

Hyung Kyu Yang

Hemorrhoids



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Preface

It is a great honor and pleasure to publish *Hemorrhoids* in English edition.

Even though I have been performing hemorrhoidectomy for 27 years, there are still many points about hemorrhoids that I have not yet understood.

Recently, the concept regarding the pathogenesis of hemorrhoids has changed; hemorrhoidal tissues are now considered as normal structure that keeps anal continence.

In the past, we used to remove large amount of hemorrhoidal tissue since hemorrhoids were considered as an abnormal tissue. It is why thorough removal was thought to be the only cure, and it has aroused many complications such as anal stenosis and mild anal incontinence.

Since the fundamental concept of hemorrhoidal pathogenesis has changed, removing large amount of hemorrhoidal tissue is not necessary anymore. *Hemorrhoids* introduces my surgical method called the lift-up procedure, a way of preventing anal cushion from sliding down. Lift-up procedure makes the prolapsed hemorrhoidal tissue to roll up and fix to the upper anal canal.

Several kinds of other lift-up procedures are also introduced in this edition including my operative method. My surgical procedure for hemorrhoids is mainly composed of submucosal hemorrhoidectomy combined with lift-up procedure. I am sure that this combined maneuver is the best operative method among other hundreds of hemorrhoid surgeries. I have no doubt that this edition would be of great value for surgeons who are suffering from numerous complications after hemorrhoidectomy.

I appreciate the Springer Publishing Company, the surgeons at Yang Hospital, and Mrs. Park so much who helped me in writing. And lastly, I also thank my wife and my three children for their support.

Seoul, Republic of Korea
31st October 2013

Hyung Kyu Yang, M.D., Ph.D.

Contents

1	The History of Hemorrhoids.	1
1.1	Introduction	1
1.1.1	Greece, Rome, the Middle Age, and the Renaissance	1
1.1.2	Hemorrhoid Surgery in the Eighteenth Century: An Era of Ligation and Simple Excision	1
1.1.3	Hemorrhoid Surgery in the Nineteenth Century	2
1.1.4	The Hemorrhoid Surgery in the Twentieth Century	2
1.1.5	A Conservative Treatment of Hemorrhoids	3
1.2	The Incidence of Hemorrhoids	4
	References	4
2	Anal Anatomy	5
2.1	Anatomy Related to Hemorrhoids	5
2.1.1	The Anal Mucosa and Anoderm	5
2.1.2	Treitz's Muscle	6
2.1.3	Internal Sphincter	6
2.1.4	Conjoined Longitudinal Muscle	7
2.1.5	The External Anal Sphincter	10
2.1.6	The Levator Ani and Pelvic Floor Muscles	10
2.1.7	The Levator Ani Tunnel	12
2.1.8	The Hiatal Ligament	13
	References	13
3	The Pathophysiology of Hemorrhoids	15
3.1	What Are Hemorrhoids?	15
3.1.1	The Varicose Vein Theory	16
3.1.2	The Vascular Hyperplasia Theory	17
3.1.3	The Theory of Internal Anal Sphincter Hypertonia	17
3.1.4	The Sliding Anal Lining (Cushion) Theory	17
3.2	The Causes of Hemorrhoids	22
3.2.1	Defecation with Prolonged Straining	22
3.2.2	Constipation with a Low-Fiber Diet	23
3.2.3	Diarrhea	23
3.2.4	Hereditary	23
3.2.5	Pregnancy	23
3.2.6	Sports and Leisure Activities Causing Hemorrhoids	23
3.2.7	Occupation	24
3.2.8	Psychological Problems and Spinal Paralysis	24
	References	24

4	Diagnosis of Hemorrhoids	25
4.1	Diagnostic Sequences for Hemorrhoids (Anus)	26
4.2	The Posture for Examination	26
4.2.1	Left Lateral Position (Sims' Position)	26
4.2.2	Lithotomy Position	26
4.2.3	Knee-Chest Position	28
4.3	The Practice of Diagnosis	30
4.3.1	The History	30
4.3.2	Interview	30
4.3.3	Inspection	32
4.3.4	Prolapse Test for Internal Hemorrhoids	32
4.3.5	Digital Rectal Examination (Digital Examination)	32
4.3.6	Anoscopic Examination	33
4.3.7	Rigid Sigmoidoscopy	35
4.3.8	Colonoscopic Examination	36
4.4	Differential Diagnosis	37
4.4.1	Hypertrophied Anal Papillae	37
4.4.2	Rectal Prolapse	37
4.4.3	Rectal Mucosa Ectropion	37
4.4.4	Mucosal Prolapse Syndrome (MPS)	38
4.4.5	Rectocele	38
4.4.6	Rectal Polyp and Cancer	38
4.4.7	Skin Tag	38
	References	40
5	Indications for the Treatment of Hemorrhoids	41
5.1	Classification of Hemorrhoids	41
5.1.1	An Attempt of New Classification	42
5.2	Indications of Hemorrhoid Surgery	43
5.2.1	Bleeding Hemorrhoids	43
5.2.2	Prolapsed Hemorrhoids	44
5.2.3	Pain	44
5.2.4	Fecal Incontinence	44
5.2.5	Mucus Discharge, Pruritus Ani	44
	References	45
6	Nonsurgical Treatment of Hemorrhoids	47
6.1	Conservative Treatment of Hemorrhoids	47
6.1.1	Hot Sitz Bath	47
6.1.2	Medical Treatment of Hemorrhoids	47
6.1.3	Dietary Treatment: High Fibers	48
6.1.4	Bowel Movement Education	52
6.2	Rubber Band Ligation (Barron, McGivney)	52
6.2.1	Principles of Rubber Band Ligation	53
6.2.2	Indication of Rubber Band Ligation	53
6.2.3	Procedure	53
6.2.4	Limitations and Contraindications of Rubber Band Ligation	53
6.2.5	The Complications of Rubber Band Ligation	53
6.3	Sclerotherapy	55
6.3.1	The Principles of Sclerotherapy	55
6.3.2	Indications	55
6.3.3	Contraindications	56
6.3.4	Sclerosing Agents for Sclerotherapy	56
6.3.5	The Injection Method of Sclerosing Agent	56
6.4	Cryosurgery	60

6.5	Infrared Coagulation.	61
6.6	Ultroid.	61
6.7	Laser.	61
6.8	Hemorrhoidal Artery Ligation (HAL)	61
6.9	Anal Dilatation Treatment	62
6.9.1	Contraindications	62
	References	63
7	Surgical Treatment of Hemorrhoids: Lift-up Submucosal Hemorrhoidectomy	65
7.1	Various Operations for Hemorrhoids Based on the Concept of Lift Up	67
7.1.1	PPH (Stapled Hemorrhoidopexy).	67
7.1.2	Whitehead Operation	67
7.1.3	Rubber Band Ligation	67
7.1.4	Sclerotherapy	68
7.1.5	Dr. Takano's Operation.	68
7.1.6	Ligation and Excision Method	68
7.2	The Procedure of the Lift-Up Submucosal Hemorrhoidectomy	69
7.2.1	The Practice of Surgical Operation	69
7.3	Plan of Hemorrhoidectomy and Design of Incision.	75
7.3.1	Basic Form	76
7.3.2	Mucosal Prolapse	76
7.3.3	Incarcerated Hemorrhoids	76
7.3.4	Long Prolapsed Hemorrhoids.	76
7.3.5	Thrombosed Hemorrhoids	77
	References	78
8	Famous Surgical Operations for Hemorrhoids Tracing Experts' Operations.	79
8.1	Parks' Submucosal Hemorrhoidectomy	79
8.1.1	Surgical Technique	79
8.2	Ligation and Excision Method by Sumikoshi Yukio	82
8.2.1	Surgical Technique	83
8.3	Dakano's (高野正博) Anoderm-Preserving Hemorrhoidectomy	85
8.3.1	Surgical Technique	85
8.4	Closed Hemorrhoidectomy.	89
8.4.1	Surgical Technique	89
8.5	Whitehead's Hemorrhoidectomy	90
8.5.1	Surgical Technique	92
8.6	Hemorrhoid Surgery with Circular Stapler (PPH)	93
8.6.1	Surgical Technique	93
	References	95
9	Day-Case Hemorrhoidectomy	97
9.1	Preoperative Considerations	97
9.1.1	Social Conditions	97
9.1.2	Selection of the Patients	97
9.1.3	Consent Form	97
9.1.4	Preoperative Preparation.	97
9.1.5	Surgical Technique	97
9.1.6	The Postoperative Treatment	97
9.2	Considerations for Anesthesia	98
9.2.1	Preoperative Patient Selection	98
9.2.2	Methods of Anesthesia	98
9.2.3	Discharge After Surgery.	98

10 Perioperative Management	99
10.1 Preoperative Management	99
10.1.1 Preoperative Examination and Preparation	99
10.1.2 Preoperative Preparation and Management	100
10.2 Monitoring During Operation	101
10.3 Postoperative Management	101
10.3.1 Check the Immediate Postoperative Vital Signs	101
10.3.2 Management of Pain	101
10.3.3 Bleeding After Hemorrhoidectomy	105
10.3.4 Management of Bowel Evacuation After Surgery	107
10.3.5 Skin Tag	107
10.3.6 Anal Stenosis	109
10.4 Critical Pathway	111
10.5 Day Surgery	113
10.6 Outpatients (OPD) Treatment	113
References	116
11 Special Consideration and Contraindications of Hemorrhoidectomy	119
11.1 Age	119
11.2 Concomitant Chronic Disease	119
11.3 Pregnancy and Delivery	119
11.4 Gastrointestinal Disease	119
11.5 Drug Addiction and Alcoholism	119
11.6 Immune Deficiency	120
11.7 Weakness of Anal Sphincter	120
11.8 Anal Canal Deformity	120
11.9 Mucosal Inflammation	120
11.10 On the Specific Disease Status	120
12 Hemorrhoids in a Specific Condition	121
12.1 Thrombosed External Hemorrhoids	121
12.1.1 Operative Methods	121
12.2 Incarcerated Hemorrhoids	121
12.3 Hemorrhoids in Pregnancy	122
12.4 Hemorrhoids in Portal Hypertension	122
12.5 Hemorrhoids in IBD	123
12.6 Hemorrhoids in Leukemia	123
12.7 Others	123
References	123
13 Anesthesia for Anal Surgery	125
13.1 Local Anesthesia	125
13.1.1 Drugs	125
13.1.2 Indication	125
13.1.3 Induction of Local Anesthesia	125
13.1.4 Method of Local Infiltration	127
13.1.5 Precautions	128
13.2 Spinal Anesthesia (Saddle Block)	128
13.2.1 Drugs	130
13.2.2 Positions for the Lumbar Puncture	130
13.2.3 Setting the Puncture Site	130

13.2.4	Approach Methods of the Lumbar Puncture	130
13.2.5	Saddle Block.	132
13.2.6	Complications of Spinal Anesthesia.	132
13.3	Caudal Block	134
13.3.1	Position of Patient.	134
13.3.2	Puncture Site on the Caudal Block: Identification of the Sacral Hiatus	134
13.4	Epidural Anesthesia	136
13.5	General Anesthesia.	136
	References	137
	Index.	139

1.1 Introduction

Only successfully evolved organisms can survive. This evolutionary theory did not just appear but has also developed itself over time. Therefore, it is important to look back and understand the past theories of the overall treatment of hemorrhoids for our future studies.

Human beings have suffered from hemorrhoids since they have started to walk, and hemorrhoids are described in both Old Testament and Buddhist scriptures. Some known mentioning of this affliction are the existence of doctors treating hemorrhoids in Egyptian palaces in 2500 BC, treatment records of both Edwin Smith Papyrus (1700 BC) and Ebers Papyrus (1500 BC), and treatment records in India, China, Greece, and Rome.

The word “hemorrhoid” came from the ancient Greek word “haema,” blood, and “rhoos,” flow, meaning flow of blood. Hippocrates (460 BC) is assumed to be the first person to use the term “hemorrhoid.” Another word for hemorrhoids is “piles,” derived from the Latin word *pila* (ball), meaning anal swelling (round mass). The term “piles” became generally used since the birth of English doctor John of Arderne (1307 AD), where hemorrhoids were usually called piles. Even now, not much of the hemorrhagic (bleeding) piles but piles with mass are rather called hemorrhoids.

1.1.1 Greece, Rome, the Middle Age, and the Renaissance

Around 460 BC in ancient Greece, Hippocrates has recorded the clinical signs and surgical therapy of hemorrhoids in detail. He seems to have preferred simple ligation of the hemorrhoid in a simple way and also practiced hemorrhoidectomies using an anal retractor that is similar to Eisenhammer’s. He thought that the hemorrhoids are formed in this way when swollen blood vessels are damaged by the excrement passing by; blood vessels are swollen when bile or mucus (phlegm) enters into the vein of the rectum, which heats up the blood.

Celsus (25 BC–4 AD, Rome) has mentioned about several hemorrhoidal surgeries: ligation method and ligation and excision method, as well as the urinary retention after the surgery. Galen (131–201 AD) has introduced a method of ligating 2 h before the surgery, mainly to reduce pain and to prevent the spreading of tissue necrosis in the nineteenth century.

Medieval Europe is an era when the operative procedures were developed by surgical professors. Theodoric (1205–1296 AD), trained at the University of Salerno, insisted the method of healing by primary intention, instead of Galen’s theory.

Lanfrank (died in 1315 AD) of Milan, Italy, became a distinguished professor of French surgical field after moving to Paris and has educated Henry de Mandeville, Guy de Chauliac, and John of Arderne, the best colorectal doctors of their generation. Since then, for about few 100 years, surgical studies have suffered, as barbers started to act as surgeons. However, starting from the Renaissance in the eighteenth centuries, barbers stopped acting as surgeons, and an era for specialist surgeons had returned. Loren Heister (1739) wrote a book called “Chirurgie,” which is one of the earliest surgical textbooks with detailed illustration, including descriptions of the excision and ligation of hemorrhoids. Heister sutured and ligated the bleeding hemorrhoids with a needle and thread excising the lower part.

Around this time, Morgagni also published his varicose vein theory as etiology of hemorrhoids. He believed that the reason human beings suffer from hemorrhoids is because they walk upright, caused by varicose veins. It was an innovative theory as it overturned the hypothesis of Hippocrates concerning the cause of hemorrhoids.

1.1.2 Hemorrhoid Surgery in the Eighteenth Century: An Era of Ligation and Simple Excision

A surgical book written by Jean Louis Petit in 1774 rejected excision which may cause fatal bleeding and anal stenosis and also discouraged ligation which may cause pain and

necrosis. As the lower part of anus is considered a sensitive area, he attempted submucosal hemorrhoidectomy to relieve the severe pain caused by ligation. This technique had not received significant support due to its difficult surgical technique, but it is known as the precursor of submucosal hemorrhoidectomy that is to be discussed in detail later on.

Between the late eighteenth century and the early nineteenth century, Percivall Pott, William Cheselden, and John Hunter actively carried out studies and wrote many papers and books, encouraging other doctors to write about their surgical methods as well. During these days, there was great debate about whether ligation or excision method was better for hemorrhoid. Neither of these methods caused deadly severe complications; however, ligation caused severe pain. The pain seems to be caused by excessive ligation of epithelium of the anus by surgeons of that time. They were not able to distinguish the sensitive epithelium of the anus from the dull mucosa as they considered the dentate line as the border between them.

In 1835, Brodie reported that ligation of internal hemorrhoids causes less pain, but only a minor inflammatory reaction follows because the mucosa is not as sensitive as the anoderm.

To summarize, the mainstream of hemorrhoid surgery from the eighteenth century to the nineteenth century was ligation and simple excision.

1.1.3 Hemorrhoid Surgery in the Nineteenth Century

1.1.3.1 The Beginning of the Excision and Ligation Method

Samuel Cooper supported the excision and ligation method of Petit (the founder of submucosal resection) stating in his book “*A Dictionary of Practical Surgery*” in 1809. At that time, excision and ligation were not generally accepted since it was more time consuming than performing either ligation or excision alone because general anesthesia had not yet been introduced.

In 1828, Frederick Salmon, founder of Saint Mark’s Hospital, recommended anal stretch in his brochure of rectal surgery and revised the excision and ligation technique (no record of Salmon is available, but Allingham, 1988, described his method later). This surgery involves incision of the perianal skin with dissection of the hemorrhoid to the level of the rectal mucosa and the ligation of the hemorrhoidal pedicle.

This method involved less pain as it dissects right above the dentate line and caused only few bleeding problems, but anal stenosis was observed in many cases. Consequently, other additional methods were created to avoid this problem. The most renowned doctors in this era were Smith (1876), Astley Cooper (1887), Goodsall (1900), Miles (1919),

Lockhart Mummery (1923), and Milligan and Morgan (1937).

In 1836, Sir Astley Cooper supported ligation method because three patients died subsequently after the excision surgery; two died from bleeding, and the other died from peritonitis.

Copeland believed that hemorrhoids were caused by the increased pressure in the anus. So he suggested rectal bouginage and also suggested that the excision and ligation method creates complications such as pain, urinary retention, anal stenosis, and tetanus.

Miles carried out low ligation surgery, which was followed by severe pain as the sensitive lower mucosa of the anus was ligated.

1.1.3.2 The Period of the Completion of the Excision and Ligation Method

The modified methods of Salmon’s excision and ligation which were widely performed in the United Kingdom, completed by Milligan and Morgan of Saint Mark’s Hospital, are carried out until now. Milligan and Morgan drew pictures to standardize this procedure so that less experienced surgeons could also follow it. They dissected the upper part of the dentate line to prevent the sensitive lower mucosa from being ligated. They also emphasized leaving a quarter of the mucosa intact, so that the anoderm could be reproduced after hemorrhoidectomy. However, there are still many cases that have shown excessive removal of anoderm.

1.1.4 The Hemorrhoid Surgery in the Twentieth Century

The main surgical techniques for hemorrhoids in the twentieth century are Milligan and Morgan’s excision and ligation and Whitehead’s hemorrhoidectomy and submucosal hemorrhoidectomy.

1.1.4.1 An Era of Whitehead’s Procedure

In 1882, Whitehead suggested a very radical surgery to remove all of the hemorrhoids. This surgery involved transverse incision of the mucosa at the upper anal canal, dissection of submucosal tissues, and suturing squamous epithelium near the dentate line. He tried to leave three vertical lines if possible, to prevent the mucosa from being excised completely (Fig. 7.4). The suture often ruptured when the rectum mucosa was severely tensed, resulting in stricture after secondary healing. Overly excised mucosa causes anal eversion, exposing mucosa outside of the anus to bleed and secrete which becomes “Whitehead’s anus.” Whitehead’s technique was originally to excise mucosa above the dentate line, but since the upper part of anus is so deep and narrow, surgery then involved resection of the lower mucosa, resulting in

“Whitehead’s anus.” Because of these reasons, it was prohibited by the law in England.

However, based on Whitehead’s procedure, various other techniques were devised. One of them was the Fansler method, creating three skin flaps below the dentate line, placing lowest skin flap to be at the anal verge allowing smooth blood circulation, and preserving mucosa of the lower anus. Although this method was superior to Whitehead’s procedure in theory, it was still an extensive procedure, and stricture might occur when the lower skin flap was dragged upward.

Graham-Stewart’s excision of hemorrhoids proximal to the dentate line is the other method. It excises three main hemorrhoids at the upper part of the dentate line but may leave external hemorrhoids or skin behind. Regardless of the flaws of Whitehead’s procedure, it is still widely used nowadays.

A technique invented recently, similar to Whitehead’s, has been spotlighted. This method has been to excise hemorrhoids using Dr. Longo’s circular stapler (PPH). Since hemorrhoids are caused by the prolapse and downward movement of the mucosa and submucosa of the anal canal, Whitehead’s procedure may be still kept as a good surgical method, as long as when only mucosa and submucosa of the upper anal canal are removed and sealed.

1.1.4.2 Submucosal Hemorrhoidectomy

The first trial to remove the hemorrhoids without excising mucosa of the lower anal canal was done by J.C. Petit in 1774. He made a vertical incision at hemorrhoidal pile to dissect the tissue underneath the mucosa creating two flaps. Then, he dissected the submucosal tissue from the underlying internal sphincter and removed the upper pedicle after ligation. Mucosal flaps were returned to its original location and sutured into its place. It is doubted whether the surgery had been done radically on the upper anal canal. Not only was this method considered hard and time consuming to proceed, but it was also during an era where no effective anesthetic methods were present. Copeanal had tried the same procedure himself but stated that it was impossible to carry out, as the surgical techniques involved were too difficult. However, Petit’s theory was innovative. Calman described a similar method in 1941, but it was not accepted.

Based on Petit’s theory, Alan G. Parks from Saint Mark’s Hospital in Britain announced the submucosal hemorrhoidectomy in 1956. The theory itself was fine, but since the surgical technique required was very demanding and time consuming, it was generally not used. Nevertheless, many surgeons in Europe are currently performing this method. Also, 20 % of hemorrhoidectomies carried out in Germany are based on this procedure. Now that the hemorrhoid tissues are found to be normal tissues, not abnormal tissues, it would

be most logical if prolapse of hemorrhoids is prevented, while less hemorrhoid tissues are resected and as much of the mucosa of the anal canal is preserved.

It would also become the most popular operation if the techniques of this procedure are amended so it can be followed easily. I would like to introduce lift-up submucosal hemorrhoidectomy, which is a modified method based on Sir Parks’ procedure, and this book is focused on introducing this procedure.

1.1.5 A Conservative Treatment of Hemorrhoids

Dittel (1923) primally described the rubber band ligation method in the history of conservative treatment for hemorrhoids. Blaisdell (1958) ligated hemorrhoids with a rubber band, using an umbilical cord ligator. Barron (1963) made a hemorrhoidal ligator, making further progress. This ligator is still being used nowadays and is very effective.

1.1.5.1 The Nitric Acid Application Method

Riverius proposed the nitric acid application to hemorrhoids in 1657, and Houston (1843) introduced it again later.

1.1.5.2 Injection Therapy

The first use of an injection as a treatment for hemorrhoids on record was done by J. Morgan in 1869, using an iron sulfate. In addition, a subcutaneous injection was first used with morphine in 1855, about 10 years before Morgan’s in Britain. It was a very new method compared to an intravenous injection in 1862.

Injection methods for the treatment of hemorrhoids similar to Morgan’s, using various different corrosive agents, went into effect in the United States, Japan, and other countries until recently. Although it is an effective method, it may cause serious complications such as infections and stenosis. Thus, despite of various modifications and improvements by practitioners, it is not commonly used now.

On the other hand, in 1926, Albright used sclerosing method of injecting of 5 % of phenol in hemorrhoid pile to cause contraction with fibrosis. Since then, sclerosing agents such as quinine, urethane, chloral hydrate, magnesium, and alum are partly used and achieved some good results. Sclerosing method with phenol-almond oil is valid for bleeding hemorrhoids and is commonly used in the United States and United Kingdom. Recently, a new injection method with ALTA has been being used. ALTA has potassium aluminum sulfate and tannic acid as its main components. It was called OC-108 after changing some substances in Xiaozhiling, which was invented in China, and later it was on sale under the name of “Ziohn” in Japan. In Korea, it is also sold and used with the same trade name.

1.1.5.3 Other Conservative Treatments

Lately, hemorrhoid surgery using ultrasound and laser has been introduced. Dr. Longo from Italy has drawn attention by introducing a procedure using circular stapler in 1997. This surgery is to remove mucosa in the upper anal canal or lower rectum and is especially useful for hemorrhoids with mucosal prolapse. However, for the external hemorrhoids, remnant and sphincter injuries are possible that need further tracking observation. Other than these drawbacks, it is also not applicable for all types of hemorrhoids, and the price of the equipment is expensive.

1.2 The Incidence of Hemorrhoids

The incidence of hemorrhoids differs depending on sociocultural conditions. For example, hemorrhoids are very rare for African natives, but the number of cases increases for Africans or African-Americans who are exposed to Westernized dietary habitus. Hemorrhoids can occur in both sexes of all ages.

According to statistics in the United States, more than a million people a year suffer from hemorrhoids, about 4.4 % of the American population. Furthermore, 50 % of adults who are over the age of 50 have experienced the symptoms of hemorrhoids. Also, there are differences between races, showing more prevalence of Caucasian. In fact, it is hard to investigate the accurate incidence of hemorrhoids, because there are much more cases of self-diagnosed patients than those diagnosed in hospitals. There are also circumstances where patients believe that they have hemorrhoids whenever they have anal problems.

Johanson and Sonnenberg in 1990 said that even though men visit hospitals more often than women mentioning hemorrhoidal symptoms, there is no difference on the actual incidence of hemorrhoids between both sexes. Women may definitely show symptoms of hemorrhoids when they are pregnant, after childbirth, or during menstruation. Although estrogen receptors were found in hemorrhoid tissues, non-hormonal but physical factors, such as an increased pelvic pressure, have a greater effect on the occurrence of

hemorrhoids. Family history is also a contributing factor, but whether hemorrhoids are caused by genetic factors or similar dietary habitus or lifestyle, it lacks confirmation.

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2.1 Anatomy Related to Hemorrhoids

To devise a rational treatment for hemorrhoids, studies on its pathophysiology are necessary. “Why do hemorrhoids occur?” To answer this question, it eventually returns back to focus on the basic anatomical structure. Also, an appreciation of the anorectal anatomy is mandatory for the surgeons in practice.

All of the following important factors in the formation of hemorrhoids are to be focused in this section: Treitz’s muscle, conjoined longitudinal muscle, internal anal sphincter and external anal sphincter, mucosa, and the pelvic floor muscles that play an important role in the formation of prolapsed hemorrhoids.

The anal canal refers to the last portion of the rectum and is about 3–4 cm long. The anal canal is an embryologically complicated organ. It looks like as if two tubes are overlapping, one enclosing the other. The external tube is made up

of the external sphincter and the pelvic floor muscle that is mostly comprised of the levator ani muscle. Since the levator ani muscle is fan shaped, it closes the lacuna of the pelvis near the exit of the rectum.

The external sphincter, innervated by the somatic nerve, is skeletal muscle that comprises the external tube. The internal tube is innervated by the autonomic nervous system and is involuntary visceral origin. It is composed of mucosa, submucosa, internal sphincter, and conjoined longitudinal muscles (Fig. 2.1).

2.1.1 The Anal Mucosa and Anoderm

The upper part of anorectal ring, the rectal mucosa, is covered with single layer of columnar epithelium. This is also called as “goblet cell mucosa,” and it contains shallow glands inside the lamina propria which secrete mucus.

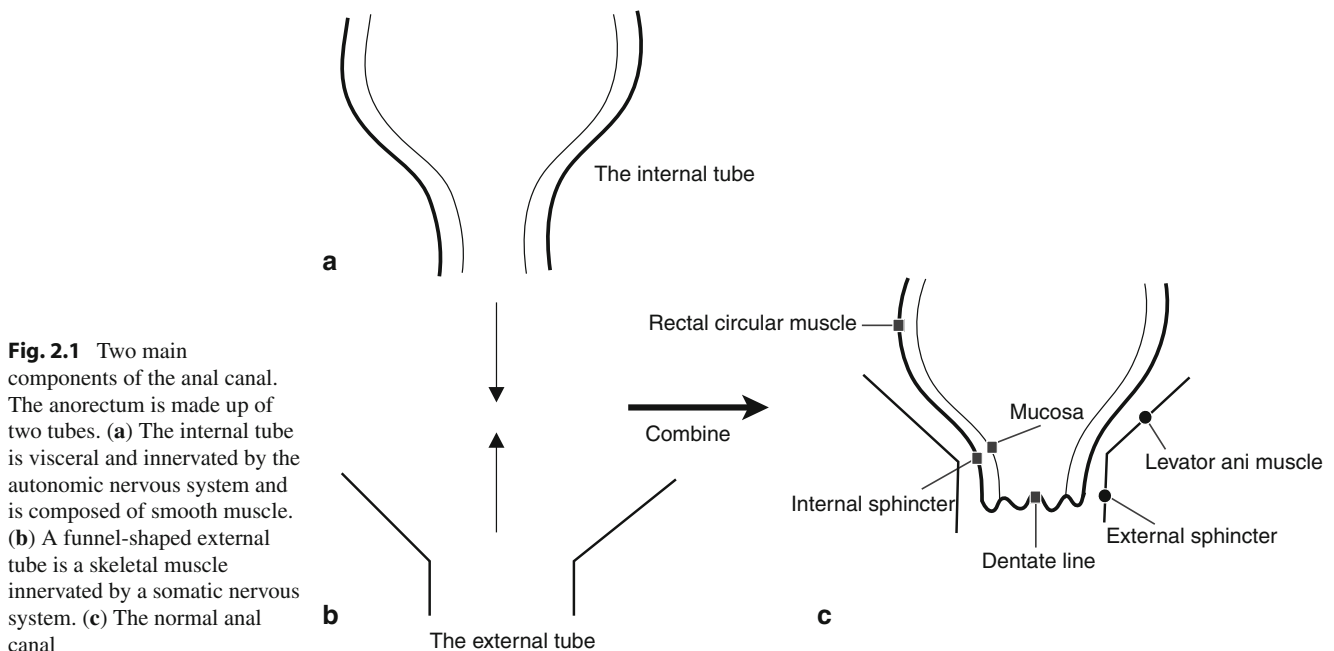
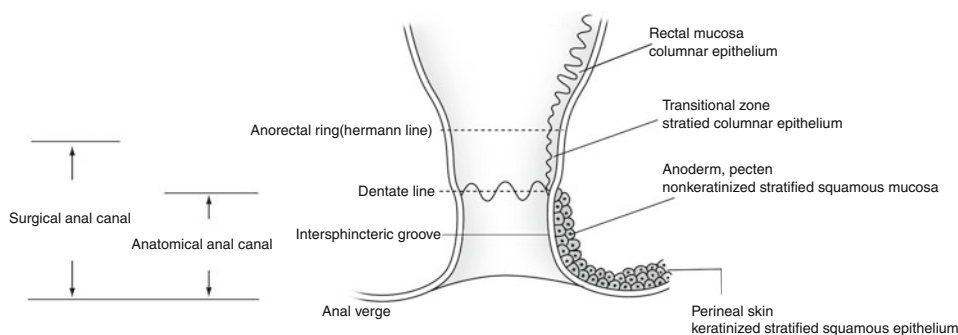


Fig. 2.1 Two main components of the anal canal. The anorectum is made up of two tubes. (a) The internal tube is visceral and innervated by the autonomic nervous system and is composed of smooth muscle. (b) A funnel-shaped external tube is a skeletal muscle innervated by a somatic nervous system. (c) The normal anal canal

Fig. 2.2 Epithelium of the anal canal

If the mucosa would be prolapsed through the anal canal in such conditions as rectal prolapse, prolapsed hemorrhoids, or after Whitehead's operation, it would become "wet anus" that inflamed chronically and secreted mucus excessively. Anal submucosa is similar to the rectal submucosa. It is wide and has mobility from muscular layer underneath, is easily expandable, and contains many blood vessels.

There is a transitional epithelium between the anorectal ring and the dentate line. This transitional epithelium has 8–10 prominences called the "anal column of Morgagni" with a length of 1 cm. It is created when the wider rectum transits to the narrower anal canal. They are comprised of stratified epithelium formed with columnar cells. Based on a study of 113 people using Alcian blue stain, Fenger found that the anal transitional zone is located at the upper part of dentate line and averaged 9 mm in length.

The epithelium from the dentate line to the intersphincteric groove is called "anoderm," or "pectin," and is covered by squamous epithelium. It is similar to skin, but it does not have skin appendages such as hair, sebaceous gland, sweat gland, apocrine gland, and stratum corneum. It is not innervated by the autonomic nervous system but by the lower hemorrhoidal nerve, which belongs to the somatic nervous system. Therefore, it is sensitive to pain, has an important sensory function that is related to anal sphincter function, and causes a reflex contraction of the external sphincter even by weak stimulation. Anal fissures and thrombotic hemorrhoids are often formed here and are very painful. The zone of fusion between the transitional mucosa and squamous mucosa, the dentate line, was also called "mucocutaneous junction," but this is actually an incorrect nomenclature because it is in fact a fusion of two mucosae.

In dentate line, there are anal gland and anal crypt which are intraepithelial dimpling. The distal part of the intersphincteric groove contains hair follicles, sebaceous glands, sweat glands, and apocrine glands and is made up of keratinized stratified squamous epithelium that means a normal skin (Fig. 2.2).

2.1.2 Treitz's Muscle

Treitz had named the smooth muscle, located between the anal mucosa or anoderm and internal anal sphincter, as "Treitz's muscle." Treitz's muscle passes through the internal sphincter and fixes the submucosa tissue (cushion) to the conjoined longitudinal muscle. When hemorrhoids proceed and become prolapsed, Treitz's muscle stretches and splits into pieces, which is irreversible. Therefore, it is the most important muscle in the formation of hemorrhoids.

Treitz's muscle is composed of anal submucosal muscle and mucosal suspensory ligament (Fig. 2.3). In 1982 in Switzerland, Gemsenjäger presented the surgical method about Treitz's muscle-preserving hemorrhoidectomy. Under the ordinary excision and ligation method, the internal sphincter is exposed during operation as shown in Fig. 2.4b. However, Gemsenjäger preserved the Treitz's muscle that is just above the internal sphincter, allowing the internal sphincter not to be exposed during the surgery, and sutured the Treitz's muscle, then followed by stitching the mucosa and anoderm (Fig. 2.4c–e). In short, the hemorrhoids are removed and sutured by leaving the Treitz's muscle superficial to the internal sphincter.

2.1.3 Internal Sphincter

The circular muscle of the rectum becomes thicker gradually after penetrating the pelvic diaphragm and finally becomes the internal sphincter. Lower column descends about 1–1.5 cm distal to the dentate line, the intersphincteric groove. However, it ends proximal to the lower column of the external sphincter (Fig. 2.5).

The internal sphincter is a smooth muscle innervated by autonomic nervous system. Although without voluntary function, it has a role to close the anus by contracting adequately and consistently. The internal sphincter is responsible for 60–80 % of resting anal pressure.

The internal sphincter is white in color, contrasting with the red color of the external sphincter. In the upper anal canal, it is easy to dissect the internal sphincter from submucosa, but it is

Fig. 2.3 Anatomical arrangement of Treitz's muscle (based on Gorsch, Kerremans, and Thomson). (a) Treitz's muscle is composed of anal submucosal muscle and mucosal suspensory ligament. (b) Internal sphincter. (c) Conjoined longitudinal muscle. (d) External sphincter (Reproduced from Gemesnjäger (1982), p. 633)

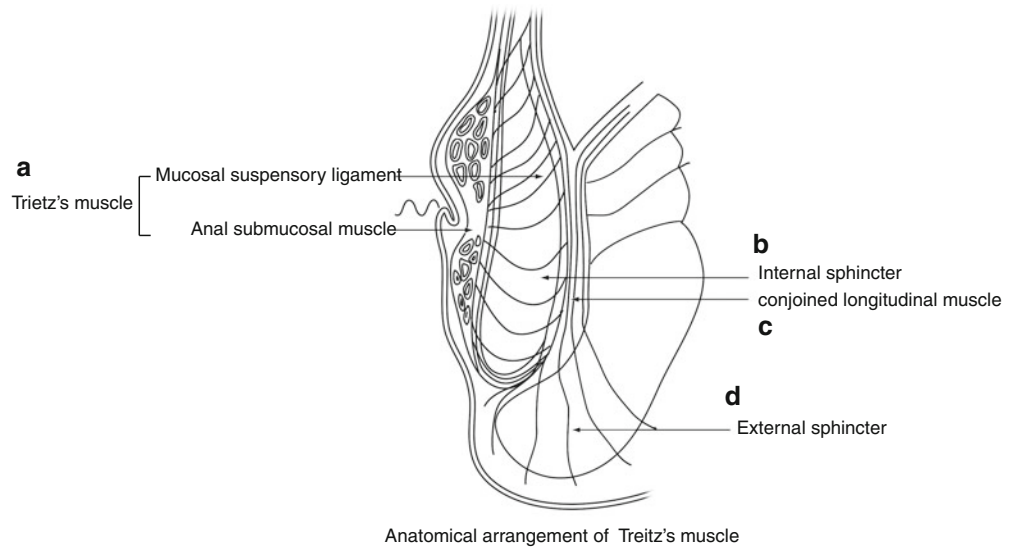
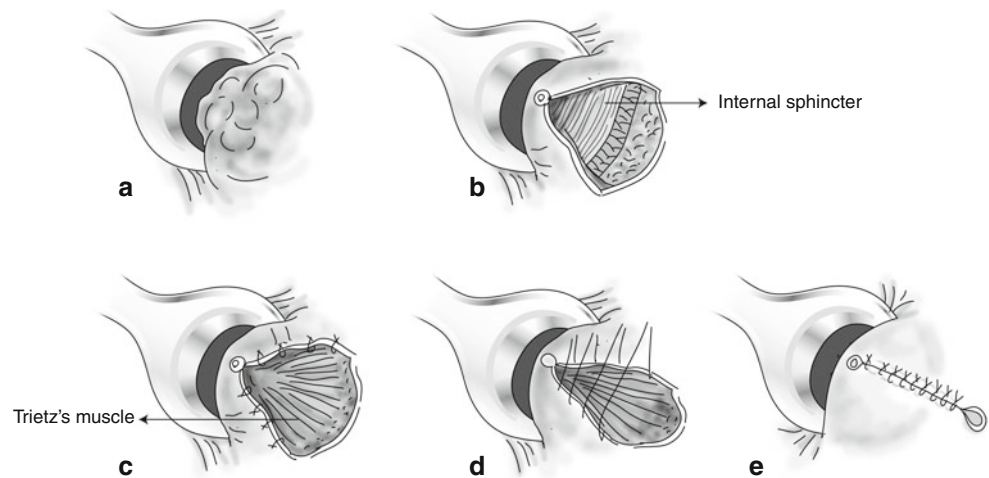


Fig. 2.4 Treitz's muscle-preserving hemorrhoidectomy. (a) The exposure of hemorrhoids. (b) The ordinary excision and ligation method to expose the internal sphincter. (c) Removal of hemorrhoid while keeping the Treitz's muscle attached to the internal sphincter. (d) Suturing Treitz's muscle loosely to narrow down the interval of the wound. (e) Complete closure of the mucosa and a semiclosure of the anoderm (Reproduced from Gemesnjäger (1982), p. 633)



Treitz's muscle preserving hemorrhoidectomy

very difficult in the lower anal canal because the internal sphincter is firmly attached to the underlying connective tissue. So the internal sphincter is prone to be damaged at this point when dissecting the lower part of the hemorrhoids while pulling.

Patients with hemorrhoids show higher anal pressure than normal people, and the activity of the internal sphincter is usually increased. Because of the high pressure in the internal sphincter, blood cannot evacuate through the vein during bowel movements that worsens the symptoms. Then the pressure of the internal sphincter increases even more, aggravating the venous blockage and worsens anal pain. Some specialists insist that the high activity of the internal sphincter is a secondary phenomenon of hemorrhoids.

2.1.4 Conjoined Longitudinal Muscle

The conjoined longitudinal muscle could not receive much attention compared to the internal sphincter, external sphincter, or

levator ani muscle. The anatomical structure of the longitudinal muscle is still controversial and is not completely known. However, the longitudinal muscle is presumed to perform the same role as the bone, as it combines and supports the internal and external sphincter complex. It is also presumed to help evacuation by extroverting the anus, support the hemorrhoid cushion tissue, and prevent the spread of inflammation.

Lastly, it is thought to play the most important role together with Treitz's muscle in the formation of hemorrhoids, and the research about this conjoined longitudinal muscle has been active for a long period of time.

In 1976, Shafik from Cairo University in Egypt claimed that the conjoined longitudinal muscle is composed of three kinds of longitudinal muscle where fascial septa surrounding each of them: medial, intermediate, and lateral. The medial longitudinal muscle is attached to an internal sphincter, the intermediate one is a sequence of puborectalis muscle, and the lateral one is a sequence of a deep external sphincter. These four fasciae are said to form a

Fig. 2.5 The conjoined longitudinal muscle, central tendon, and corrugator cutis ani. The conjoined longitudinal muscle and its fascia form central tendon and are connected to the corrugator cutis ani, playing an important role during defecation

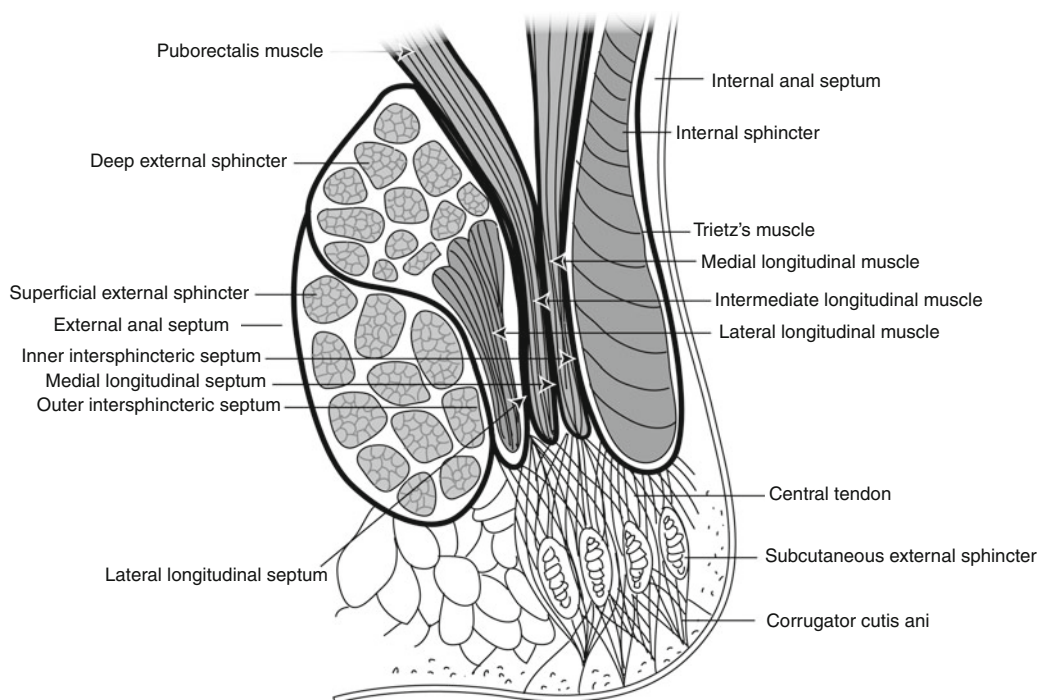
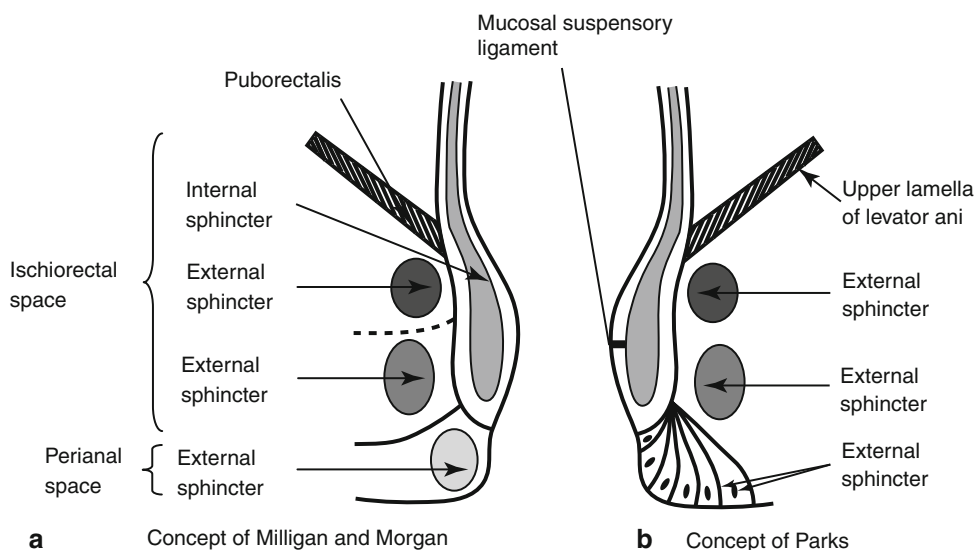


Fig. 2.6 Milligan and Morgan and Parks hold conflicting views about the conjoined longitudinal muscle in the anal canal and the space made by its route. Parks' mucosal suspensory ligament (arrow) makes an additional space (marginal space), which divides it into the submucosal and perianal spaces. (a) Perianal space is connected to ischiorectal fossa. The conjoined longitudinal muscle divides the internal sphincter into three parts as it stretches upward (discontinuous) and downward (continuous). (b) The perianal space is limited to a downward extension of conjoined longitudinal muscle (Reproduced from Lunniss and Phillips (1992), p. 883)



central tendon, gathered at the bottom of the lower conjoined longitudinal muscle. The central tendon is placed between the subcutaneous external sphincter and the conjoined longitudinal muscle and is composed of the corrugator cutis ani muscle through the subcutaneous external sphincter.

