degree hemorrhoids prolapse outside of the canal during bowel movements or straining but reduce spontaneously. Third-degree hemorrhoids prolapse out of the canal and require manual reduction. Fourth-degree hemorrhoids are irreducible. Although this classification is useful primarily for clinical trials and evaluation of results, however, what is more clinically relevant for treatment purpose is the severity of symptoms and whether an external component of the hemorrhoid is present or not.

Hemorrhoids are very common, with up to 40% cases noted on a screening colonoscopy study (Riss et al. 2011), and the prevalence rate of hemorrhoidal symptoms is reported in 4.4% of population in the USA (Johanson and Sonnenberg 1990). Many of the patients with hemorrhoids do not require treatment as more than half can be asymptomatic (Thomson 1975) or may have only brief and self-limiting symptoms. There is a wide array of treatment options available for those who require management of their symptoms. The evidence relating to the efficacies of the multitude of treatment modalities are varied and lacking at times. In addition, it is difficult to fully ascertain the true nature of success of a particular treatment due to multimodal management of hemorrhoidal disease and varying symptom profile and differing results profile for these symptoms with any treatment. Furthermore, long-term data is scarce. However, there have been few recent meta-analysis and good quality RCT that helps strengthen the evidence base that may better guide the surgeon in

deciding the appropriate intervention for the disease. Therefore, the aim of this chapter is to present a comprehensive review of the treatment interventions both new and old for the management of hemorrhoidal disease.

2 Management of Hemorrhoids

2.1 Conservative Management

2.1.1 Dietary and Lifestyle Modification

The first line therapy should be prevention. Lifestyle and dietary modification are the mainstays of conservative treatment with increasing of oral fluid intake, reducing fat consumption, avoid straining, and regular exercise. However, there is little evidence to show the effectiveness of these measures. Increased dietary fiber reduces the shearing action of the hard stools. Evidence of benefit of dietary fiber comes from a meta-analysis of seven clinical trials that showed fiber supplement relieved symptoms and minimized bleeding risk by approximately 50% but it had no effect on prolapse, pain and itching (Alonso-Coello et al. 2005, 2006a).

2.1.2 Oral Medications

Phlebotonic drugs have been prescribed to treat hemorrhoids in the acute phase of a hemorrhoidal crisis or to treat bleeding. Many of these drugs are extracted from plants such as oxerutin, diosmin, hesperidin, coumarin, rutosides, and quercetin while others are synthetic compounds such as calcium dobesilate. These drugs aim to increase vascular tone, reduce venous capacity, decrease capillary permeability, facilitate lymphatic drainage, and have anti-inflammatory effects. A Cochrane review of 24 trials recommended the use of phlebotonics due to the significant overall improvement in symptoms especially in bleeding, pruritus, discharge, and overall symptom improvement (Cerera et al. 2012). This is supported by another meta-analysis that reviewed 14 randomized controlled trials comparing flavonoids with placebo or no treatment (Alonso-Coello et al. 2006b). Another phlebotonic drug is calcium dobesilate

that acts by reducing tissue edema (Menteş et al. 2001); however, there have been cases of agranulocytosis reported with its use (Ibanez et al. 2000; Zapater et al. 2003). Additionally, three trials have demonstrated that vasoactive drugs reduced bleeding risk, improved pain control, tenesmus, itch, and reduced healing time in patient's post-hemorrhoidectomy (Ho et al. 1995; La Torre and Nicolai 2004; Ba-bai-ke-re et al. 2011).

2.1.3 Topical Therapy

Topical treatments with various compositions of local anesthetics, corticosteroids or antiseptics, and barrier creams may help patients reach quicker symptom relief. However, there is no strong evidence about the effective utility of topical ointments. A multicenter study investigated therapeutic efficacy and safety of polycresulene associated to cinchocaine administered locally as ointment, suppositories, or both formulations. Polycresulin has hemostyptic properties producing vasoconstriction of the myofibrils of the blood vessels and stopping profuse bleeding from large areas. Cinchocaine serves as a local anesthetic and contributes to the initial pain relief. The study showed satisfactory results in 83.2% of patients and adverse effect of local discomfort, itching, burning, or irritation in 10% of patients (Espinosa 2000).

High anal resting pressure may contribute to hemorrhoidal pain especially with external thrombosis. Glyceryl trinitrate – 0.2% – ointment has been evaluated for control of hemorrhoidal symptoms in patients with early stages and high resting anal pressure. It was shown that it is a safe and effective treatment of bleeding, pain, itch, irritation, and difficulty in defecation; however, 43% of patients experienced headache during the treatment (Tjandra et al. 2006).

Sitz baths are also used for the acute treatment of hemorrhoids with the aim to induce sphincter relaxation and control inflammation and edema. It was based on the theory of a “thermosphincteric reflex” in which there is pain relief after a sitz bath due to internal sphincter relaxation (Shafik 1993). However, a literature review showed the lack of scientific data to support the use of sitz baths in the treatment of anorectal disorders including hemorrhoids (Tejirian and Abbas 2005).

Key Points

The first line therapy should be prevention of hemorrhoids. Initial treatment of symptomatic hemorrhoids would be encouraging intake of dietary fiber and use of phlebotonic drugs (e.g., flavonoids). Although topical ointments may help patients reach quick symptom relief, there is no strong evidence to support its effectiveness.

2.2 Outpatient Procedures

2.2.1 Rubber Band Ligation

Rubber band ligation (RBL) technique involves rubber band to be applied to each hemorrhoid via a proctoscope, and it is undertaken for grade I, II, and III internal hemorrhoids. Rubber bands should be placed at least half a centimeter above dentate line to avoid placement into the somatically innervated tissue. It works by causing hemorrhoid ischemia, and it sloughs off after around 5 days to 2 weeks later. The resultant fibrosis reduces any element of hemorrhoidal prolapse that is present. Previous studies showed success rates of RBL range between 71% and 83% (Cheng et al. 1981; Iyer et al. 2004). Complications are seen in less than 3% of cases (Iyer et al. 2004) and include pain, urinary retention, delayed bleeding, and very rarely perineal sepsis. RBL is cheap, quick, and easy to carry out. The post RBL bleeding rate was 3% with higher rates noted in patients with concomitant use of acetylsalicylic acid/non-steroidal anti-inflammatory drugs and warfarin (Iyer et al. 2004). While compared to other non-surgical methods, like injection sclerotherapy and infrared coagulation, an earlier study had shown that RBL has better long-term efficacy, requiring fewer sessions for treatment, although with a higher rate of posttreatment pain (MacRae and McLeod 1995).