Milligan and Morgan said that the conjoined longitudinal muscle arises from the puborectalis muscle at the back and from the deep part of the sphincter at the front. The muscle fibers from the conjoined longitudinal muscle divide the external sphincter into three parts (Fig. 2.6a). The conjoined longitudinal muscle that divides the internal and external sphincters and attaches itself to the

skin of the anus is called the “anal intermuscular septum.”

Parks said that the conjoined longitudinal muscle comes down through the internal sphincter, runs deep, and through the superficial external sphincter, and then penetrates between the fibers of external sphincter. Finally, it is attached to the perianal skin, dividing the subcutaneous external sphincter into a few parts.

Parks also said that there is a mucosal suspensory ligament near the dentate line, which divides the space into marginal space and submucosal space.

Rudinger (1878) and Roux (1881) said that the conjoined longitudinal muscle comes down through the space between

the internal and external sphincters forming an arch. They also said that the muscle fibers from the longitudinal muscle join the submucosal muscle, penetrating sparsely through the internal sphincter (Fig. 2.7). Most specialists think that this theory is correct.

Abel claimed that the longitudinal muscle goes down to two layers, dividing the external sphincter into superficial and deep parts, and surrounds the external sphincter (Fig. 2.8a). Courtney said that the fibers of the longitudinal muscle penetrate and separate the external sphincter throughout its whole length. The fibers that are as thin as a filament penetrate the deep part of the external sphincter, whereas the

thick fibers penetrate the superficial part of the external sphincter (Fig. 2.8b).

There were many scholars who were unable to discover laterally stretched out longitudinal muscle. Many scholars claimed that the subcutaneous external sphincter is anatomically separated from the other external sphincters and the conjoined longitudinal muscle is divided into few pieces after passing through the space between the internal and external sphincters. Conjoined longitudinal muscle penetrates through the fiber of the subcutaneous external sphincter—a distal of an external sphincter—and finally attaches to the skin of the lower anal canal or perianal skin. This was called the “corrugator cutis ani,” which caused a lot of controversies. Milligan and Morgan stated that the anal longitudinal muscle is an anal intermuscular septum, a sequence of the conjoined longitudinal muscle, while Goligher et al. have called it as a sequence of muscularis submucosae ani. Shafik said that it is a terminal structure of intermediate septa that originate from the central ligament. Fowler even said that no such structure exists. Shafik said that these septa divide the ischiorectal fossa into ischiorectal and perianal space.

It seems that the function of the conjoined longitudinal muscle is like a bone, which combines and supports the internal and external sphincters as a complex and fixes the anorectum to the pelvis. Shafik said that even though the conjoined longitudinal muscle has almost no sphincter function to tighten the anus, the most important roles are letting the stool downward during defecation and fixing the anal canal to the pelvic sidewalls which prevents it from prolapsing out of the anus. As shown in Fig. 2.9, the longitudinal muscle contracts during defecation to make the anal canal short, wide, everted, and opened. So Shafik suggested naming the longitudinal muscle as evertor ani muscle.

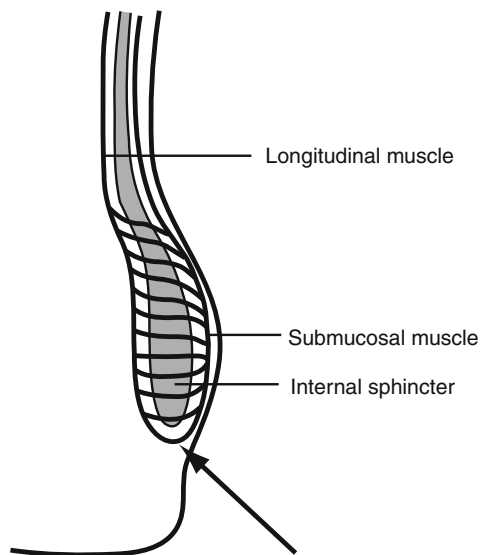


Fig. 2.7 Fibers from the conjoined longitudinal muscle penetrate the internal sphincter and attach to the submucosal smooth muscle (as described by Roux). The fibers (arrow) that wind the distal end of the internal sphincter were named the “anal suspensory ligament” later (Quoted from Lunniiss and Phillips (1992), p. 883)

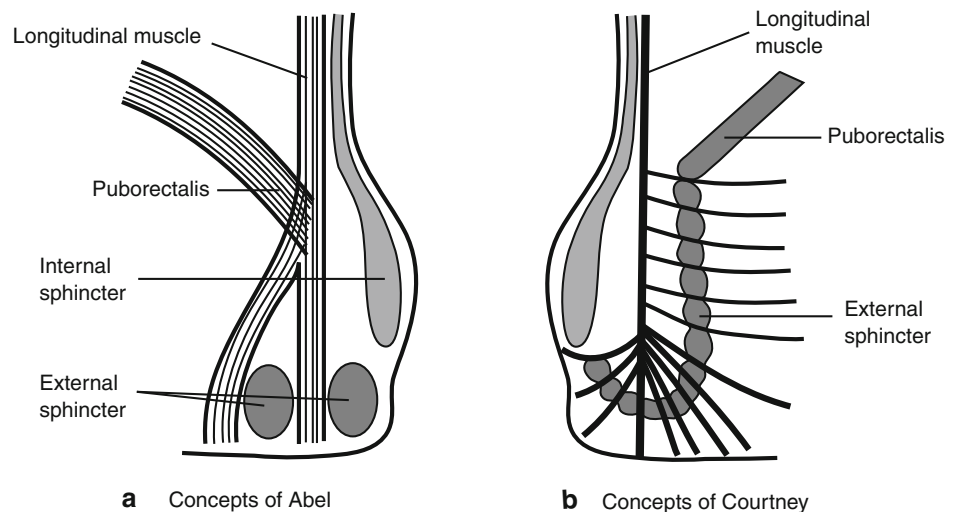


Fig. 2.8 Differences between the connection of the conjoined longitudinal muscle and the external sphincter described by Abel (a) and Courtney (b). (a) The external sphincter is surrounded by the conjoined longitudinal muscle. (b) The conjoined longitudinal muscle goes into the ischiorectal fossa penetrating the external sphincter throughout its whole length (Reproduced from Lunniiss and Phillips (1992), p. 883)

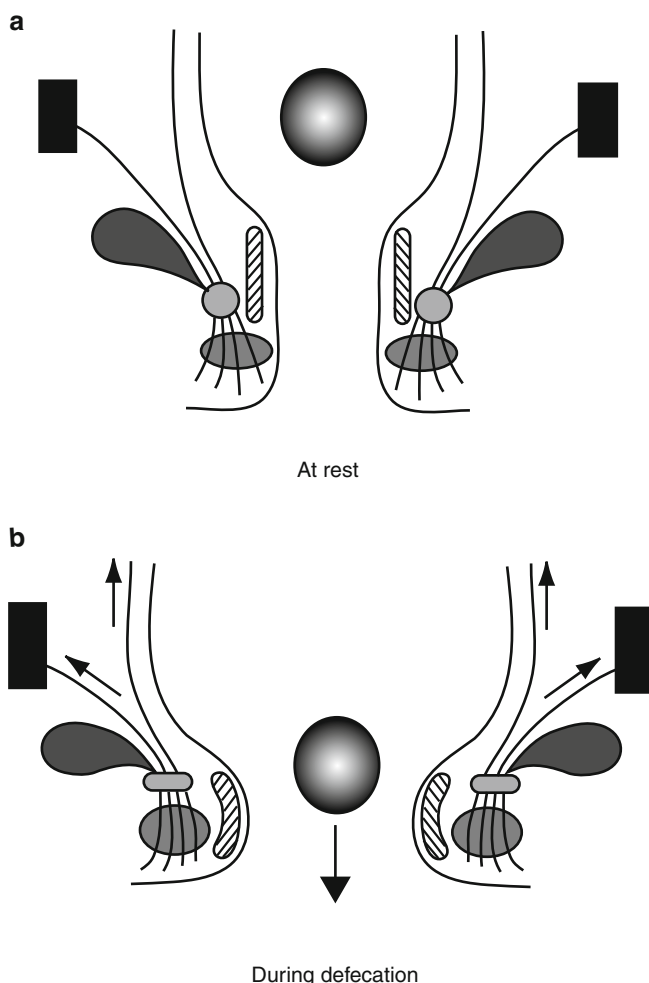


Fig. 2.9 A schematic diagram of the mechanism of the function and fixation of the conjoint longitudinal ligament during defecation. (a) At rest. (b) As the conjoint longitudinal muscle contracts, it shortens and widens the anal canal to extort during defecation. Also, the subcutaneous external sphincter gets wider and moves upward. The anal suspensory ligament fixes the anal canal to the pelvic sidewall during defecation (Reproduced from Shafik (1976), p. 276)

2.1.5 The External Anal Sphincter

The external anal sphincter is a skeletal muscle, surrounding the anal canal from the outside of the internal sphincter and longitudinal muscle, forming 25 % of the resting anal pressure, and plays an important role on defecation by controlling or interrupting. From a purely anatomical viewpoint, the external anal sphincter can be classified into many groups, but in reality, it is a structure of sequence except for the subcutaneous external sphincter. Therefore, there are still many controversies regarding the structure.

The first scholar who divided the external anal sphincter into three parts was Santorini (1715): subcutaneous, superficial, and deep. Von Holl (1897) and Thomson (1899) supported this theory, and Milligan and Morgan also described

the septa that divide it into three parts (Fig. 2.9a). Shafik has added and categorized the puborectalis and deep external sphincter as the upper ring (top loop) because the puborectalis is connected to the external sphincter and has a high sphincteric function. And he categorized the superficial external sphincter as a middle ring and the subcutaneous external sphincter as a lower ring. This triple ring theory is being denied. Some other researchers have categorized it into two groups rather than three. Courtney and Goligher et al. agreed that the muscle fiber of the conjoint longitudinal muscle is separated from the other external sphincters as it penetrates through the subcutaneous external sphincter (Fig. 2.10b). Changryul Oh et al. from New York Mount Sinai Hospital classified the sphincter as deep compartment (together with the deep external sphincter and puborectalis) and superficial compartment (together with superficial and subcutaneous external sphincter) (Figs. 2.10c and 2.11). Because the puborectalis and deep external sphincters are connected, some thought that they were the same muscle, but based on MRI scans and other studies, there are some scholars who currently insist that fibrous septum or groove exists between them.

Milligan and Morgan claimed that only superficial external sphincter was attached to the coccyx. However, according to recent studies, most of the outer muscle fibers of the external sphincter are anococcygeal ligament and are attached to the end or attached to coccyx and natal cleft. Some of the muscle fibers were said to be attached to an ischial tuberosity on the opposite side.

In conclusion, even though there are a lot of controversies over whether to divide the external anal sphincter into three or two, it is thought best to accept the three-part theory (subcutaneous, superficial, and deep) for the time being and reconsider this issue after more research has been carried out in the future.

2.1.6 The Levator Ani and Pelvic Floor Muscles

As hemorrhoids occur when the anal cushion tissues prolapse downward, mild hemorrhoids are caused by the tearing or extension of Treitz's muscle; however, severe prolapse is likely to be caused by the disorder of the conjoint longitudinal muscle or levator ani muscle. It is why investigating the anatomical structures of the levator ani and pelvic floor muscles is necessary in order to understand and treat hemorrhoids, mucosal prolapse, and rectal prolapse. The pelvic floor muscles, which are often called the levator ani, are a pair of muscles that are attached on both sides of the center (perineal body), vagina, anal canal, and anococcygeal plate. Most of them are made up of smooth muscles.

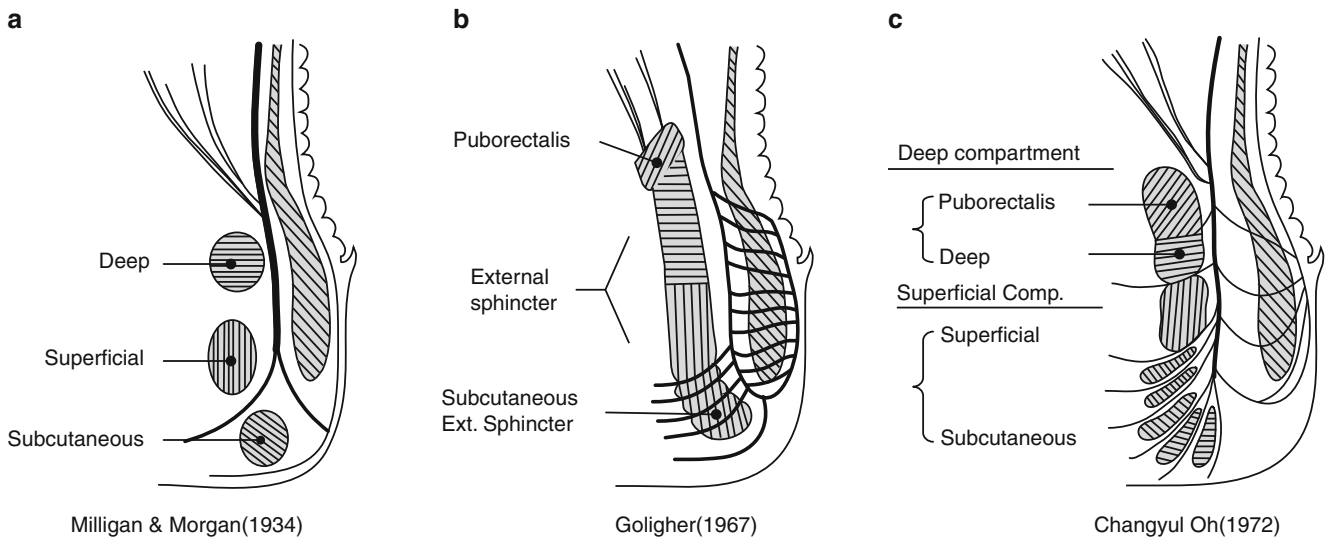
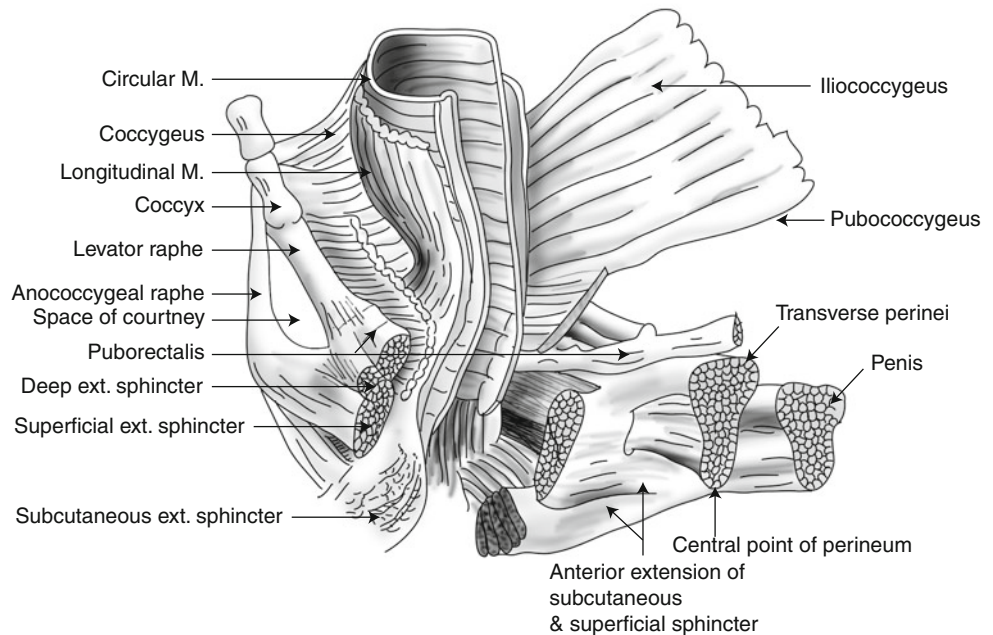


Fig. 2.10 Schematic diagrams of the external anal sphincter by Milligan and Morgan, Goligher, and Changryul Oh. (a) The external anal sphincter described by Milligan and Morgan, divided into three parts (1934). (b) The external anal sphincter described by Goligher, divided into two parts (1967). (c) The external anal sphincter described

by Changryul Oh, divided into a deep compartment and a superficial compartment. The deep compartment is comprised of the puborectalis and deep external anal sphincter, and the superficial compartment is comprised of the superficial and subcutaneous external sphincter (Reproduced from Oh and Kark (1972), p. 718)

Fig. 2.11 An anatomical chart of a man's anus—pelvic muscles. It shows the correlation of the external sphincter, internal sphincter, and the levator ani muscles. The pubococcygeus is joined to the longitudinal muscle of the rectum and is attached to the wall of the rectum (Reproduced from Oh and Kark (1972), p. 719)



The perineal body is a V-shaped fiber muscular bundle placed between the urogenital viscera and the anal canal. And there is anococcygeal raphe of iliococcygeus muscle between the anal canal and the coccyx (Figs. 2.12 and 2.13).

Thomson described the levator ani muscles based on the attached parts of the muscles into three parts: pubococcygeus, iliococcygeus, and ischiococcygeus. Today,

the pubococcygeus is subdivided into the puborectalis and pubococcygeus in detail.

The puborectalis originates from the bottom of the rear pubic symphysis with no attachments in the upper part. This surrounds the recto-anal flexure and forms an anorectal angle by pulling the flexure forward. The puborectalis is located lower than the other levator ani, with no tendinous fibrous raphe unlike the centers of the other levator ani muscles.

Fig. 2.12 The levator ani muscle viewed from pelvis. They can be divided into the ischiococcygeus, iliococcygeus, pubococcygeus, and puborectalis according to their attached site (Reproduced from Keighley and Williams (1999), p. 9)

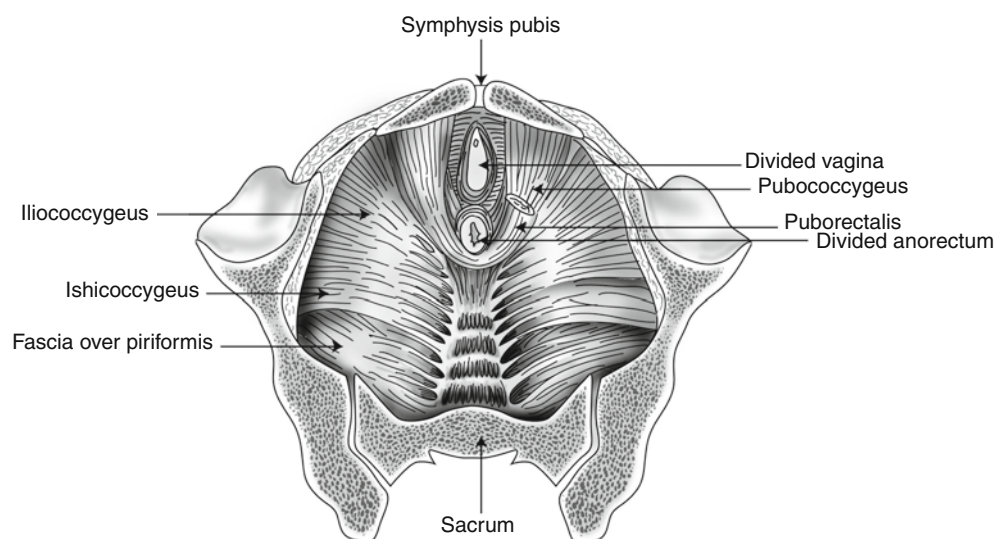
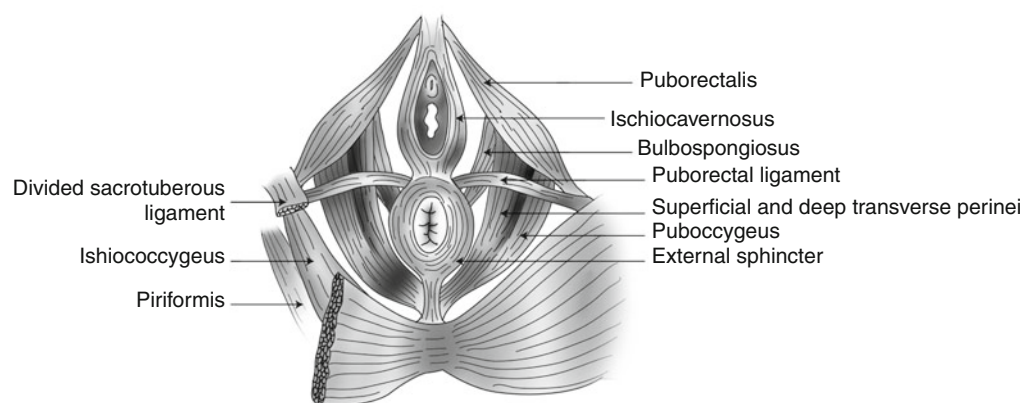


Fig. 2.13 A cross section of the perineum of the levator ani muscles. The arrangement between the ischiococcygeus and the gluteus maximus is similar between the puborectalis and the pubococcygeus (Reproduced from Keighley and Williams (1999), p. 9)



Shafik stated that the puborectalis should not be included in the levator ani but rather included in the anal sphincters. He also asserted that the puborectalis is the sequence of the deep external sphincter and considered it to be a part of the top loop. Shafik's reasons for asserting the puborectalis as sphincters were that it does not have tendon fibers like the other levator ani muscles, and the arrangement of the muscle fibers in the puborectalis is vertical and contractible, while the other levator ani muscles are horizontal.

However, Ayoub and Parks et al. discovered an anatomical cross section that separates the deep external sphincter from puborectalis, which makes purulent disease difficult to spread upward. The pubococcygeus originates from the pubis and the first half of the fascia of the obturator. It is stretched out horizontally and attached to the posterior part of the rectum (positioned in front of the coccyx) and to the anococcygeal raphe.

Shafik stated that the pubococcygeus is a funnel-shaped part composed of horizontal and vertical portion. The horizontal portion is called the "levator plate," and the vertical portion is called the "suspensory sling." The horizontal

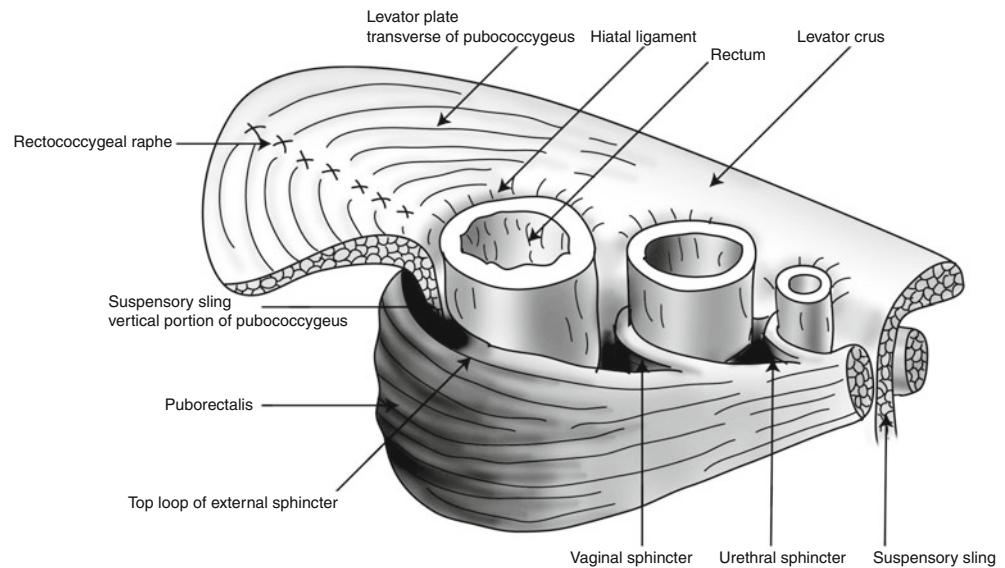
portion of the pubococcygeus forms the floor of the pelvis by extending horizontally, in a shape of an elliptical cone (at the anterior, the levator hiatus is located that the anus, vagina, and urethra pass through, and at the posterior, the puborectal raphe is located).

The iliococcygeus is a thin muscle that originates from the inner side of the sciatic pole and the posterior of the fascia covering the obturator internus. It partially overlaps with the pubococcygeus and is attached to the end of the coccyx and anococcygeal raphe. The ischiococcygeus is a small muscle which is only vestigial in humans. It is located on the surface of the sacrospinous ligament, originating from the end and rear of the sciatic pole, and is attached to the outer side of the upper part of the sacrum and coccyx.

2.1.7 The Levator Ani Tunnel

The levator ani tunnel is a muscular tube that expands from the levator ani hiatus to the perineum, surrounding the organs inside the hiatus such as the anal canal, prostate, vagina, and

Fig. 2.14 The structures below the levator hiatus. A schematic view of an individual sphincter originating from the puborectalis that works as sphincters (Reproduced from Shafik (1987), p. 974)



urethra. The length of the posterior wall of the tunnel is 3–4 cm, which is longer than the anterior wall of 2.5–3 cm. The tunnel is wrapped twice by the suspensory sling internally and the puborectalis muscle externally. The internal cover widens the tunnel to open the anal canal during defecation, and the external cover contracts the tunnel.

2.1.8 The Hiatal Ligament

The horizontal side of the pubococcygeus, the levator plate, is connected to the organs inside the hiatus by a thickened fascia called the lacunar ligament. The lacunar ligament comes from the inner border of the levator plate, widens into a few septa like a fan, and goes into the anal canal, upper bladder, and upper vagina. It also plays an important role in harmonizing the movement between the organs inside the hiatus and the levator plate during voiding and defecation. If the lacunar ligament is weakened, excretion activity will be interrupted, and the organs in the hiatus will be prolapsed (Fig. 2.14).

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3.1 What Are Hemorrhoids?

Since doctors are not fully aware of the cause of hemorrhoids, it is somewhat natural for them to try diverse treatments and surgical procedures. Therefore, the cause of hemorrhoids should be clearly identified to prevent effectively and treat properly.

An accurate understanding of pathophysiology is just as important as surgical method and treatments of hemorrhoids. Until recently, these are the leading theories that have been established: varicose vein theory, vascular hyperplasia theory, anal lining (cushion) sliding theory, and hyperactivity of the internal sphincter theory.

Varicose vein theory asserted that the hemorrhoids were varicose veins originated from the hemorrhoidal venous plexus, on the grounds of observing a tissue mass full of blood vessels at the anal canal. Stelzner et al. proved the arteriovenous communication at the anal submucosa, and they called this tissue “corpus cavernosum recti” and argued that

hemorrhoids were formed by overgrown blood vessels (vascular hyperplasia theory) (Fig. 3.1).

Thomson insisted that hemorrhoids are nothing but a prolapse of the anal mucosal tissue, and it is the most widely accepted theory nowadays. According to Thomson, there is cushion tissue full of blood vessels in the anus. All human beings have this thick submucosa tissue composed of blood vessels, smooth muscle called “Treitz’s muscle,” and elastic connective tissue, and it can be said it’s a synonym for hemorrhoid tissue.

I personally think that hemorrhoids are creases formed during the closure of anal canal, which widens up to a diameter of 4 cm on defecation (anal crease theory) (Fig. 3.2). Since hemorrhoids are tissues full of blood vessels, regardless of whether they are creases or anal cushion tissues, it will be referred as anal cushion tissue from now on.

Since cushion tissue of hemorrhoids is normal tissue, it should be specifically identified as “pathologic hemorrhoids”;

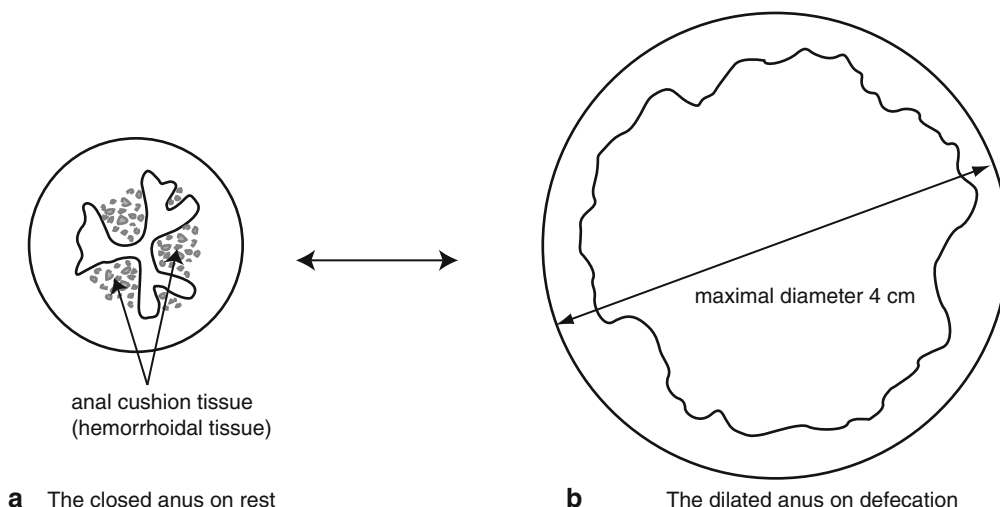


Fig. 3.1 The cushion tissue of the anus. The anus widens during defecation and remains closed usually. The anal cushions seal the anus completely. (a) The closed anus on usual time (b) The dilated anus on defecation

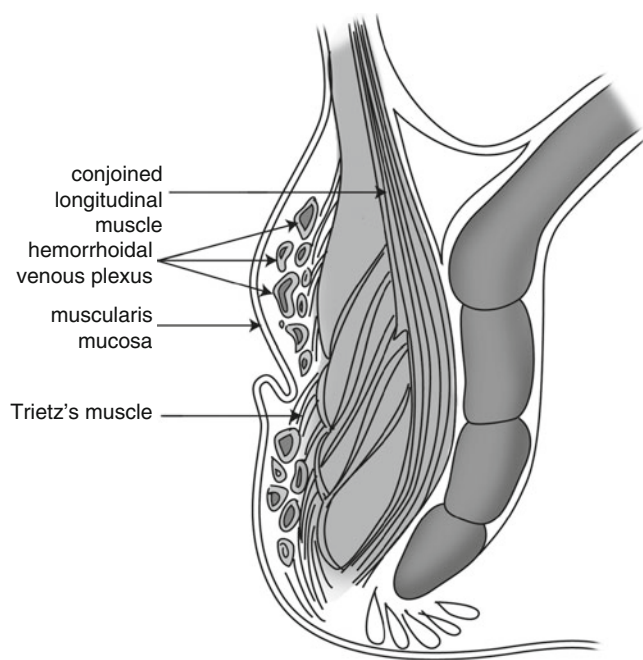


Fig. 3.2 The anal cushion. It is the tissue between the mucosa and internal anal sphincter. It consists of blood vessels, Treitz's elastic fiber derived from the conjoined longitudinal ligament, and collagen connective tissue (Reproduced from Thomson (1975))

however, it will be termed as hemorrhoids in this book to be simple.

Thomson suggested that sliding anal lining theory was correct after reviewing the three main theories concerning the origin of hemorrhoids, varicose vein theory, vascular hyperplasia theory, and sliding anal lining theory. Also, a textbook for colorectal studies published recently has accepted sliding anal lining theory as an established theory as well. The original text is included below. Although the sliding anal lining theory is widely accepted, other theories are partially reasonable.

What Are Hemorrhoids?

New concepts of the pathophysiology of hemorrhoids have been defined during the past 20 years, yet medical educations at the undergraduate and graduate levels have not kept pace with the newer concepts. The traditional concepts are perpetuated in all medical dictionaries and in most textbook of surgery, medical, anatomy, and pathology.

Hemorrhoids are not varicosities, instead they are vascular cushions composed of arteries, venules, and arteriolar-venular communications that slide down prolapse, become congested and enlarged, and bleed. (From Gordon PH and Nivatvongs S. Principles of and practice of surgery for the colon, rectum, and anus, 2nd ed. St. Louis: QMP; 1999. p. 194–5).

3.1.1 The Varicose Vein Theory

Since distended vessels were observed in many cases of anal tissue or excised hemorrhoidal tissues during surgery, the varicose vein theory was considered to be the most important among the pathophysiologies of hemorrhoids during the times of Hippocrates and Galen until recent 30 years. Even though this theory is not accepted nowadays, hemorrhoidal surgeries with excessive excision that are based on this theory are still carried out.

According to this theory, hemorrhoid is considered to be the result of varicose vein with distension and, furthermore, a cluster of widened veins.

John Hunter et al. were able to observe extended veins through resected specimens of hemorrhoids, and they assumed that those veins were pathologic results that are not common within healthy people.

According to this hypothesis, two pathologic changes must be preceded for a varicose vein to occur in the anus. Either the pressure of the vein increases locally to distend and make a varicose vein, or a weak portion on the wall has to be present to make a varicose vein. The former theory was asserted by Morgagni in 1749, who claimed that human beings walk upright, so that the venous pressure increases in the non-valvular portal vein forming varicose vein (hydrostatic pressure). The latter theory was insisted by Quenu and Hartmann in 1895, who believed that the vein becomes distended by repetitive minor trauma from defecation, causing infection each time and thus weakening the venous wall. But studies by Jackson and Roberson in 1965 had not found any evidence of infection on excised hemorrhoid tissues.

This theory cannot be accepted as the cause of hemorrhoids because distended anal veins were also found in all normal persons to keep continence, not pathologic varicose vein but normal structure.

In 1975, Thomson proved that the anal veins were also distended among normal people. It was found that distended vein is filled with blood to take a roll of anal continence (contributes 15 % of anal pressure). The patients with portal hypertension suffering from liver cirrhosis are expected to

have an increased frequency of hemorrhoids as much likely as esophageal varices, but its frequency is similar to normal people.

The varicose vein theory cannot verify the fact that hemorrhoids frequently occur on one side, especially on the right anterior side (11 o'clock). If the varicose vein theory is valid, hemorrhoids should arouse on all sides of the anus, not on just one side. The reason why hemorrhoids develop on one side is because of the disruption of anal connective tissue (Treitz's muscle), protruding anal cushion tissue out of the anal canal.

3.1.2 The Vascular Hyperplasia Theory

This theory, which is still of interest to many doctors in Germany, was first proposed in Europe. It suggests that hemorrhoidal tissues are derived from metaplasia of erectile tissue and are considered to be hemangioma because of its microscopic similarity with true hemangioma. In the nineteenth century, Malgaigne (1859), Velpeau (1826), and Bourguery (1840) thought that hemorrhoids are developed from the metaplasia of erectile tissue. Virchow (1863) and Allingham (1973) considered hemorrhoids to be hemangiomatous in nature because of their structural similarity with cavernous tissue.

Staubesand et al. demonstrated arteriovenous communications in the anal submucosa in 1963 and called the hemorrhoidal tissue as corpus cavernosum recti because of the arteriovenous communication erectile properties. Under the influence of their study, Stelzner at the University of Hamburg in 1963 suggested that hemorrhoids might result from hyperplasia of the corpus cavernosum recti, and in spite of venous blood, hemorrhoidal bleeding is bright red color with arteriovenous anastomosis. He also insisted that bleeding is the symptom that occurs prior to protrusion of hemorrhoids. Thulesius and Gjores checked the oxygen concentration in hemorrhoidal blood to prove arteriovenous anastomosis, and Thomson inserted latex at the superior hemorrhoidal artery to confirm arteriovenous communications. The presence of arteriovenous communications in the anus is now widely accepted.

The idea that hemorrhoidal tissue is corpus cavernosum recti is somewhat similar to Thomson's anal cushion concept. It seems that the distended vein looks like corpus cavernosum. It is known that anal submucosal tissue has the function of congestion of arteriovenous communications as in the penile corpus cavernosum. Unlike the penile structure, however, the hemorrhoidal tissue is not supported with strong fascia. The arteriovenous communication functions to keep continence by rapidly filling with blood after defecation.

But this theory is not supported due to several tissues. First issue is that Thomson had found no differences between excised hemorrhoidal tissue and tissue taken from a normal cadaver, where no vascular hyperplasia was observed. Second issue is that hemorrhoidal bleeding occurs from the dilated capillaries in the lamina propria, not from the venous spaces. Lastly, anal bleeding, which is generally taught to be the first symptom of hemorrhoids, is usually a later symptom and probably secondary to prolapse.

3.1.3 The Theory of Internal Anal Sphincter Hypertonia

This theory suggests that anal pain can be provoked during defecation due to hyperactivity of the internal anal sphincter. With the tension of the internal anal sphincter, pain and venous congestion may be caused. But some investigators insist that the internal anal sphincter can be activated due to the existence of hemorrhoid itself.

In patients with hemorrhoids, the venous pressure was observed abnormally high with direct needle puncture in the anal cushion tissue. This anal pressure became lower after removing the protruded anal cushion. So the increased tone of the internal anal sphincter seems to be a secondary phenomenon rather than the primary cause of hemorrhoids. And the high resting anal pressure could be caused by abnormal engorgement of blood in the anal cushion.

Nevertheless, this theory partially explains the development of hemorrhoids because hemorrhoidal patients generally show an increased anal pressure. Lord et al. treated hemorrhoids mainly by performing anal dilatation under the belief that this theory was correct. But it seems better to use this method as a secondary treatment combined with the main operation for a patient with increased anal pressure rather than as a primary operation itself.

3.1.4 The Sliding Anal Lining (Cushion) Theory

In 1975, Thomson announced that hemorrhoids result from the sliding down of the anal cushion (anal endothelial lining) on the basis of his anatomical studies which is now widely accepted. Thomson first introduced this theory, and Gass, Adams, Hughes, Patey, and Parks have also contributed to the theory.

In 1950, Gass and Adams studied 200 excised hemorrhoidal tissues and found the connective tissue, disrupted into multiple fragments. They concluded that hemorrhoids are derived from the degradation of the supportive tissue of

the anal canal. They also thought that hemorrhoids can develop from the anus with loose and coarse connective tissue degradation. Hughes (1957) and Patey (1972) also support this theory.

Parks classified hemorrhoids into four components. He divided internal hemorrhoids into vascular internal hemorrhoids and mucosal prolapses and external hemorrhoids into vascular external hemorrhoids and skin tags. In vascular internal hemorrhoids, he found that the anal mucosa and dentate line (anal canal) descend downward, and in mucosal prolapses, distal downward of the proximal anal mucosa through the anal canal was found with no evidence of varicose changes. He noticed that the most important abnormality in all cases of internal hemorrhoids was the distal prolapse of the anal mucosa through the anal canal. He said everyone has some degree of physiologic prolapse, though some have consistent prolapse, and others experience prolapse only during straining. It occurs most commonly on the right anterior side of the anus (11 o'clock) and more frequently in women than in men. The relaxation of the pelvic floor muscle may be the main cause of prolapse, and the fibromuscular strand around the dentate line is stretched along with the prolapse. Parks' has been the guide for Thomson's sliding anal lining theory.

In 1975, Thomson studied the anal tissue from 95 cadaveric anorectal specimens and 25 hemorrhoidectomy patients. He concluded that hemorrhoids came from the descent of the anal cushion. The anal cushion functions as the continence mechanism and changes the width of the anal canal. On straining during defecation, with increased venous pressure, the anal cushion is dilated and protrudes out of the anal canal. The Treitz's muscle stretches and disintegrates with the force of repeated straining causing the permanent prolapse of the anal cushion. The anal cushion of right anterior prolapses more frequently than that of the other side, probably because more pressure is applied in this direction during defecation.

Another supportive evidence for the sliding anal lining theory is the decreased sensitivity on electrostimulation and temperature response of the anal canal for hemorrhoid patients. Decreased sensitivity appears most prominently around the mid and distal parts of the anal canal. This is probably because of the distal shift of less sensitive rectal mucosa with the prolapsed anal canal, where decreased sphincter function is followed. But judging from the normal rectal sensory response in a balloon distension test, this change seems to occur only in the anal canal.

3.1.4.1 Anal Cushions

In 1975, Thomson explained the hypertrophy of the anal submucosal layer as being an anal cushion. The tissue

between the anal mucosa and internal sphincter is called a cushion, which comprises vessels, smooth muscle (Treitz's muscle), and elastic and collagen fibers. The cushion is fixed to the internal sphincter and the conjoined longitudinal muscle via collagen connective tissue. The venous plexus is concentrated in the cushion, which is formed in the embryonic stage and contributes to anal closure.

The three main cushions are located at left lateral (3 o'clock), right anterior (11 o'clock), and right posterior (7 o'clock) in the anal canal. Thomson called hemorrhoidal tissue an anal cushion. Therefore, according to Thomson, anal cushion and hemorrhoidal tissue are synonyms. The tissues in the cushion are fixed to the internal sphincter and the conjoined longitudinal muscle with collagen connective tissue and become weak and loose with age. Especially with repeated straining by defecation, the anal cushion becomes engorged and prolapsed, which disrupts Treitz's muscle and eventually anal cushion prolapses.

What Is the Difference Between the Anal Cushion and Hemorrhoids?

The anal cushion is normal tissue which everybody has, but hemorrhoids are an abnormal condition resulting from the descent and prolapse of the anal cushion. Although I agree with the function of the anal cushion, I believe that the anal cushion may in fact be anal wrinkle tissue which opens and closes during defecation.

3.1.4.2 The Function of the Anal Cushion and Its Progression to Hemorrhoids

The function of anal cushion is to ensure continence by closing anal canal after defecation. Anal pressure is formed by the anal cushion and the internal and external anal sphincter. Venous pressure of anal cushion filled with blood constitutes 15–20 % of resting anal pressure. Under low anal pressure on usual time, the anal canal is completely closed by the distended anal cushion filled with blood, whereas under high anal pressure during defecation, the anal canal opens as blood drains away from the anal cushion. This hypothesis explains why mild incontinence occurs frequently after a hemorrhoidectomy (Fig. 3.3).