Despite the larger number of recurrences described with longer follow-up periods, recurrences can be treated with repeat sessions and time to recurrence shortened with subsequent treatment course (Iyer et al. 2004). A RCT comparing single and multiple rubber band ligations showed that multiple ligations are equally safe and effective procedure to manage hemorrhoids

and a more cost-effective strategy with fewer treatment sessions (Khubchandani 1983).

The efficacy and safety RBL has been extensively studied with the most recent HuBLLe Trial comparing hemorrhoidal artery ligation (HAL) against rubber band ligation for grade II and III hemorrhoids. Although the recurrence rates were less for HAL compared to RBL after 1 year, the recurrence was similar to a patient undergoing multiple RBLs. Pain was less severe and of shorter duration in the RBL group. Additionally, HAL was not as cost-effective compared with RBL (Brown et al. 2016a).

Overall, considering the evidence, RBL should be considered as first-line treatment for bleeding or grade I and grade II hemorrhoids. With regard to grade III hemorrhoids, conventional excisional hemorrhoidectomy offers long-term efficacy over RBL despite the associated higher postoperative pain and complications (Shanmugam et al. 2005). Excisional hemorrhoidectomy should also be considered in the presence of a significant external component, thrombosis, or symptomatic piles refractory to repeated RBLs.

2.2.2 Injection Sclerotherapy

Injection sclerotherapy involves a submucosal injection of 5% phenol in oil via a proctoscope and cause sclerosis around the hemorrhoidal vessels. Although injection sclerotherapy is simple, relatively safe and rapid, however it is not as effective as RBL (MacRae and McLeod 1995; Mann 2002). In a meta-analysis comparing RBL, injection sclerotherapy, and infrared coagulation, RBL was better than injection sclerotherapy in response to treatment for all hemorrhoids as well as for hemorrhoids stratified by grade I to grade III and with no difference in the complication rate. Although there was some short-term benefit in terms of controlling rectal bleeding (Clark et al. 1967), but at 6 months after treatment, the symptoms were no better than if the patient had been treated with a bulk laxative alone (Senapati and Nicholls 1988). Results are particularly poor with grade II hemorrhoids, with the majority of patients reporting worse symptoms at 3 years after treatment than before treatment (Kanellos et al. 2000).

Therefore, this treatment modality is reserved for patients with high risk of secondary hemorrhage (e.g., on anticoagulants or with advanced cirrhosis) and those who are immunocompromised (Scaglia et al. 2001). Complications include bleeding, pain, prostatic symptoms if the injection is placed too deep anteriorly. Injection of the prostate can also result in urinary retention (often resolving spontaneously), epididymitis, prostatitis (presenting as pain in ejaculation and hemospermia), and even prostatic abscess (Mann 2002).

2.2.3 Infrared Coagulation

Infrared coagulation (IRC) refers to direct application of infrared light waves to the hemorrhoidal tissues and can be used for grade I and II internal hemorrhoids. The tip of the infrared coagulation applicator is usually applied to the base of the internal hemorrhoid for 2 s, with three to five treatments per hemorrhoid. The heat emitted by the applicator causes necrosis of the hemorrhoid, which over time, scars and leads to retraction of the prolapsed hemorrhoid mucosa.

A previous RCT evaluated the percentages of improvement with IRC for different hemorrhoidal degrees reporting an improvement in 75%, 61%, and 23% for grade I, II, and III hemorrhoids, respectively (Dimitroulopoulos et al. 2005). Another study showed 81% symptom control with IRC but with a postprocedure complication rate of 13% (Ahmad et al. 2013). In RCT's comparing IRC versus RBL, IRC had less pain/anal discomfort compared to RBL (Marques et al. 2006; Gupta 2003; Templeton et al. 1983). However, postprocedure symptom control was lower in IRC at 85% compared to 92% in RBL (Templeton et al. 1983), and recurrence of symptoms at 1 year was higher for IRC at 13% compared to 7% with RBL (Gupta 2003).

In a meta-analysis comparing RBL, injection sclerotherapy and infrared coagulation, although pain was greater after RBL, patients treated with sclerotherapy or infrared coagulation were more likely to require further therapy than those treated with RBL (MacRae and McLeod 1995).

Overall, infrared coagulation offers possible alternative to RBL for grade I and grade II

hemorrhoids especially with regard to less pain/anal discomfort. However, IRC equipment is expensive, and there is an associated longer learning curve. In addition, RBL has advantages of relatively better symptom control and lower recurrence rates.

Key Points

Rubber band ligation compared to other non-surgical methods such as sclerotherapy and infrared coagulation has better long-term efficacy and require fewer sessions but is associated with relatively higher rate of posttreatment pain/anal discomfort. Rubber band ligation may be considered as first line treatment for bleeding or grade I–III hemorrhoids.

2.3 Operative Interventions

Surgical treatment is generally considered for grade III hemorrhoids, grade IV hemorrhoids, strangulated or thrombosed hemorrhoids, and hemorrhoids with significant external component. Surgical treatment may also be required for those patients with persistent hemorrhoidal symptoms that are refractory to conservative or outpatient forms of management.

2.3.1 Excisional Hemorrhoidectomy: Milligan–Morgan (Open) and Ferguson (Closed)

There are two main types of excisional hemorrhoidectomy – Milligan–Morgan (open) (Milligan et al. 1937) or Ferguson (closed) hemorrhoidectomy. Both techniques essentially involve excision of both internal and external component of hemorrhoid while preserving anal sphincter complex and maintaining adequate intervening mucosal–skin bridges so as to prevent anal stenosis.