The anal canal cannot be closed completely only with the internal sphincter nor even with the aid of anal mucosal wrinkle. According to an MRI scan, internal sphincter solely leaves 7–8 mm gap; the anal cushion is necessary for the complete closure of the anal canal.

Another function of the anal cushion is to prevent it from tearing on defecation by cushioning and dilating the anal canal. The anal cushion protrudes physiologically on

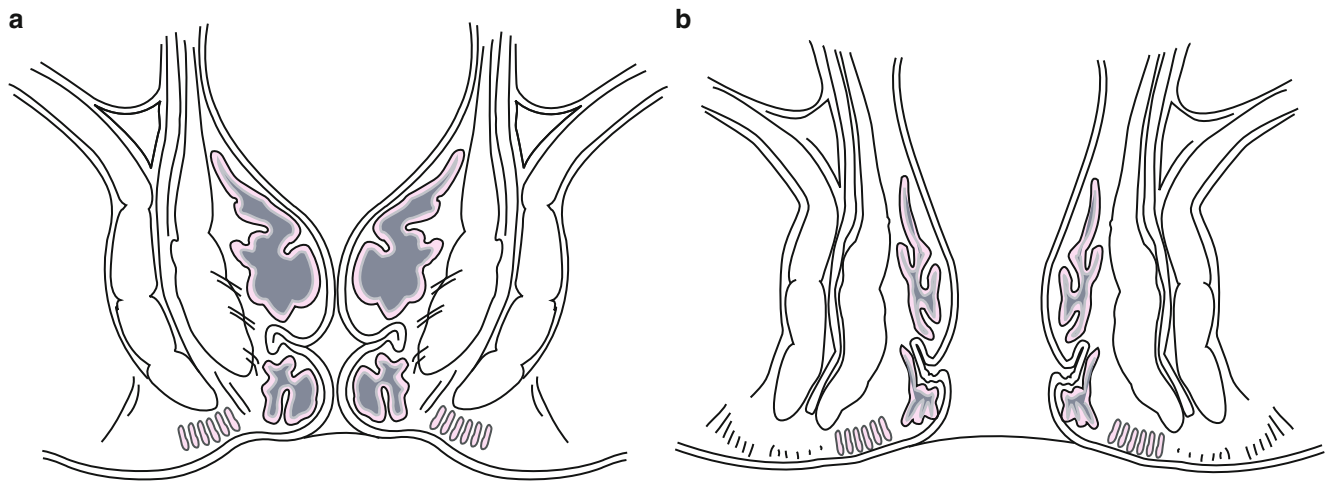


Fig. 3.3 The function of anal cushion. (a) On usual time (resting anal pressure). (b) During defecation (high anal pressure)

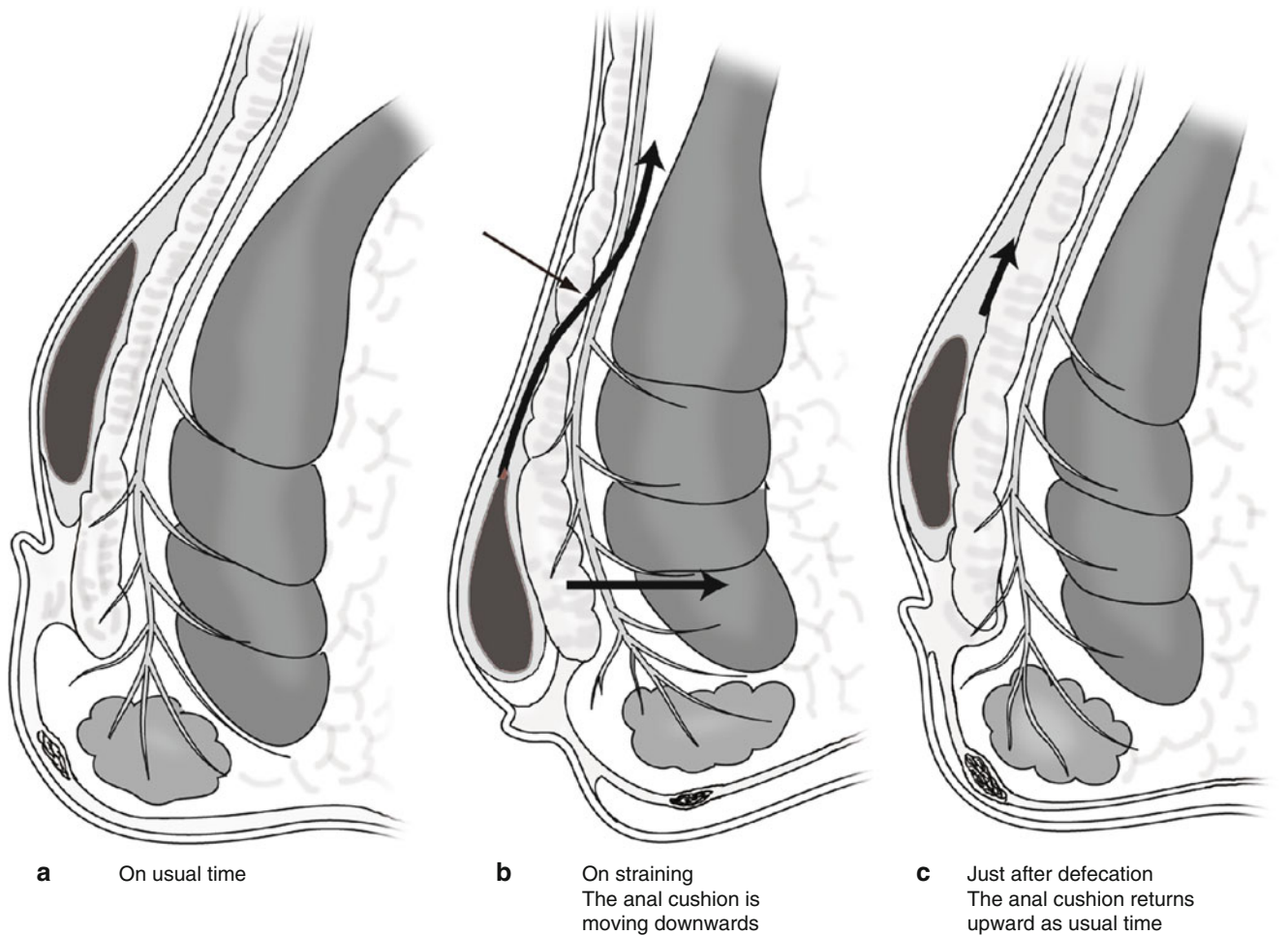


Fig. 3.4 The change of the vascular inner cushion on defecation; the roll of the anus as "lips." The cushion descends downward on straining and returns to its original site after defecation. The anal cushion rolls as the lips of the anus. (a) On usual time. (b) On defecation. The anal

cushion is moving downward. Arrow shows the direction of venous drainage and anal sphincter dilatation during defecation. (c) Just after defecation. Arrow shows the anal cushion returns upward as usual time

Fig. 3.5 Descent of the anal cushion on straining. Hemorrhoids develop when the anal cushion fails to return to its original site. (a) On usual time. (b) On defecation

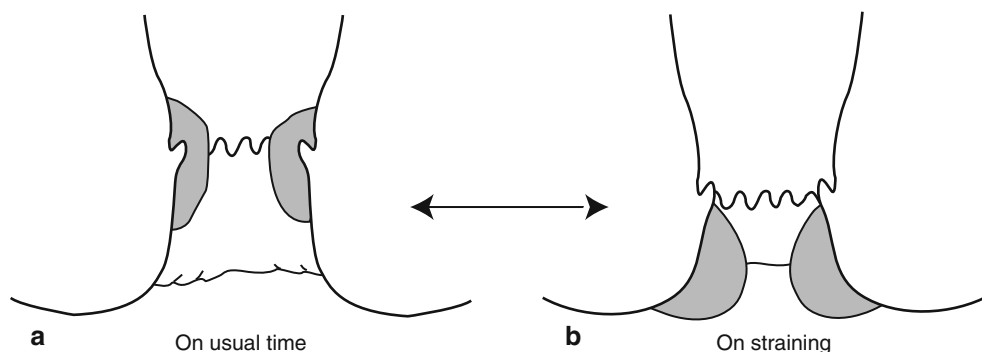
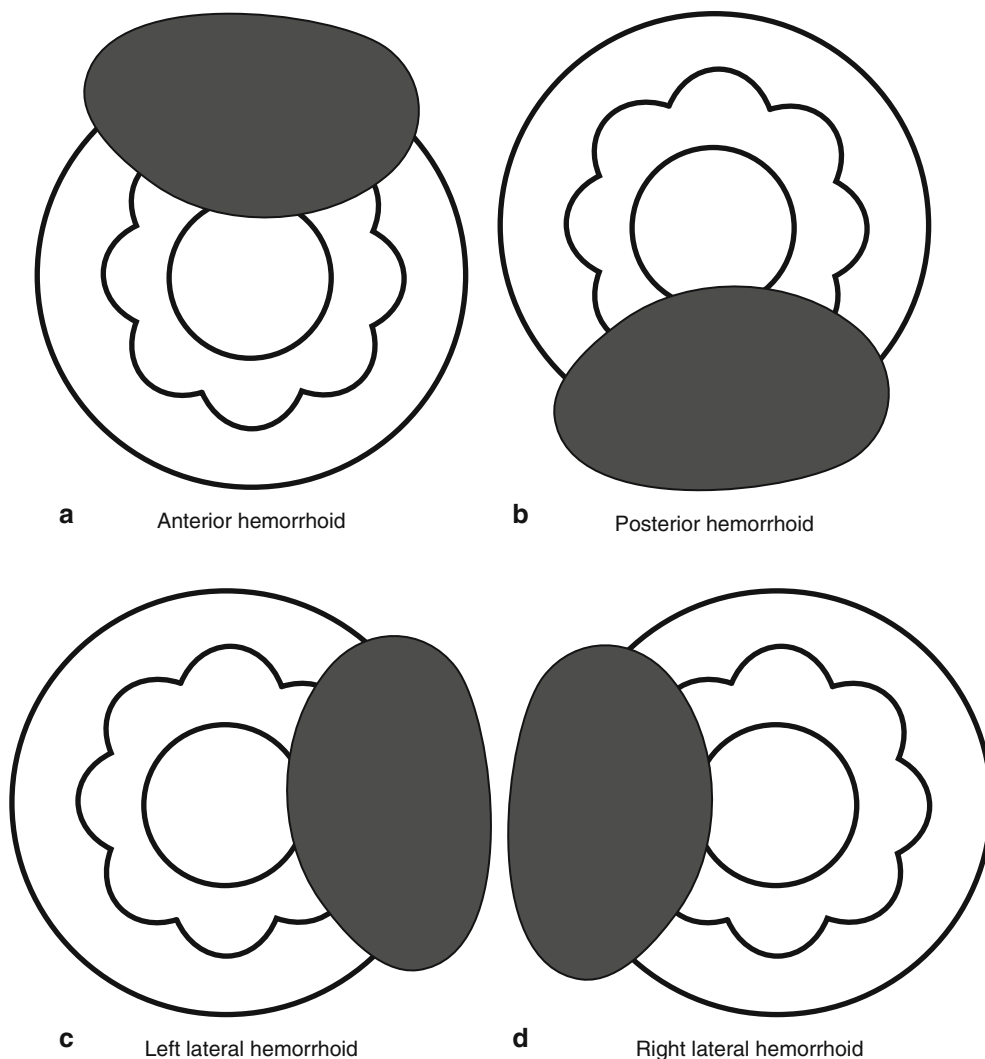


Fig. 3.6 Hemorrhoids only in one direction. The prolapse toward each direction is caused when the supportive anal ligament (Treitz's muscle) is disrupted in each direction. (a) Anterior hemorrhoid. (b) Posterior hemorrhoid. (c) Left lateral hemorrhoid. (d) Right lateral hemorrhoid



straining and returns to its original site after a bowel movement and performs as “the lips of the anus.” When the cushion fails to return to its original site after progressive protrusion, it is called a hemorrhoid (Fig. 3.4).

For easier understanding, refer to the following schematic illustrations (Fig. 3.5).

3.1.4.3 Hemorrhoids Only in One Direction

Although there are circumferential prolapsed hemorrhoids, there are hemorrhoids that develop only in one or two directions: anterior, posterior, left lateral, or right lateral. This prolapse is caused when the supportive anal ligament (Treitz's muscle) is disrupted only in this area (Fig. 3.6).

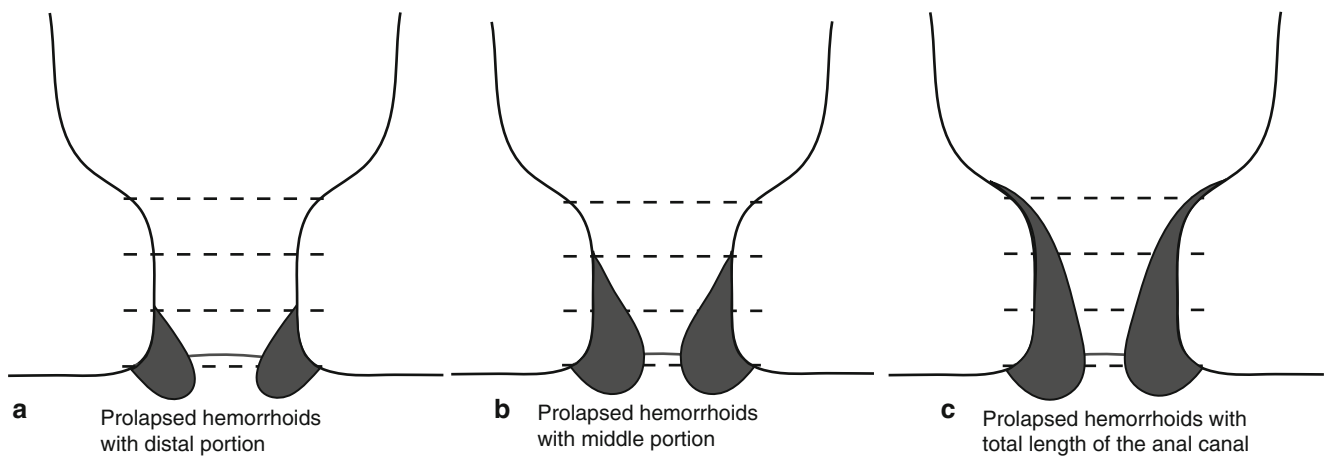


Fig. 3.7 Hemorrhoid formed only in one direction of the longitudinal axis. This also occurs as a result of disintegrated mucosal suspensory ligament (Treitz's muscle) at this site. (a) Prolapsed hemorrhoids with

distal portion. (b) Prolapsed hemorrhoids with middle portion. (c) Prolapsed hemorrhoids with total length of the anal canal

3.1.4.4 Hemorrhoids Which Occur in One Direction Along the Longitudinal Axis (Axis Z)

Although hemorrhoid develops in the proximal, middle, and distal portions of the anal canal along the longitudinal axis, it can also develop from the protrusion of one or two portions of the anal canal (Fig. 3.7).

3.1.4.5 The Mechanism of Anal Cushion Contraction

The mechanism of how the congested anal cushion shrinks and allows the pathway of the stool is not well known until now. Although the anal canal can be dilated passively via firm stool, there may be two active mechanisms involved.

First, when the stool dilates the anal canal, the height of the anal cushion lowers allowing easy defecation. Second, the submucosal smooth muscle (Treitz's muscle), which is derived from the conjoined longitudinal ligament, also makes the anal cushion shrink on defecation. The conjoined longitudinal muscle is especially important in terms of containing both voluntary and involuntary elements. Just as smooth muscle (involuntary) of the esophagus contracts and coordinates with the movement that started from voluntary muscle when swallowing food, the pelvic floor muscle contracts to coordinate rectal and movement of anal smooth muscle on defecation (Fig. 3.8).

3.1.4.6 The Relationship Between Hemorrhoids and Rectal Prolapse

In the past, hemorrhoids and rectal prolapse were originally considered to be different disease entities, so different diagnostic methods were occasionally tested on school examinations.

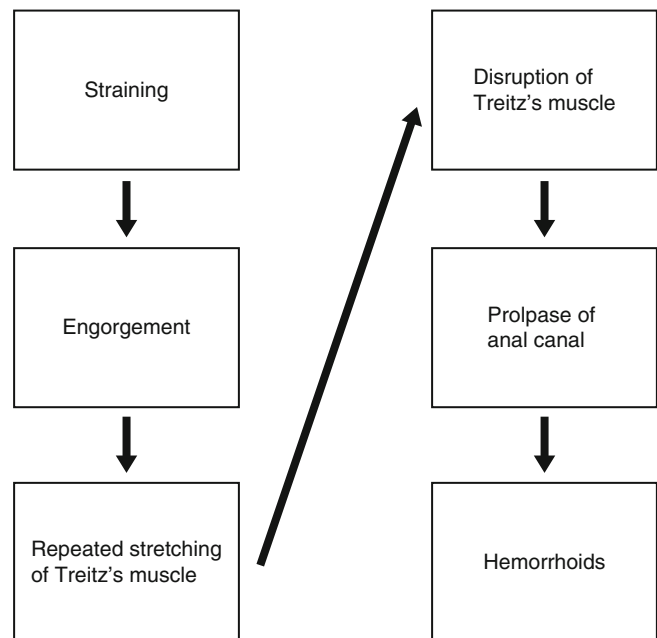


Fig. 3.8 The mechanism of anal canal prolapse

In my opinion, hemorrhoids develop by going through mucosal prolapse (partial rectal prolapse) to rectal prolapse when the mucosal suspensory ligament, levator muscle, and pelvic floor muscle are disintegrated. I'd like to suggest the hypothesis that first- and second-degree hemorrhoids come from the disintegration of the mucosal suspensory ligament, third- and fourth-degree hemorrhoids come from the relaxation of the conjoined longitudinal ligament, mucosal prolapse comes from the elongation of the lower level of the levator ani muscle, and rectal prolapse comes from the relaxation of the pelvic floor muscles (Figs. 3.9, 3.10, and 3.11).

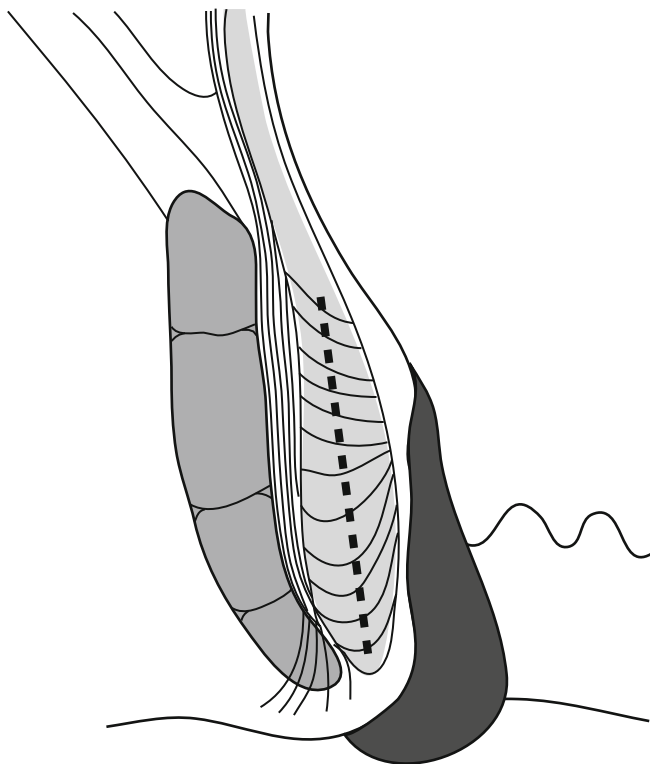


Fig. 3.9 Hemorrhoids with disintegration of the suspensory ligament only (in my opinion). *Dotted lines* show distegration portion

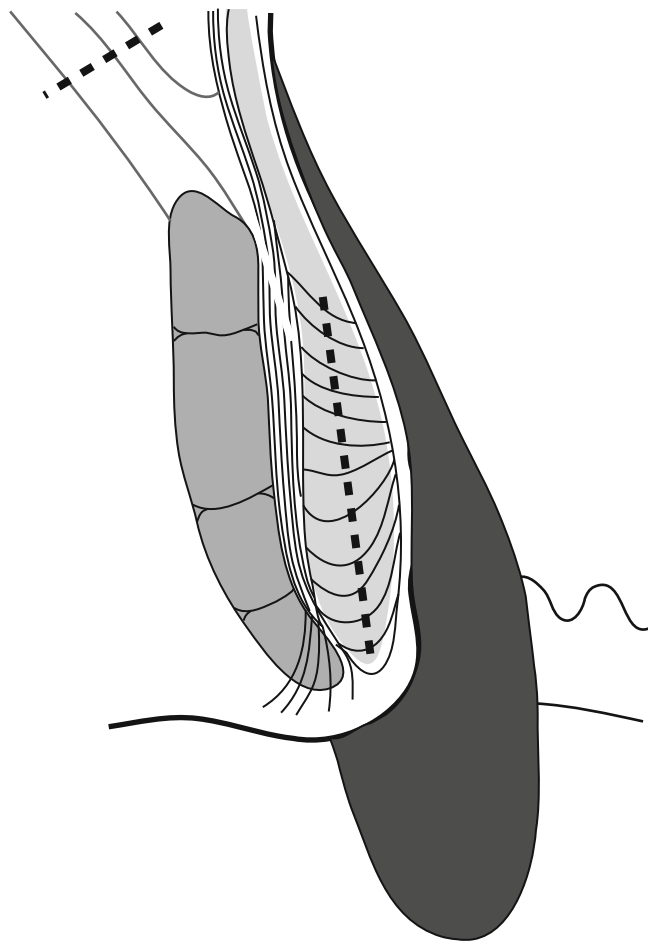


Fig. 3.11 Rectal prolapse with the disintegration of the pelvic floor muscle (in my opinion). *Dotted lines* show distegration portion

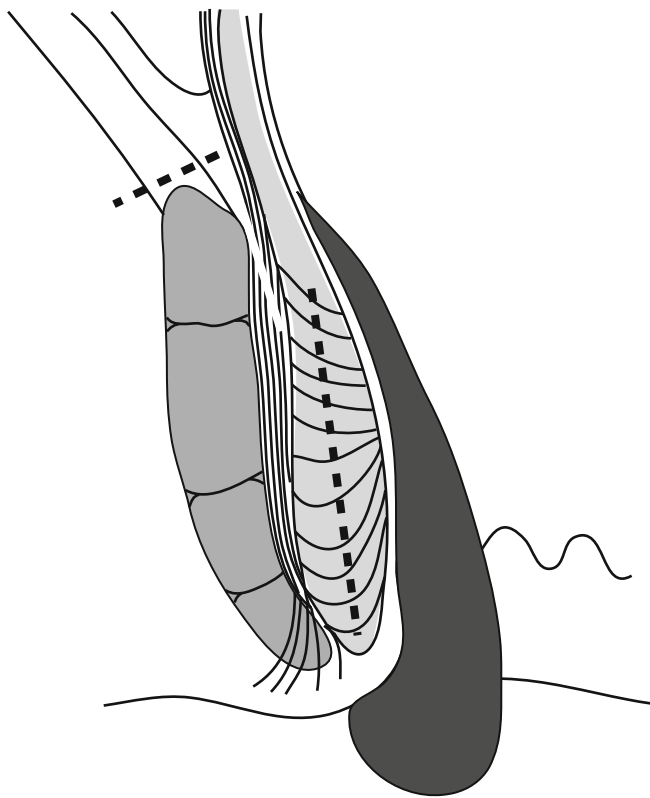


Fig. 3.10 Mucosal prolapse (partial rectal prolapse) with disintegration of the conjoint longitudinal ligament and the lower part of the levator ani muscle (in my opinion). *Dotted lines* show distegration portion

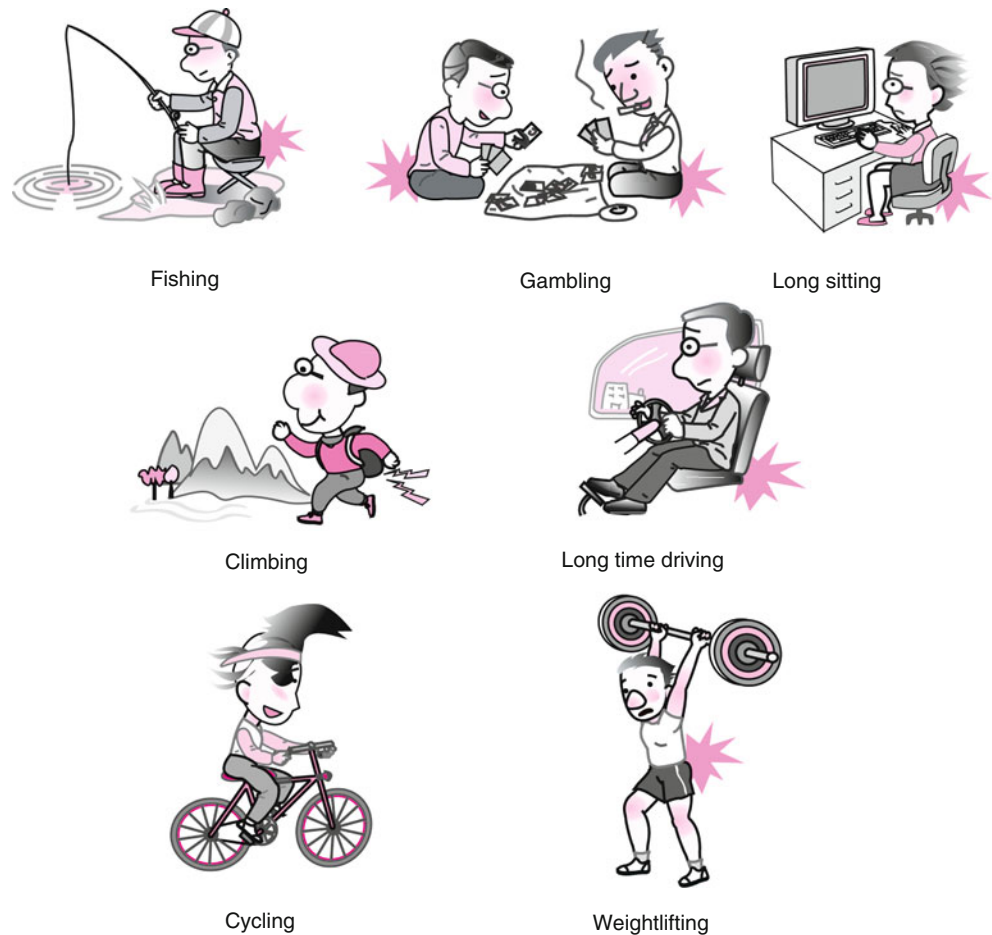
3.2 The Causes of Hemorrhoids

Hemorrhoids are caused by the disruption of the mucosal suspensory ligament (Treitz's muscle) and relaxation of the pelvic floor muscle. The anal cushion protrudes out of the anal canal by repetitive straining, resulting in disintegration of the ligament. Furthermore, the relaxation of the pelvic floor muscle aggravates hemorrhoids. When the sliding anal lining theory is considered as the pathogenesis of hemorrhoids, the causative factors can be easily surmised, and this can be helpful in the prevention of hemorrhoids.

3.2.1 Defecation with Prolonged Straining

Everyone's anal cushion descends on defecation. When the posture for defecation is held for a long time, the mucosal suspensory ligament relaxes and does not return to its original site even after bowel movement. So defecation should be completed in a short time, within 3 min, if possible. For

Fig. 3.12 Sports and leisure activities causing hemorrhoids



easier defecation, it is better to use the gastrocolic reflex after breakfast, rather than before breakfast.

3.2.2 Constipation with a Low-Fiber Diet

With constipation or a low-fiber diet, hemorrhoids will develop as a result of prolonged straining. Hemorrhoids occur more frequently among Westerners than Africans and more in the higher socioeconomic classes because they consume more meat and less fiber. During defecation, reading a newspaper or books which prolongs defecation time is also not recommended.

3.2.3 Diarrhea

Diarrhea also is apt to descend of anal cushion resulting in prolapse, because the frequency of bowel movement increases.

3.2.4 Hereditary

With high anal tension, more straining is needed on defecation, and hemorrhoids are more likely to occur. With a lax

anus, the anal cushion is also more likely to prolapse. Failure of the mucosal suspensory ligament to return after relaxation causes hemorrhoids to prolapse easily. These can be hereditary factors contributing to the development of hemorrhoids.

3.2.5 Pregnancy

During pregnancy with abdominal distension and backward posture of the buttocks, abdominal pressure increases and hemorrhoids can prolapse easily. Furthermore, the enlarged uterus tends to compress the vena cava, which disturbs venous circulation to cause the engorgement and aggravate hemorrhoids.

3.2.6 Sports and Leisure Activities Causing Hemorrhoids

Adequate physical activity is helpful in preventing hemorrhoids as it enhances physical strength and improves blood circulation. But the following activities can aggravate hemorrhoidal prolapse: golf, cycling, horse riding, climbing, weight lifting, being the catcher in baseball, wrestling, fishing, card playing, driving, sitting for a long period of time, and alcohol drinking (Fig. 3.12).

Table 3.1 Factors influencing the development of hemorrhoids

Straining on defecation	Defecating for long time
Constipation	Diarrhea
Pregnancy	Some sports and leisure activities
Occupation	Low-fiber diet
Hereditary	Psychological problems
Anatomical features	Age
Others: infection, endocrine change	

3.2.7 Occupation

Hemorrhoids are frequent for those who sit for a long period of time while working, such as drivers, or those who work in a squatting position.

3.2.8 Psychological Problems and Spinal Paralysis

The frequency of hemorrhoids is also high in those with psychological problems or spinal paralysis (Table 3.1).

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In the past, many people did not know which department of the hospital to go for anal disease treatment. With the recent increase of coloanal diseases, such as colon cancer and hemorrhoids, clinics and hospitals specializing in this field have increased as well. However, patients are still hesitant of visiting hospital for a coloanal examination because they feel ashamed. Because of this behavior of patients, it is imperative that doctors try to reduce the fear and degradation of the patients during an anal examination and try to conduct examinations in a gentle manner.

Because a rough examination or a treatment that causes pain tends to create antipathy for patients, painless medical service must be provided as far as possible. For the patients with anal pain, careful care like applying anesthetic ointment around the anus is necessary prior to an examination. The doctor's office should also be different from other ordinary clinic, and as in an obstetrics and gynecology unit, there should be a separate space for patient to change their clothes. The doctor should leave the patient while they are changing clothes for the examination, and the rest of the patient's body, which do not need to be examined, should be covered with towels for the patient's comfort (Fig. 4.1).

Although the process of diagnosing hemorrhoids is considered to be easy, detailed interview is needed to cover for the possibility of combined diseases such as colon cancer or inflammatory bowel disease. If some suspicious symptoms such as anal bleeding are noticed, further work-up like colonoscopy, barium enema, or blood tests should be recommended.

During the examination, it is essential to quickly figure out the patient's needs by asking questions like "What kind of treatment does the patient need?" or "What is the cause of the patient's pain?" and perform the necessary procedure based on the diagnosis.

The diagnosis and treatment of an anal disease are usually decided during the first visit to the clinic. After the examination, the doctor should try to give the patient precise

information about the suspected disease and possible ways of treatment by using pictures or figures. Anus is an important part of the body. Once a problem starts to arise, patients will suffer for their entire lives. It is for this reason that a proctologist should treat patients with sufficient knowledge of the anatomy and physiology of the anus while remaining vigilant for the patient's well-being.



Fig. 4.1 In Yang Hospital, a small curtain is placed on the patient's waist to reduce the embarrassment of the patient during an anal examination

4.1 Diagnostic Sequences for Hemorrhoids (Anus)

As the diagnostic procedure of proctology is a little different from other departments, the arrangement of the doctor's office and treatment system is also a little different. Generally, when patients first visit the clinic, a nurse asks them to fill in a questionnaire about their symptoms. The diagnosis and treatment plan for the patient's condition will be decided after the doctor's physical examination and some tests:

1. Fill in a questionnaire form about symptoms with the help of an experienced nurse in the preliminary medical room.
2. After entering the doctor's office, a nurse explains and helps the patient to adopt the examination posture.
3. The nurse covers other exposed parts of the body with a blanket for the patient's comfort.
4. The doctor examines the anus. Simple tests, such as anoscopy or sigmoidoscopy can be done instantly.
5. After the examination, the doctor will explain further necessary tests or treatment methods for the patient's condition. The use of pictures or figures will help making the explanation process more understandable for the patient.
6. Outlines of surgery or hospitalization may also be explained, if necessary (Fig. 4.2; Tables 4.1, 4.2, and 4.3).

[Checkup sequence for a new patients]

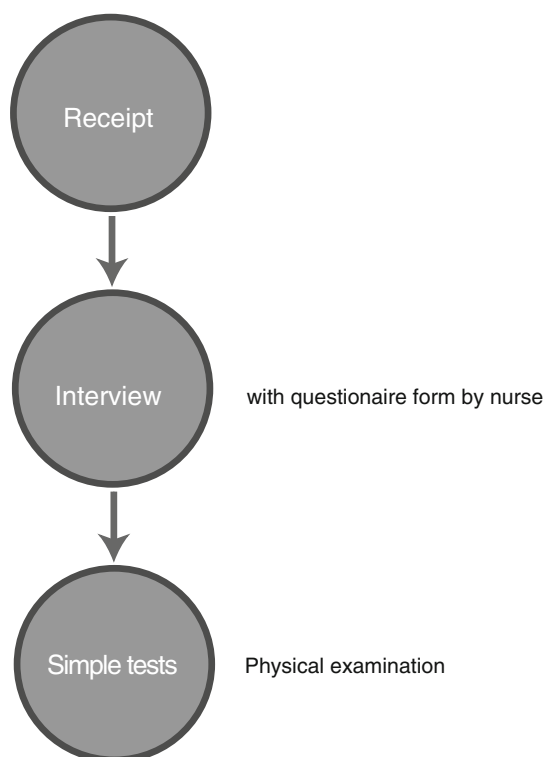


Fig. 4.2 Diagnostic sequences for hemorrhoids

4.2 The Posture for Examination

The left lateral lithotomy or knee-chest position is most widely used for anal examination. The best position for examination is a posture which is more convenient for doctors and less embarrassing for patients.

4.2.1 Left Lateral Position (Sims' Position)

The left lateral position is most widely used, and over 70 % of proctologists prefer this position. As shown in Fig. 4.3, while holding left lateral posture, the hip (buttocks) and knee joints are flexed fully to force the buttocks to protrude backward. When the right side of the hip joint flexes a little more than the left side and the right buttock makes slope about 120°, it is easier to examine or treat the anus. Placing a pillow under the buttocks is also convenient for the examination.

4.2.1.1 Advantages of the Left Lateral Position

- Patients feel comfortable. That is, it is easy to take and maintain this position.
- Patients feel less shameful. It is the most preferable position especially for female patients.
- This position is easy for elderly patients to take.
- Doctor can have a conversation with the patient without difficulties.
- It is convenient for the nurse or guardian to stay at the bedside with the patient.
- The examination tools can be placed nearby.

4.2.1.2 Disadvantages of the Left Lateral Position

- Inspection is only possible by pulling both sides of the buttocks outward to separate them apart. This position is especially difficult for the case of obese patients.
- Straightening of the rectosigmoid angle is difficult.

4.2.2 Lithotomy Position

Many doctors in Japan prefer the left lateral position for female patients and the lithotomy position for male patients. For this position, patients lie on their back with a pillow underneath their head and waist. Both hands pull the knee joints as shown in Fig. 4.4. When performing a digital rectal examination, there is no difference between both positions (left lateral and lithotomy). But for rectoscopic examination, the lithotomy position is more convenient than the left lateral position. Towels or underwear with a hole can be used to prevent female patients from feeling humiliated.

Table 4.1 A form of questionnaire for anal disease

Questionnaire for anal disease			
Name	Sex (M F)		
Age	Marital status (Married Unmarried)	date	month year
1. Bleeding			
1. Yes (from when:) 2. No			
Amount	1. stained toilet paper	2. dripping	3. shooting
Color	1. fresh red	2. dark red	
Condition	1. before defecation	2. mixed with stool	3. after defecation 4. no relation with defecation
2. Prolapse			
1. Yes (from when:) 2. No			
Degree	1. circumferential of anus	2. part of anal circumference	
When	1. on defecation	2. on squatting	3. always
Reduction	1. spontaneously	2. manually	3. not reducible
3. Pain			
1. Yes (from when:) 2. No			
When	1. on defecation	2. after defecation	3. always
Location	1. around the anus	2. inside the anus	
Degree	1. slight	2. severe	
4. Itching sensation 1. Yes (from when:) 2. No			
5. Anal mass 1. Yes (from when:) 2. No			
6. Discharge 1. Yes (from when:) 2. No			
7. Incontinence 1. Yes (from when:) 2. No\			
Nature 1. gas 2. loose stool 3. solid stool			
8. Defecation			
Frequency ()	times/day		
Duration ()	minutes		
Tenesmus	1. Yes	2. No	
1. normal 2. constipation 3. diarrhea 4. alternatively			
9. Abd. pain			
1. Yes 2. No			
From when			
Location			
Degree			
10. History of coloanal disease and treatment			
Diagnosis			
When			
Where			
11. Other current disease			
Hypertension () DM () Liver disease ()			
Heart disease () Tb () Renal disease ()			
Hemophilia () Anemia () Venereal disease ()			
Thyroid disease () Gynecological disease ()			
Urological disease () Stomach and intestinal disease ()			
Asthma () Others ()			
12. Adverse drug effect 1. Yes (name of drug:) 2. No			
13. Back pain 1. Yes (diagnosis:) 2. No			
14. Condition of hemostasis on usual time			
1. good 2. hard			
15. Pregnancy (yes, no) time of delivery ()			
16. Alcohol () Smoking ()			
17. Family history of coloanal disease			
1. Yes (who:) 2. No			
18. Family history of cancer			
1. Yes (who: diagnosis:) 2. No			
19. Occupation			
20. Desired treatment			
1. medication			
2. operation, if needed			
3. operation as soon as possible			
4. desired date of operation (month, early, middle, last)			
5. want colonoscopy? (yes, no)			
21. Motives for visiting			
1. introduction of an acquaintance			
2. advertisement from newspaper, magazine, internet, wildposter etc			
3. close to house			
4. introduction from other hospital's doctor			
5. others ()			

Table 4.2 Manuals for day surgery

Mr./Ms. _____

Please visit this clinic ____: ____ (AM/PM), date/month/year for day surgery.

<Preparation before operation>

1. Take a bath the day before surgery.
2. On the appointed day, have regular breakfast as usual but a light meal for lunch.
3. After breakfast, use two suppositories and go to toilet after 20 minutes.
4. Have everyday medicine as usual, if any (esp. for hypertension, etc).

<Notes after surgery>

The returning home will be at least 6 PM, but depends on the recovery time from the anesthesia. A driving is not allowed and a guardian should be accompanied.

After returning home, lie down and rest instantly without doing anything. Don't worry about voiding difficulties for several hours which is due to the pain or anesthesia. Please contact with us if there were no voiding after 5-6 hours after your returning home.

- Depending on your symptom, have a rest for () days at home.
- The toilet is allowed whenever you want after operation. If pain is concerned, have analgesics 20-30 minutes before toilet. Keep the anus clean with warm water or clean material after defecation and protect the wound with gauze. Blood mixed discharge may be found from the wound for about 2-3 weeks according to the kind and degree of the operation. It will be improved gradually, and need not worry. Please let us know at the next visit if you had firm stool.
- Have the prescribed medicines after a meal. Use suppositories from next morning, which make the wound heal soon.
- Taking a bath is allowed from the following day, within 10 minutes.
- Please abstain from any strenuous exercise. According to the condition, keep off the cycling or other kinds of sports at least for 2 weeks.
- Meals as usual are allowed except strong-tasting foods or alcohol until symptom improvement.

<When faced with a problem>

- Bleeding: Need not worry about the small amount of blood which is tinged with gauze or shown on defecation. But, with spurting blood, apply strong pressure with 4-5 gauzes. If bleeding persists, call us instantly. Sometimes you need to visit hospital and check the wound immediately.
- Pain: The pain will be improved gradually. It usually disappears within 3 weeks even with serious degree of hemorrhoids. Take analgesics with severe pain. Have one more capsule when the pain persists after analgesics. (the maximum 4-6 tabs/day is allowed)

* Please purchase clean material, gauze or tissue at the reception, which is needed after operation. Please do not hesitate to contact with the doctor or nurse if you have any questions.

Matzda coloproctology clinic: Tel. () - () - ()

(Referred from "Practice of Day Surgery for anal diseases", 1994)

Table 4.3 Manuals for hospital life

Thank you very much for visiting our 000 Hospital.

1. Tissues and slippers are provided free on hospitalization. Please return the slippers to the nurses' station on your discharge.
2. Meals will be served at 7 AM, at noon, and 5 PM.
3. Just dial 9 for an outside line and for the call from outside to hospital room, the direct extension number can be available. (But, incoming call only for the shared room)
4. Though going out is prohibited during admission, please ask with the nurse in charge on unavoidable situation.
5. A private library is prepared at 7th floor for your convenience.
6. When discharge is determined, the nurses will take proceedings for you. There will be a call from the office while staying in your room.
7. Please show the certificate of discharge to the nurses' station after paying hospital expenses and get the medicine for discharge with further follow-up schedule.
8. Your valuables are on your responsibility, and private electric heating appliance is not allowed.

* For further details, please feel free to contact with the nurses' station.

4.2.2.1 Advantages of the Lithotomy Position

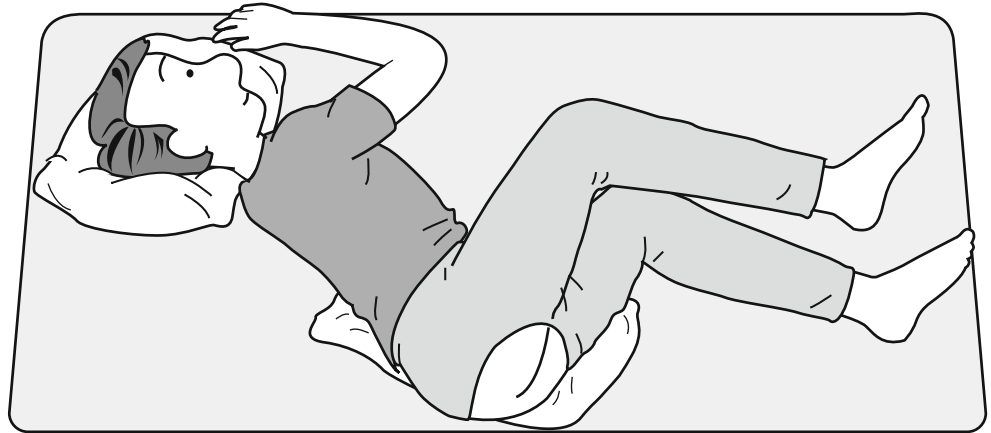
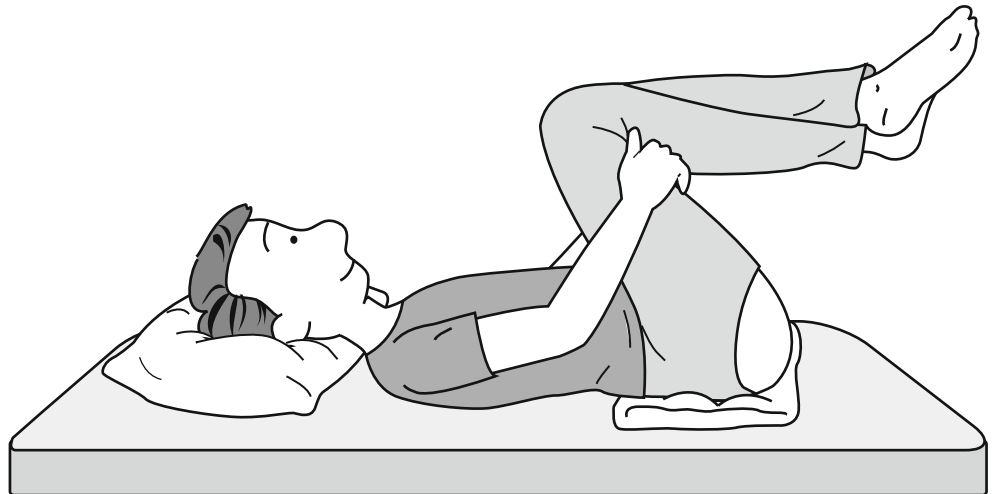
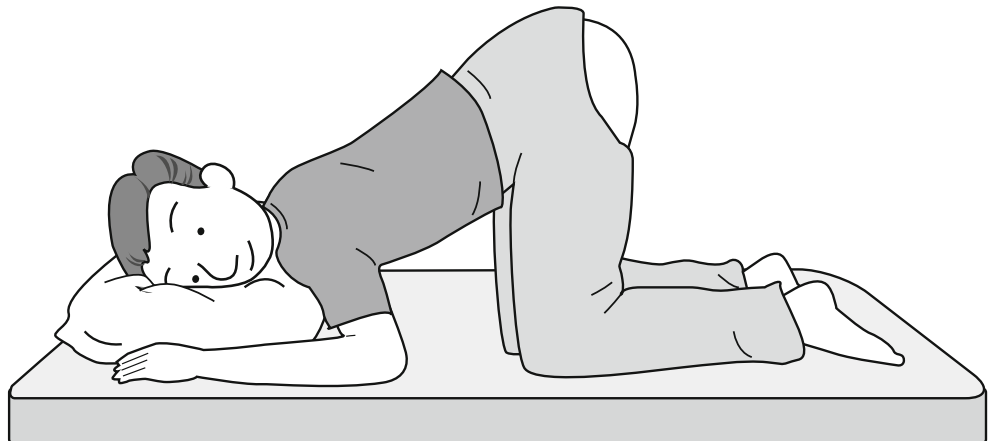
- Easy to perform inspection
- Easy to treat the patients with instruments, such as a rectoscopy

4.2.2.2 Disadvantages of the Lithotomy Position

- Female patients are apt to feel ashamed.
- It is hard to maintain this position for a long time.

4.2.3 Knee-Chest Position

With this position, an inspection is easy without having to pull both buttocks apart. Because the angle of the rectosigmoid junction becomes obtuse, it is the best position for a sigmoidoscopic examination. But it is hard to take and maintain this position, especially for the elderly patients. I use the left lateral position for the ordinary examinations

Fig. 4.3 Left lateral position**Fig. 4.4** Lithotomy position**Fig. 4.5** Knee-chest position

and the knee-chest position for the sigmoidoscopic examinations.

4.2.3.1 Advantages of the Knee-Chest Position

- Inspection is easy with both buttocks being apart.
- Instrumental examinations using a sigmoidoscope or rectoscope are easy.
- The angle of rectosigmoid junction becomes obtuse.

4.2.3.2 Disadvantages of the Knee-Chest Position

- Female patients feel uncomfortable.
- It is hard to take and maintain this position for a long time.
- It is difficult for the doctor to have a conversation with the patient (Fig. 4.5).

4.3 The Practice of Diagnosis

4.3.1 The History

Patients are sometimes hesitant to receive an operation even in a necessary situation because of their work, household responsibilities, or other personal reasons. So it is convenient for the doctor to know the age, sex, occupation, marital status, children, family history, address, and operation history of the patients (Fig. 4.6).

4.3.2 Interview

It is quite possible to diagnose many benign anal diseases such as hemorrhoids with careful interview. So the interview is one of the most important diagnostic procedures. Since it may be difficult for doctors to ask every single question, it is advisable for a well-experienced nurse to ask about detailed personal questions in a questionnaire form before the doctor's interview. In case of anal bleeding, many visitors worry about colorectal cancer rather than hemorrhoids. So during the interview, it is desirable to ask "What is your concern?" or "Is there any specific examination you want to receive?" It is good to apprehend patients' intention precisely before making a diagnosis and treatment plan. The patient's treatment history for coloanal disease, other specific disease history such as heart problems or diabetes, and family history of malignancy especially for colon cancer should be ascertained during the interview. The following points should be included in the interview:

4.3.2.1 Bleeding

Bleeding is the most frequent symptom of hemorrhoids. It occurs during, or sometimes after, defecation (especially in cases with too much straining), with fresh red color. When a patient is straining, anal mucosa protrudes out of the anal

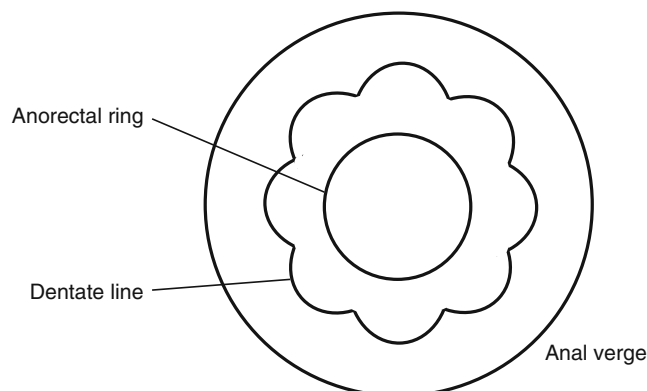


Fig. 4.6 Schema for anal recording

canal, and bleeding occurs from the lamina propria, just beneath the rectal mucosa.

Generally speaking, fresh red-colored blood is due to anal disease. But when the stool is mixed with dark red-colored blood, colon disease, such as colon cancer or ulcerative colitis, can be suspected. Exceptionally, dark red-colored blood may be seen in specific prolapsed hemorrhoids which are reduced manually into the rectum. As the lesion is more proximal to the anal canal, the color of the blood should be darker through oxidation of the hemoglobin. Therefore, bleeding from the upper gastrointestinal tract becomes tar-like dark color. The nature of bleeding from internal hemorrhoids may vary from spurting and dripping to just staining on the toilet paper. The level of hemoglobin may fall down to 4–5 g/dl with long-term bleeding. So it is necessary to make an urgent check when the patient's face appears pale. After a hemorrhoid operation, the patient may feel a strong desire for defecation, and large bolus of blood clot can be evacuated with fall of blood pressure, cold sweat, and shock. When bleeding is found as a symptom, it is important for the doctor not to presume the bleeding to be a symptom for benign diseases, because this presumption may lead the doctor to misdiagnose colon cancer as a benign disease. So for the patients with anal bleeding, a colonoscopic examination is recommended, and at the very least a sigmoidoscopic examination must be performed (Fig. 4.7).

4.3.2.2 Prolapse

The most important symptoms of internal hemorrhoids are bleeding and prolapse. The mechanism of prolapse is the relaxation and disruption of Treitz's ligament and the conjoined longitudinal ligament due to the squatting or defecation position. The bleeding is secondary to the prolapse.

Internal hemorrhoids are classified from 1st to 4th degree according to the severity of prolapse. The severity



Fig. 4.7 Bleeding from hemorrhoids

of the prolapse may look different depending on posture, so the doctor should instruct the patient to take a squatting position for 1–2 min to diagnose the degree of prolapse precisely. Internal hemorrhoids and rectal prolapse are regarded as being different kinds of prolapse disease, but I consider that both diseases have same pathogenesis. I believe that as the internal hemorrhoids become severe, rectal prolapse may also develop. The treatment procedure for the internal hemorrhoids is decided according to the severity of prolapse. A conservative treatment is used for 1st degree hemorrhoids. For 2nd degree, conservative treatment, rubber band ligation, or injection of a sclerotic agent is used. Although rubber band ligation is also used for 3rd degree hemorrhoids, usually for 3rd- and 4th degree hemorrhoids, a surgical procedure is necessary (Table 6.2).

4.3.2.3 Anal Pain

Internal hemorrhoids usually do not cause pain. Anal disorders distal to the dentate line of the anal canal, such as thrombosed external hemorrhoids or anal fissures, frequently cause pain. In the internal hemorrhoids, the incarcerated form can cause severe anal pain. Perianal abscess also causes pain with a sense of heat. If the patient is suffering from the pain caused by internal hemorrhoids which have reduced into the anal canal, a combined anal fissure should be suspected.

4.3.2.4 Itching Sensation

Patients with internal hemorrhoids sometimes complain of itching sensation around the anus. With mucosal prolapse, the amount of perianal discharge increases which stimulates perianal skin with itching sensation. There are various other possible causes of pruritus ani, including mycosis, allergic dermatitis, contact dermatitis, psoriasis, benign tumor, malignancy, oxyuriasis, and diabetes. So it is important for the doctor to make an accurate diagnosis (Figs. 4.8 and 4.9).

4.3.2.5 Discharge

The mucoid discharge is from the mucosa proximal to the dentate line. The mucoid discharge normally happens from the mucosa proximal to the dentate line. It can appear with prolapsed hemorrhoids. In addition to the prolapsed hemorrhoids, mucoid discharge can also occur in other conditions such as rectal polyps, anal fistula, ulcerative colitis, Crohn's disease, and irritable bowel syndrome. So, differential diagnosis is necessary.

4.3.2.6 Change of Bowel Habit

Frequent defecation can be seen in severe internal hemorrhoids. But if the frequency is more than three times a day, colonoscopic examination must be performed to rule out the possibility of other diseases such as rectal cancer, ulcerative colitis, or irritable bowel syndrome.



Fig. 4.8 Prolapse of hemorrhoids



Fig. 4.9 An anus with pruritus

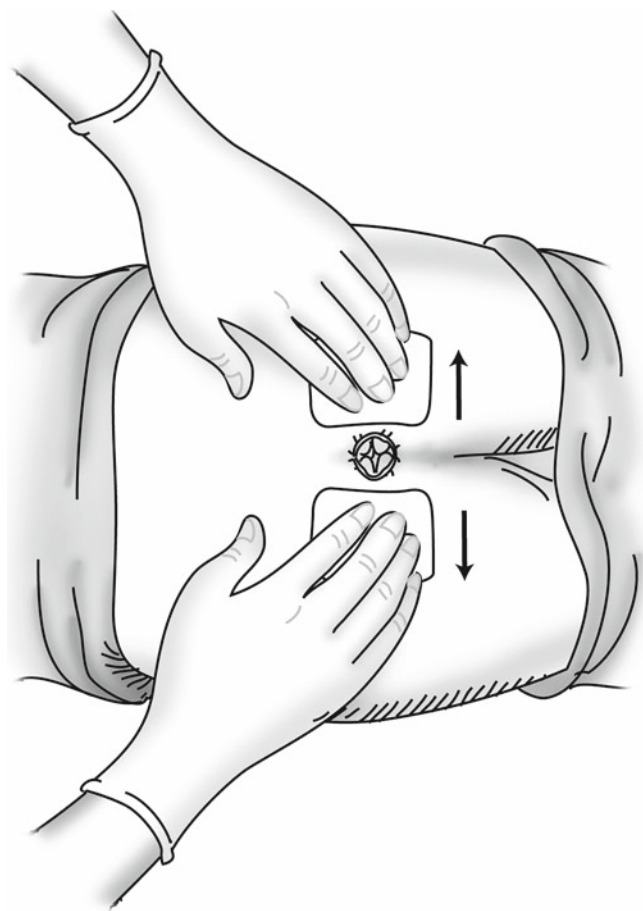


Fig. 4.10 Inspection

4.3.3 Inspection

The inspection is followed by the interview, which is necessary to get additional information for diagnosis. For effective inspection, a comfortable atmosphere is needed to relax the patient with a well-equipped side lamp and a height-controllable bed. After inspection, digital rectal examination, anoscopic examination, or sigmoidoscopic examination is usually performed right away.

In the case of prolapsed hemorrhoids, I ask the patients to do a straining test in a squatting position to find out the degree of prolapse of the hemorrhoids. Although patients attend the clinic with hemorrhoids, the skin of the buttocks, perianal region, and perineum should be checked together. The presence of external hemorrhoids and the involved circumference of the anus with hemorrhoids should be checked as well. The treatment procedure, including operation, is decided after inspection (Fig. 4.10).

4.3.4 Prolapse Test for Internal Hemorrhoids

What kinds of tests should be used for a normal-appearing anus with an attending complaint of prolapse or bleeding? Generally speaking, there are three kinds of tests.

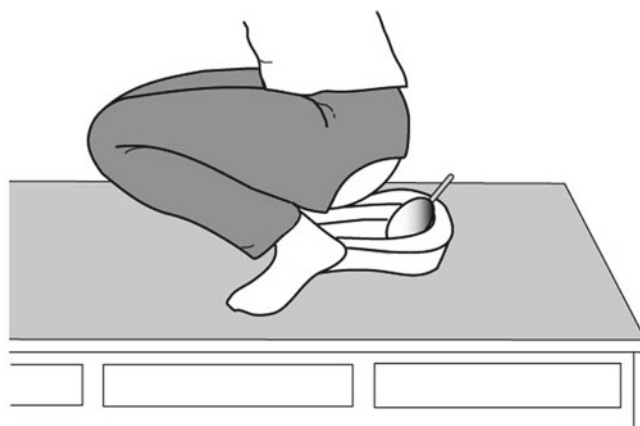


Fig. 4.11 Straining test

These tests include (1) a straining test, (2) a prolapse test for hemorrhoids using bilobar anoscope, and (3) a prolapse test using gauze and an anoscope. In the second method, Aragawa's bilobar anoscope is inserted into the anus toward the hemorrhoids and withdrawn open to find the hemorrhoidal pile, which will have been pulled out as shown in the Fig. 4.16. To examine a prolapsed hemorrhoid pile, I prefer the squatting position with straining for 1–2 min rather than the anoscope method. After finding the prolapsed piles with this method, I decide on a treatment strategy.

Although some clinics equip toilet nearby the examination room, I use the squatting position on the examination bed with a portable bedpan as shown in Fig. 4.11.

Generally, the need for an operation is decided simply with this test. But it can be difficult for some shy patients to make a protrusion of hemorrhoid pile. In such cases, for the patient's comfort, I advise checking the prolapse again after the patient has tried straining at the toilet. It is a very useful test to check the involved anal sphere, the degree of the prolapse, and the bleeding of hemorrhoids. The third method is to check the degree of prolapse by withdrawing the gauze inserted into the anus through a circular anoscope. But this test is relatively difficult to perform in the office (Fig. 4.17).

4.3.5 Digital Rectal Examination (Digital Examination)

The digital rectal examination is important for proctologists. The importance can be exemplified by saying that a proctologist should have eyes on his fingertip. The index finger is used with a lubricated glove for this examination. Although any nonirritating lubricant will suffice, lidocaine jelly or ointment for hemorrhoids is widely used. Patients with an anal fissure, perianal abscess, or hyperactive sphincter tend to feel severe anal pain on insertion of a finger. It is important to perform sufficient anal massage before the insertion, and

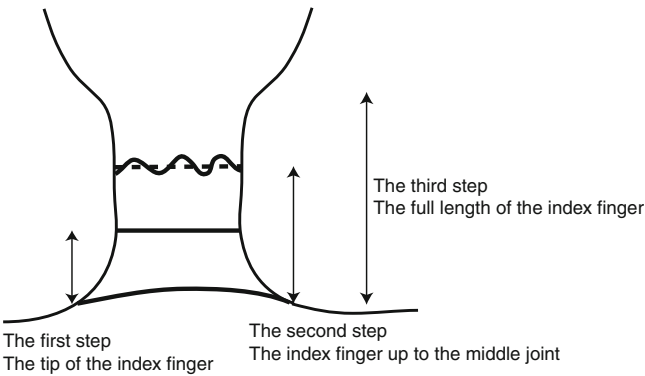


Fig. 4.12 Depth of finger insertion according to the technique

telling the patient when the insertion will take place also helps the patient (Fig. 4.12).

For patients with incarcerated hemorrhoids, anal fissure, or perianal abscess, it is advisable to use a local anesthetic ointment like lidocaine jelly and wait 3–4 min to reduce the severe anal pain. In any case, proctologists should not omit a digital examination. It is performed in three steps from anus to rectum. Rectal cancer is frequently missed when this examination is performed only at the anal entrance. The three steps for digital examination are as follows: palpate the anus by inserting up to the distal joint of the index finger (first step), wait for a while then insert the index finger up to the middle joint (second step), and, finally, insert up to the proximal joint while palpating the anal canal (third step).

4.3.5.1 The First Step

This step of the examination uses the tip of the index finger (up to the distal joint) to check from the anal verge to the dentate line. The state of the internal sphincter tone, external hemorrhoids, anal fissure, perianal abscess, or anal cancer can be checked through this step. The thumb is sometimes used together to palpate the anus. It is useful for the differential diagnosis with the anal fissure and perianal abscess and to confirm the existence of an anal fistula tract (Fig. 4.13; Table 4.4).

4.3.5.2 The Second Step

At this step, insert the index finger up to the middle joint. It is possible to palpate 2–3 cm upward from the dentate line. By rotating the finger 360°, the hemorrhoid is palpated to check its size and the degree of prolapse. If a fistula is present, the tract and the internal opening are also palpated.

4.3.5.3 The Third Step

This step involves inserting the full length of the index finger. If it were not performed properly, rectal cancer may not be noticed. In a patient who reports anal pain, the levator muscle should be checked for the levator ani syndrome. Rectocele examination (relaxation of the rectovaginal wall) is carried out in women with constipation. The adjacent organs of the rectum can also be examined, such as the prostate in men and

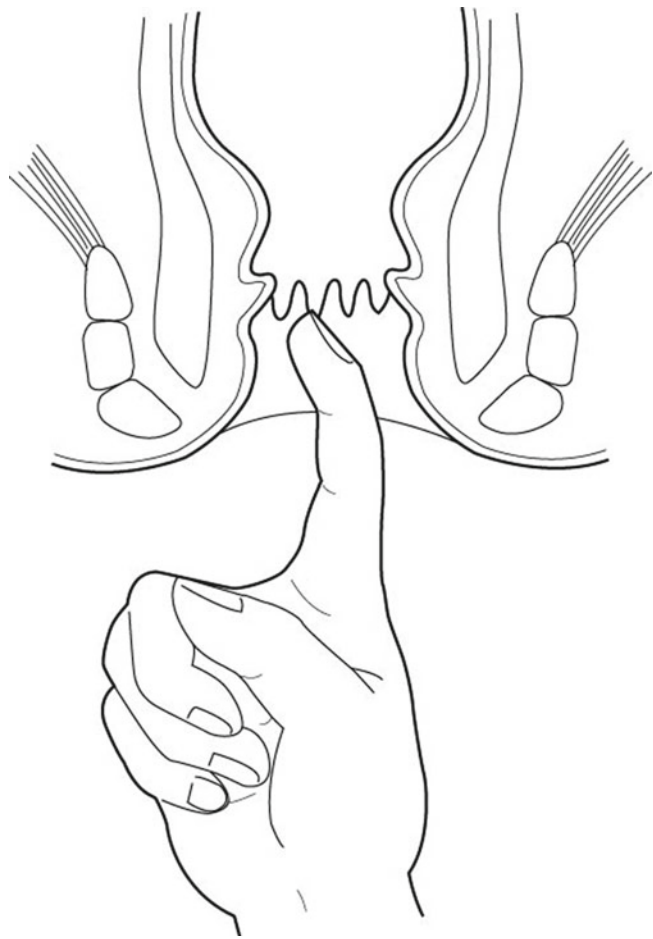


Fig. 4.13 The first step of digital rectal examination

Table 4.4 Diagnosis by ascertaining the tonic state of the internal sphincter

Hypertonic state	Hypotonic state
Incarcerated hemorrhoids	Prolapsed hemorrhoids
Fissure	Rectal prolapse
Thrombosed hemorrhoids	Rectal cancer
	Old age
	Strokes

the cervix in women. From the behind, the coccyx and part of sacrum can be palpated (Figs. 4.14 and 4.15).

4.3.6 Anoscopic Examination

As the inside of the anal canal cannot be seen by inspection, a digital rectal examination must be used. Using the anoscope makes it possible to inspect the inside of the anal canal. It can check hemorrhoids and fissures as well as differentiate thrombosed external hemorrhoids from perianal abscess. There are three types of anoscope: cylindrical, specular, and the ladle type. Cylindrical and specular anoscopes are used frequently (Fig. 4.16).

4.3.6.1 Cylindrical Anoscope

This is useful for observing the change of the entire anal canal. For the prolapsed hemorrhoids, insert the anoscope and take the obturator out. Then insert the gauze through the

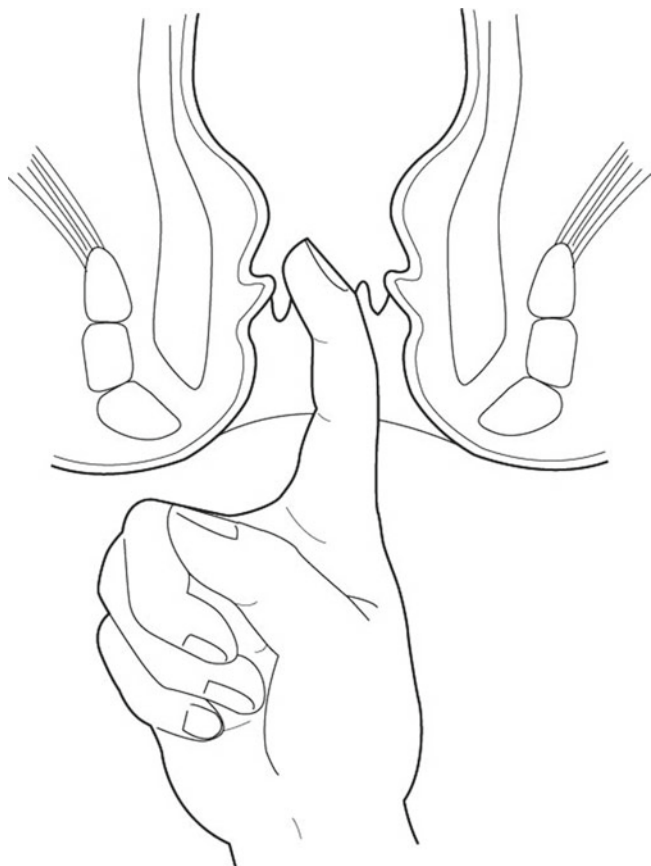


Fig. 4.14 The second step

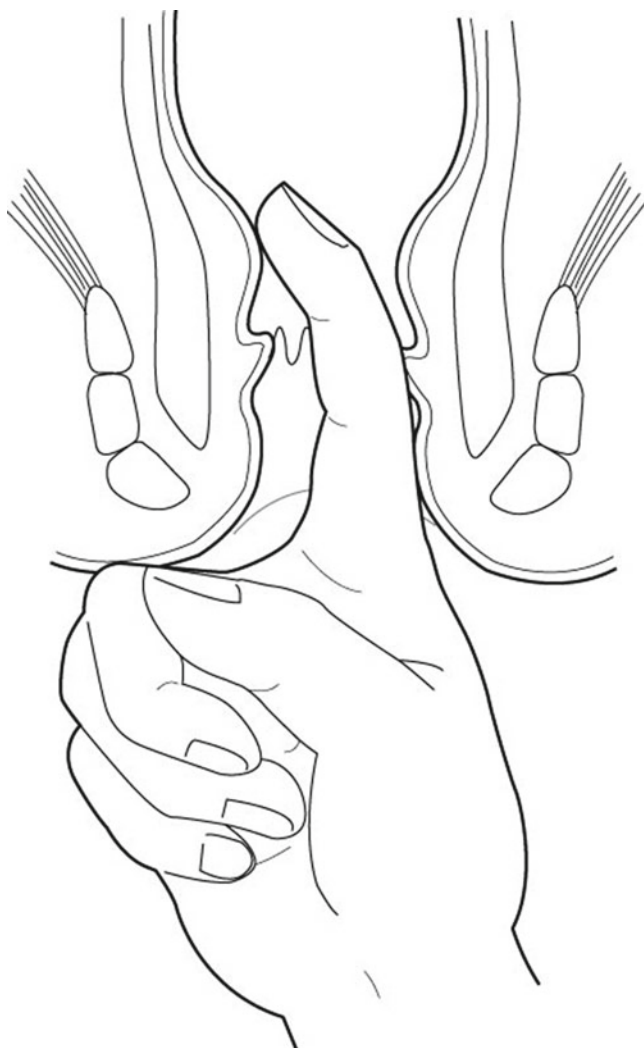


Fig. 4.15 The third step



Fig. 4.16 Various types of anoscopes

anoscope and remove the anoscope only. Instruct the patient to give pressure as usual on defecation and observe the site and degree of the prolapse while withdrawing the previously inserted gauze. Some cylindrical anoscopes have one side open, which is convenient for sclerosing agent injection or rubber band ligation (Fig. 4.17).

4.3.6.2 Specular Anoscope

The specular anoscope is used to inspect the anal canal by inserting and opening the anoscope sideways. This was developed in Japan, and the Aragawa anoscope is known widely. The anal verge, dentate line, and rectum can be observed consecutively using the specular anoscope. To see

the degree of prolapse, pull the anus open with one hand and insert the anoscope into the anal canal with the anoscope closed. Then withdraw the anoscope widening slowly. This makes the hemorrhoid to be pushed out of anal canal. Repeat this procedure three times following the usual direction of the main pile, at 3, 7, and 11 o'clock (Fig. 4.18).

4.3.7 Rigid Sigmoidoscopy

With rigid sigmoidoscope, it is possible to observe the internal structure of the anus from the anal verge up to 30 cm proximally. The anal canal, rectum, and a part of



Fig. 4.17 Diagnosis of hemorrhoid prolapse using a cylindrical anoscope



Fig. 4.18 Diagnosis of a prolapsed hemorrhoid using a specular anoscope

the sigmoid colon can be observed. There are various lengths and sizes of sigmoidoscope, but the Strauss' is the most well known. An enema can be used beforehand, but in most cases, the examination is carried out without the enema. The stimulation due to the enema not only increases the rectal mucous discharge but also changes the color of the rectal mucosa reddish and the status of the stool. It's helpful to see whether blood mixed with stool or the color of the stool is helpful in diagnosis. The patient's position can be either the knee-chest position or the Sims' position, but the knee-chest position is more convenient to perform. Comparing with colonoscopic examination, the rigid sigmoidoscope shows lower detection rate and is also more likely to cause pain during examination. So nowadays a colonoscope tends to be used more frequently. The rigid sigmoidoscope is currently used only for the patients who are very busy to have a colonoscopic examination or with emergency situations. However, sigmoidoscope is still important for hospitals that do not have a colonoscope because with the barium enema study the rectum cannot be precisely examined (Figs. 4.19 and 4.20).

4.3.8 Colonoscopic Examination

The colonoscopic examination is highly recommended before surgery for patients suffering with bleeding anal disease, bowel habit change along with defecating more than three



Fig. 4.19 Rigid sigmoidoscope

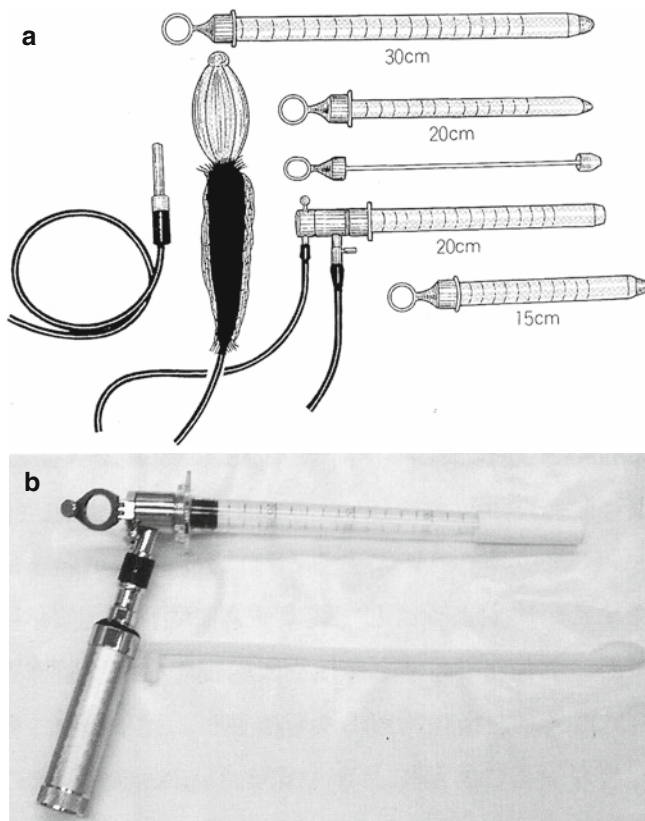


Fig.4.20 Strauss proctoscope

times a day, and suspected colon disease like colon cancer or ulcerative colitis. Even if the anal surgery was conducted due to an emergency, the colonoscopic examination is highly recommended after 2 months of the surgery when the wound healed. An accurate diagnosis is necessary to ascertain the appropriate treatment strategy, so the diagnostic process is

very important. History taking, inspection, palpation, digital rectal examination, anoscopic examination, blood test, and even a colonoscopic examination (if needed) are used in the diagnosis of hemorrhoids. This is because diagnosing hemorrhoids is as important as diagnosing the presence of other colonic disease like cancer. Sufficient practice is needed to prevent misdiagnosis as well as being restrained and considerate while treating the patient.

4.4 Differential Diagnosis

Although hemorrhoids can simply be diagnosed based on patients' symptoms, it is mandatory to carry out an anal inspection, digital rectal examination, and an anoscopic examination. There is a saying that states, "If you do not put your finger in the anus now, you will end up putting your foot inside later." Like the saying, if the digital rectal examination is excluded or not carried out thoroughly, rectal cancer can be easily missed and will not be treated. Doctors must always keep in mind that diseases such as the Crohn's disease and ulcerative colitis might be hidden within the anal canal. For the patients with anal bleeding, the stool should be checked instantly through an anal examination without any preparation. The following should be differentiated from hemorrhoids:

4.4.1 Hypertrophied Anal Papillae

It is considered normal if there are more than one hard hypertrophied papillae of equal size on the dentate line as long as they are not excessively large. Although no explanation is yet to be found, this phenomenon may be caused by anal fissure. Usually there are no symptoms, but if it grows excessively large, it protrudes below the dentate line which is called a fibrous anal polyp.

4.4.2 Rectal Prolapse

This is easily confused with prolapsed hemorrhoids. The rectal mucosa can easily bleed in a prolapsed state. When the entire layer of the rectal wall prolapsed circumferentially, it is called a complete rectal prolapse. This occurs easily if the rectum is not fixed properly in the weakened pelvic floor muscle group. This is mostly present in elderly people, especially women, in which excessive abdominal pressure during defecation causes the perianal muscle group to relax excessively, and with repetition this can fall into a vicious cycle. As rectal prolapse is accompanied by an anal sphincter dysfunction, it must be treated differently from hemorrhoids.

4.4.3 Rectal Mucosa Ectropion

A part of rectal mucosa can be everted out of the anal canal due to circumanal scar formation with previous anal surgery. Secretion of mucus and bleeding occurs from the everted rectal mucosa. Whitehead's anus is an example of this condition (Figs. 4.21 and 4.22).



Fig. 4.21 Rectal polyp. It is accompanied by hemorrhoids



Fig. 4.22 Rectal prolapse

4.4.4 Mucosal Prolapse Syndrome (MPS)

It can be derived from the more advanced internal hemorrhoid and is the prior stage of rectal prolapse syndrome (RPS). It is common in women with weak sphincters.

4.4.5 Rectocele

For women over the age of 50, the suspensory tissue of anterior rectal wall is relaxed and distended toward the vagina which results in defecation difficulties and bleeding problem.

4.4.6 Rectal Polyp and Cancer

A tumorous lesion sometimes prolapses outside the anus. It is easy to distinguish from hemorrhoids but needs to be removed in its early stage along with a pathologic examination. Even in the case of one polyp visible, a colonoscopic examination is needed to find out other possible polyps (Figs. 4.23 and 4.24).

4.4.7 Skin Tag

It is wrinkles formed in the anal verge after a thrombosed external hemorrhoid or incarcerated hemorrhoid treatment through the conservative methods (Figs. 4.25, 4.26, 4.27, 4.28, and 4.29).

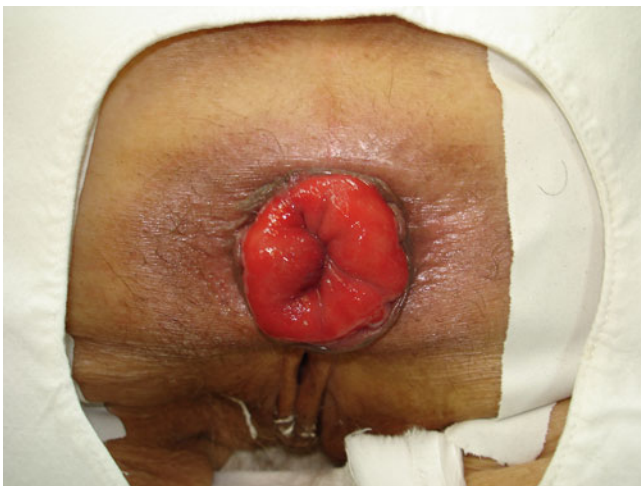


Fig. 4.23 Mucosal prolapse syndrome (MPS)

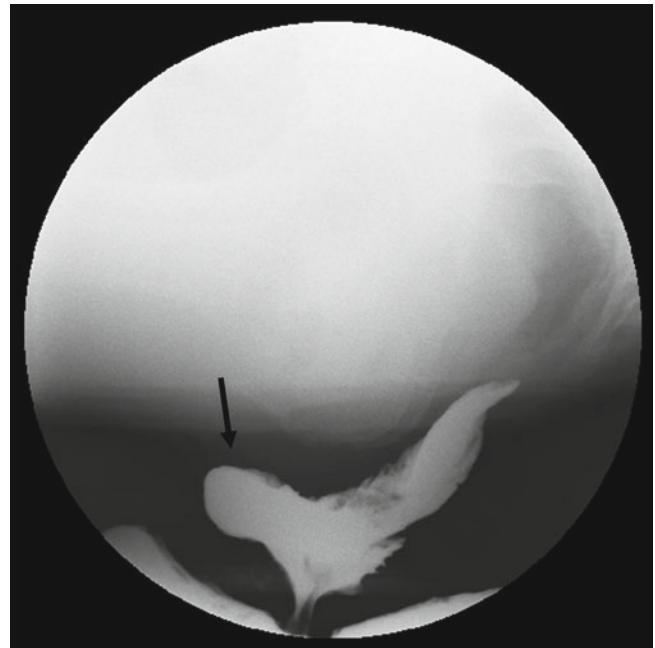


Fig. 4.24 Rectocele in defecography



Fig. 4.25 Polyp combined with hemorrhoids

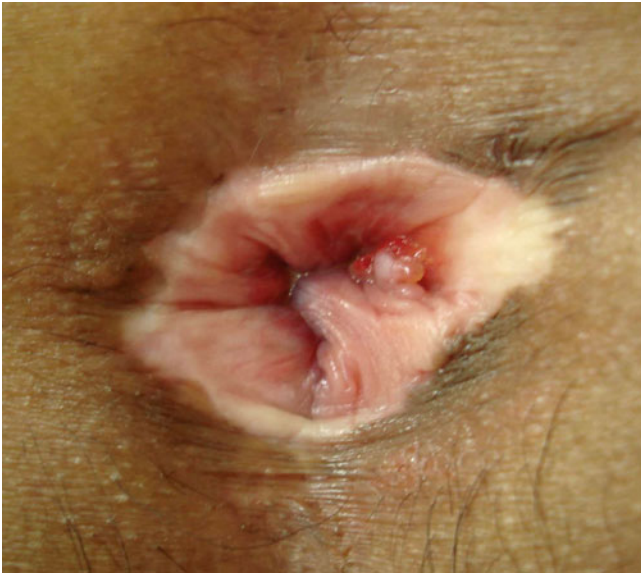


Fig. 4.26 Whitehead's anus



Fig. 4.28 Complete rectal prolapse with circumanal involvement on straining (female)



Fig. 4.27 Mucosal prolapse syndrome



Fig. 4.29 The protruded villous adenoma arising from the distal rectum

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Only 30 years ago, hemorrhoids were assumed to be an abnormal structure caused by varicose vein. Also, after the sliding anal lining theory introduced by Thompson from United Kingdom in 1975, many other studies were presented to support this theory that is now accepted worldwide. However, the vascular hyperplasia theory deserves reconsideration. According to the sliding anal lining theory, the hemorrhoids are regarded as normal structure that closes the anal canal. Therefore, the treatment of hemorrhoids should not simply remove or destroy the hemorrhoid structure but rather focus on relieving the symptoms that patients claim.

The level of dissection in hemorrhoid surgery has been always controversial. While some would advocate 2 cm proximal to the dentate line, others advocate dissecting up to the dentate line level; historically, low ligation, high ligation, and other issues were also debatable. The level of dissection depends on the condition of each hemorrhoid, where dissecting level is sufficient as long as the hemorrhoid does not prolapse out of the anus.

5.1 Classification of Hemorrhoids

The hemorrhoid can be divided into internal, external, or mixed type based on the dentate line. The internal hemorrhoid is covered by the transitional epithelium (or the columnar epithelium), whereas the external hemorrhoid is covered by the squamous epithelium. A skin tag can be a result of a thrombosed hemorrhoid, or it can be a complication of an inflammatory bowel disease that has nothing to do with hemorrhoids. More than 80 % of hemorrhoids are internal, approximately 5 % are purely external, and the rest are mixed.

Internal hemorrhoids can be divided from first to fourth degree depending on the severity of their prolapse (Fig. 5.1):

- First degree: The state of venous engorgement during bowel movement that does not protrude out of the anus but may bleed sometimes.
- Second degree: The hemorrhoid that prolapses out of the anus during bowel movement but goes back inside spontaneously into the anal canal after defecation.

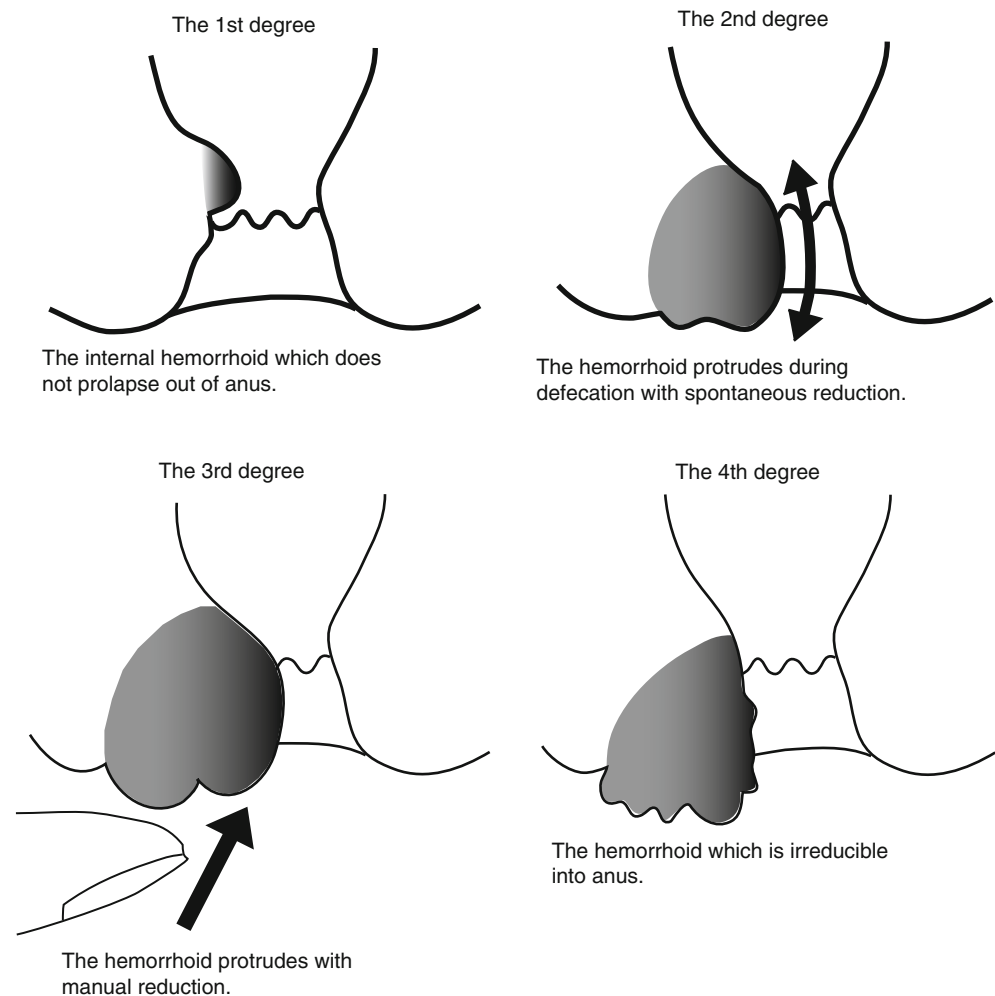
- Third degree: The prolapsed hemorrhoid which is reducible into the anal canal by manual reduction:
 - Third degree hemorrhoids can be divided into third degree A and third degree B.
 - Third degree A: Hemorrhoid prolapses on defecation only and is reduced with manual reduction.
 - Third degree B: Prolapse of the hemorrhoid occurs not only during bowel movement but also on usual time, which must be pushed back in manually.
- Fourth degree: The hemorrhoid protrudes from the anal canal all the time and is irreducible.

The pitfalls of this classification is that the third degree of hemorrhoid is sometimes more harder than that of the fourth degree to operate, and some scholars say that this is not a helpful classification for surgery. Therefore, I suggest that it should be reclassified according to the length of the prolapse measured after anesthesia during surgery. Hemorrhoids with mucosal prolapse are also thought to be the stage prior to rectal prolapse. Hemorrhoid and rectal prolapse are not two different diseases; the hemorrhoid seems to be a prolapse where Treitz's ligament is destroyed, whereas the rectal prolapse seems to be caused by the weakness of the pelvic floor.

Since it is hard to classify the hemorrhoids after checking the length of prolapse at office, there is no choice but to use the Goligher classification.