The Ferguson technique is similar to Milligan–Morgan technique except that the mucosal defects are sutured together at the end of the procedure. With the Ferguson technique, it was envisaged that with preservation of the anoderm, this would lead to less pain and more rapid healing than the open technique. There is conflicting

outcomes following both procedures, and this has been debated in the published literature. A recent meta-analysis that reviewed 11 RCTs comparing both techniques encompassing 1326 patients showed that closed technique had clinically measurable advantages over open hemorrhoidectomy in terms of reduced postoperative pain, lower risk of postoperative bleeding, and faster wound healing, but it had a prolonged duration of operation (Bhatti et al. 2016). These findings contraindicated with an earlier published meta-analysis of six RCTs that advocated that the closed technique had faster wound healing but failed to demonstrate other potential advantages (Ho and Buettner 2007). The six trials included in the initial meta-analysis did not have a uniformed standardized pain measuring tools. Surgeons performing the procedure were of variable experience and operator dependent pain score differences were not reported adequately. However, it is also unwise to generalize the results of the most recent meta-analysis to the all patients given that the studies included were of small sample size and may not have sufficient power to reveal small differences in outcomes.

Excisional hemorrhoidectomy is still relatively morbid compared to the less invasive outpatient-based options described earlier. Postoperative bleeding may occur in 1–2% of patients, up to 1 week from the surgery, but is usually self-limiting (Bleday et al. 1992). Infection is uncommon, while urinary retention seen in 5% of cases (Nienhuijs and Hingh 2009) but can be as high as 35% likely due to pelvic floor spasm, narcotic use, and excess fluids (Hoff et al. 1994). Fecal incontinence due to sphincter injury occurs in 2–10% of cases (Gravié et al. 2005). Finally, anal stenosis is a late complication, seen in less than 1% of cases (Nienhuijs and Hingh 2009), and is associated with multiple excised quadrants.

Postoperative pain to varying severity degree is common. Various strategies to reduce the degree of postoperative pain can be considered. Closed hemorrhoidectomy is perceived to be less painful than open hemorrhoidectomy as noted above. It is not unreasonable to start some laxatives prior to operation so as to reduce postoperative constipation that may then help reduce pain symptoms

(London et al. 1987). Postoperative use of oral or topical metronidazole has been shown in a few studies to reduce pain (Carapeti et al. 1998; Nicholson and Armstrong 2004; Ala et al. 2008; Solorio-López et al. 2015). Topical GTN or Diltiazem ointment may also benefit with regard to pain management by aiding sphincter relaxation (Karanlik et al. 2009; Amoli et al. 2011).

Despite its higher morbidity, excisional hemorrhoidectomy is more effective than RBL as well as other outpatient interventions in preventing recurrent symptoms, with patients with grade III and IV hemorrhoids most likely to benefit from this (MacRae and McLeod 1995; Shanmugam et al. 2005).

A Cochrane systematic review showed that medium- to long-term hemorrhoidal recurrences were 2% with excisional hemorrhoidectomy (Lumb et al. 2006). There is limited data regarding long-term follow-up. Long-term hemorrhoidal recurrences have been reported around 11% at 7 year follow-up, but the data is limited due to higher drop-out rate at the longer term follow-up period (Ganio et al. 2007).

2.3.2 Whitehead Hemorrhoidectomy

The Whitehead procedure is applied for grade IV hemorrhoids. This technique has been taken over by stapled hemorrhoidectomy as the procedure for prolapsing hemorrhoids (PPH). The Whitehead procedure involves circumferential excision of the anal mucosa and hemorrhoids. This is less preferred due to technical difficulties and high morbidity rate. The procedure involves an incision made in the skin mucosal line extending from 12 to 6 o'clock. The anal mucosa is dissected together with the hemorrhoids up to the dentate line and another incision made from skin to the superior part of the dentate line and the skin sutured to the rectal mucosa. Subsequently, the left half of the anal mucosa was excised just above the dentate line and the mucosa sutured to the skin. The same was applied symmetrically to the reciprocal remaining part of the anal mucosa (Erzurumlu et al. 2017).

Complications from the Whitehead procedure are stenosis (up to 8.8%), ectropion or wet anus (Whitehead's deformity), anal incontinence (2–12%), severe pain (up to 50%), urinary

retention (2–50%), fecal impaction (0.3%), intra-operative blood loss or postoperative bleeding (0.03–6%), fistula or abscess (1.1%), complications of wound healing (1–2%), and infection (0.5–5.5%) (Erzurumlu et al. 2017; Mukhashavria and Qarabaki 2011; Wolff and Culp 1988).

2.3.3 Techniques Using Energy Devices: Bipolar Energy/ Ultrasonic Scalpel

Relatively recent advances in the open technique have involved different energy-based technologies to excise the hemorrhoid including bipolar diathermy, ultrasonic dissectors, and lasers. A variation of the Ferguson technique involves the LigaSure™ (Medtronic Minn, USA) coagulator which is postulated to seal the tissue with minimal thermal spread resulting in less postoperative pain.

The LigaSure™ is a bipolar electrothermal tissue-sealing device that allows the sealing of blood vessels up to 7 mm in diameter with minimal collateral damage to the surrounding tissues and limited tissue charring, as the thermal spread is confined to within 2 mm of the adjacent tissues. This device uses a very high frequency current and provides hemostasis by denaturing collagen and elastin from the vessel wall and surrounding connective tissues (Kennedy et al. 1998). The limited spread of thermal energy is supposedly meant to reduce anal spasm and permits a bloodless hemorrhoidectomy with reduced postoperative pain and faster wound healing.