The Goligher classification only considers the status of prolapse, omitting symptoms such as anal discomfort, incontinence, or the skin conditions. Other method of classification according to the anatomical standardization is suggested. A hemorrhoid can be classified into a primary hemorrhoid (a hemorrhoid that occurs at the anal cushion), a secondary hemorrhoid (a hemorrhoid that occurs between the anal cushions), and a circumferential hemorrhoid. The degree of prolapse can also be classified into "no prolapse, prolapse distal to the dentate line on rest, distal to the dentate line on straining, prolapse visible at the anal verge on rest, and visible at the anal verge on straining." The condition of the anal verge (skin tag, congestion of external hemorrhoid, etc.), anal pressure, and severity of the perineal descent also needs to be described (Table 5.1).

Fig. 5.1 Goligher classification of internal hemorrhoids



Graham Stewart divided hemorrhoids into vascular and mucosal forms. Vascular hemorrhoids occur frequently among young and muscular people. Even without straining, engorgement in the anal cushion can be easily formed. In inspection, a large lump of hemorrhoid can be found and even minor trauma can cause bleeding. However, it rarely protrudes out of the anus. Mucosal hemorrhoids are found more often in women than men and occur more frequently among older and thinner person. The main symptom is the prolapse of the hemorrhoid, composed of vascular cushion and stretched rectal mucosa. Sometimes, these two kinds of hemorrhoids are said to appear in mixed type, regardless of sex or age.

5.1.1 An Attempt of New Classification

5.1.1.1 PEC Classification

Masuda et al. from Masuda Hospital in Japan presented the PEC classification at the Japanese coloproctology congress in 2005.

According to the degree of prolapse of the internal hemorrhoid:

P₀: No prolapse

P₁: Reducible prolapse

P₂: Irreducible prolapse

According to the condition of the external hemorrhoids:

E₀: No external hemorrhoid

E₁: Less than half circle of the anus

E₂: More than half circle of the anus

According to the involved anal circumference:

C₀: Individual hemorrhoids are independent.

C₁: Individual hemorrhoids are connected partly.

C₂: The hemorrhoids are connected to each other to the full circumference of the anus.

(*Journal of Japan Coloproctology*. 2008 p. 666; 2005 p. 491)

For example, it is categorized as P1E1C2 if a hemorrhoid presents reducible prolapse, the external hemorrhoid involves less than 50 % of the anus, and the hemorrhoids are connected to each other to the full anal circumference. This would be useful in deciding operative method and comparing objectively pre- and postoperative results.

Jung Moo Lee et al. of Hanlim University divided hemorrhoids into island form and sliding form. In the island

Table 5.1 Classification of internal hemorrhoids

Degree	Form	Major symptoms	Minor symptoms	Size according to the naked eye	Age	Treatment
0	Anal cushion	1. Bleeding (rare) 2. No protrusion	None	No difference in size	All ages, if symptoms are present, under age of 20	Correct diet/lifestyle, medication; if no response, consider sclerotherapy or IRC
1	Small-sized hemorrhoid	1. Bleeding (sometimes) 2. No protrusion	None ^a	Slight size change on anoscope	Age 20–45	Sclerotherapy/IRC; if no response, RBL or PPH ^b
2	Medium-sized hemorrhoid	1. Protrusion but reduced spontaneously 2. Frequent bleeding (sometimes severe bleeding)	Anal itching, skin tag (rarely)	Moderate increase in size of the protruded hemorrhoid pile on straining	Age over 30	RBL or PPH; if no response, consider surgery
3	Large hemorrhoid	1. Protrusion, manual reduction needed 2. Frequent bleeding (severe bleeding is common)	Anal itching, discomfort, skin tag (common)	Severe increased size, manual reduction required with circumanal protrusion	Age more than 40	Conventional surgery
4	Very large, mixed hemorrhoid	1. Irreducible protrusion 2. Bleeding ^d severe to wet the underwear	Pain ^c , anal itching, incontinence Skin tag is common, complications (thrombosis)	Size increases, enough to protrude out of the anus Accessory pile and skin tags are also formed	Age more than 50	Modified method of surgery (anoplasty) may be needed

IRC infrared coagulation, RBL rubber band ligation, PPH procedures for prolapse and hemorrhoids

^aThis cannot be proved, but patients complain clearly perceived pain. Fissure may be a cause

^bThere can be many variables according to the size (severity) of the hemorrhoid

^cIf the pain is severe, the general cause is complication such as blood clots or a fissure

^dSometimes bleeding can stop in a persistently protruded hemorrhoid. This is due to mucosal hypertrophy and squamous dysplasia

form, internal hemorrhoids are separated from external ones with dentate line as a landmark with the pecten existing normally, and this form is prevalent in the young age group. The sliding form, so-called mixed hemorrhoid, appears mostly in the middle-aged group, in which the dentate line is shifted outside the anus with frequent rectal mucosal prolapse. He proposed operative method for internal and external hemorrhoids separately in the former type and suture-ligation method for the internal hemorrhoid only in the latter type (Fig. 5.2).

5.2 Indications of Hemorrhoid Surgery

5.2.1 Bleeding Hemorrhoids

Bleeding is one of the most common symptoms of hemorrhoids. Bleeding had been described in the Chap. 4.

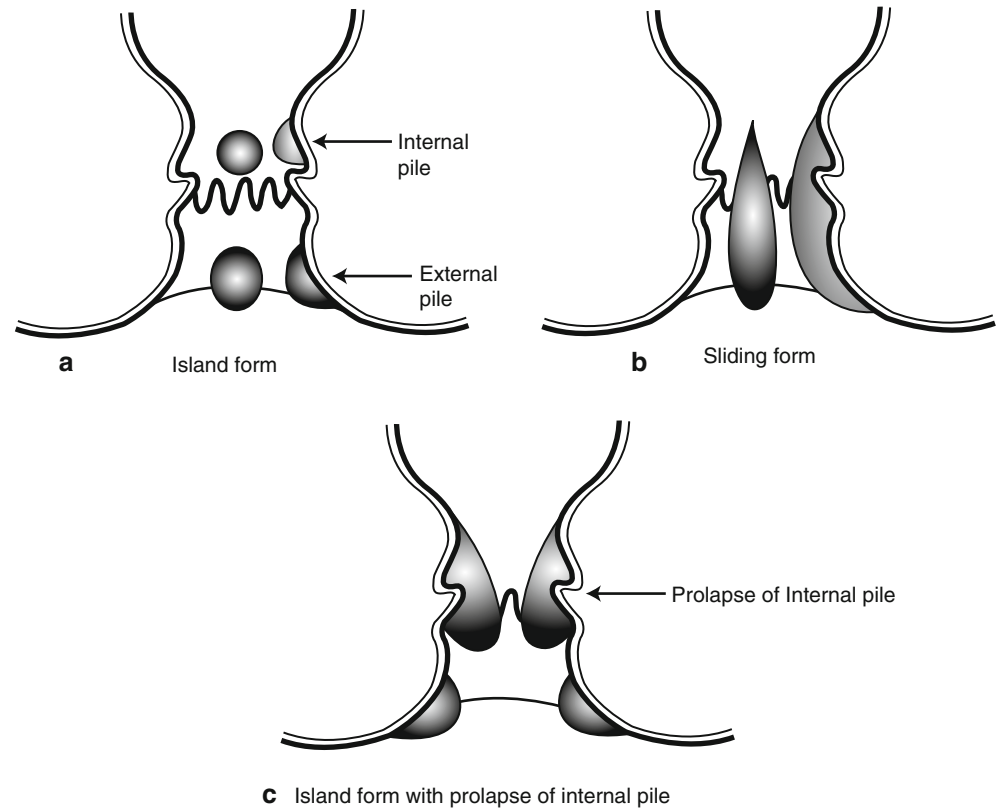
Although most bleeding is due to anal diseases such as hemorrhoids or fissures, it is sometimes caused by colorectal cancer, ulcerative colitis, polyps, or other diseases, so colon or upper gastrointestinal tract examination is mandatory prior to the treatment. A digital rectal examination should be performed in all cases, and it is also recommended to conduct

a colonoscopy or barium enema. Sigmoidoscopy must be performed at least.

For female patients, menstruation, pregnancy, and delivery worsen hemorrhoids and are especially related with bleeding. Hormones (mostly estrogen) and the mechanical factor worsen the bleeding, namely, (1) decreased coagulability, (2) weakening of the anal sphincter pressure, (3) increased pelvic blood flow, (4) descent of pelvic diaphragm by the pregnant uterus, and (5) tendency of constipation—straining during defecation, complicated environment during pregnancy and birth, dietary problem, and lack of exercise are special factors for constipation. The hard stool passing by and straining can increase the tendency of bleeding. Because the pregnancy and delivery induces or aggravates hemorrhoids, it is not advisable to recommend surgery for those who are pregnant or planning to have pregnancy soon.

Bleeding hemorrhoids without prolapse, first degree hemorrhoids, can be sufficiently treated with a conservative treatment. A sclerosing agent injection or IRC can also be used. For prolapsed hemorrhoids with bleeding, the bleeding would subside spontaneously after the treatment of prolapse. The second degree internal hemorrhoids can be treated using RBL or sclerosing agent injection, and third-, fourth degree hemorrhoids are best treated with surgery.

Fig. 5.2 Jung Moo Lee's classification of hemorrhoids. (a) Island form. (b) Sliding form. (c) Island form with prolapse of internal pile



5.2.2 Prolapsed Hemorrhoids

Prolapse with no symptom does not need treatment. However, if patients are troubled with symptoms such as combined bleeding or manual reduction on defecation of hemorrhoids, it needs to be treated. Second degree hemorrhoids are also recommended to treat with RBL or a sclerosing agent injection. If the third degree is not so severe, RBL or sclerosing agent injection can also be applied, but severe third degree or fourth degree hemorrhoids must be dealt with surgery.

For incarcerated and strangulated hemorrhoids, there are two methods of treatment: an emergency surgery and a scheduled surgery after conservative treatment. If the patient's condition permits, it is advisable to perform an emergency surgery even if the mucosa is weak, friable, and easy to bleed. Hemorrhoidectomy is needed on the following conditions, regardless of prolapse:

1. Hemorrhoid with large skin tag
2. Hemorrhoids with combined anal disease such as fissure or anal fistula
3. Large thrombosed hemorrhoid
4. When rubber band ligation or sclerotherapy has already failed

5.2.3 Pain

The internal hemorrhoids show no pain. But the incarcerated hemorrhoids or thrombotic hemorrhoids cause pain and should be treated. The small thrombotic external hemorrhoid is treated conservatively. However, if it covers more than 40 % of the anal circumference, surgery is better. Also, as the hemorrhoid combined with fissure causes pain, surgery is recommended. But the pain from the levator ani syndrome needs to be treated conservatively.

5.2.4 Fecal Incontinence

Fecal incontinence and sphincter muscle tone must be checked before operation. If the incontinence is derived from sphincter abnormality, it would be aggravated after hemorrhoidectomy.

5.2.5 Mucus Discharge, Pruritus Ani

With inappropriate condition such as prolapsed hemorrhoids, the patients are unavoidably destined to suffer from mucous

discharge from the anal mucosa. The skin around the anus complains itching sensation from persistent irritation due to the discharge. Even though the prolapsed hemorrhoid pile doesn't show any symptoms, the severe pruritus ani with or without mucous discharge can be the indication for operation.

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The knowledge about hemorrhoids has shown significant progress recently. Hemorrhoid was regarded as an abnormal structure of varicose vein before, but it is now regarded as a normal structure that closes the anus to keep continence. It is thought to be a descent of the anal cushion (mucosa and sub-mucosal connective tissue).

Excessive or unconditioned excision of the hemorrhoids should be avoided. The treatment of hemorrhoids should be focused on improving the symptoms rather than removing the hemorrhoid itself. In other words, it should be aimed at the correction of prolapse. In the past, bleeding was thought to be the first symptom of hemorrhoids, but it is now regarded as a symptom followed by hemorrhoidal prolapse. In this sense, it is expected that there will be further development in rubber band ligation, PPH, or sclerotherapy.

Treatments for hemorrhoids can be broadly divided into conservative and surgical treatment. The latter is subdivided into noninvasive and invasive treatment. The noninvasive treatment includes various methods like rubber band ligation and sclerosing agent injection therapy (sclerotherapy) (Fig. 6.1).

The first-degree internal hemorrhoids can be treated with conservative treatment; second-degree hemorrhoids require conservative treatment, sclerotherapy, and rubber band ligation. Mild third-degree hemorrhoids may be treated with rubber band ligation and other noninvasive treatments, but severe cases of third-degree and fourth-degree hemorrhoids are required surgical procedures. Mild cases of external hemorrhoid could be treated with conservative means; however, severe cases are treated by surgical procedures (Table 6.1).

6.1 Conservative Treatment of Hemorrhoids

With conservative treatment for all kinds of hemorrhoids, either early or severe stage, symptoms are expected to be improved to a certain degree. Therefore, it can be said that conservative treatment is basic treatment that should be performed, regardless of their severity. Early internal or

external hemorrhoids can be treated with the conservative method including the following:

1. Hot sitz bath
2. Medication
3. Diet
4. Defecation counseling

6.1.1 Hot Sitz Bath

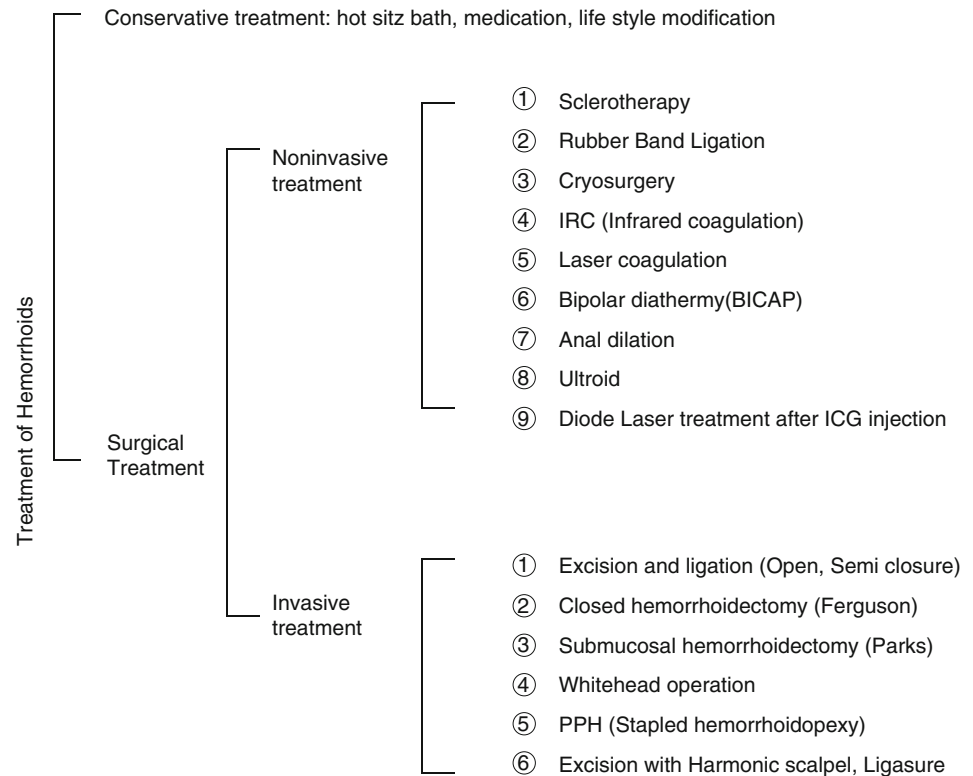
It is essential for the conservative treatment, postoperative management, and prevention of benign anal diseases such as hemorrhoids, anal fissures, etc. Hot sitz bath means to immerse anus in a bowl, filled with warm water of 40–42 °C for 3 min; one may also use bidet or shower. In the past, 20 min of a sitz bath was recommended, but since there are possibilities of congestion or prolapse, shorter bath time is more recommended recently to prevent congestion or edema. Hot sitz bath relieves pain by lowering anal pressure, helps to keep anus clean, and improves anal blood circulation that relieves congestion and edema.

6.1.2 Medical Treatment of Hemorrhoids (Table 6.2)

6.1.2.1 Medication (Table 6.3)

The oral medications for hemorrhoids include the following: agent to improve circulation by strengthening the vein and capillary, anti-inflammatory agent, and stool softener to facilitate defecation:

- Phlebotonics
These compounds help blood circulation around the anus to settle edema and relieve congestion. The agents such as diosmin belong to this category.
- Anti-inflammatory agents
The agents such as Melilotus belong to this category which relieves inflammation and pain. They are effective on edematous or inflammatory hemorrhoids.

Fig. 6.1 Treatment methods for hemorrhoids**Table 6.1** Management of hemorrhoids according to the degree

Type	Treatment
1st degree	Conservative treatment
2nd degree	Rubber band ligation, sclerotherapy, conservative treatment
3rd degree	Surgery, ligation and excision, sclerotherapy, rubber band ligation
4th degree	Surgery
Incarcerated hemorrhoid	Surgery
External hemorrhoid (mild)	Conservative treatment
External hemorrhoid (severe)	Surgery

Table 6.2 Effectiveness of hemorrhoid medications

Oral medicine	Ointment/suppository
1. Enhance blood circulation	1. Improve inflammation
2. Improve inflammation	2. Relieve pain
3. Stool softener	3. Wound healing
4. Relieve pain	4. Prevent infection
5. Prevent bleeding	5. Treat itching sensation

- Stool softener

The symptoms of hemorrhoids are relieved with stool softener which makes the stool smoother and easier to defecate. Laxatives such as fibers and magnesium oxide are mainly used. Stimulant laxatives are prohibited as much as possible.

6.1.2.2 Ointment

Ointment applied around the anus is usually made up of anti-inflammatory agent to relieve inflammation and itching sensation. Other components such as steroid or anesthetics are used for relieving pain. Although ointment containing steroid is effective for severe inflammations, it should not be applied more than a month since side effects may occur when applied for a long period of time (Table 6.4).

6.1.2.3 Suppositories

Suppositories are inserted into lower rectum through the anus, where they are melted and absorbed. It acts like an ointment but also has the effect of oral medication. It is generally said that ointment has an immediate effect, whereas suppositories have a lasting effect. However, suppositories can cause the anal canal injury and sense of defecation (Table 6.5).

6.1.2.4 Injections

Most injections for hemorrhoids are the anti-inflammatory agents made of Melilotus ingredient. Muscle injection is usually available once a day, and intravenous injection is also possible (Table 6.6).

6.1.3 Dietary Treatment: High Fibers

For hemorrhoid patients, fluid and fiber intake should be increased for the stool to be soft and easy defecation.

Table 6.3 Oral medications used to treat hemorrhoids (tablets)

Trade name	Ingredients and content (mg)		Usage/dosage
Dismin	Diosmin	150	Two times/day (afternoon, evening)
Venoron			Two tablets with food
Venitol	Diosmin	450	Acute: first 4 days two times/day, two tablets
	Hesperidin	50	Two times/day, one tablet
Perivar	Ginkgo biloba ext	14	Three to four times/day, one tablet
	Heptaminol HCL	300	
	Troxerutin	300	
Marobiven	Melilotus ext	250	Three times/day, two caps
Merilo			
Melibycin			
Esberon			
Esberiven			
Glyvenol	Tribenoside	200	Three times/day, 1–2 caps
Maronin	Aesculus ext	25/50	Three times/day, 50 mg
Essaven	EPL substance	75	Three times/day, two caps before meals
	Aescin conc	90	2 weeks later, one cap/morning, two caps/evening
Chirona	Lysozyme chloride	22.5	Three times/day, one cap
	Tocopherol acetate	25	
	Carbazochrome	5	
	Inositol nicotinate	100	
	Aloin	5	
REXEN-T TAB	Melilotus (50 % ethanol ext)		Adult: three times/day, 3–4 tablets 7–15 year: three times/day, 1–2 tablets
Roratus	Melilotus ext	250	Three times/day, two caps

Table 6.4 Topical ointment used to treat hemorrhoids

Trade name	Ingredients and content (mg)		Usage/dosage
Preparation H	Shark liver oil	30	Apply morning, evening, after defecation (up to four times/day)
	Phenylephrine HCl	2.5	
	Petrolatum	7.9	
	Light liquid paraffin	140	
Proctosedyl	Dibucaine HCl	5	Apply one to three times/day
	Esculose	10	
	Hydrocortisone	5	
Chitha	Fluocortolone trimethylacetate	1	Apply two times/day (In severe case, three times/day)
	Lidocaine HCl	40	
Faktu	Policresulen	50	Apply two to three times/day
	Dibucaine HCl	10	
Chinaron	Lidocaine	30	Apply one to two times/day
	Prednisolone acetate	0.5	
	Chlorhexidine HCl	2.0	
	Tocopherol acetate	10	
	Aluminum chlorhydroxy allantoinate	2.5	
Sulgan-99	Benzocaine	50	Apply one to two times/day
	Hamamelis water	50	
	Camphor	10	
	Menthol	5	
Glyvenol P	Lidocaine HCl	20	(Acute case): apply two times/day
	Tribenoside	50	After symptom relief

(continued)

Table 6.4 (continued)

Trade name	Ingredients and content (mg)		Usage/dosage
Venot H	Heparin Na	50 U	Apply one time/day
	Aesculus seed ext	0	Apply several times/day
	Hamamelis water	250	
Rexen	Hamamelis ext (2.5:1)	30 %	Apply three times/day
Chinals	Hydrocortisone acetate	5	Apply two to three times/day
	Lysozyme Cl	15	
	Allantoin chlorhydroxy alum	5	
	Tocopherol acetate	10	
	Zinc oxide	50	
	Ethyl aminobenzoate	25	
	Isopropyl methyl phenol	1	
Proctolog	Ruscogenin	5	Apply two times/day
	Trimebutine	58	

Table 6.5 Commercially available suppositories

Trade name	Ingredients and content (mg)		Usage/dosage
Preparation H	Shark liver oil	66	Morning, evening, after defecating (up to six times/day)
	Cocoa butter	1738	
Chitha	Fluocortolone trimethylacetate	1	One to two times/day (in severe case, three times/day)
	Lidocaine HCl	40	
Proctosedyl	Dibucaine HCl	5	One to three times/day
	Esculoside	10	
	Hydrocortisone	5	
Faktu	Policresulen	100	Two to three times/day
	Dibucaine HCl	2.5	
Chinaron	Lidocaine	60	One to two times/day
	Prednisolone acetate	1	
	Chlorhexidine HCl	4	
	Tocopherol acetate	20	
	Allantoin chlorhydroxy alum	5	
Sulgan-99	Benzocaine	70	One to two times/day
	Hamamelis water	200	
	Camphor	20	
	Menthol	10	
Venot	Aesculus seed ext	60	One to two times/day
	Hamamelis bark ext	80	
	Hamamelis bark powder	120	
Rexen	Hamamelis ext (2.5:1)	20	After defecation, before sleep
	Hamamelis bark	60	
Rexen	Hamamelis folium	40	After defecation, before sleep
	Polydocanol	100	
	Chamomile	20	
Chinals	Hydrocortisone acetate	5	One to two times/day
	Lysozyme Cl	30	
	Allantoin chlorhydroxy alum	5	
	Tocopherol acetate	20	
	Zinc oxide	100	
	Ethyl aminobenzoate	150	
	Isopropyl methyl phenol	1.6	
Proctolog	Ruscogenin	10	Two times/day
	Trimebutine	120	

Table 6.6 Injections used to treat hemorrhoids

Trade name	Ingredients and content (mg)		Usage/dosage
Nesbiron Marugen	Melilotus ext	100	1–2 amp/day, daily or every other day IM, IV
Mybenta			
Melos			
Marobiven	Melilotus ext	100	
Malotus	Melilotus ext	300	
Melubin			1–2 amp/day, daily or every other day IM, IV
Mesven			
Metus			
Esberon			
Esberiven Porte			

Table 6.7 Foods containing much amount of dietary fiber

Classification	Foods including much dietary fiber
Grain	Brown rice (1.3), adlay, barley (0.2), corn (0.7), oats, taro (1.0), oatmeal, corn flakes
Hardy plants	Potato (0.5), sweet potato (0.6), glucomannan
Soya	Adzuki beans (3.7), soybean, kidney bean (3.2), pea (2.1), soybean paste, mung beans (3.8)
Vegetables	Chrysanthemum (1.0), water parsley (0.7), lettuce (0.8), leek of bracken (1.2), dry bracken (11.1), burdock (1.7), celery (1.5), bean sprouts (0.4), parsley, Swiss chard, mugwort (3.7), lotus root (1.1), cabbage (0.7), taro
Mushroom	Dry shiitake mushroom (5.7), dry oyster mushroom (5.3), matsutake mushroom
Fruits	Apple (0.2), strawberry (1.9), pear (0.8), dry jujube (6.1), fig, apricot (0.8), pineapple (0.3), persimmon (0.1)
Nut products	Chestnut (1.1), walnut (1.2), pine nut (0.9), almonds (2.7)
Seaweeds	Dry kelp (7.5), dry seaweed (5.0), laver (2.1), green laver (2.3), fusiform, agar

() Amount of fiber content per 100 g (mg/100 g)

Alcohol drinking should be forbidden to prevent diarrhea and inflammation. Also, patients' diet should restrict spicy foods and coffee, since they also stimulate the intestine and the anus.

Nowadays, since people have a tendency to eat a lot of refined food, meat, and fast food of low-fiber diet, they are easily constipated because of delayed transit time. High-fiber diet does not only treat hemorrhoids but is also effective on preventing hemorrhoids. It is why a coloproctologist must have knowledge about fibers.

6.1.3.1 Fibers (Table 6.7)

Dietary fibers are components of plants that resist by human digestive enzymes. They are nonnutritive substance which is not digested nor absorbed. The structure of fiber can be divided into water-soluble (nonstructural) and insoluble (structural) component. Insoluble fibers, such as cellulose, semi-cellulose, and lignin, make up 70 % of the whole fibers that increase the volume of stool and shorten the transit time through the stomach and the intestine.

Water-soluble (nonstructural) fibers account 30 % of the whole fibers, which disturb reabsorption of bile acid and have water-binding capacity. They consist of plant rubber like pectin, guar gum, Karaya rubber and mucilage like psyllium seed, and algae polysaccharide like agar.

Water-Insoluble (Structural) Fiber

- **Cellulose**
It is dextrose polymer (exists on the cellular wall of plants) that shows the most distinctive characteristics of fiber and is rich in wheat bran and apple peel.
- **Lignin**
It exists on the cellular wall of wood and is not a carbohydrate.
- **Hemicellulose**
It comprises 15–30 % of the cellular wall of plants, and pentose-contained polysaccharide in hemicelluloses of wheat bran influences the volume of stool.

Water-Soluble (Nonstructural) Fiber

- **Pectin**
- **Pectin** has a tendency to be like a gel and is abundant in citrus, apple, and coats of an onion. It holds the water of the intestinal lumen easily.
- **Plant rubber (guar gum, Karaya rubber)**
It is a kind of bulk-forming laxatives, extracted from the tropical plants and seeds.
Guar gum thickens the salad dressing, toothpaste, and soup.
- **Mucilage (psyllium seed, ispaghula)**
It has hydrophilic materials to hold water for its seed.
Psyllium is rich in mucilage which affects the characteristics of volume forming and laxatives of materials.

- Algae polysaccharide (agar)
It is found only on the cellular wall of seaweed and algae. It has characteristics of forming a gel and holding water.

Others

- Phytate
Exists almost on all of the cell walls of seed and has adsorption properties of iron, calcium, magnesium, and zinc.
- Minerals
- Cuticles
Dietary fiber holds the water like a sponge and has the ability to absorb bile, protein, and glucose. It is fermented by bacteria.
The components of dietary fiber have substantially different properties chemically and physically; however, they generally increase the volume of stool and shorten gastrointestinal transit time. Therefore, they are effective on constipation as well as prevention and treatment of hemorrhoids.

6.1.3.2 The Physical Characteristics of the Dietary Fiber

- Dietary fiber has the ability to hold water.
- Bran, carrot, and potato have the ability to hold water of 4.5, 2, and 0.4 g per gram each. The water exceeding this capacity is called free water.
- Viscosity
- Ion exchange ability
- Lignin and pectin: exchange ions after combining with calcium, iron, magnesium, zinc, and phosphate.
- Adsorption capacity
Dietary fiber absorbs substances like bile salt and protein.
Lignin especially has high bile-binding capacity.

6.1.3.3 Fermentation of the Dietary Fiber

- Dietary fibers are fermented variously by bacteria.
50 % of the cellulose is broken down by bacteria and is highly influenced by the size of its particles (the smaller the particle size, the easier the bacteria to access facilitating fermented).
The lignin is not fermented by bacteria and reduces the possibility of spoilage of cellulose by bacteria.
- Productions
- Volatile fatty acid (acetate, propionic acid, and butyric acid)
It is the source of energy of an ox or a rabbit.
- Gas (Hydrogen, methane and carbon dioxide)
Although the gas may cause abdominal bloating initially, it eventually reduces the volume of colonic gas by reducing transit time through decreased required fermentation time.
- Energy
It is used in the proliferation of colonic bacteria to influence the weight of the feces. 70–80 % of feces are com-

posed of water; half of solid stool components are composed of undigested cellulose, and the other half composed of bacteria.

6.1.3.4 Drugs Made of the Dietary Fiber

Although patients with hemorrhoids are recommended to intake a lot of dietary fiber, bulking agents are often prescribed at the clinic.

Psyllium seed, polycarbophil, synthetic polysaccharide, Karaya rubber, etc., are the examples of bulking agents. Psyllium not only absorbs water but also shortens the colonic transit time by increasing the bacterial masses through bacterial fermentation in the large intestine. Amount of bulking agents must be increased gradually because it has a side effect of gas emission from the intestine.

As synthetic polysaccharides and methylcellulose are not fermented by bacteria in the large intestine but absorb water to increase the amount of the stool, the early experience of gas distension from other dietary fiber can be reduced.

To increase the amount of fiber intake, one should increase the amount of grains, fruit, vegetables, and seaweed. When vegetables are parboiled, it is easier to consume more fiber than raw vegetables as the water contained in the vegetables is reduced. Water-soluble fiber increases the volume of stool by absorbing water, but sufficient fluid must be taken to prevent adverse effects.

6.1.4 Bowel Movement Education

During defecation, the anal cushion descends downward normally. If it stays at its descended state for a long time, it cannot be recovered to its original site causing prolapse and bleeding. Therefore, finishing bowel movement within a short period of time is a way to prevent hemorrhoid without worsening.

Patients should be instructed to finish bowel movement within 3 min even if they have sense of more defecation and to induce their defecation after breakfast, if possible. For the one who has a habit of defecation right after waking up should be instructed to drink one to two cups of water to induce gastrocolic reflex. Teach to rinse with water rather than wiping with paper after defecation. If a tissue must be used, instruct to use it after soaking with water.

6.2 Rubber Band Ligation (Barron, McGivney)

Rubber band ligation is the most commonly used method of noninvasive treatment of hemorrhoids. It causes ischemic necrosis by blocking the circulation with rubber band to eliminate the hemorrhoidal tissue. This method can be performed without anesthesia in the outpatient clinic and

also can be applied to the relatively small piles remained after excision of main large pile. During hemorrhoidectomy, it is usually used in the internal hemorrhoids of second or early third degree. The devitalized hemorrhoidal tissue drops out in 7–10 days after the procedure. This procedure is simple but not effective on severe hemorrhoids. If the procedure is applied to several hemorrhoids at one time, it may cause anal stenosis. The complications of rubber band ligation include pain (1–29 %) and bleeding (2–10 %).

6.2.1 Principles of Rubber Band Ligation

It is a method of grasping hemorrhoid with Allis forceps and tightening with rubber band. In the case of protruding hemorrhoid, relaxed longitudinal axis is the main problem. But the rubber band ligation reduces the longitudinal axis as well as the horizontal axis. Therefore, if this procedure would be applied excessively, it might result in the anal stricture.

6.2.2 Indication of Rubber Band Ligation

As shown in Fig. 6.2, hemorrhoid with mucosal prolapse which is pulled easily can be the indication for rubber band ligation. So the indication will be the hemorrhoids with lots of mucosal prolapse component with less fibrotic change.

The indications are as follows:

1. Internal hemorrhoid of second and early third degree.
2. Prolapsed mucosal hemorrhoid.
3. Curative surgery is impossible due to comorbidity in the heart, liver, lung, etc.
4. Non-excised internal hemorrhoidal pile during hemorrhoidectomy.
5. Removal of rectal polyp.

6.2.3 Procedure

After exposing the hemorrhoids using anoscope, load rubber band and grasp the hemorrhoid pile through the drum with Allis forceps, and then pull the relaxed pile (Figs. 6.4 and 6.5) proximal to dentate line and fire the rubber band. Loaded rubber band ligator should be located close to the rectal wall and then fired to tie (Figs. 6.6 and 6.7). Additional silk tie is recommended in order to prevent the early disruption of the rubber band.

To make loading rubber band into the ligator easy, the Helios corp. in Japan invented the rubber band pusher. The rubber band inserted on the tip of round cone is loaded easily into the ligator when pushed with rubber band pusher (Fig. 6.3).

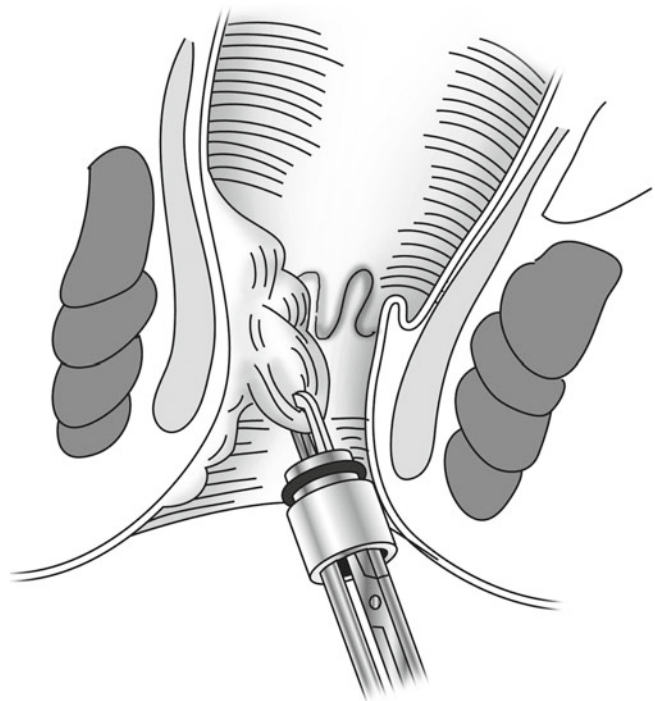


Fig. 6.2 Rubber band ligation. Firstly, grasp hemorrhoids with Allis forceps and tighten with rubber band

6.2.4 Limitations and Contraindications of Rubber Band Ligation

1. The rubber band ligation can only be applied to the internal hemorrhoids proximal to dentate line without external pile. The ligation should be applied at more than 1 cm proximal to the dentate line to avoid severe pain. It is not suitable for external or mixed hemorrhoids.
2. This procedure cannot be applied for large hemorrhoids because the caliber of ligator drum is 1 cm, so that the larger one cannot be drawn into the instrument. The procedure is suitable for second- and early third-degree hemorrhoids, but not for late third- and fourth-degree hemorrhoids.
3. The procedure cannot be used for too small internal hemorrhoids because the band can be slipped out easily.
4. For the patients with anal stricture, rubber band ligation should not be used because it aggravates the symptom.
5. For the risk of sepsis, rubber band ligation should be avoided at patients with combined inflammation.

6.2.5 The Complications of Rubber Band Ligation

When the banded hemorrhoid sloughs off in 1 or 2 weeks later, delayed bleeding can be developed. The rate of delayed bleeding is about 1–2 % statistically, which can be prevented by

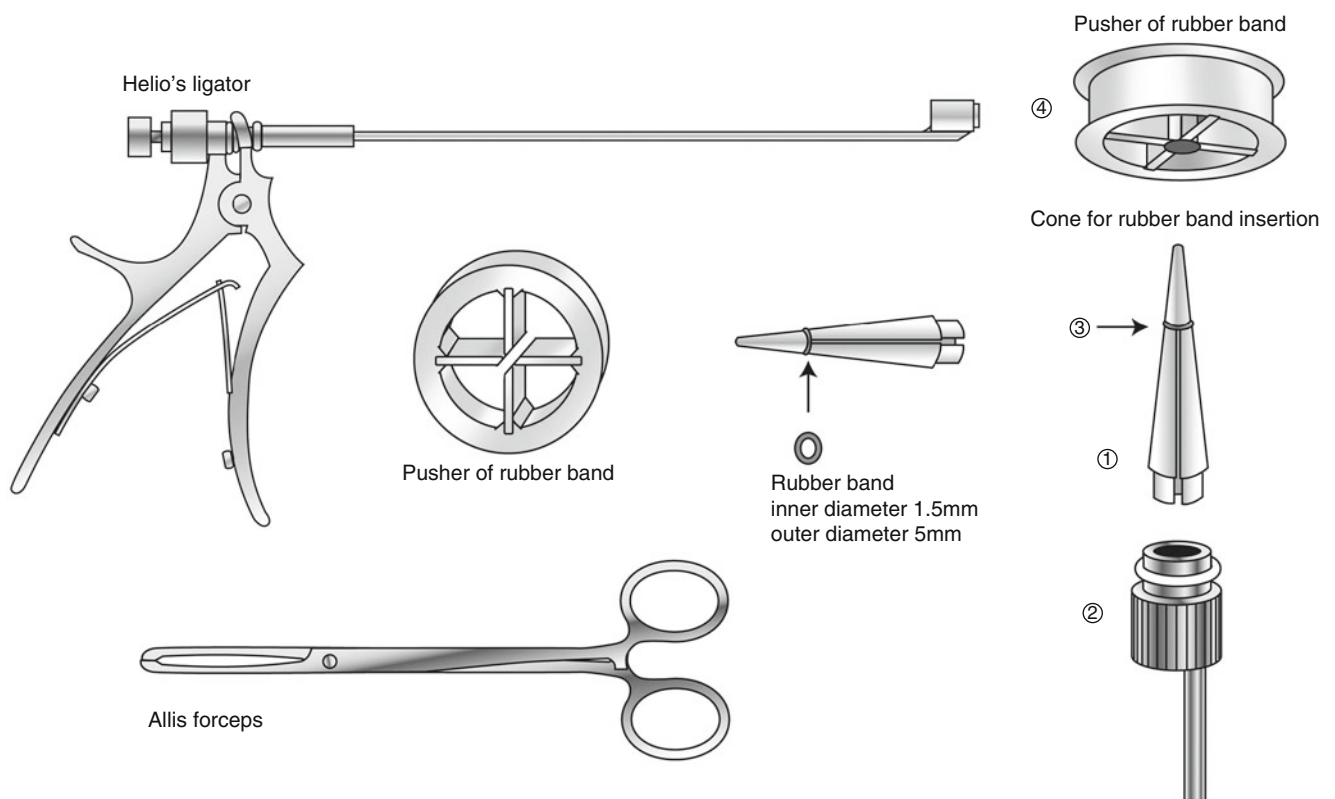


Fig. 6.3 Instruments of rubber band ligation. Helio's product is easy to mount a rubber band. It uses a rubber band mounting cone (①), inserts rubber band at the end of cone (②), and pushes the rubber band to the bottom of the cone (③) using rubber band pusher (④)

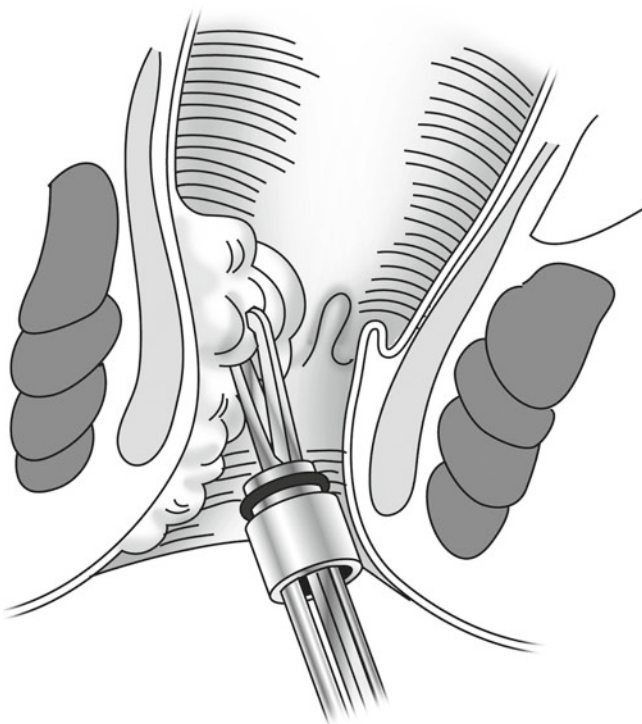


Fig. 6.4 Loading a rubber band

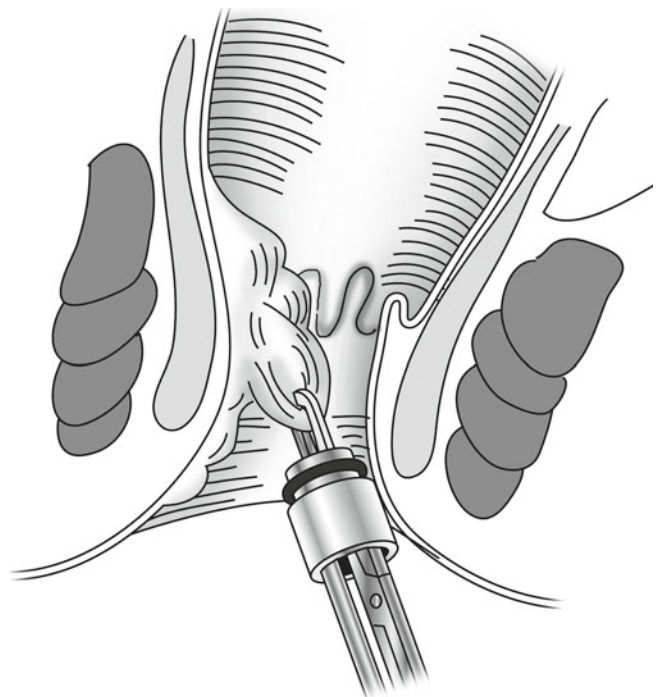


Fig. 6.5 Pulling the pile with the Allis forceps through the drum

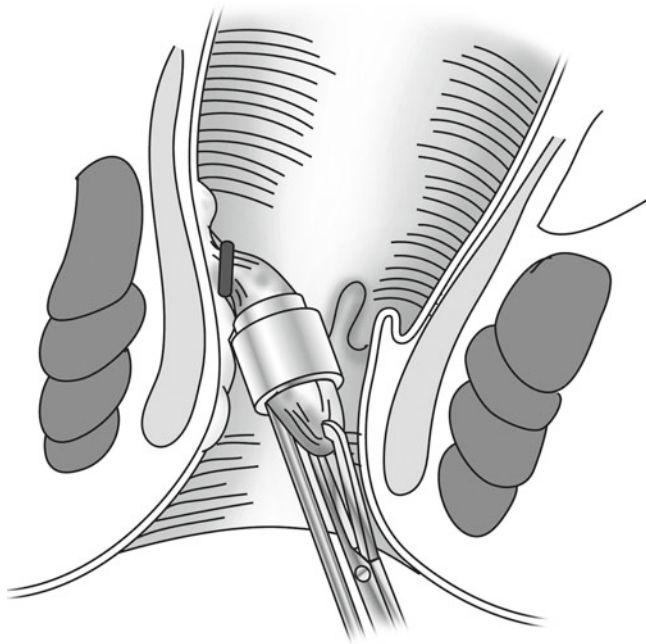


Fig. 6.6 Fire the rubber band to ligate the hemorrhoid pile by pulling the handle of the ligator, and remove the drum

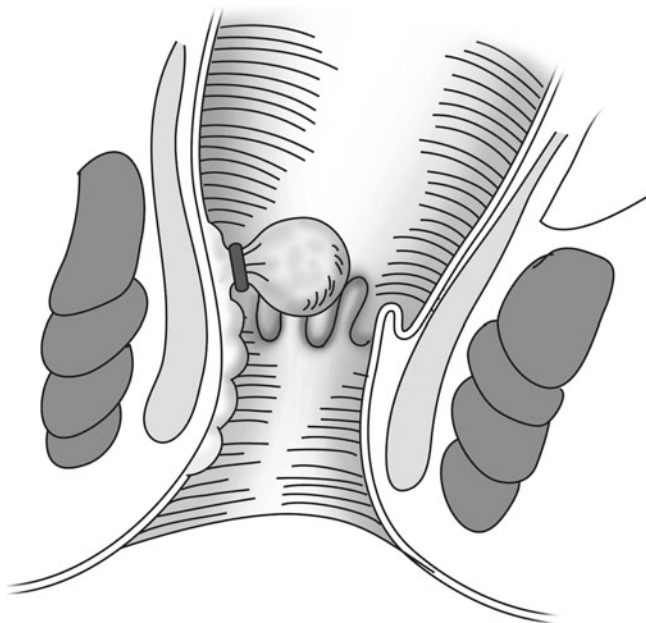


Fig. 6.7 Appearance after rubber band ligation

injecting sclerosing agent such as ALTA (Ziohn®) or Paoscle (5 % phenol in almond oil) to the pedicle of hemorrhoids or ligation site. As severe pain, vague abdominal pain, sepsis, or even death has been reported, this procedure is not recommended for inflammatory patients or immunodeficient patients. Rarely, some patients complain urinary retention.

6.3 Sclerotherapy

“Could hemorrhoids be treated with simple methods such as injection?” It must be a common question for both surgeons and patients.

The injection of sclerosing agent for the treatment of hemorrhoids had been widely used at 200 years ago. The injection method of using iron sulfate has been first reported by Molgan in England in 1869. In 1871, Michael in America used mixed agent of olive oil and phenol (2:1) and reported good result. However, he didn’t disclose the secret method of the mixture. He sold the secret to non-practitioner before his death. Later, 27–95 % of high-concentration phenol had been used by nonmedical personnel all around the United States, and many complications such as severe pain and mucosal disruption were caused.

In 1897, Andrew got good results after curtailing the concentration of the phenol after knowing the secret of non-practitioner. Quinine urea widely used in USA is effective for prolapsed hemorrhoids by inducing fibrosis.

In the past, injection method was widely practiced in Japan, but the material was not opened to public and was only transmitted to posterity as the family’s secret. Later, Paoscle®, made up of 5 % phenol and almond oil, was developed by drug company “Torii,” which is effective for hemorrhoids with bleeding.

The combination product of aluminum potassium sulfate and tannic acid (ALTA, Ziohn®) is a further developed one of chinese agent Xiaozhiling for sclerotherapy and has been used widely in Japan and South Korea. It is made possible for the treatment of third- and fourth-degree internal hemorrhoids, which used to be treated surgically, but requires care in using because severe complications like anal stricture may arouse.

6.3.1 The Principles of Sclerotherapy

The principles of the sclerotherapy are fibrosis and inflammatory reaction, which lead to compression of vessels, hemostasis, and fixation of prolapsed hemorrhoid tissues in the anal canal.

6.3.2 Indications

1. First- and second-degree internal hemorrhoids with bleeding
2. Third- and fourth-degree prolapsed internal hemorrhoids especially ALTA; ALTA is a very strong sclerosing agent, so indication of sclerotherapy has been widened recently.

6.3.3 Contraindications

1. External hemorrhoids
2. Thrombosed hemorrhoids
3. Anal fistula and perianal abscess
4. Anal fissure

6.3.4 Sclerosing Agents for Sclerotherapy

1. Ziohn®.
2. Xiaozhiling®.
3. 5 % phenol dissolved in vegetable oil (mainly almond oil); this material can be manufactured personally and used after sterilization with autoclave. There is Paoscle® (1 ampule=5 cc) developed by Torii pharmacology company, in Japan.
4. 5 % quinine urea hydrochloride (Figs. 6.8, 6.9, and 6.10).

6.3.5 The Injection Method of Sclerosing Agent

In ALTA, four steps of injection are commonly used. Completion of the workshop for ALTA must be required before conducting this procedure in South Korea and Japan. Due to severe complications such as anal stenosis, any position of patients like Jackknife, left lateral, or lithotomy is possible to practice the procedure.

6.3.5.1 ALTA (Ziohn®)

The composition of ALTA was finalized after the slight change of additives in Xiaozhiling® of China. After the approval of commercial use, the commercial name of the agent became Ziohn®. In Korea, ALTA has been imported from Japan and is used under the name of Ziohn® since 2007.

Academically, it is called ALTA, and its main ingredients are aluminum potassium sulfate and tannic acid. The aluminum potassium sulfate induces an aseptic inflammatory reaction, forming granuloma and fibrosis that fixes mucosal and



Fig. 6.8 Paoscle®, Torii pharmacology company, Japan



Fig. 6.9 Xiaozhiling

submucosal layers to muscle layer. Then, it occludes blood supply to control hemorrhage and shrink hemorrhoids. Compared with other sclerotic agents, ALTA has more significant effects on inflammatory responses and fibrosis. Therefore, ALTA injection may be effective in all internal piles including third- and fourth-degree hemorrhoids (Fig. 6.11).

The 4-stage injection method is used under spinal or local anesthesia.

The 4-Stage Injection Method (Figs. 6.12 and 6.13)

1. Place a needle at proximal pole of hemorrhoid, and inject 2 ml into the deep submucosal layer. Then, inject 1 ml



Fig. 6.10 Ziohn® of Japan

while pulling the needle to the side. Mucosal surface changes slightly pale after the injection (near the superior hemorrhoidal artery).

2. Inject 3–4 ml into the submucosal layer at the center of hemorrhoid.
3. Inject 1–2 ml into the lamina propria at the center of hemorrhoids.
4. Inject 2–3 ml into deep submucosal layer of hemorrhoid at distal pole, which is located 0.1–0.2 cm proximal to the dentate line. Inject additional 1 ml while withdrawing the needle.
5. Massage: The whole injection area must be massaged to diffuse the drug. Care should be taken not to inject into the muscle layer, bladder, prostate, or vaginal wall. Avoid injection or diffusion in the area distal to the dentate line to prevent pain and stenosis.

Relative contraindications

1. Patients with impaired renal function
2. Old-aged patients or patients with poor general condition
3. Patients with heart conduction disorder
4. Patients with severe impairment of hepatic function

Absolute contraindication

1. Women with pregnancy or possible pregnancy
2. Breast feeding women
3. Patients with dialysis
4. Incarcerated hemorrhoids
5. Patients with hypersensitivity from lidocaine

Outcomes of Ziohn® Treatment

After 28 days from injecting 9–13 ml Ziohn® per each main pile of third- or fourth-degree internal hemorrhoids, prolapse

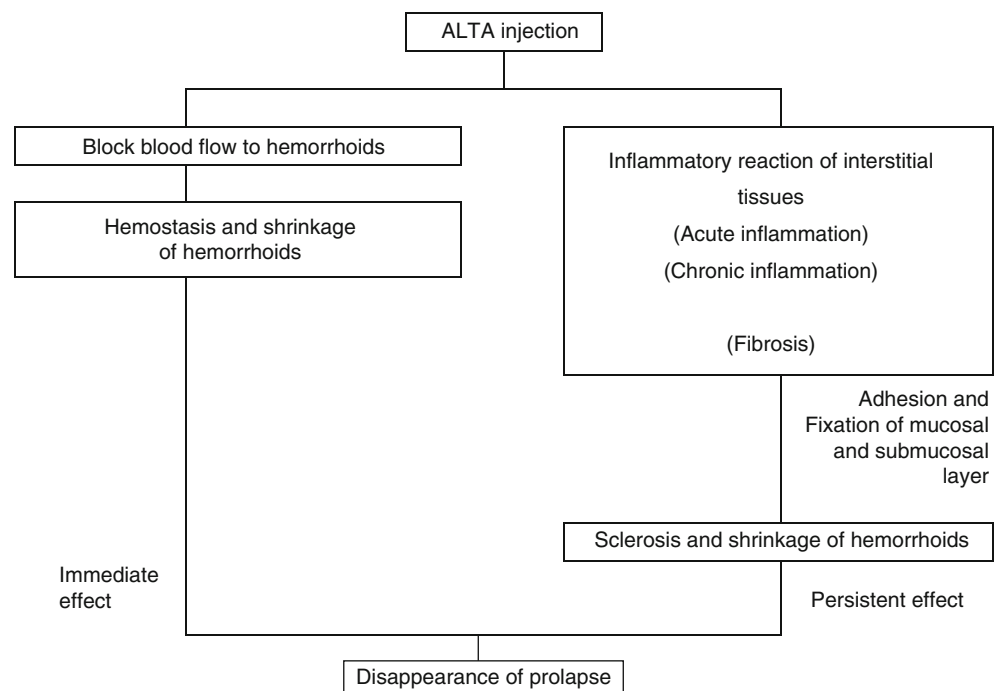


Fig. 6.11 Mechanism of ALTA injection

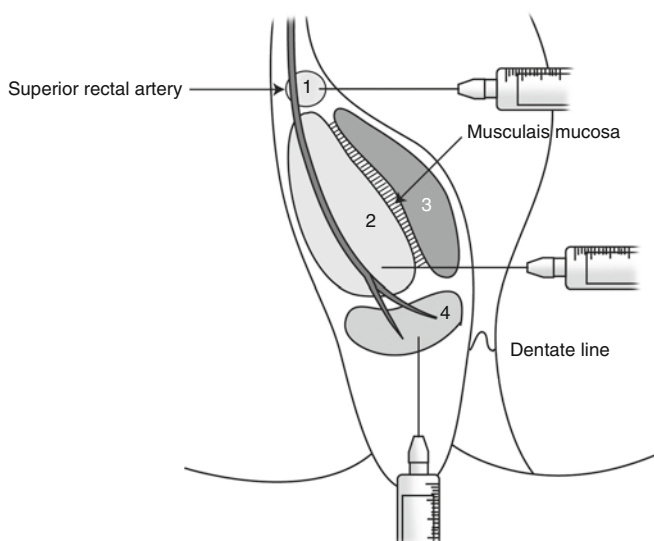


Fig. 6.12 The 4-stage method of Ziohn injection. 1 Submucosal layer of hemorrhoid at the proximal pole, 2 Submucosal layer of the center of hemorrhoid, 3 Lamina propria of the center of hemorrhoid, 4 Submucosal layer of hemorrhoid at the distal pole

and bleeding on defecation have disappeared, and shrinkage of hemorrhoids was noted (Table 6.8).

Compare ALTA Injection with Operation (Ligation and Excision)

- Subject: 85 patients with protruding internal hemorrhoids (Goligher classification III and IV degree)
- Method: To compare the outcomes of Ziohn® and operation, the patients who underwent Ziohn® injection and operation were assessed for each item (Table 6.9).

Severe side effects are noted such as fever, hypotension, headache, nausea, anorexia, rectal ulcer, and rectal stenosis. Over 38 °C of fever was sometimes observed, and it may persist up to 2 weeks. There are also several complications such as induration of perianal area (78 %), anal pain (48 %), defecation difficulty (21 %), and swelling. When it was injected in prostate, hematuria, urinary frequency, and polyuria were observed.

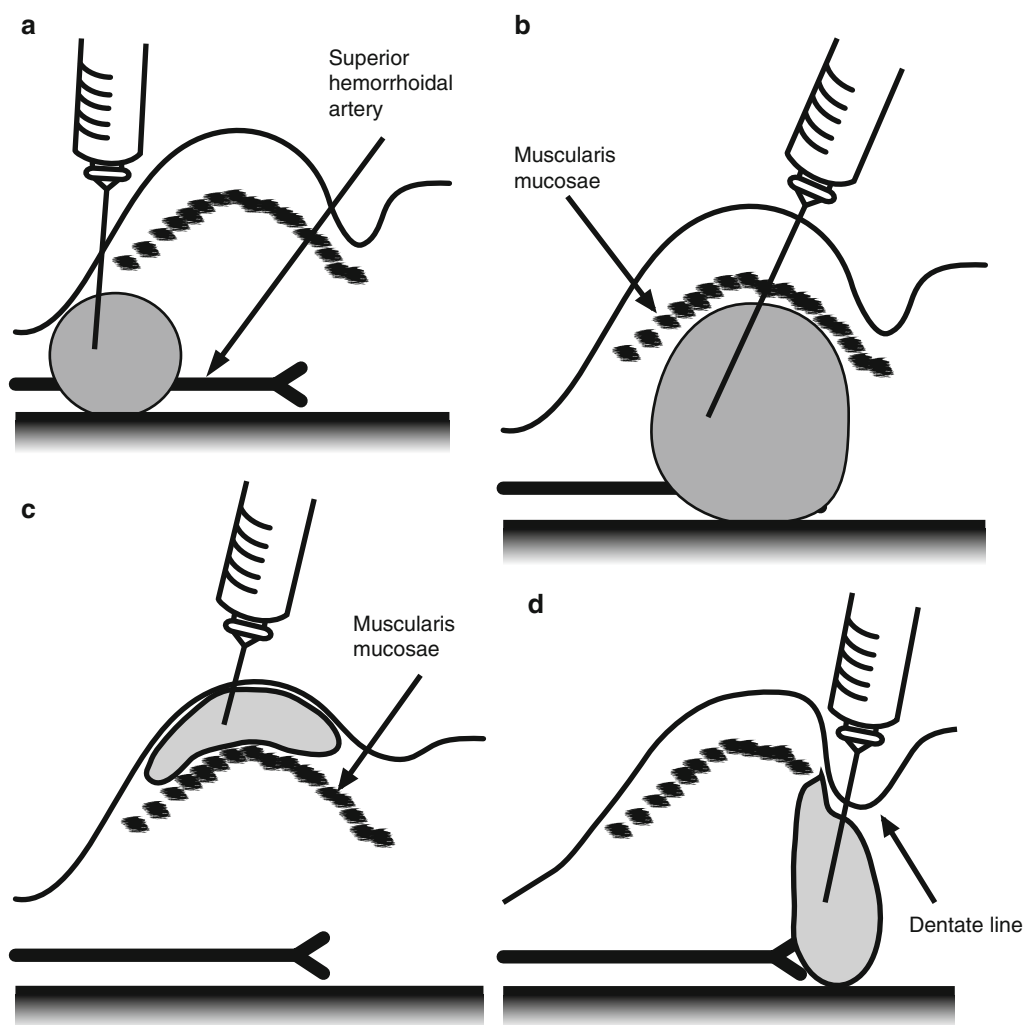
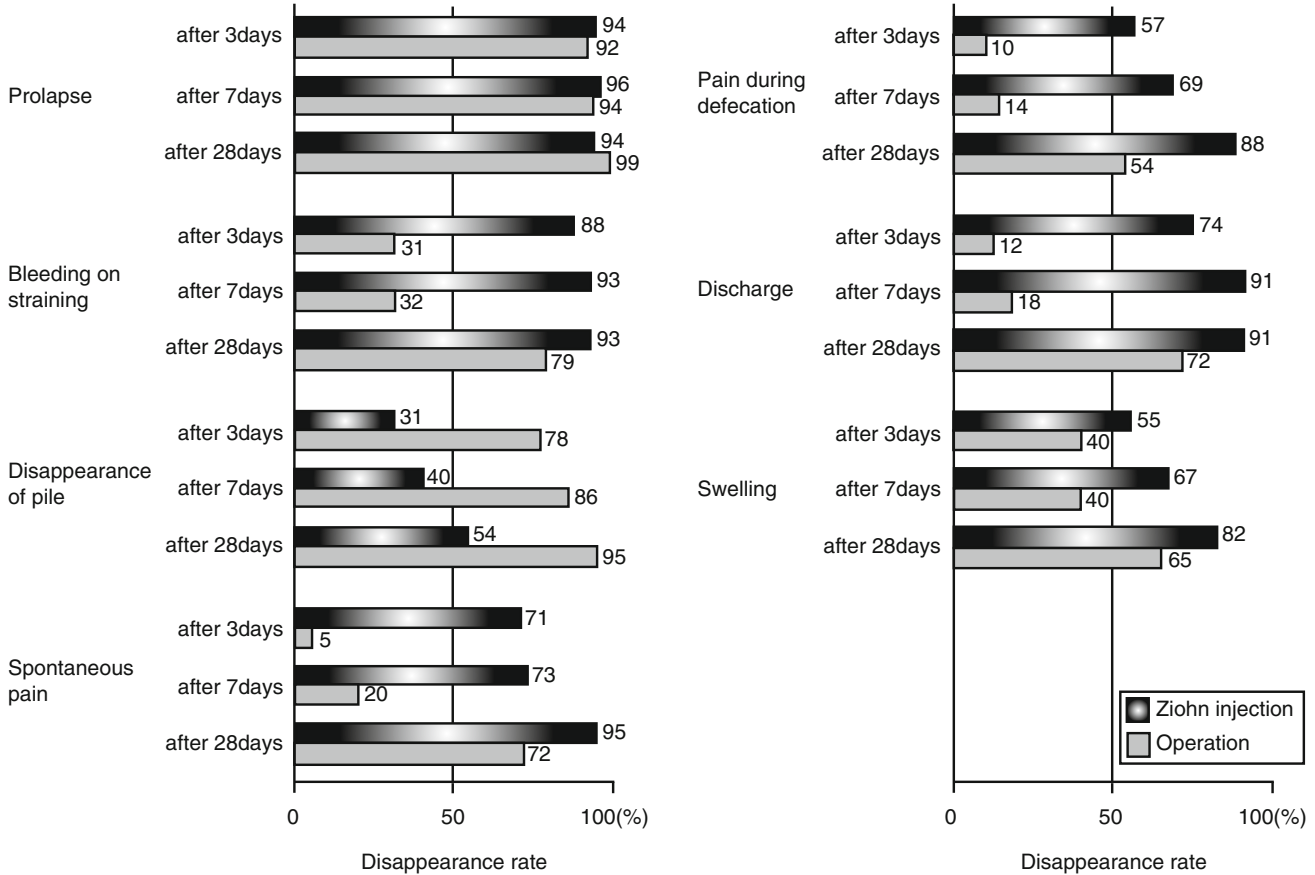


Fig. 6.13 The 4-stage injection method of ALTA. (a) First step: inject ALTA at the superior pole of hemorrhoids. Mucosal surface changes slightly pale. (b) Second step: inject ALTA into the submucosal layer at the center of hemorrhoids. (c) Third step: inject ALTA into the mucous lamina propria at the center of hemorrhoids. Mucosal surface changes pale. (d) Fourth step: inject ALTA into the submucosal layer at the inferior pole of hemorrhoids

Table 6.8 Prolapse, bleeding on defecation, and disappearance rate

Assessment	Compound fluids		Total
	With 0.5 % lidocaine	With saline	
Prolapse	92 % (44/48)	96 % (53/55)	94 % (97/103)
Bleeding on straining	88 % (21/24)	100 % (30/30)	94 % (51/54)
Disappearance of pile	56 % (27/48)	60 % (33/35)	58 % (60/103)

Disappearance of pile means the percentage of cured case with no protruding pile after injection

Table 6.9 Comparison of the symptom disappearance rate after Ziohn injection and operation

Ziohn® has 20 ml of an ampule with two kinds of mixture, Ziohn® with saline or Ziohn® with lidocaine. Ziohn® with saline is used under the spinal or caudal anesthesia, and Ziohn® with lidocaine is used under local anesthesia. 10 ml of local anesthesia product contains 50 mg of lidocaine (0.5 %).

Because of the high possibility of various side effects and complications, doctors have to get certification after training course to use Ziohn® in Japan. In Korea, Ziohn® has been sold and available only for the doctors after training course, too.

6.3.5.2 Xiaozhiling®

Xiaozhiling® contains 10 mL in 1 ampule. The agent is used after mixing with 0.5 % of lidocaine (Xiaozhiling®: lidocaine=1:1). It works well with 25-gauge syringe needle.

The main component of the agent is potassium aluminum sulfate which rapidly occludes blood circulation to hemorrhoids resulting in hemostatic and shrinkage effects. Moreover, the sclerosing agents induce an inflammatory reaction, resulting in fibrosis and fixation of hemorrhoidal tissue (Fig. 6.14).

6.3.5.3 Phenol Almond Oil (Paoscle®)

Before the procedure, hemorrhoids should be inspected carefully with anoscope. There are Albright and Takano's method for injection: Albright method places injection needle on submucosa, 2–3 cm above the dentate line (Fig. 6.15) and Takano's method places the injection starting 2–3 mm proximal to the dentate line and pushes upward (Fig. 6.16). Takano's method is comparably easier than Albright's.

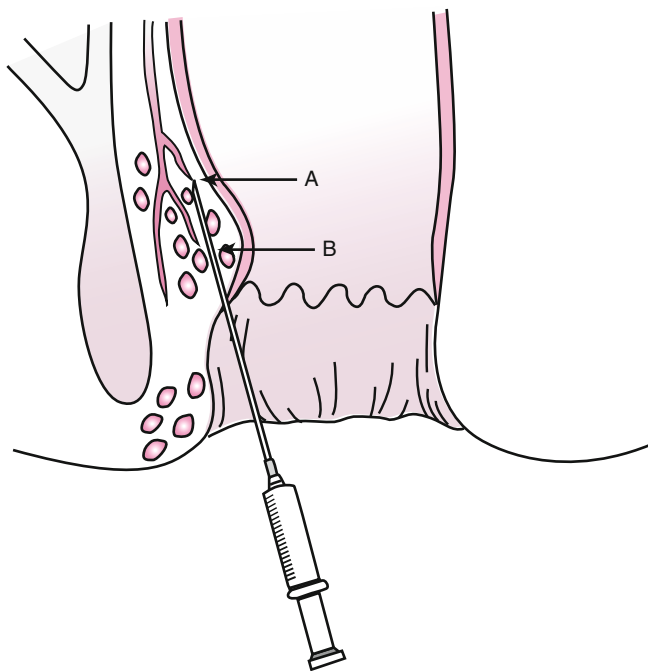


Fig. 6.14 Xiaozhiling® injection. Three milliliter of the solution is injected into B, and another 2 ml is injected into A on the way back out

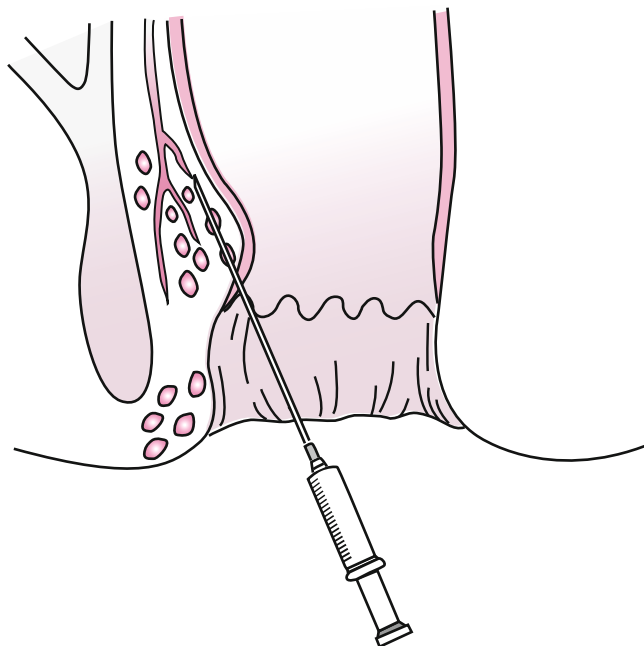


Fig. 6.16 Dakano's method (Paoscle® injection)

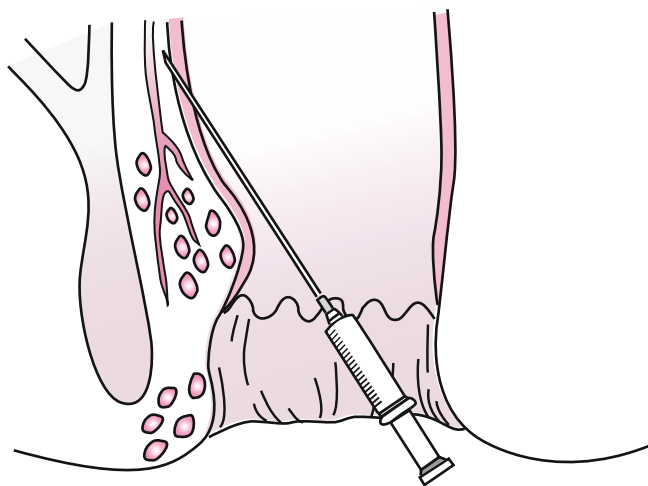


Fig. 6.15 Albright method

Paoscle is made up with phenol dissolved in oil, which is too viscid to charge and inject. So, 18-gauge needle is used when taking out from vial, and 22-gauge needle is used for injection. Firmly fixed disposable syringe can be used, but Gabriel syringe is more convenient when injecting.

Although the puncture site doesn't matter whether it is proximal or distal to the dentate line, the sclerosing agent must be injected proximal to the dentate line to prevent pain. Local anesthesia is not mandatory, but is convenient for the procedure.

The 2–3 mm of injection depth is optimal. The mucosa swells after the injection. When the injection is too shallow,

the mucosa becomes pale and forms blisters to be necrotic and ulcerative. When the injection is too deep, internal sphincter injury is possible. When the agent is injected deep into the anterior side of anus, complications from its adjacent organ (vagina for women and prostate or urethra for men) can be caused.

Injection of agent should be carried out after checking regurgitation because complications could occur if the agent would be injected into intravascular. The dose of solution is 1–2 ml for small hemorrhoids and 2–3 ml for large hemorrhoids. The agent is injected into three areas and totals 5–10 ml (1–2 ampules).

Dr. Gono et al. of Japan reported that delayed bleeding can be prevented when 1–2 ml Paoscle® is injected into mucosa of rectum, proximal to the stump, after the hemorrhoidectomy. On the other hand, Santos et al. of England reported that Paoscle injection was only effective on short-term treatment of bleeding internal hemorrhoids, where other treatments are needed for prolapsed hemorrhoids.

6.4 Cryosurgery

Cryotherapy was widely used in 1970–1980, but now it is rarely used. For the treatment of bleeding and pain, the effect of Zeroid lasts only for a short period of time, but using liquid nitrogen shows permanent necrotic effect. Disadvantages are long therapeutic period, large amount of discharge, and secondary bleeding.



Fig. 6.17 Instrument of infrared coagulation

6.5 Infrared Coagulation

It is the photocoagulation method to expose the internal hemorrhoids under infrared rays, which is effective to control bleeding temporarily. Although the exposure time and frequency are variable according to the practitioner, 1–1.5 s per time, two or three times per each pile are usually applied. In the prolapsed hemorrhoids, five or six times can be applied (Fig. 6.17).

6.6 Ultroid

This method coagulates feeding vessels of hemorrhoidal stump using low-voltage current of monopolar. It is not a heat transmission method, but a method generating sodium hydroxide from cathode. The level of electric current can reach up to 16 mA and can persist 10 min for the treatment. However, since this method takes a long time, it is difficult to treat more than two sites of pile at outpatient clinic. Although another trial is possible after the first one, other treatment method should be considered when the second trial has failed.

6.7 Laser

CO₂ or Nd-YAG laser has been usually used. CO₂ laser uses 10–20 W of output. For the first- and second-degree hemorrhoids, defocused beam is used to vaporize, and for the third- and fourth-degree hemorrhoids, mixed method with



Fig. 6.18 Surgical diode laser

defocused and focused beam is used to excise the piles. Nd-YAG laser uses 0.2–0.4 mm probe for excision and 0.4–0.6 mm probe for coagulation. The advantages of this method are minimal bleeding during the procedure, less pain after the procedure, and short treatment time.

Submucosal application of the diode laser was first described as treatment to first- and second-degree hemorrhoids by Karahaliloglu, in 2007. The diode laser has been used to treat varicose veins of the inferior limbs which applied inside the vein. Compared with Nd-YAG laser, diode laser has lesser penetration depth (up to 2 mm); therefore, it could apply in submucosal tissue without anal sphincter injury. Recently, the diode laser combined with hemorrhoidal artery ligation (HeLP) was reported by Giamundo and colleagues. However, reports in the literature are extremely limited; longer follow-ups and randomized trials are needed to establish role of procedure with diode laser (Fig. 6.18).

6.8 Hemorrhoidal Artery Ligation (HAL)

Doppler-guided ligation of the hemorrhoidal arteries was first described as an alternative treatment to hemorrhoids by Morinaga and colleagues, in 1995. This non-excisional procedure is consisted of the ligation of the terminal branches of the superior rectal artery that feed the hemorrhoidal plexus through a Doppler-guided identification. The blood flow of hemorrhoidal plexus is reduced and followed by shrinkage of the hemorrhoidal cushions and a consequent

improvement in symptoms. Under spinal or local anesthesia, proctoscope coupled with a Doppler transducer is inserted, so that the transducer is approximately 2–3 cm above the dentate line. After localization of the terminal branches of the superior rectal artery with rotation of the proctoscope, a figure-of-eight suture is made around each located artery. Some surgeons performed this procedure combined with mucopexy.

This technique may be adequate alternative treatment of second-degree and third-degree hemorrhoids. The main advantages are included non-excision, less discomfort, and short-recovery time. However, longer follow-up is required to access long-term benefit (Fig. 6.19).



Fig. 6.19 Hemorrhoidal artery ligation system

6.9 Anal Dilatation Treatment

This method is safe and can proceed in a short period of time. It can be done instead of main surgery when immediate operation is unavailable. The author usually uses this method just prior to the hemorrhoidectomy. Theoretically, anal dilatation procedure is based on the belief that hemorrhoids are caused by increased activity of internal anal sphincter. The hemorrhoidal vein connects with portal system through submucosal tissue of lower rectum where occlusion often occurs due to increased rectal and abdominal pressure. It causes regurgitation and congestion of blood to result in enlarged hemorrhoidal complex. The fibrotic bands (pectin band) of internal anal sphincter aggravate the pressure on vessels. This method is based on the fact that the dilation of the band with fingers relieves the occlusion prevents vascular congestion and treating hemorrhoids. This method is especially useful for the acute incarcerated hemorrhoids (third- and fourth-degree hemorrhoids) (Fig. 6.20).

6.9.1 Contraindications

1. The first- and second-degree hemorrhoids (use other methods as RBL or sclerotherapy)
2. Hemorrhoids without symptom
3. Symptom derived from other reasons, though with large pile (such as mucosal prolapse, pruritus ani due to mucus discharge)
4. Weak internal anal sphincter

After the spinal or general anesthesia, enlarge fibrotic band of internal sphincter gently and softly with both index

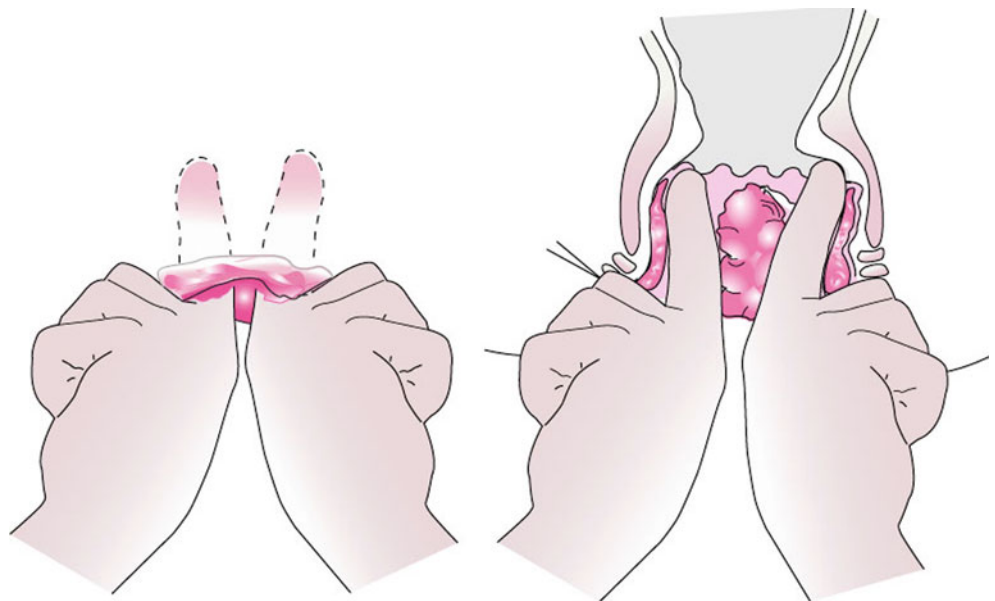


Fig. 6.20 Digital anal dilatation of anus

fingers. The dilatation is focused toward both lateral direction of 3 and 9 o'clock direction, because the anal sphincter is weak in anteroposterior. It is essential to dilate the sphincter gently and not excessively. Complications are postoperative bleeding, voiding disturbances, defecation difficulty, and anal stenosis. But the incontinence rarely develops when used in the patients with adequate indication. After procedure, remnant skin tag or mucosal prolapse should be treated with other appropriate methods.

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The submucosal hemorrhoidectomy was described by A. G. Parks of St. Marks' hospital in 1956. It is a kind of excision and ligation method, but preserves most of the mucosa. This method is currently prevalent in Europe, and about 20 % of hemorrhoid surgery is said to be performed by this method in Germany. The submucosal hemorrhoidectomy excises the hemorrhoidal tissue, but preserves the anoderm and the rectal mucosa as much as possible.

The advantages of this procedure are that the wounds allegedly heal more quickly by less induration and scars, decreased incidence of postoperative stenosis, and less likelihood of delayed wound bleeding. The disadvantages are that it is difficult technically for surgeons to perform and takes a long operation time.

It took one and a half hour for me to operate three piles in the beginning. And many doctors were skeptical about this operation since it costs the same regardless of its difficulty. But I have kept on trying this method, and now I can manage to operate this method as fast as excision and ligation method.

The lift-up submucosal hemorrhoidectomy is a modified method of original Parks' submucosal hemorrhoidectomy. It removes mucosa and hemorrhoidal tissue as little as possible and fixes the descended hemorrhoids to the anatomically original site, through the lift-up procedure. Through this method, the anal cushion tissue is preserved along with preventing anal stenosis and thus keeping anus as its natural status.

- The principles of lift-up submucosal hemorrhoidectomy:
 1. Keep mucosa and anoderm as much as possible.
 2. Shorten the longitudinal axis (axis Z).
 3. Manual dilatation before the surgery is beneficial to most hemorrhoidal treatment.

Hemorrhoid tissues are normal anatomical structures present in every individual, which act as cushions and are anchored to the internal anal sphincter and the conjoined longitudinal muscles by the connective tissue system. When the anchoring connective tissues deteriorate, the hemorrhoids not only bulge but also descend down to the lumen of the anal canal. The veins also become distended as they lose their support.

Hemorrhoids are the protrusion of anal cushion tissue which is normal anatomical structure in anal canal. The prolapse itself does not always need operation. The purpose of treatment is to improve the symptom and correct the anatomical change. When the anal sphincter relaxes, blood flows into the vessel to keep the anal pressure and closes the anal canal keeping continence. Normally, the anal cushion slides down the anus during defecation, and the status of this stretched cushion unable to return to its original site is called hemorrhoids. It is due to the stretching and disintegration of the mucosal suspensory ligament.

The pathologic condition of hemorrhoids is caused by the distal movement of the pile. Therefore, the treatment of the prolapse is the most important procedure to correct this status. In other words, shortening the longitudinal axis is most important. I set imaginary X, Y, and Z axes along with the anal canal like in Fig. 7.1.

For the treatment of hemorrhoids, it is most important to shorten the Z axis to prevent prolapse in addition to the treatment on the planes of X and Y axes. As shown in the figure, the anal cushion is enlarged on the plane of X and Y axes and is displaced distally toward Z axis. Until now, most doctors concentrated on treating the hemorrhoids only on the planes of X and Y axes, but did not focus on shortening the Z axis. The elongation and prolapse along with the Z axis is more important than the hemorrhoidal distension on the planes of X and Y axes. So the shortening of the Z axis, called lift up, is said to be the most important factor in the treatment of the hemorrhoids (Fig. 7.2).

The hemorrhoidal tissue is enlarged along with the X and Y axes due to the disintegration of the mucosal suspensory ligament.

The hemorrhoidal tissue is protruded along with the Z axis.

On the viewpoint of lift-up procedure, the reason why the treatment mechanism of the PPH is widely welcomed, even

Electronic supplementary material Supplementary material is available in the online version of this chapter at http://dx.doi.org/10.1007/978-3-642-41797-9_7. Videos can also be accessed at <http://www.springerimages.com/videos/978-3-642-41797-9>.

Fig. 7.1 The hemorrhoids on the planes of X, Y, and Z axes

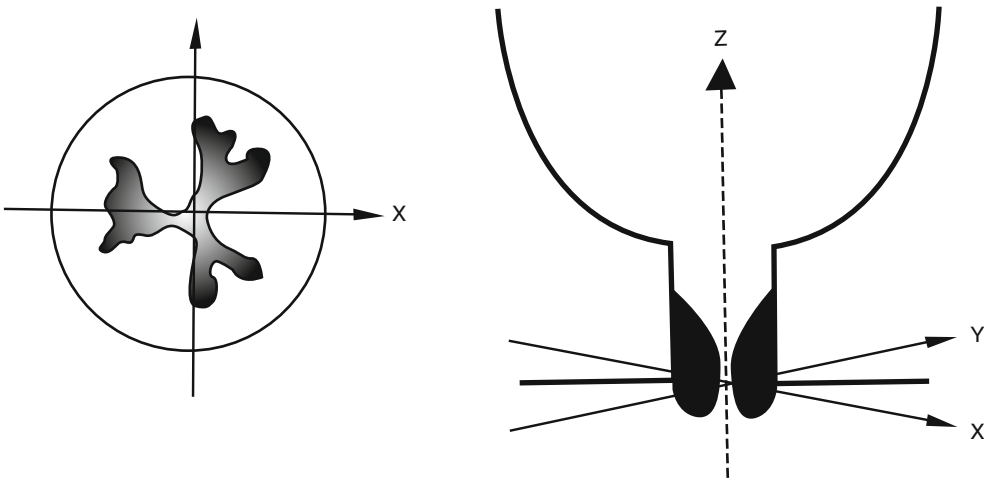
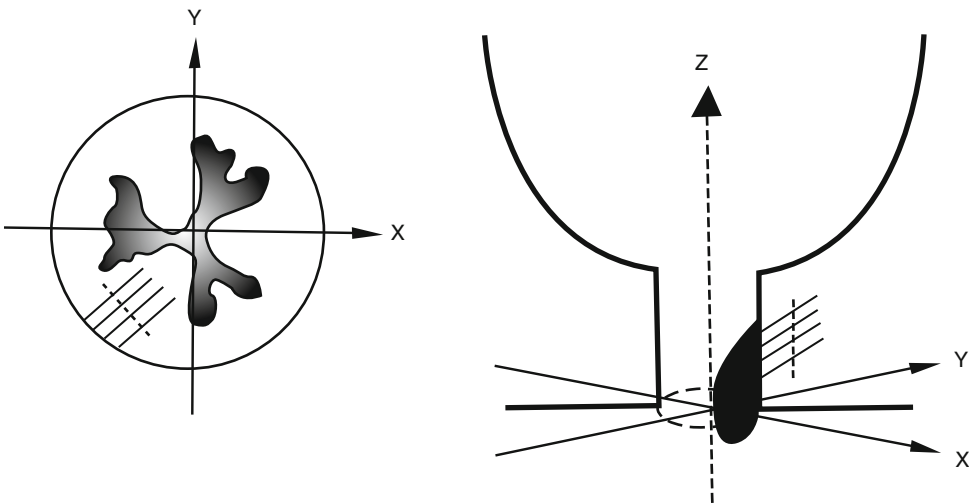


Fig. 7.2 The disintegration of mucosal suspensory ligament causing hemorrhoids



though it does not remove hemorrhoidal pile itself, seems to be because of the successful lift up rather than the interruption of circulation to hemorrhoids. In Whitehead hemorrhoidectomy, the lift-up procedure also seems to be a more important factor than removing hemorrhoid tissue itself. In this point of view, although Whitehead procedure results many kinds of complication, it has somewhat useful aspect with lift up. I believe the upward lift up with resection of small amount of hemorrhoidal tissue is more important than the complete removal of hemorrhoid itself in Whitehead operation.

Rubber band ligation is a sort of lift-up procedure, ligating excessive mucosa with rubber band. Excision and ligation procedure seems to be ineffective based on the viewpoint of the lift up.

The principles of the hemorrhoidectomy are to keep the function of the anal sphincter to prevent dangerous complications such as incontinence and to be cautious about rough and excessive excision to prevent anal stricture. Also, maintaining sufficient anal canal caliber to enable normal defecation with no pain or discomfort is essential. The so-called lift-up submucosal hemorrhoidectomy, which is conducted in our hospital, is designed based on the fact that the hemorrhoid itself is

Table 7.1 The different concepts of hemorrhoids in terms of pathophysiology and the current direction of operation

Pathogenesis	Viewpoint for hemorrhoids	Amount of removed tissue on hemorrhoidectomy
Varicose vein theory Vascular hyperplasia theory	Abnormal tissue	Large
Sliding anal lining theory	Normal tissue	Small

not an abnormal tissue but a prolapsed normal tissue. I mainly focus on lift-up procedure during my hemorrhoid operation along with removing small tissue as far as possible.

Among the pathophysiologic theories of hemorrhoids, the varicose vein theory states that the hemorrhoid is an abnormal tissue to be removed as much as possible. On the other hand, the sliding anal lining theory states that the hemorrhoid is a normal tissue which does not need much removal during the operation, but needs excision only to the point where it will not prolapse out of the anus. Therefore, I believe back up of the hemorrhoidal tissue to its original upper site through lift-up procedure is the most important (Table 7.1).

7.1 Various Operations for Hemorrhoids Based on the Concept of Lift Up

If hemorrhoids are caused by the prolapse of the anal canal, the lift-up procedure of restoring the anal tissue to its original site must be the most important factor. The original operative methods need to be studied again under the viewpoint of lift-up concept, and new methods focused on lift up are expected sooner or later. The following are some methods based on the viewpoint of lift-up procedures for hemorrhoids.

7.1.1 PPH (Stapled Hemorrhoidopexy)

This was first introduced by Prof. Longo in 1998. With a circular stapler, the mucosa and submucosal tissue of the upper anal canal were resected and anastomosed. Although the hemorrhoidal piles are not excised completely, it treats hemorrhoid successfully. Blocking the circulation to hemorrhoids was thought to be the reason for this cure, but it rather seems to be because of its lift up of the anal canal by excising and suturing redundant mucosa and submucosal tissue. Since lifting up the external hemorrhoids alone has limitation, other additional methods such as excision are needed (Fig. 7.3).