There have been a few standard pairwise meta-analyses that compared conventional hemorrhoidectomy with LigaSure™ hemorrhoidectomy and they showed the latter to have better outcomes with regard to duration of surgery, operative blood loss, postoperative pain, length of hospital stay, and time to return to normal activities (Nienhuijs and de Hingh 2009, 2010; Mastakov et al. 2008; Milito et al. 2010; Tan et al. 2007).

Another energy device used is the ultrasound scalpel – Harmonic® (Ethicon Endo Surgery INC – Johnson & Johnson Medical). It uses ultrasonic energy for cutting, the blade vibrating at 55,500 cycles per second, thereby denaturing the protein in the tissue. Many of the ascribed benefits

of the harmonic scalpel in hemorrhoid surgery include less desiccation and eschar formation, improved wound healing, minimal thermal spread, no passage of electricity to or through the patient, and decreased postoperative pain (Miller and Amaral 1994). A meta-analysis looked at 8 trials and 468 patients showed that compared to conventional hemorrhoidectomy, the Harmonic procedure resulted in fewer postoperative complications, less postoperative pain, and earlier return to work (Mushaya et al. 2014).

2.3.4 Stapled Hemorrhoidectomy

A circular staple device is used to excise a ring of redundant rectal mucosa just above hemorrhoid bundles. By doing this stapled hemorrhoidectomy (SH) procedure, the prolapsing hemorrhoids will be repositioned (hemorrhoidopexy) and shrink (due to a partial interruption of blood supply to hemorrhoid plexus).

Initial RCT's have shown significantly better postoperative pain control and earlier return to activities after SH compared to conventional hemorrhoidectomy (Rowell et al. 2000; Taha et al. 2009; Nyström et al. 2010) and results at 1 year showing similar symptom control between the two modalities (Taha et al. 2009; Nyström et al. 2010).

A Cochrane systematic review in 2006 showed that SH is less painful than conventional excisional hemorrhoidectomy but is associated with long-term hemorrhoidal recurrences of 8% compared to 2% for conventional hemorrhoidectomy. In addition, SH group had significantly higher symptoms of prolapse and is associated with increased need for additional operations (Lumb et al. 2006).

Other various meta-analyses comparing conventional with stapled hemorrhoidectomy showed the stapled procedure to have similar immediate postop better outcomes with regard to operating time, postoperative pain, length of hospital stay, and time to return to normal activity. However, stapled hemorrhoidectomy was also reported to have higher rates of skin tags, hemorrhoid recurrence, and recurrent prolapse than conventional hemorrhoidectomy (Jayaraman et al. 2006; Giordano et al. 2009a; Lan et al. 2006; Laughlan et al. 2009; Nisar et al. 2004; Shao et al. 2008;

Tjandra and Chan 2007). Studies comparing SH versus LigaSure™ hemorrhoidectomy, showed SH to have a higher recurrence rate, with no difference in postoperative complications, postoperative pain, and length of hospital stay (Chen et al. 2014; Lee et al. 2013; Yang et al. 2013).

Another relative recent meta-analysis comparing various surgical treatments showed that compared to excisional hemorrhoidectomy SH had shorter operating time, less postoperative pain, shorter hospital stay, and quicker return to normal activities. However, SH has higher recurrence rate than after open, closed and LigaSure™ procedures. SH was associated with more postoperative complications compared with Harmonic® hemorrhoidectomy and a higher postoperative bleeding rate than THD. SH was also shown to be expensive (Simillis et al. 2015).

Recently, the landmark eTHoS study reported its results (Watson et al. 2016, 2017). The eTHoS study was a large, multicenter RCT involving 32 UK hospitals that recruited 777 patients with grade II to grade IV hemorrhoids between January 2011–August 2014 and randomized 1:1 to either staple hemorrhoidectomy or conventional hemorrhoidectomy. It showed that postoperative complications were similar in both groups. SH was less painful in the short term. However, after 6 weeks, the recurrence rates, symptoms, reinterventions, and quality-of-life measures all favored conventional hemorrhoidectomy which was cheaper.

2.3.5 Doppler-Guided Hemorrhoidal Artery Ligation (DG-HAL) or Transanal Hemorrhoidal Dearterialization (THD)

The DG-HAL/THD requires a Doppler probe to identify the six main feeding arteries within the anal canal, ligation of these arteries with absorbable suture and a specialized anoscope, and then plication of redundant hemorrhoidal mucosa which enhances reduction of any existing prolapse. The plication is often referred to as recto-anal-repair, mucopexy, or hemorrhoidopexy, and the sutures are above the dentate line and therefore should be associated with less pain. A meta-analysis showed that the recurrence rate at

1 year or more was 10.8% for prolapse, 9.7% for bleeding, and 8.7% for pain at defecation (Giordano et al. 2009b). The results of several RCTs are mixed with some concluding that THD had less postoperative pain compared to conventional hemorrhoidectomy (Denoya et al. 2013; Elmér et al. 2013) while another showing similar postoperative pain and morbidity between both treatment arms (De Nardi et al. 2014).

A recent meta-analysis showed that THD had fewer postoperative complications, a shorter operating time, and decreased levels of postoperative pain than open, closed, and Ligatures™ procedures. These resulted in THD having a shorter length of hospital stay and an earlier time to the first bowel movement. However, it was associated with higher recurrence rates (Simillis et al. 2015).

A recent multicenter trial by the LigaLongo Study Group, compared DG-HAL versus SH, showed DG-HAL resulted in lower pain but was more expensive, took longer, and were suggestive of increased risk of recurrence with this group (Lehur et al. 2016).

The Hubble RCT which was another recent landmark trial, compared THD against RBL for grade II and III hemorrhoids. At 1 year post-procedure, THD had lower recurrence at 30% compared to 49% with RBL. However, when single THD was compared with multiple RBLs, there recurrence was similar. Symptom scores, complications, quality of life, and continence score were no different, and patients had more pain in the early postoperative period after THD. THD was also more expensive than RBL (Brown et al. 2016b).

Key Points

Conventional hemorrhoidectomy should be considered over stapled hemorrhoidectomy as the treatment of choice for hemorrhoids that are refractory to clinic-based treatments. Although newer energy devices such as LigaSure™ and Harmonic may be less painful with equivalent effectiveness, the long-term benefits have yet to be proven, and in addition, these newer technologies are significantly more costly in comparison.

3 Special Considerations

3.1 Thrombosed or Strangulated Hemorrhoids

Thrombosed or strangulated hemorrhoids are relatively uncommon but with dramatic presentation of severely painful, swollen, and irreducible hemorrhoids. Traditionally, conservative management (with laxatives, topical anesthetic ointments, nonconstipating analgesics, icepack application, and avoidance of constipation/straining) is a reasonable approach provided the pain control can be adequately provided, there is no necrosis and also importantly patient is agreeable for a conservative approach. The most intense pain period is within the first 48–72 h, following which it continues to slowly subside. Usually, the anus returns back to almost normal in few months and it is debatable whether one needs to undertake a subsequent elective hemorrhoidectomy. There is an alternative view advocated by some established colorectal specialists in undertaking emergency hemorrhoidectomy routinely. Emergency hemorrhoidectomy does carry increased risks including anal stenosis of 6–7% (Eu et al. 1994; Ceulemans et al. 2000) and anal sphincter damage. The previously perceived increased risks of portal pyaemia seem to have been exaggerated. There were no incidences of portal pyaemia in trial with over 200 emergency hemorrhoidectomies (Eu et al. 1994)

3.2 Hemorrhoids in Pregnancy

Hemorrhoids are common in pregnancy with up to 40% pregnant women affected by it, and majority of these cases occur during the last trimester of pregnancy and 1 month after delivery (Poskus et al. 2014). As symptoms usually resolve after few months of delivery, the symptoms are generally managed with simple conservative measures, and it is generally not advisable to undertake interventional modalities for hemorrhoids during pregnancy and puerperal period.

3.3 Hemorrhoids in Immunocompromised Patients

In general, conservative measures are considered in immunocompromised patients mainly due to the increased risks of sepsis and poor wound healing (Scaglia et al. 2001; Morandi et al. 1999; Wexner et al. 1986). Injection sclerotherapy can be considered when intervention is warranted and conservative measures have failed (Scaglia et al. 2001). It is advisable to consider antibiotic prophylaxis for such interventions. RBL may have poor outcome in immunocompromised cases as reported in a single case report (Buchmann and Seefeld 1989).

3.4 Hemorrhoids and Patients Requiring Anticoagulation

For minor hemorrhoidal bleeding symptoms, stoppage of anticoagulation treatment is usually not required unless the bleeding symptoms persist or become more significant. Usual conservative measures usually suffice in these patients. If procedural or operative intervention is required, then it is advisable to preoperatively stop the anticoagulation for the required number of days so as to wear off the anticoagulant effect. There may be a need of bridging anticoagulation therapy in high-risk cases requiring anticoagulation. Specific operative techniques that could possibly be considered, apart from usual careful hemostatic control measures, include use of injection sclerotherapy in lower grades and DG-HAL/THD techniques for higher grade hemorrhoids. Conventional hemorrhoidectomy is also a possible option for grade III and grade IV hemorrhoids, with the obvious caveat to be vigilant in maintaining meticulous hemostasis. Rubber band ligation is not recommended due to the increased risk of profound secondary bleeding.

4 Conclusion

In conclusion, there are different treatment options available for hemorrhoids that require treatment. The type of treatment should be

adjusted to the grade of hemorrhoid, and in addition, consideration should be given to severity of symptoms. Conservative management should be introduced to all patients and may be adequate for management of grade I hemorrhoids. Grade II would likely benefit from a course of RBL with the provision for a repeat RBL if required. Failure of treatment and refractory symptoms may justify operative interventions with DG-HAL/THD as possible option. Grade III and IV hemorrhoids will most likely benefit from conventional excisional hemorrhoidectomy, which despite its main drawback of postoperative pain, has benefits from proven long-term effectiveness and low recurrence rates. Stapled hemorrhoidectomy has significant benefit of lower postoperative pain, but increased costs and higher long-term recurrences needs to be taken into account when considering stapled hemorrhoidectomy. Stapled hemorrhoidectomy may be considered as a possible option for those select few cases with circumferential prolapse hemorrhoids whereby achieving adequate mucosal bridges may be challenging with conventional hemorrhoidectomy. The newer energy-based excision hemorrhoidal techniques using bipolar and ultrasonic scalpel has equivalent efficacy compared to conventional excisional hemorrhoidectomy; however, increased equipment costs and lack of long-term efficacy data limits their recommendation and widespread adoption.

5 Cross-References

- [Anatomy, Physiology, and Pathophysiology of Hemorrhoids](#)
- [Classification of Hemorrhoidal Disease and Impact on the Choice of Treatment](#)
- [Literature Review on Dearterialization of Hemorrhoids and Mucopexy](#)
- [Literature Review on Hemorrhoidectomy](#)
- [Literature Review on Outpatient Treatments for Hemorrhoids](#)
- [Literature Review on Stapled Hemorrhoidopexy](#)
- [Management of Hemorrhoidal Disease in Special Conditions](#)
- [Medical Therapy of Hemorrhoidal Disease](#)

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Literature Data on Perioperative Management After Surgery for Hemorrhoids

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Christopher Emmett and Mark Mercer-Jones

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Abstract

Excisional hemorrhoidectomy is a commonly performed procedure for symptomatic hemorrhoids. This term encompasses both “open” (Milligan-Morgan) and “closed” (Ferguson) hemorrhoidectomy techniques, as well as excisional procedures performed using surgical devices such as LigaSure™ and harmonic scalpel. These procedures pose certain challenges in the perioperative period, especially in the management of postoperative pain, bowel function, and wound healing. Traditionally, patients

undergoing hemorrhoidectomy remained in hospital for up to a week postoperatively; however, in recent years, the procedure is increasingly being carried out as a day case operation.