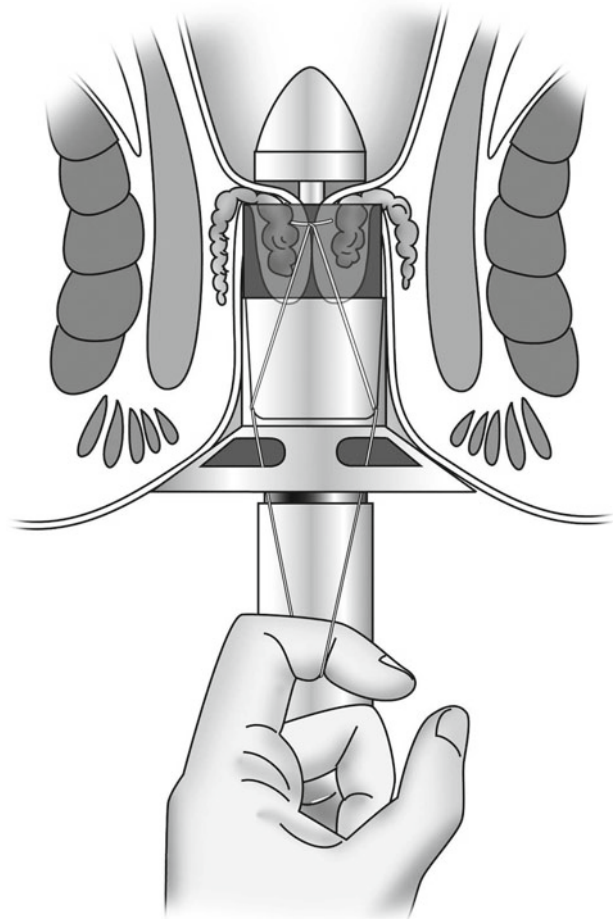


Fig. 7.3 Hemorrhoid surgery with circular stapler (PPH)

7.1.2 Whitehead Operation

In original Whitehead hemorrhoidectomy, he tried to leave three longitudinal axes, instead of 360° circumferential excision of hemorrhoidal tissue. If leaving three longitudinal axes and removing mucosa in upper part of anal canal would be possible, the Whitehead hemorrhoidectomy might be remained as good hemorrhoidectomy method.

In 1882, Whitehead from England first described this technique. This method has been the main operative method used widely until several decades ago. Although it was thought to be discarded due to many complications, many surgeons still use this method.

The key of this operation is suturing the flap of anoderm to the mucosa on the upper anal canal rather than pulling the mucosa down to the anoderm on the dentate line. Its basic concept is the same as the lift-up procedure, but many doctors thought that it was difficult to perform properly. Also, since it can lead to stricture and ectropion, this procedure should be performed without removing too much anoderm and mucosa (Fig. 7.4).

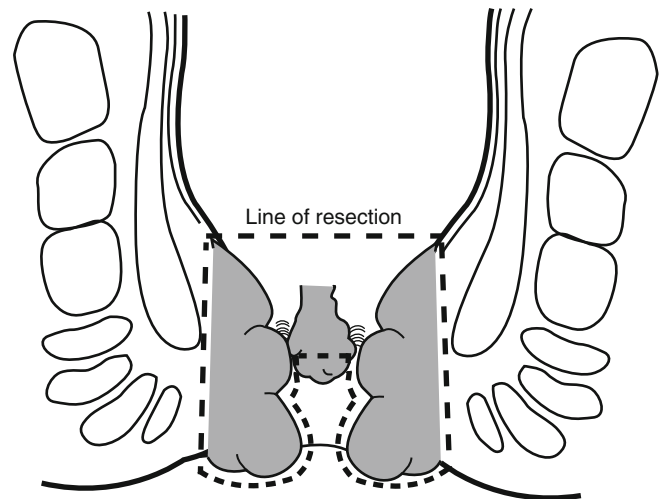


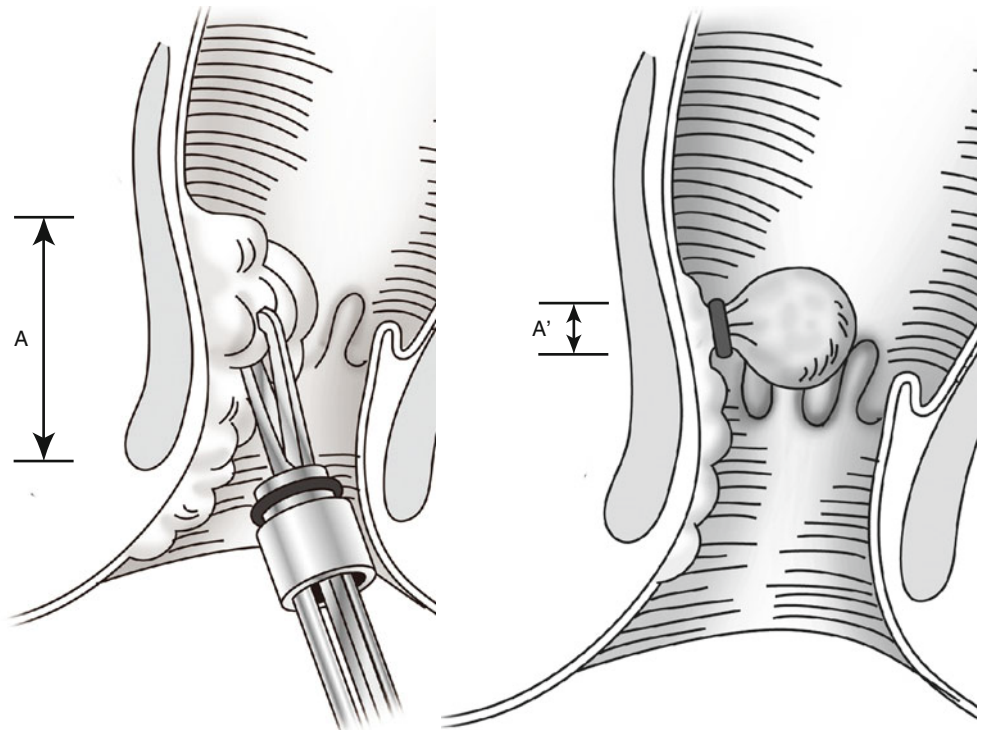
Fig. 7.4 Whitehead lift-up effect. Lift up by removing and suturing the dotted line

7.1.3 Rubber Band Ligation

In the past, this procedure was considered to treat hemorrhoids by forming fibrosis after removal of the hemorrhoidal tissues. From the lift-up point of view, the ligation

of the redundant mucosa with the submucosal tissue shortens the longitudinal axis of anal canal as a result, and hemorrhoid is treated by its lift-up effect as shown in the Fig. 7.5.

Fig. 7.5 The lift-up effect of rubber band ligation. The part A lifted up to the part A' after ligation



7.1.4 Sclerotherapy

It is a method of arousing fibrosis by injecting sclerosing agent, such as ALTA (Ziohn®, Xiaoxhiling®), phenol-almond oil on the proximal part of hemorrhoidal pile. The mechanisms of this treatment are follows: (1) induce fibrosis resulting lift up of anal canal and thus preventing prolapse and (2) make sclerosis occur at the bleeding vessels of submucosal layer to stop the hemorrhage. There are detailed explanations in Chap. 6 (Fig. 7.6).

7.1.5 Dr. Takano's Operation

Dr. Takano of Japan described a method of purse-string suture around the pedicle after excising the pile, which shortens longitudinal axis as a result. The length of the anoderm shrinks from point A to A' and gives a lift-up effect. So protruding anoderm heading toward outside of the anal canal returns back into the anal canal. It is somewhat an effective method in the case of the mucosal prolapse with redundant mucosa (Fig. 7.7).

7.1.6 Ligation and Excision Method

This is a method of excising redundant mucosa and anal cushion widely. As shown in the figure, wide excision along

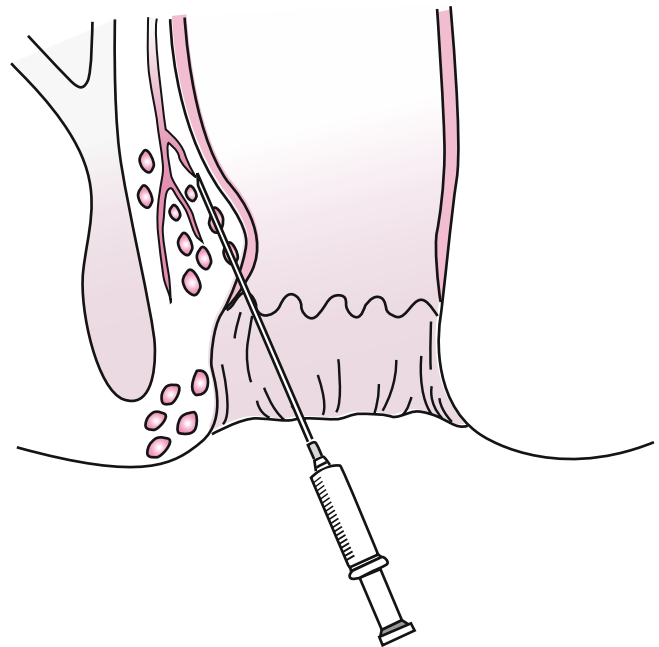


Fig. 7.6 Sclerotherapy. Through fibrosis and inflammatory reaction after the injection of sclerosing agent, the effect of the lift up is accomplished

with the Y axis results in fibrotic healing and thus shortens the longitudinal axis. Although wide excision along with the Y axis shortens the Z axis, it is less effective based on the viewpoint of lift up (Fig. 7.8).

Fig. 7.7 Purse-string suture method of Takano (Takano M. Anoderm preserving Hemorrhoidectomy. Dis Colon Rectum. 1980;23:546)

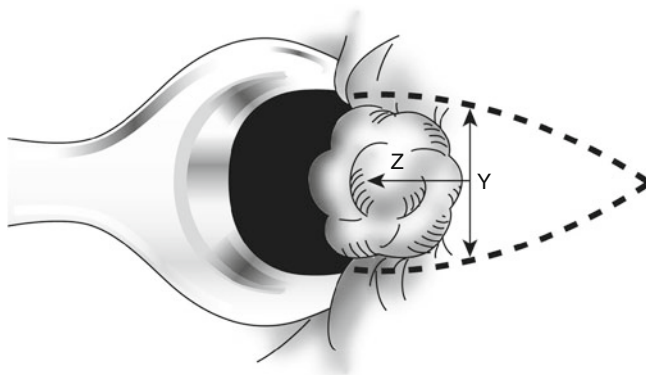
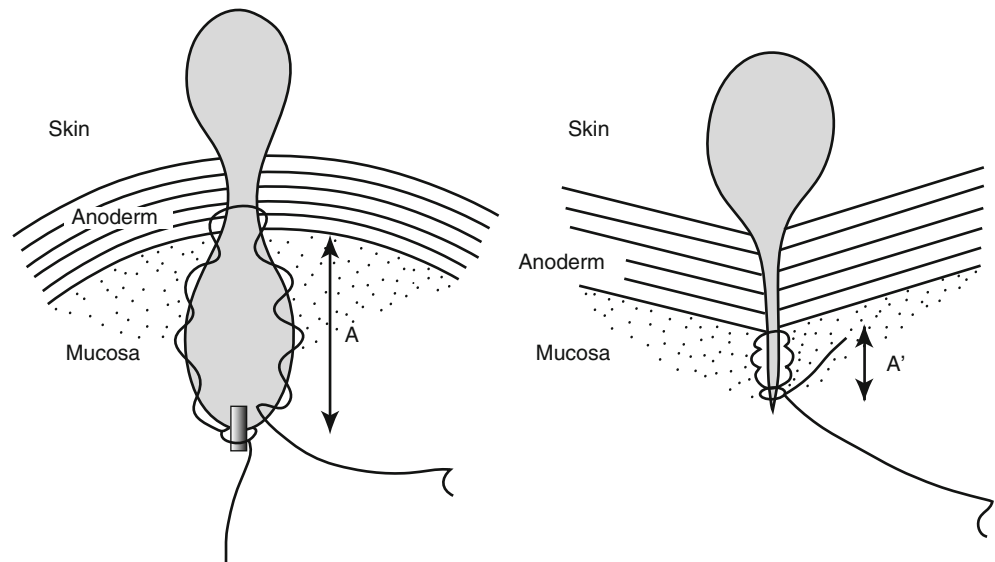


Fig. 7.8 Ligation and excision. Dotted line area: removed skin area during conservative ligation-excision Hemorrhoidectomy

7.2 The Procedure of the Lift-Up Submucosal Hemorrhoidectomy

Actual procedure of operation will be described step-by-step.

7.2.1 The Practice of Surgical Operation

7.2.1.1 Check the Prolapse Through Defecation Test Before Operation

To be under the similar condition of an actual defecation, about 2-cm-sized betadine-soaked gauze ball with a clamp is inserted into the anal canal and moved back and forth to check the presence of prolapse and the number of piles. Through this process, the length and the height of piles as well as the number of piles to be removed should be decided.

Depending on its degree of prolapse, the level of dissection should be determined. The scope and range of operation can be easily decided with this test. Even if enlarged hemorrhoidal piles are found on the axis of X and Y through anoscopic examination, the operation is not always necessary if no prolapse are observed out of the anal canal (Fig. 7.9).

7.2.1.2 Manual Dilatation of the Anal Canal

When checking the tone of the internal anal sphincter, internal hemorrhoids should be checked once again.

Manual dilatation should be performed gently, and L-shaped anal dilators can be also used. Since anal sphincter muscle can be destroyed by strong and violent dilatation, it should be dilated gently. Through finger dilatation, the widened anal canal makes the operation easy and decreases post-operative pain markedly.

The spasm of internal anal sphincter is known to be the primary cause of postoperative pain. There are doctors who combine LIS (lateral internal sphincterotomy) during the hemorrhoid operation. I also used to carry it out, but now I rather perform finger dilation to avoid the injury of sphincter muscle.

If the anal tone is too tense after the dilatation, additional LIS is needed. If the tone is too weak, Thiersch procedure may be needed. Also, since the tone of anus cannot be checked properly under deep anesthesia, patients should be under slight anesthesia enough to keep the tonicity of the sphincter (Fig. 7.10).

7.2.1.3 Ballooning of the Hemorrhoidal Pile with Injection

Inflate the hemorrhoidal pile by injecting 1:100,000 epinephrine mixed lidocaine solution. This procedure is essential for submucosal dissection (Fig. 7.11).

Fig. 7.9 The defecation test to check prolapse of hemorrhoidal pile

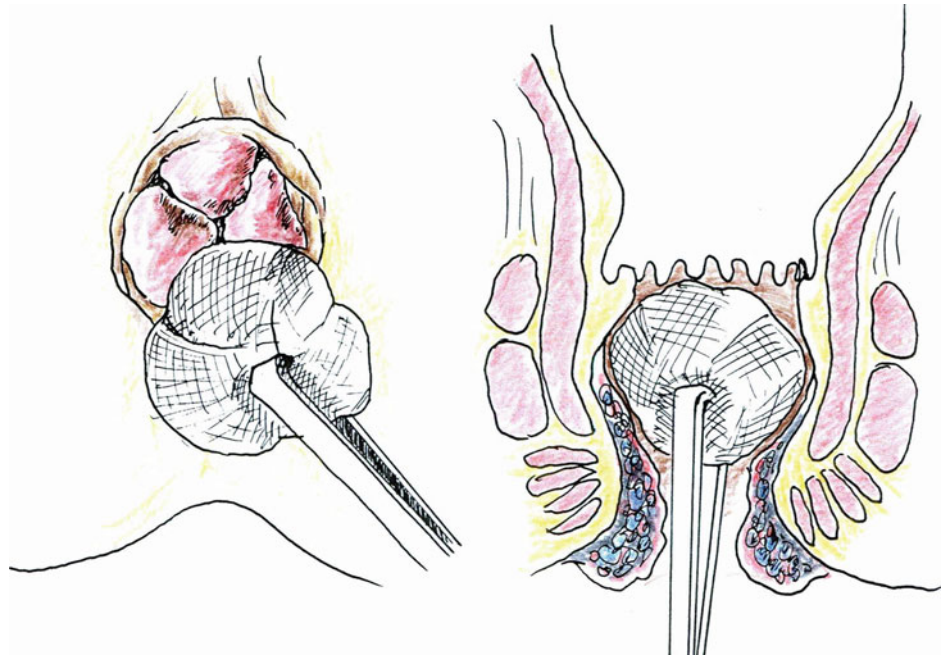
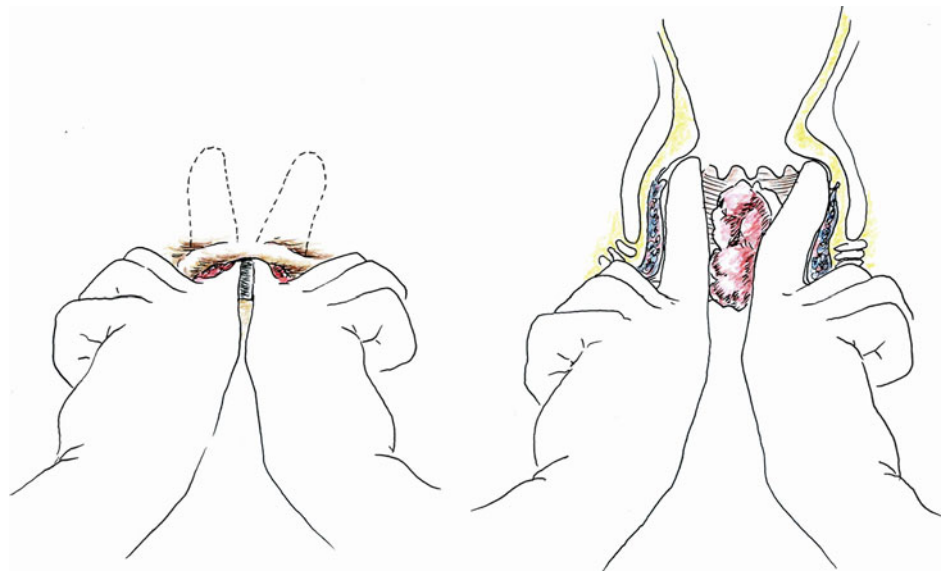


Fig. 7.10 Manual dilatation of the anal canal



- *Why should we use injection?*
 1. The surface of hemorrhoidal pile is uneven and is apt to be perforated during the submucosal dissection. With injection, it distends and makes dissection easier.
 2. It decreases the amount of bleeding by injecting the epinephrine mixed solution during the surgery.
 3. Postoperative pain can be reduced. Although bupivacaine lasts longer than lidocaine, lidocaine is used more widely because it's cheaper.
- *Cautions*
 1. For patients suffering from hypertension or heart problems, avoid epinephrine mixture.
 2. For patients who have had lidocaine shock, normal saline can be replaced.

- *The site of injection*
Author usually inject on the midline of the hemorrhoidal pile, in other words, on the anoderm to be incised.

7.2.1.4 Skin Incision

Begin a narrow incision of 2–3 mm in width on the area where hemorrhoidal pile starts (Figs. 7.12 and 7.13).

- *The beginning point of incision*
In excision and ligation method, the incision usually begins at about 1 cm in the outer part of hemorrhoidal pile. On the contrary, the author begins incision on

the border of hemorrhoidal tissue and normal tissue or 0.5 cm in the inner part of hemorrhoidal border.

- *The shape of the incision*

Make an incision in a shape of a racket near the dentate line. Since the anal mucosa near the dentate line is depressed by mucosal suspensory ligament, the incision should be made narrowly.

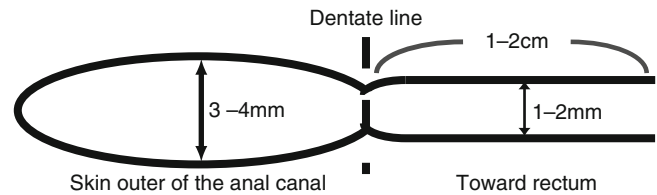


Fig. 7.13 Shape of the incision

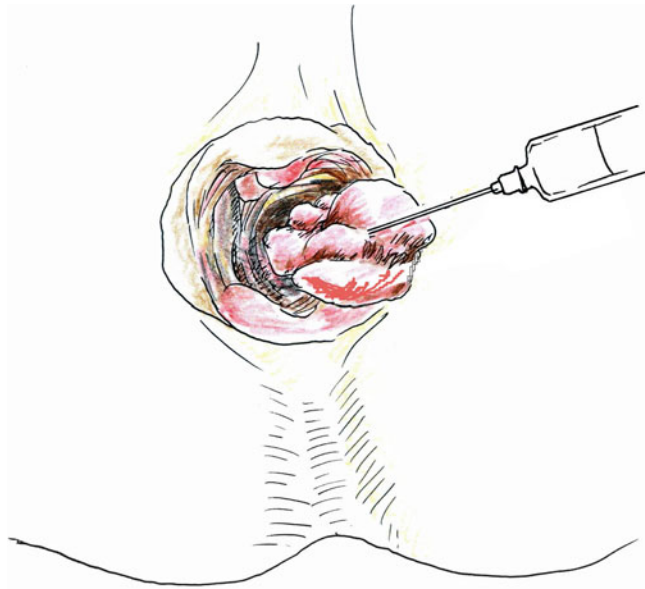


Fig. 7.11 Ballooning of hemorrhoidal pile with injection

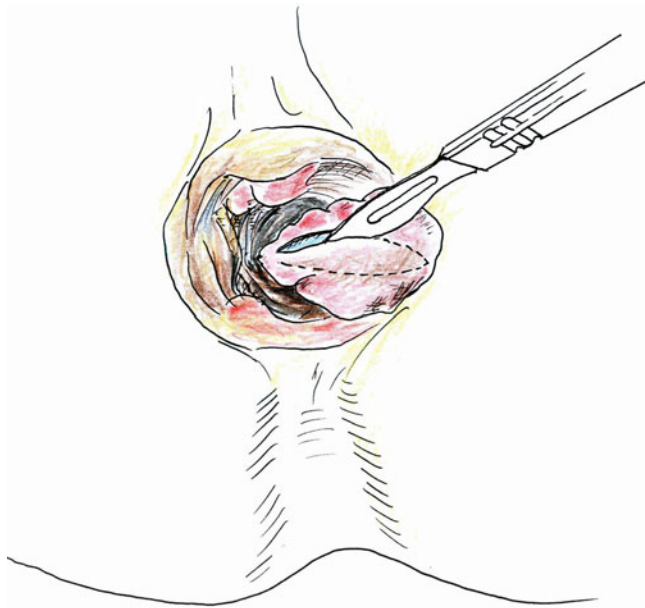


Fig. 7.12 Incision of anoderm. A narrow incision (about 2–3 mm) is made

The width of the mucosal incision made proximal to the dentate line should be narrow, about 1–2 mm, in order to prevent anal stricture. A linear skin incision as Parks' method

is ideal theoretically, but submucosal dissection with this incision is very difficult in practice.

The width of the skin incision should be made about 3–4 mm on the distal part of the dentate line, and it can be wider depending on cases. This may prevent skin tag formation. Since resected skin is irreversible, it can start out with narrow incision. If the skin remains after the surgery, it should be redesigned and resected.

Once the operation is complete, remaining skin should be resected under the natural state, after removing the traction bandages applied on both sides of buttocks.

7.2.1.5 Submucosal Dissection on One Side

During excision and ligation method, the direction of the mucosal dissection is usually from the outer to the inner side of the anus, but I dissect toward both directions on both sides of the submucosa (Fig. 7.14).

The submucosal dissection technique is the most difficult procedure during the submucosal hemorrhoidectomy. It seems like many surgeons have given up because this step of Parks' operation was too difficult. In Parks' submucosal dissection, only one part of the mucosa was grasped with forceps for dissection, but I grasp two points with forceps to stretch the mucosa tight, and this makes dissection much easier.

7.2.1.6 Submucosal Dissection on the Remained Other Side

After dissecting one side of the mucosa, the other side should be dissected in the same manner. If it is difficult to dissect both mucosae, likewise, the dissection can be conducted by resecting the pile from outside to inside of the anus with Metzenbaum scissors, like in an ordinary incision and ligation method.

The Thickness of the Mucosa After the Dissection

In the early days of practicing this operation, it took a lot of time because I tried to make the mucosal dissection too thin. The mucosa was often perforated during dissection. Now, I can manage to save a lot of time by leaving the mucosa thick. The remaining mucosa need not to be thin. In Parks' era, the hemorrhoidal tissue was thought to be an abnormal varicose tissue which should be stripped off as thin as possible. But nowadays, since the hemorrhoids are considered to be normal, leaving thick tissue is permissible. I leave the mucosa to be about 1–2 mm thick.

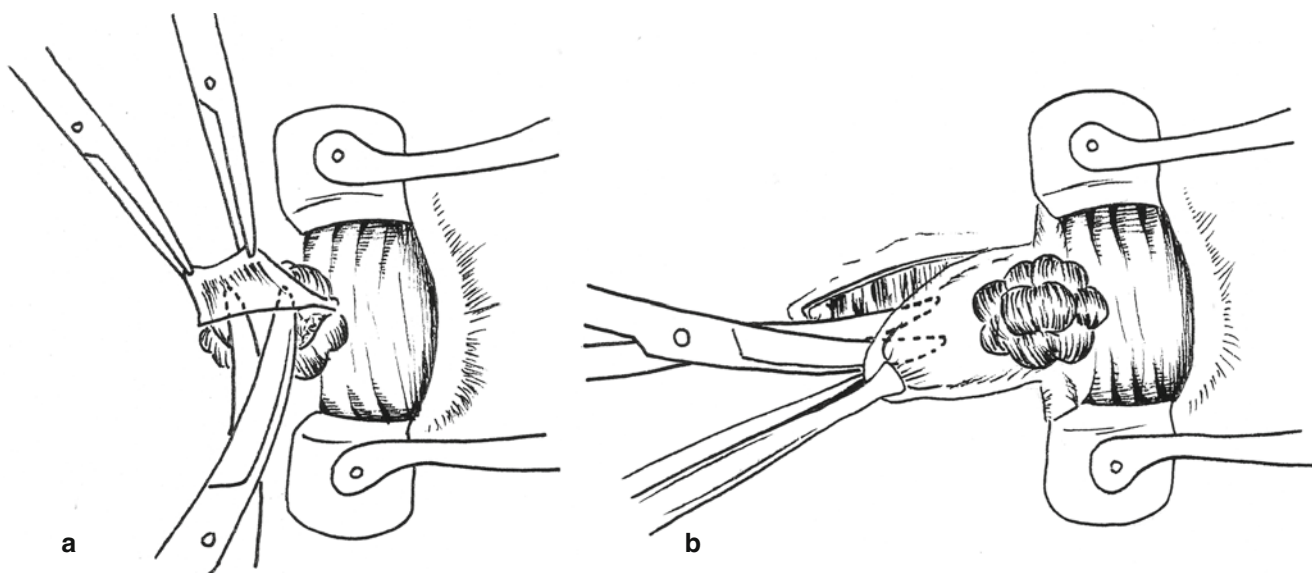


Fig. 7.14 The direction of dissection. (a) Submucosal hemorrhoidectomy. After the skin incision, submucosal dissection begins on both directions of the mucosa. (b) In excision and ligation method, the direction heads from outer to inner side

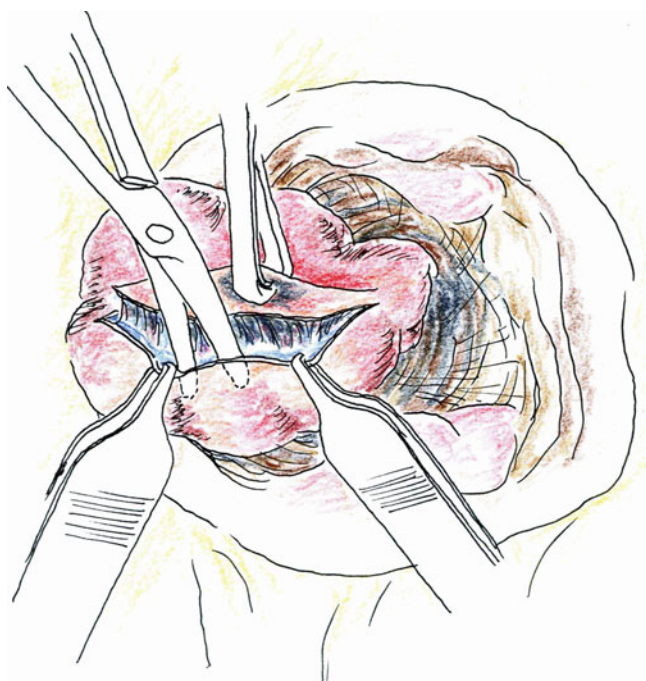


Fig. 7.15 The submucosal dissection toward one side

7.2.1.7 Separation of Hemorrhoidal Tissue

When the hemorrhoidal tissue remained after dissecting both sides of mucosa, it is separated with electric cautery up to the level of 50 % of its height and leaving the other 50 %. Keeping the submucosal tissue 1–2 mm over the internal sphincter makes a good result. I never expose the internal sphincter during hemorrhoidectomy. Removing too much hemorrhoidal tissue is not necessary because hemorrhoidal tissue is normal. The Treitz ligament preserving hemorrhoidectomy of Gensensjager has similar concept with this method

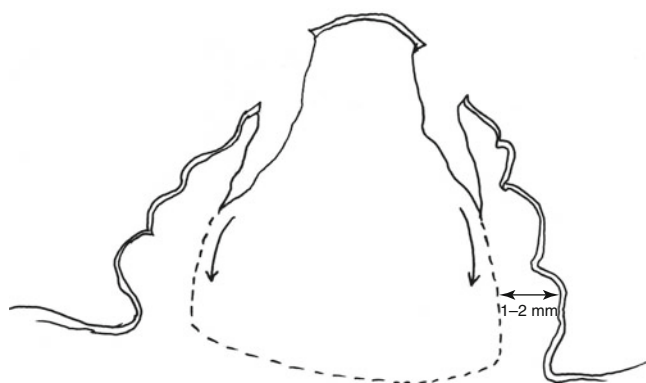


Fig. 7.16 The thickness of the remaining mucosa after dissection (depth of the dissection under the mucosa). Dotted line area of dissection and removal

of avoiding the exposure of internal sphincter (see Figs. 2.4, 7.15, and 7.16).

Also, severe upward traction of internal sphincter will cause damage, weaken sphincter strength, and decrease anal pressure. Surgeons should be cautious with the circumferential prolapse hemorrhoids, since internal sphincter is easily damaged.

The height of the hemorrhoidal dissection should be 1–2 cm proximal to the dentate line. Proximal dissection should be lower than that in other hemorrhoidectomies and use the lift-up procedure to the upper part when managing the hemorrhoid stump.

7.2.1.8 Ligation of the Hemorrhoid Stump

After mobilization, the hemorrhoid pedicle including the proximal mucosa is secured with a straight hemostat. Then ligature is made using nonabsorbable material (5-0 white silk). In this procedure, anal canal was lifted up as much as proximal anal mucosa was included. Amounts of proximal anal mucosa

Fig. 7.17 Alternative lift-up procedures with silk tie. **A** First suture-ligation site of pedicle. **B** 2nd suture-ligation site and A is lifted upto B

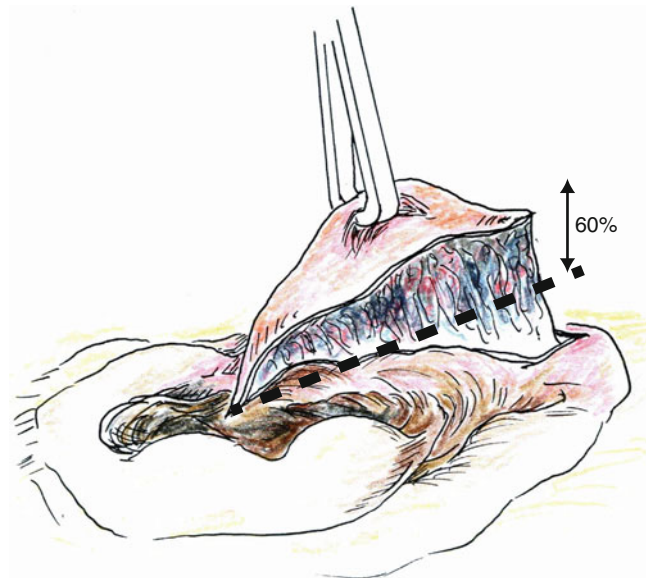
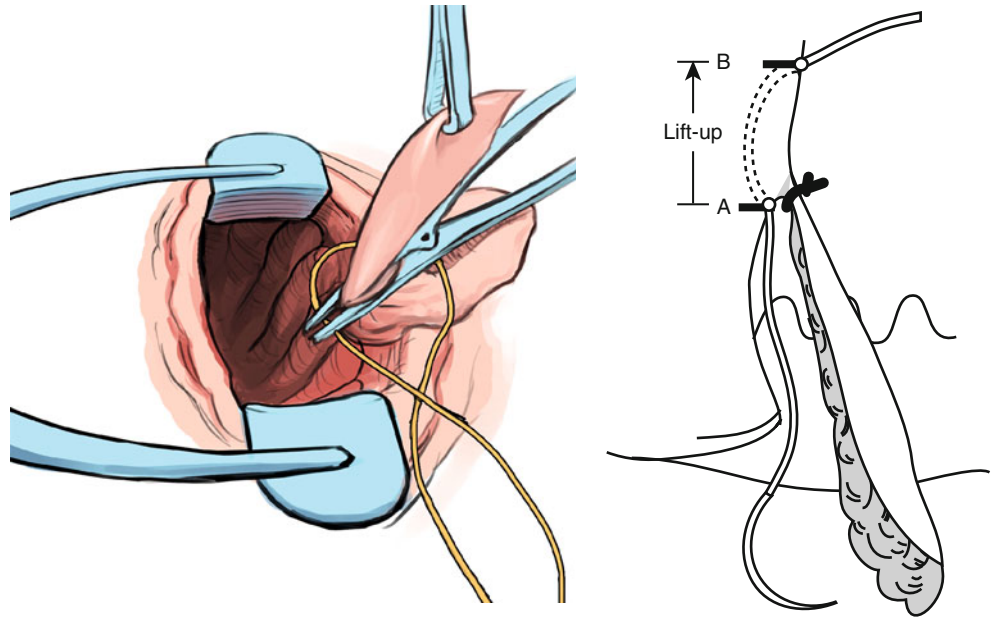


Fig. 7.18 Separation level of the hemorrhoidal tissue

to be ligated were determined according to the degree of prolapse. Recently I use this lift-up method with silk tie frequently, because of its technical simplicity and effectiveness.

Then suture ligation is added 7 mm proximally to the stump with 2-0 chromic catgut or 2-0 Vicryl®. Repeated suture makes the anal canal to be lifted up to 1.5–3 cm proximally. In case of severe prolapsed hemorrhoids, three times of lift up, by 1 cm each, can lift the anal canal approximately up to 3 cm. This procedure is the most important step in lifting up the anal canal (Figs. 7.17, 7.18, 7.19, and 7.20).

From the side view, the suture needle should be inserted 7–8 mm above the hemorrhoid stump and emerged in the inferoposterior side of the stump.

Although the lift up of the anal canal is performed only on the site where hemorrhoid is prolapsed, it should be done

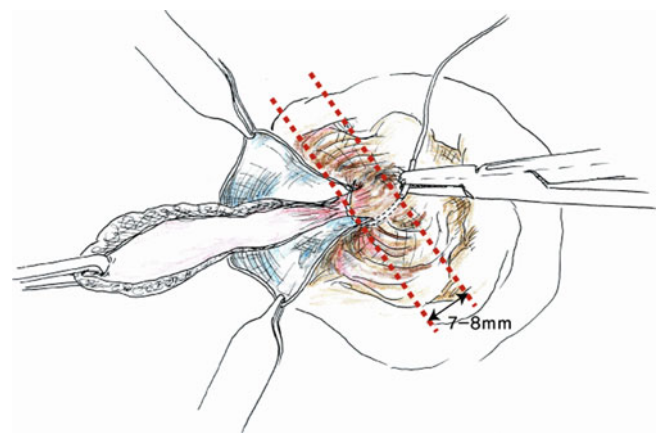


Fig. 7.19 Ligation of the hemorrhoid stump. Dotted line A,B: A is lifted upto B

less than three sites (usually at 3, 7, 11 o'clock direction) in circumferential hemorrhoids, and for the additional other sites, one suture ligation is enough, if necessary. It is because too many lift ups may cause anal stenosis. Even if three-site suture ligation would be used, anal stenosis could be prevented by lift-up stump tie and suture.

Lift Up of Severely Prolapsed Hemorrhoids

In the case of severe prolapse such as mucosal prolapse or the early phase of rectal prolapse, the usual method of lift up has limitation. In such a case, I add a transverse resection on the remained pile after the lift up of hemorrhoid stump. During stump ligation, lift up can be done by upward traction as much as possible with rubber band ligation. It is simple and easy method which I am in use recently. This can make additional 1–2 cm of lift up.

ALTA injection at upper part of the hemorrhoidal stump is added. This procedure is very effective in severe prolapsed hemorrhoids and widely used in Japan.

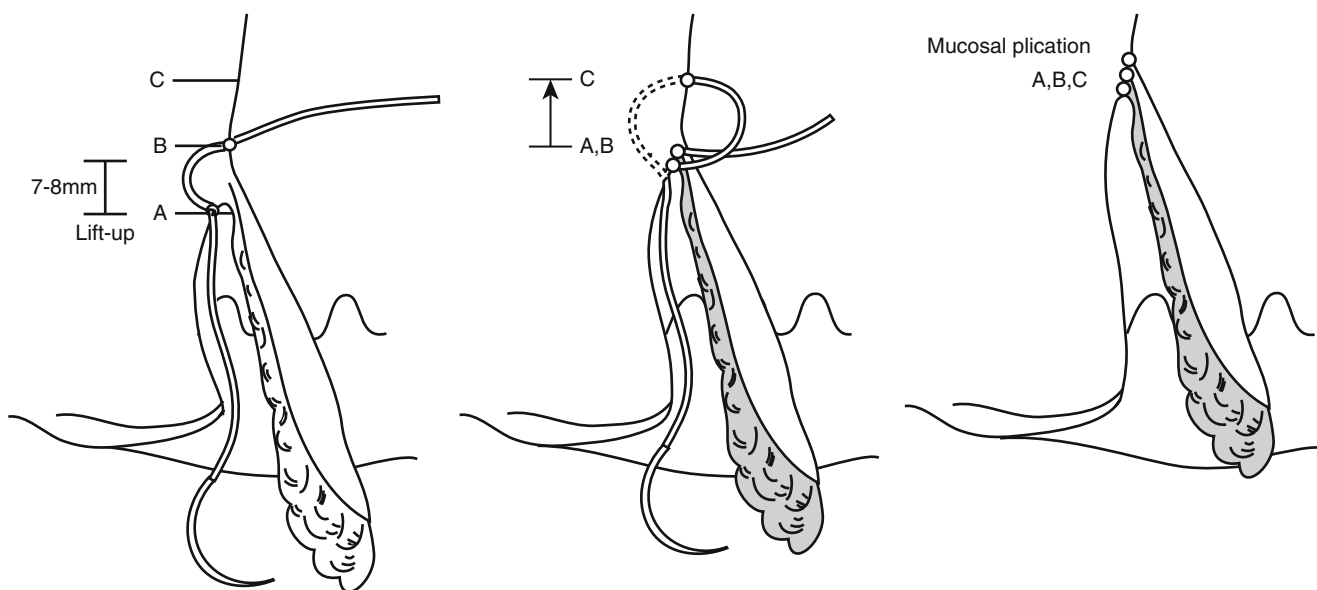


Fig. 7.20 Lift up of the anal canal. Approximately 7 mm proximal to the highest part of the dissected stump is fixed by suture ligation. It allows lift up by making plication at the part A–C

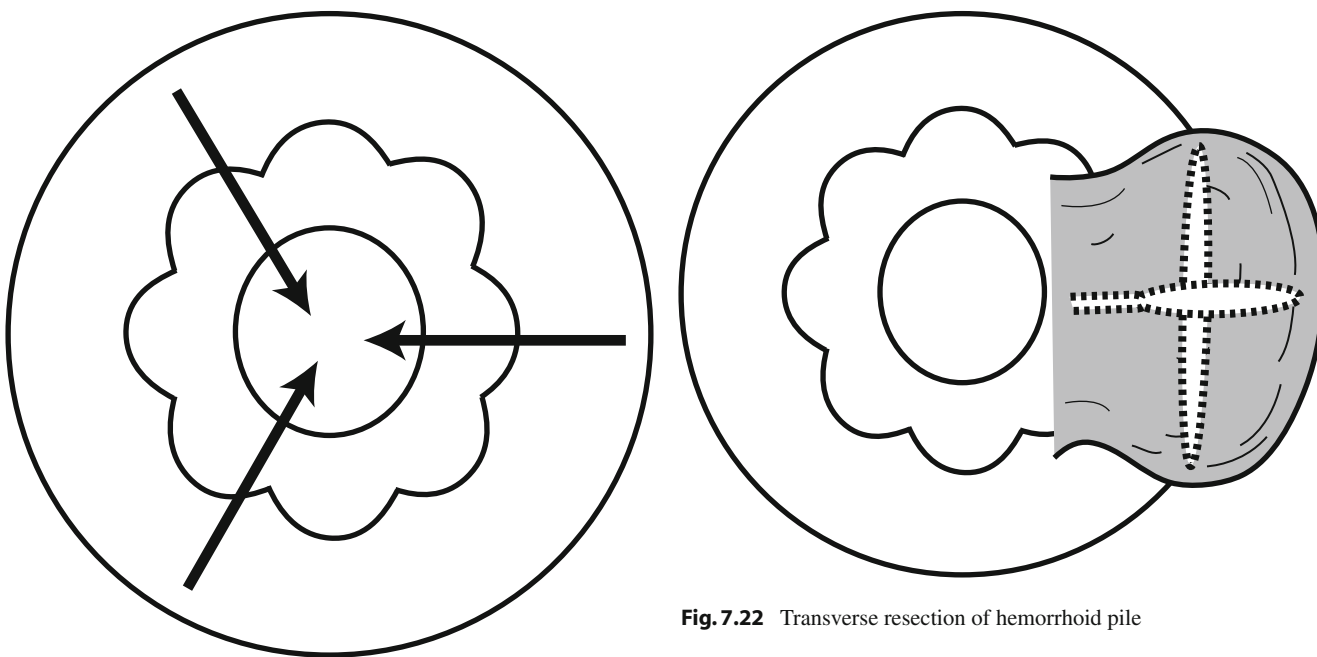


Fig. 7.21 Lift up of the anal canal is not allowed more than three sites. Due to preventing anal stenosis in severe prolapsed hemorrhoids. Arrows indicate direction of lift-up into the anal canal

Other Lift-Up Procedures

Figures 7.21, 7.22, and 7.23.