A variety of strategies for reducing postoperative complications and improving postoperative pain have been suggested; usually, combinations of local anesthetic, oral medications, and topical therapies are employed with the aim of optimizing patients’ postoperative recovery, reducing hospital stay, and preventing readmission. This chapter aims to evaluate the current published evidence for postoperative management of patients undergoing excisional hemorrhoidectomy.

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1 Introduction

Excisional hemorrhoidectomy has existed as a technique in various forms for many years. Despite an increasing array of alternatives for the management of symptomatic hemorrhoids, for example, stapled hemorrhoidectomy, hemorrhoidal artery ligation, and rubber band ligation, it remains an important and commonly-performed procedure. Although the basic technique (with some variations) has remained largely the same, the approach to postoperative care of patients undergoing excisional hemorrhoidectomy has undergone considerable change.

Excisional hemorrhoidectomy is associated with severe post-operative pain (Joshi and Neugebauer 2010; Sammour et al. 2017). Controlling pain in the postoperative period is, therefore, very important, and is the primary aim of the majority of interventions described in this chapter. Traditionally, patients would remain in hospital postoperatively (Hunt et al. 1999). However, in recent years, management has shifted significantly toward performing the procedure as a day case, and several studies have demonstrated the feasibility of this approach (Hunt et al. 1999; Ho et al. 1998), with associated reduction in hospitalization and medical costs (Ho et al. 1998). A systematic review of ambulatory surgical management of hemorrhoids (Vinson-Bonnet et al. 2015) concluded that all surgical procedures for hemorrhoids could be performed as day case procedures. Special care should be taken to minimize the impact of postoperative pain and the risk of urinary retention in patients undergoing excisional hemorrhoidectomy; such measures include use of local anesthetic nerve blocks or wound infiltration, and limiting the duration of spinal anesthesia (as spinal blockade was associated with a higher incidence of postoperative urinary retention).

2 Analgesia

Postoperative pain management in excisional hemorrhoidectomy patients can be challenging. The pain is multifactorial, arising from a

combination of anal sphincter spasm, surgical wounds to the sensitive anoderm, and tissue edema surrounding the wound (Nicholson and Armstrong 2004). A variety of analgesic strategies have been described in the literature, with the aim of minimizing patient pain in the postoperative period. The main components of these encompass local anesthetic agents administered by the surgeon or anesthetist at the time of surgery, and oral/topical agents given to the patient on discharge.

2.1 Local Anesthetic Infiltration

Several different ways of administering local anesthetic for hemorrhoidectomy surgery have been described in the literature, using a variety of agents. Perhaps the most straightforward method involves local wound infiltration either at the beginning or at the end of the procedure. One study (Morisaki et al. 1996) described local infiltration of 1% lidocaine immediately before performing hemorrhoidectomy, as an adjunct to spinal anesthesia. This randomized, placebo-controlled study of 168 adult patients demonstrated better and more prolonged pain relief in the patients who received local anesthesia, as well as reduced supplementary analgesic requirements. The improved pain relief was recorded up to 3 days postoperatively. In this study, all patients were given 48 h of epidural analgesia, which is not possible in day case surgery. Therefore, the generalization of these results to current practice may be limited.

A further similar study (this time using ropivacaine) also demonstrated lower patient-reported pain scores and reduced analgesic requirements up to 12 h postoperatively (Vinson-Bonnet et al. 2002). However, a small placebo-controlled trial of local infiltration of bupivacaine at the end of the procedure did not demonstrate any significant benefit with respect to visual analogue scale pain scores, analgesic requirements, or length of hospital stay (Marsh et al. 1993). There is some evidence to suggest that a newer preparation of bupivacaine (liposome bupivacaine) may be more effective than bupivacaine HCl in managing postoperative pain. This is a multivesicular

formulation which aims to achieve more prolonged release as well as rapid absorption, thereby prolonging the analgesic effect compared with standard bupivacaine HCl (Hu et al. 2013). One study reported statistically significant improvement in pain scores at 72 h postoperatively in the liposome bupivacaine group, as well as reduced analgesic requirements in the period 12–72 h postoperatively (Haas et al. 2012). A further randomized study demonstrated significantly reduced pain scores in the liposome bupivacaine group compared to placebo up to 72 h postoperatively (Gorfine et al. 2011).

2.2 Local Anesthetic Nerve Block

The pudendal nerve innervates the perineum, transmitting sensation from the external genitalia and anal canal. Therefore, targeted blockade of this nerve may have a role in managing pain after hemorrhoidectomy. Randomized studies have been performed comparing nerve stimulator-guided pudendal nerve block (alone or in combination with general anesthesia) with general anesthesia alone, or GA plus placebo nerve block. One study randomized patients to either general anesthesia or pudendal nerve block (Naja et al. 2006); this trial demonstrated improved pain relief and reduced analgesic requirements in the pudendal nerve block group, although the block failed in three patients resulting in conversion to general anesthesia. A further study randomized patients to one of three groups; pudendal nerve block plus GA, GA alone, or GA plus placebo block (Naja et al. 2005). This study demonstrated statistically significant improvements in postoperative pain scores, reduced hospital stay, reduced supplementary analgesic requirements, and improved patient satisfaction in the pudendal nerve block group compared to the other two.

A further local anesthetic strategy described in the literature is injection of local anesthetic into the ischiorectal fossa. One study compared ischiorectal fossa block with no block and placebo, demonstrating improved pain scores and reduced analgesic requirements in the block

group (Rajabi et al. 2012). Another randomized study compared ischiorectal fossa block plus local anesthetic wound infiltration, compared with wound infiltration alone (Luck and Hewett 2000). This study demonstrated improved pain control and reduced analgesic requirements in the ischiorectal fossa block group in the first 24 h postoperatively.

A recent update of a systematic review of pain management post hemorrhoidectomy recommended both long-acting local anesthetic infiltration and nerve blocks, but that local infiltration alone may be preferable in the clinical setting due to ease of administration (Joshi and Neugebauer 2010; Sammour et al. 2017). The role of specialist anesthetic techniques such as spinal or epidural anesthesia is beyond the scope of this chapter.

2.3 Postoperative Analgesia

Opioid analgesics are known to cause constipation which exacerbates pain post hemorrhoidectomy; therefore, their use in this patient group is not generally recommended (Joshi and Neugebauer 2010). However, one study described the use of a fentanyl patch applied 6 h preoperatively, and reported better pain scores and reduced breakthrough analgesic requirements in the fentanyl group compared to placebo (Kilbride et al. 1994).

There is little procedure-specific data on the use of paracetamol (acetaminophen) or cyclooxygenase-2 inhibitors (Joshi and Neugebauer 2010), although nonsteroidal anti-inflammatory drugs (NSAIDs) in various forms have been studied in hemorrhoidectomy patients. One study found that diclofenac suppositories administered at the end of the procedure led to improved pain management in the evening and the morning after surgery, compared with topical application of local anesthetic cream (EMLA), and placebo (Rahimi et al. 2012). A further study comparing oral administration of the NSAIDs nimesulide and naproxen found them to be of comparable benefit post hemorrhoidectomy (Zuckermann et al. 1993).

It is recommended that patients should be given combinations of simple analgesics (paracetamol), NSAIDs, and weak opioids after hemorrhoid surgery, with strong parenteral opioids reserved for the immediate postoperative period (Joshi and Neugebauer 2010).

2.4 Topical Agents

A variety of topical therapies have been described for use in patients after hemorrhoidectomy. Broadly, these aim to improve pain and wound healing by reducing anal spasm, reducing infection, reducing inflammation, and by numbing the wounds.

Anal spasm and raised anal canal pressure have been described after hemorrhoidectomy (Patti et al. 2006) and this is thought to contribute to postoperative pain. Various strategies to reduce anal spasm after hemorrhoidectomy have been described, including intersphincteric **botulinum toxin (Botox)** injection at the time of surgery (Patti et al. 2006; Singh et al. 2009), and performing internal sphincterotomy at the same time as the hemorrhoidectomy (Amorotti et al. 2003; Diana et al. 2009). However, the role of internal anal sphincter pressure is not entirely clear-cut, as another study did not show any benefit to sphincterotomy in terms of postoperative pain (Khubchandani 2002). Another study looking at intersphincteric botox injection found that, although sphincter pressure was reduced, this did not translate into reduced pain (Singh et al. 2009). Neither of these techniques was recommended in a systematic review of pain management post hemorrhoidectomy (Sammour et al. 2017).

Glyceryl trinitrate (GTN) ointment has been suggested as an effective and safe topical therapy to improve postoperative pain and aid wound healing after excisional hemorrhoidectomy. The GTN is metabolized to release nitrous oxide (NO), which is an inhibitory neurotransmitter leading to the relaxation of the smooth muscle of the internal anal sphincter (Rahimi and Abdollahi 2012). Several randomized controlled trials have demonstrated improved pain scores in patients

using GTN ointment (Wasvary et al. 2001; Hwang et al. 2003; Tan et al. 2006; Karanlik et al. 2009). A systematic review and meta-analysis of the use of GTN post hemorrhoidectomy found that there was statistically significant reduction in pain in patients using GTN on postoperative days 3 and 7, but no significant difference on day 1 (Ratnasingham et al. 2010). The authors hypothesize that this is due to the pain in the immediate postoperative period being predominantly due to the injury to the sensitive anoderm distal to the dentate line, and that the anal spasm component of the pain becomes more significant later (Ratnasingham et al. 2010). This analysis also demonstrated significant improvements in wound healing at 3 weeks postoperatively in patients using GTN. The precise mechanism for this is not clear (Ratnasingham et al. 2010). One recent review of the evidence for posthemorrhoidectomy pain management recommended either 0.4% GTN ointment alone, or a combination of 0.2% GTN with 2% lignocaine (Sammour et al. 2017).

EMLA local anesthetic ointment has been shown to have some increased analgesic benefit in the immediate postoperative period (Shiau et al. 2008; Rahimi et al. 2012), although one study found that this effect was less sustained than that achieved by using a diclofenac 100 mg suppository (Rahimi et al. 2012).

3 Antibiotics

Metronidazole (Flagyl[®]) is an antibiotic that is commonly used in posthemorrhoidectomy patients, both as a topical preparation and orally. It is hypothesized that it has several beneficial effects, and several studies suggest that its use can lead to a reduction in postoperative pain and pain at first defecation, as well as improved wound healing (Ala et al. 2008; Nicholson and Armstrong 2004; Ng et al. 2006). The proposed mechanism of action of metronidazole is twofold; firstly, its antimicrobial effect reduces infection from gut commensal bacteria which may lead to infection/inflammation and delayed healing (Lyons et al. 2017). Secondly, there is evidence

that metronidazole itself has anti-inflammatory properties independent of its antimicrobial effect (Lyons et al. 2017), by modulating the action of neutrophils. The precise mechanism of this second effect is unclear.

The use of metronidazole after excisional hemorrhoidectomy has been the subject of two recent meta-analyses (Lyons et al. 2017) (Wanis et al. 2017) that reached different conclusions concerning its use. The first (Wanis et al. 2017) included trials of systemic metronidazole only, and demonstrated that although postoperative pain was reduced on days 1 and 4 in patients using metronidazole, there was no significant benefit seen after this period. The authors note, however, that the time to return to normal activities was significantly shorter in patients given metronidazole.

The second meta-analysis (Lyons et al. 2017) included randomized studies of topical as well as systemic metronidazole. This increased the number of patients included in the final analysis from 168 to 437 (Lyons et al. 2017). In this analysis, the authors report significantly improved pain scores in patients given metronidazole on days 1, 2, and 7, with a mean difference on day 1 of 1.47, of 1.43 on day 2, and 2.40 on day 7 (Lyons et al. 2017). All were statistically significant. Additionally, meta-analysis was performed on three studies reporting pain on first defecation. This reported a mean difference in pain of 1.38 ($P = 0.0005$) in favor of metronidazole (Lyons et al. 2017).

The fact that two meta-analyses including a similar range of studies have drawn different conclusions is interesting. Reasons for the potential include the differences in study populations, the difference in interventions included (topical and systemic compared to systemic alone), and differences in method of analysis. This topic is discussed by the authors of the second study (Lyons et al. 2017), who suggest that, in addition to the larger number of studies included in their analysis due to the inclusion of topical metronidazole, differences in method of effect size calculation may account for some of the differences in results between the studies. They draw attention to the fact that they used raw data to obtain this information, contrasting this with the

retrospective calculation of effect size based on sample size and p-values used by Wanis et al. (Lyons et al. 2017).

This disagreement reflects the inherent difficulties in interpreting and analyzing trial data, even when the included studies are of reasonable methodological quality. Regarding whether metronidazole should be used in practice, it seems reasonable to conclude, given the number of studies reporting benefit from both topical and oral metronidazole, and given the relative safety and low cost of metronidazole as a treatment, that it should be given routinely to patients undergoing excisional hemorrhoidectomy. This is the conclusion of a recent review by the PROSPECT group looking at pain management after hemorrhoid surgery (Sammour et al. 2017). The evidence does not favor one particular route of administration over another, with both topical and oral routes providing benefit. Additionally, treatment duration cannot be definitively recommended; course length varied from 3 to 7 days between studies, or no course length was reported (Lyons et al. 2017). At our hospital, patients undergoing hemorrhoidectomy are given 5 days of oral metronidazole (400 mg three times a day).

4 Laxatives and Bowel Management

Avoiding constipation in the postoperative period is considered a very important aspect of the management of hemorrhoidectomy patients (Cheetham and Phillips 2001), and the use of laxatives and stool softeners has long been standard practice. Constipation can arise in patients who have undergone hemorrhoidectomy for a variety of reasons, including anal pain and spasm leading to a painful defecation and therefore reluctance to pass stool in the early postoperative period, as well as the use of opiate analgesia.

Trial data for the use of specific laxatives is limited; one study demonstrated shorter hospital stay, less pain on defecation, and less fecal leakage in patients given wheat fiber, compared with a laxative regime of sterculia, magnesium sulfate, and mineral oil (Johnson et al. 1987). A further

placebo-controlled study found that giving lactulose for a period of 4 days preoperatively resulted in less post-operative pain on defecation and reduced analgesic requirement in the lactulose group (London et al. 1987). A review of the evidence base for hemorrhoidectomy strongly recommended the use of stool softeners postoperatively (Cheetham and Phillips 2001), and a recent review of pain management post hemorrhoidectomy also recommended the use of laxatives (Sammour et al. 2017).

5 Other Management Options

The administration of oral **micronized purified flavonoid fraction** to patients undergoing hemorrhoidectomy has been the subject of several studies. This is a phlebotropic agent that acts to reduce venous tone and improve lymphatic drainage, as well as reducing capillary hyperpermeability (Lyseng-Williamson and Perry 2003). It has been used in the management of chronic venous leg ulcers and in the nonoperative management of bleeding hemorrhoids (Lyseng-Williamson and Perry 2003; Ho et al. 2000). One randomized trial reported improvement in pain and perianal symptoms in the first three postoperative days in patients given flavonoids in combination with laxatives and anti-inflammatories, in comparison to those given laxatives and anti-inflammatories alone (La Torre and Nicolai 2004). A recent update to a review of evidence-based pain management after hemorrhoidectomy recommended flavonoids (Diosmin) as an adjunct to nonopioid analgesia in the postoperative period (Sammour et al. 2017).

Injection of **methylene blue** intradermally in the perianal region at the end of surgery has been suggested as a possible way of reducing pain in the short-term postoperatively, with one randomized trial demonstrating reduction in pain in the first three postoperative days in the methylene blue group (Sim and Tan 2014).

Sitz baths are often recommended for the relief of symptoms in painful perianal conditions, and post hemorrhoidectomy. However, trial

evidence does not support their use (Tejirian and Abbas 2005; Gupta 2008).

6 Conclusion

The current literature on the topic of perioperative care after excisional hemorrhoidectomy supports a multifaceted approach to optimize patient recovery after the procedure. This approach should consist of a combination of local anesthetic techniques employed at the time of surgery, alongside topical therapies and oral agents. Effective anesthetic and analgesic regimens allow the majority of excisional hemorrhoidectomies to be performed as day cases.

The aim of this approach should be to provide sustained analgesia in the initial postoperative period. This can be achieved through the use of long-acting local anesthetic agents and perianal nerve blocks which provide optimal analgesia in the first 24–72 h postoperatively, in combination with topical agents such as 0.2–0.4% GTN ointment. Metronidazole, administered orally or topically, is recommended to reduce pain and aid wound healing. GTN ointment has also been shown to improve wound healing.

Studies have been performed looking at the potential benefits of botox injection intraoperatively, as well as performing internal sphincterotomy at the same time as hemorrhoidectomy. There is some evidence that this may reduce pain, but the evidence for these approaches is not considered strong enough to merit their routine use (Sammour et al. 2017).

The avoidance of constipation is another important consideration following hemorrhoidectomy. For this reason, strong opioid analgesics are not recommended except for severe postoperative/breakthrough pain; instead, combinations of simple analgesics and NSAIDs (unless contraindicated) should be used (Joshi and Neugebauer 2010), alongside the topical agents discussed previously. Oral laxatives should be provided to all patients in order to keep bowel motions soft and easy to pass. Combining the interventions with the strongest evidence base and most favorable safety profile is necessary

to deliver optimal postoperative care to hemorrhoidectomy patients. The precise nature of this postoperative care is subject to considerable variation between clinicians. More robust evidence is needed if a definitive evidence-based post-hemorrhoidectomy care pathway is to be developed.

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