7.2.1.9 Closure of the Mucosa

With the same 2-0 chromic catgut used in stump ligation, suture the mucosa and skin continuously. In the semiclosed method, approximately 50 % is closed and 50 % is remained open, but I prefer 80 % of closure and leaving the other 20 %

open or loosely closed by interrupted sutures (leaving the gap of one mosquito clamp point). It seems to close nearly completely. The reason for the loose suture is to permit drainage for 2–3 days after the operation and to prevent wound disruption with edema. The continuous suture (plication) makes the mucosa wrinkled which results additional shortening of the longitudinal axis for about 3–4 mm. The 2-0 chromic catgut is used also (Fig. 7.24).

7.2.1.10 Resection of the Hemorrhoidal Tissue

The hemorrhoidal stump is cut about 4–5 mm above the suture ligation with scissors or an electric scalpel (Fig. 7.25).

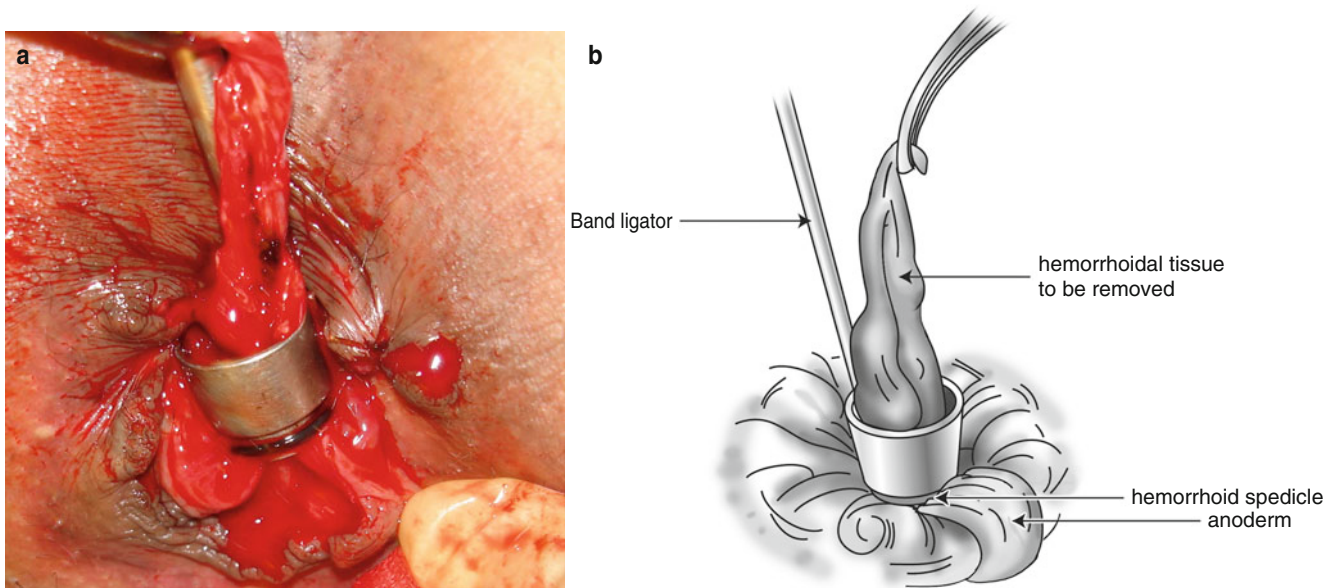


Fig. 7.23 Ligation of the hemorrhoid stump using rubber band ligator (a, b)

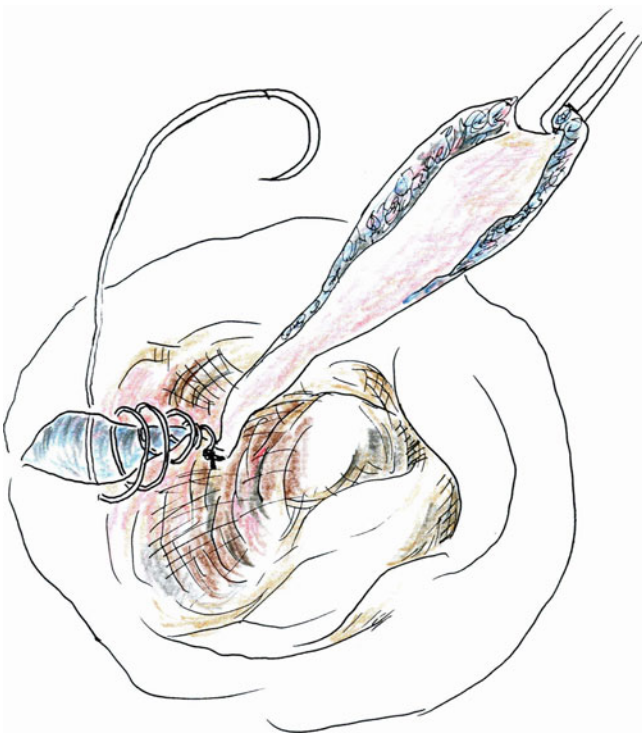


Fig. 7.24 Closure of the mucosa

7.2.1.11 Excise Other Hemorrhoid with the Same Manner

Check if the annus is narrow with digital exam every time after removing each hemorrhoid pile. In circumferential hemorrhoids, beside the previous three lift-up parts, excise the remaining hemorrhoid pile and lift up about 4–5 mm proximal to the stump with only one suture ligation. If the anal canal is found to be narrowed, lift up should not be performed.

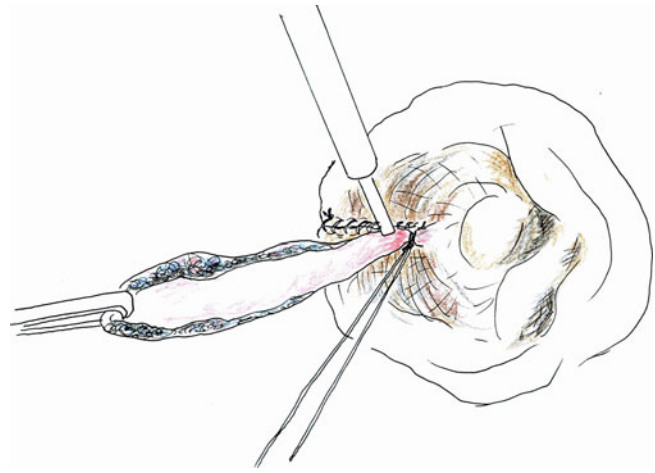


Fig. 7.25 Resection of hemorrhoidal stump

7.2.1.12 Skin Design and Excision of Redundant Skin

Skin is often redundant especially with circumferential hemorrhoids. Excessive skin should be excised to prevent skin tags after removing buttock tractions on both sides.

7.3 Plan of Hemorrhoidectomy and Design of Incision

Less experienced colorectal surgeons tend to say that they are at a loss when confronting hemorrhoidectomy actually. Constructing a hemorrhoidectomy plan is just as important as the construction plans and designs of an architect. The incision design for hemorrhoid pile is said to be difficult because each pile has different shape. We will classify the

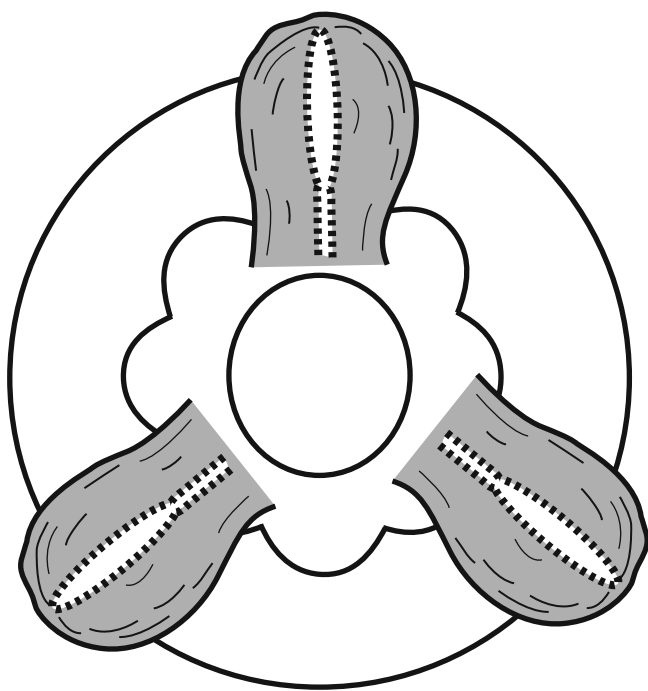


Fig. 7.26 Incision line for the basic form of hemorrhoidectomy

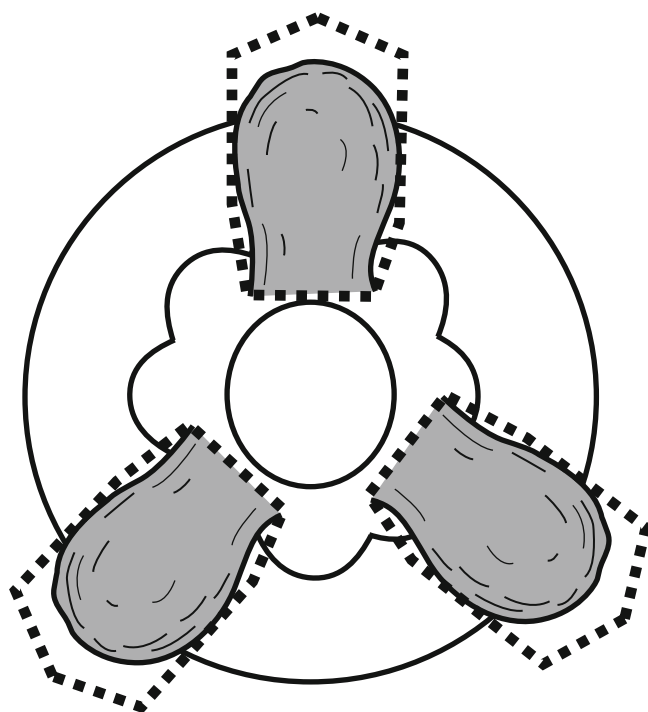


Fig. 7.27 The incision line of ligation and excision method

hemorrhoid piles according to their shape and consider the plan of hemorrhoidectomy and design of incision accordingly as shown below.

1. Basic form
2. Mucosal prolapse
3. Incarcerated hemorrhoids
4. Long prolapsed hemorrhoids
5. Thrombosed hemorrhoids

7.3.1 Basic Form

It is the basic form of protruding piles on the direction of 4, 7, and 11 o'clock which needs incision and resection as shown in the figure (Figs. 7.26 and 7.27).

During ligation and excision method, a drainage window is made with a wide incision. I think that drainage window is not necessary, and incision width should be narrowed as much as possible to prevent postoperative anal stenosis.

7.3.2 Mucosal Prolapse

It shows on the patients with incomplete rectal prolapse observed when they are on straining or in squatting position, without external component. The mucosa usually comes about 3 cm out of the anus when pulled. In this case, lift up is usually applied twice for each site in three directions. If

the mucosa still remains, excise about 1 cm in width using transverse incision, and close with chromic catgut or Vicryl; then perform hemorrhoidectomy in the usual manner (Fig. 7.28).

7.3.3 Incarcerated Hemorrhoids

Incarcerated hemorrhoids are a kind of thrombosed hemorrhoids derived from previously existing internal hemorrhoids, which are caused by hard work or squatting position, where sphincter action coagulates blood when internal hemorrhoids are prolapsed. Surgery can be relatively easy. For such case, Dr. Heald of the United Kingdom advised to operate only one biggest pile. The removal of 3–4 large piles will be enough without removing the remaining 2–3 small piles. I used to remove all the piles up to 6, but now I remove only 3–4 piles.

7.3.4 Long Prolapsed Hemorrhoids

The long protrusion which involves half circle of the anus is caused by the stretching of the mucosal suspensory ligament toward one side. It usually descends about 2–3 cm when pulled out. The usual hemorrhoidectomy with a transverse incision on both sides should be applied (Fig. 7.29).

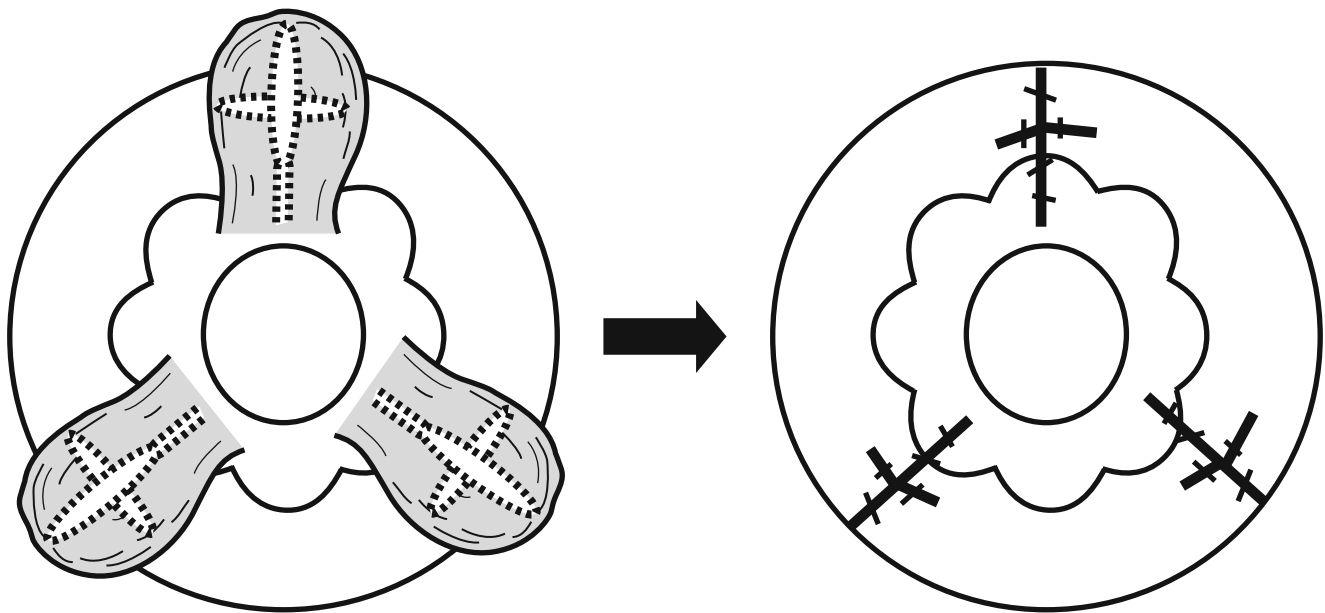


Fig. 7.28 The incision line of the mucosal prolapse type of hemorrhoids (the dentate line shifted downward in mucosal prolapse-type hemorrhoids)

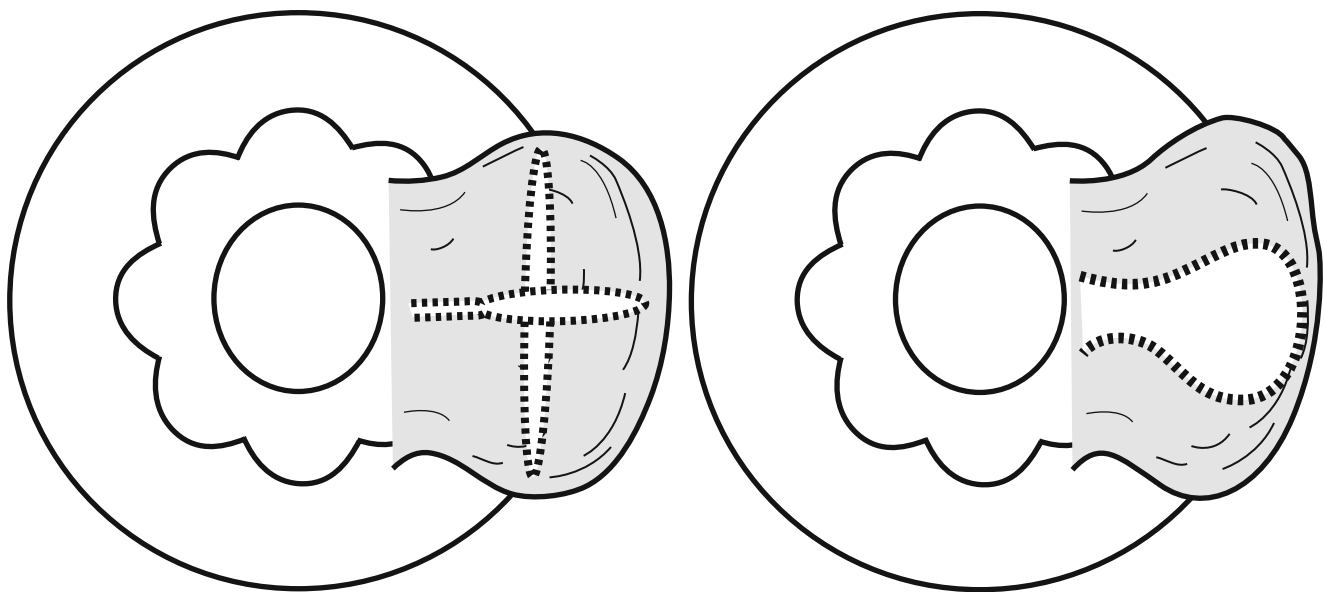


Fig. 7.29 The incision line of long prolapsed hemorrhoids. The wide incision can be used as shown in *right figure*, which could cause anal narrowing

7.3.5 Thrombosed Hemorrhoids

7.3.5.1 Incision and Drainage Method (I & D Method)

This procedure can be performed on patients with thrombotic hemorrhoids. Thrombotic hemorrhoids that burst out spontaneously sometimes may bring unexpected good results. Squeeze blood clots or curette through a small

incision, so that blood clot or blood can be discharged. Leave the incision open for drainage. If blood clots are hard, use a cruciform incision, but usually a linear incision is sufficient (Fig. 7.30).

7.3.5.2 Resection

Resection is needed when the I & D method is insufficient for drainage or when clean and rapid healing is expected.

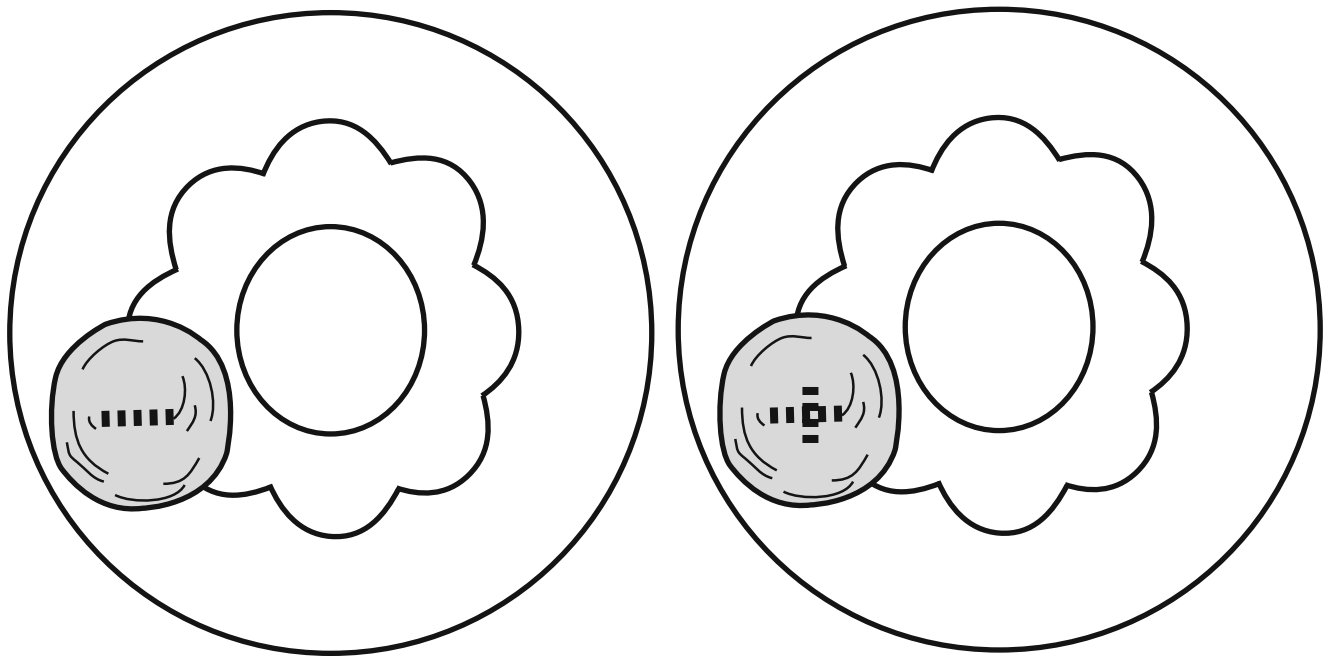


Fig. 7.30 I & D method for thrombosed hemorrhoids

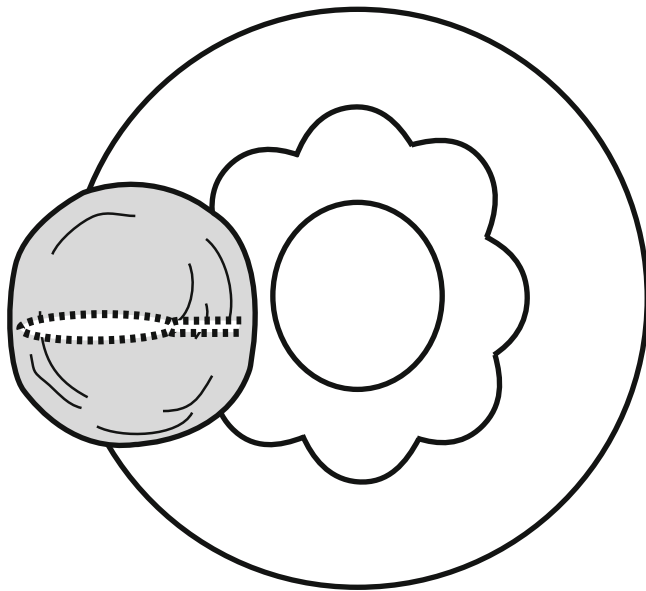


Fig. 7.31 Excision method for thrombosed hemorrhoids

Textbooks usually recommend a wide incision, but this is not always necessary. Removing the hemorrhoid with narrow incision would be enough. It is better to leave the wound open than close for healing (Fig. 7.31).

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No disease has more diverse operative methods than the hemorrhoids. Although each surgeon thinks his or her own method to be the best, surgical methods of other famous experts can give you a lot of help, and it also inspires for making your own method.

8.1 Parks' Submucosal Hemorrhoidectomy

One of the most outstanding coloproctologist, Parks from the United Kingdom, reported submucosal hemorrhoidectomy in 1956.

In 1774, J. C. Petit was the first surgeon to attempt hemorrhoidectomy without removing the mucosa of the anal canal. He made a vertical incision on the hemorrhoid pile to make two mucosal flaps, separated hemorrhoidal tissue from the internal sphincter, and removed the tissue after suture ligation of the hemorrhoidal stump. And then, the flap was sutured into its original place.

Parks based his surgery on the theory of Petit; however, since it was very time-consuming and technically too difficult, many surgeons could not perform this method. At that time of Parks, the hemorrhoidal tissue was regarded as abnormal varicose tissue, and surgeons tried to remove the tissues completely by stripping the thin mucosa. This method made the surgery more difficult to perform because the attempt has made the mucosa perforate easily.

In spite of its time-consuming procedure, we are sticking onto this method because we are sure that it is a good method to preserve the original anus as little as possible. Since my lift-up submucosal hemorrhoidectomy was accomplished by modifying Parks' method, I recommend studying this original Parks' method.

8.1.1 Surgical Technique

8.1.1.1 Ballooning with Saline Infiltration

Normal saline mixed with epinephrine (1:300,000) is injected into the submucosa of the hemorrhoid. Inject at the dentate line first, and then inject on its proximal and distal area to balloon the submucosal layer (Fig. 8.1).

8.1.1.2 Incision

While grasping the outer anoderm of anus with a hemostat, make a racquet-shaped incision (Fig. 8.2). In cases of severe prolapse, make a Y-shaped incision at the rectal side (Fig. 8.3).

8.1.1.3 Submucosal Dissection

The anoderm and mucosa are separated from the underlying submucosal layer using Metzenbaum scissors. Since they are attached to the sphincter muscle at the dentate line, the sphincter can be injured during dissection (Figs. 8.3 and 8.4).

Parks' method was difficult because he dissected mucosal flap by pulling only one point with a hemostat (this difficult step makes many surgeons no longer practice this type of surgery). When two points are held apart, keeping the area horizontal, dissection can be made much easier (Fig. 7.15).

8.1.1.4 Separation of Hemorrhoidal Tissue from the Internal Sphincter

After identifying the lower end of the internal sphincter, dissect hemorrhoidal tissue from the internal sphincter (I do not dissect from the level of internal sphincter, but I rather leave some tissues above the internal sphincter for about 1–2 mm and dissect from this level.)

And proceed the dissection upward. Dissect both sides of the mucosa while grasping with a hemostat (Figs. 8.5 and 8.6).

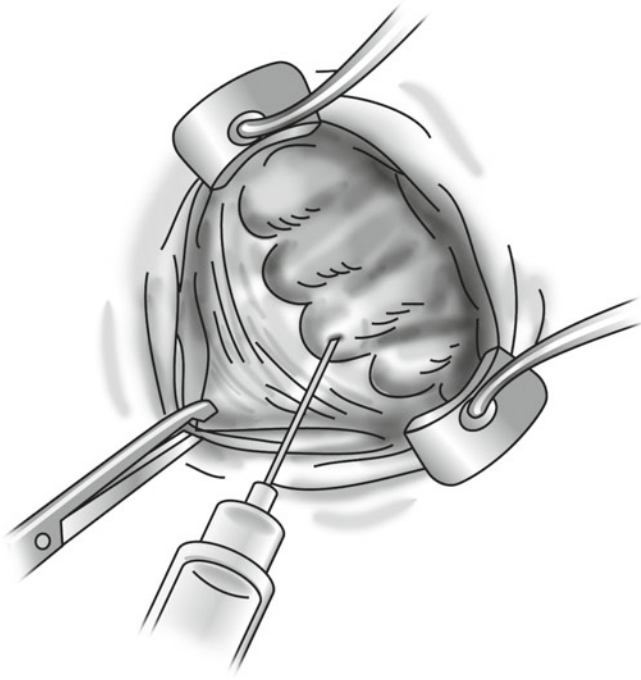


Fig. 8.1 Infiltrate the solution of normal saline mixed with epinephrine (1:300,000) into submucosal layer. Injection should be first made on the mucocutaneous junction (Reproduced from Parks (1971), p. 35)

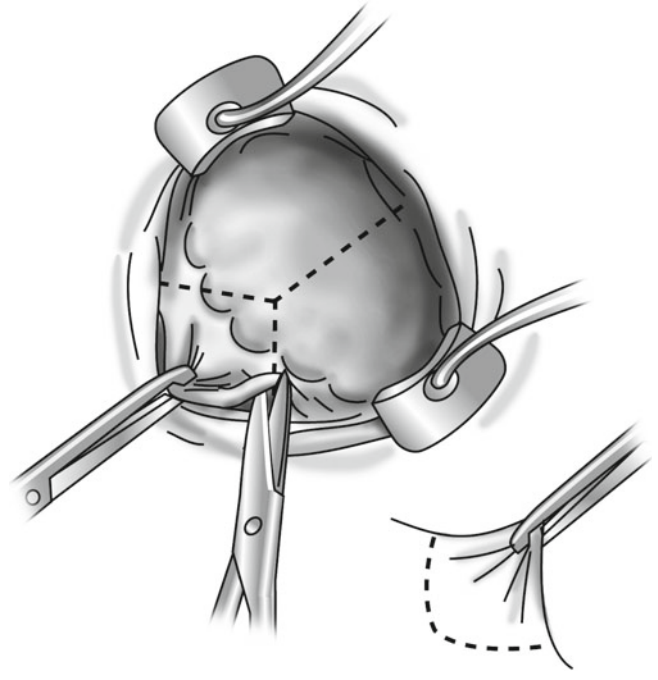


Fig. 8.2 After the ballooning, an incision is made while grasping the outer anoderm with a hemostat. An upward vertical incision of about 3–5 cm from the mucocutaneous junction is done (Reproduced from Parks (1971), p. 37)

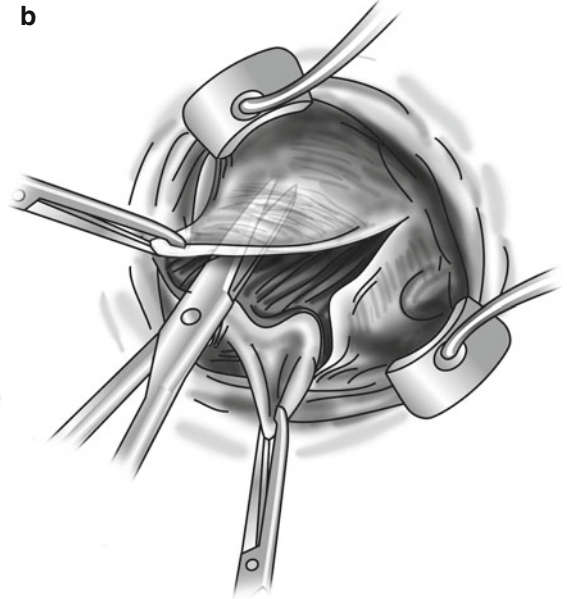
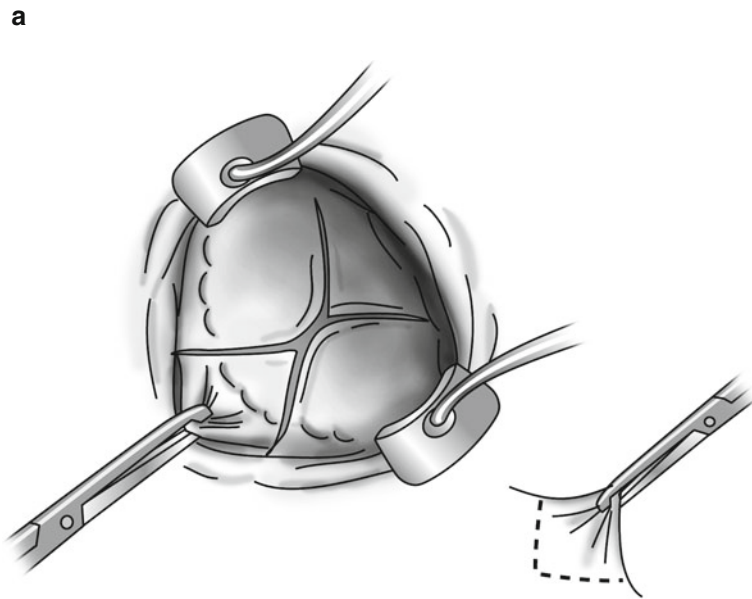


Fig. 8.3 (a) After Y incision, the anoderm and mucosa are separated from the underlying submucosal layer. (b) Around the dentate line, care should be taken for the sphincter injury (Reproduced from Parks (1971), p. 37)

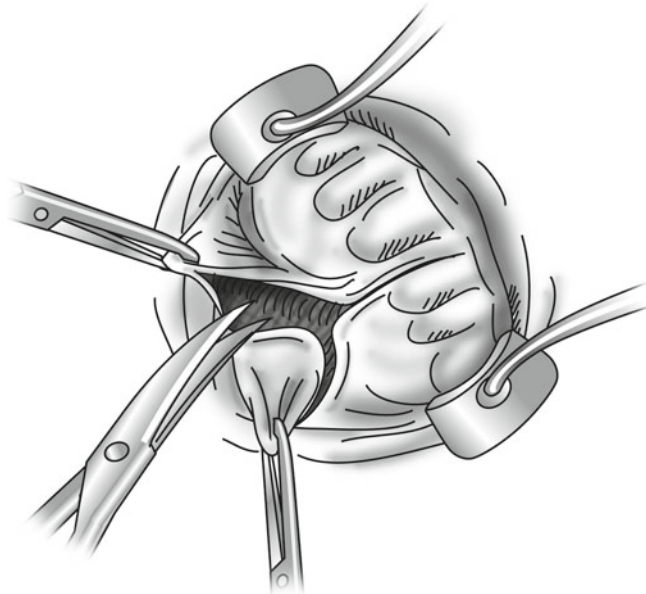


Fig. 8.4 Dissect the anoderm of the lower anal canal from the vascular submucosal tissue. Since mucocutaneous junction is fixed with underlying sphincter muscle, the sphincter can be injured (Reproduced from Parks (1971), p. 37)

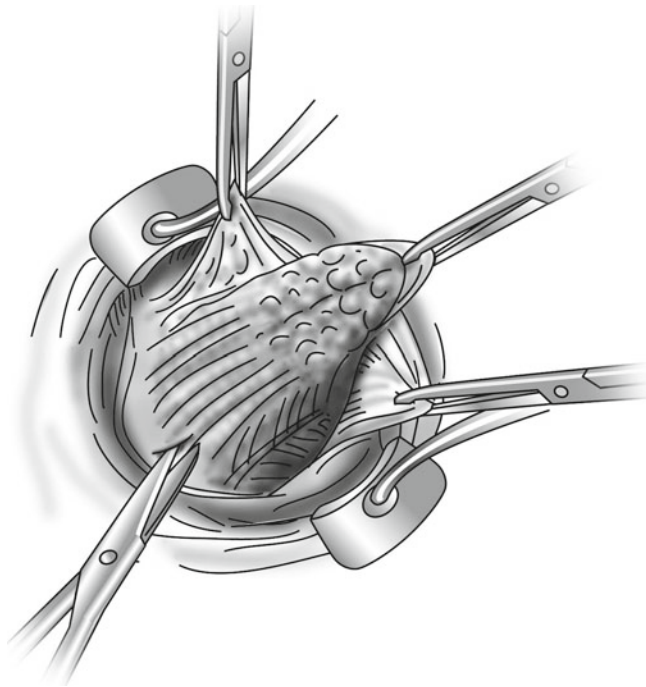


Fig. 8.5 Separate the submucosal hemorrhoidal tissue from the internal sphincter after internal sphincter (Reproduced from Parks (1971), p. 41)

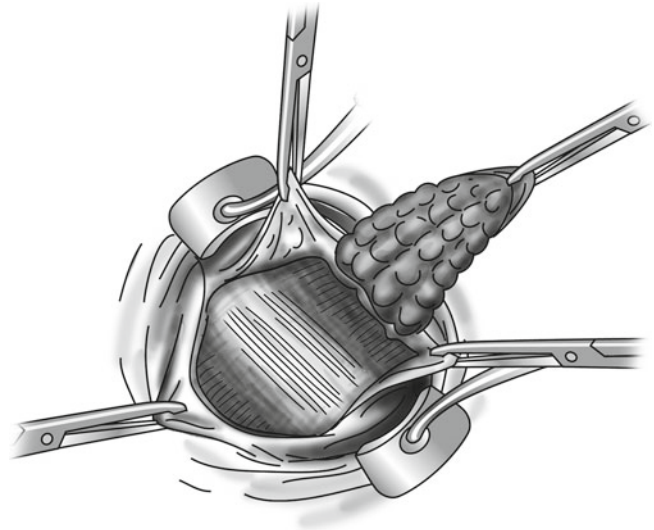


Fig. 8.6 The submucosal tissue has been stripped off the internal sphincter completely. Two mucosal flaps are clearly seen (Reproduced from Parks (1971), p. 43)

8.1.1.5 Ligation of the Hemorrhoid Stump

The hemorrhoid stump is transixed with 1-0 chromic catgut (Fig. 8.7).

8.1.1.6 Closure of Mucosa

Both mucosal flaps around dentate line are closed with one stitch of fine chromic catgut including the internal sphincter. Fix the dentate line to its normal site by suturing at 2 cm upward from the lower part of the internal sphincter (I don't suture the internal sphincter when performing continuous suture) (Fig. 8.8).

8.1.1.7 Postoperative Appearance

In the case of Y-shaped incision with severe mucosal prolapse, the mucosa between limbs is excised. Leave the area bare to arouse fibrosis and prevent prolapse. Suture the mucosa and anoderm, but leave the skin wounds opened slightly (Fig. 8.9).

(If the mucosa around this area is removed and fibrosis is triggered, I think the area that became stiff could give an uncomfortable feeling during defecation. This is why I lift up the hemorrhoidal stump 7 mm at a time and suture the mucosa continuously, rather than removing the mucosa.)

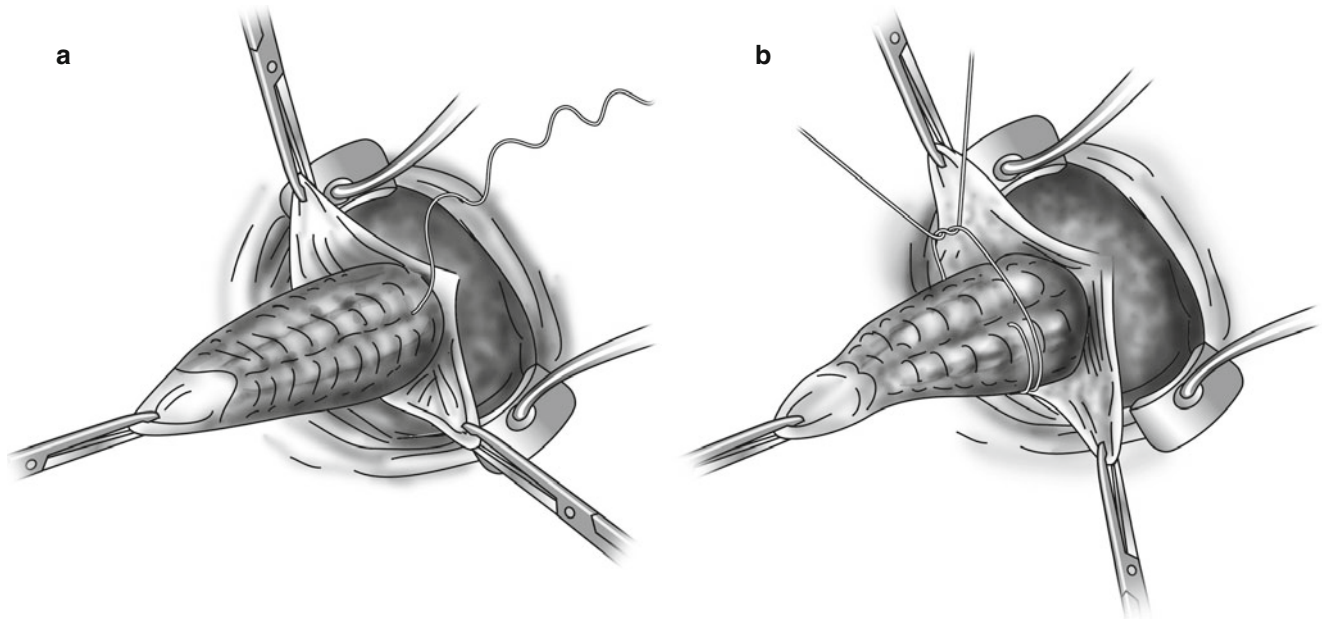


Fig. 8.7 (a) Transfixation of the hemorrhoidal stump. (b) Hemorrhoidal tissue is suture ligated with 1-0 chromic catgut (Reproduced from Parks (1971), p. 43)

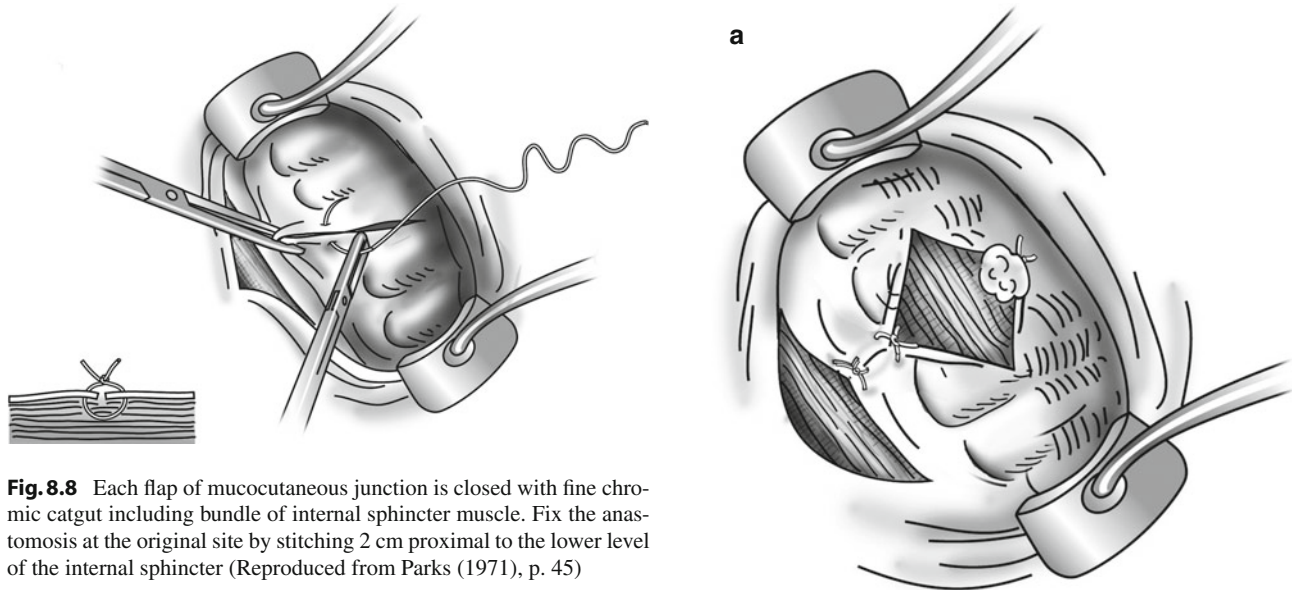


Fig. 8.8 Each flap of mucocutaneous junction is closed with fine chromic catgut including bundle of internal sphincter muscle. Fix the anastomosis at the original site by stitching 2 cm proximal to the lower level of the internal sphincter (Reproduced from Parks (1971), p. 45)

8.2 Ligation and Excision Method by Sumikoshi Yukio

Dr. Sumikoshi, the representative worldwide proctologist in Japan, had used ligation and excision method which became the prototype of Japanese hemorrhoid surgery. His method was similar to Milligan-Morgan's hemorrhoidectomy (open hemorrhoidectomy) of leaving the wound open after excising the hemorrhoid. Under the low spinal anesthesia with 3 % lidocaine, separate the buttocks apart with bandage in jackknife position. Ligation of the proximal hemorrhoidal artery had not been conducted in advance, but drainage window to the skin had been created.

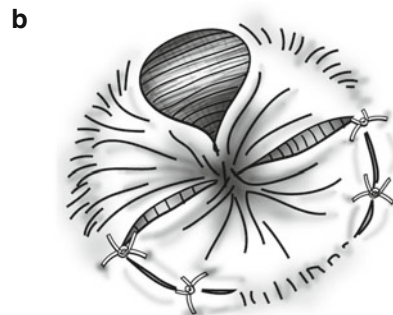


Fig. 8.9 (a) In the case of severe mucosal prolapse, Y-shaped incision is used, and the mucosa between the limbs is excised with hemorrhoid tissue. The area should be left bare to heal with a fibrosis. (b) The skin is left open usually, but it may be closed with chromic catgut if there is a concern about wound separation (Reproduced from Parks (1971), p. 45)

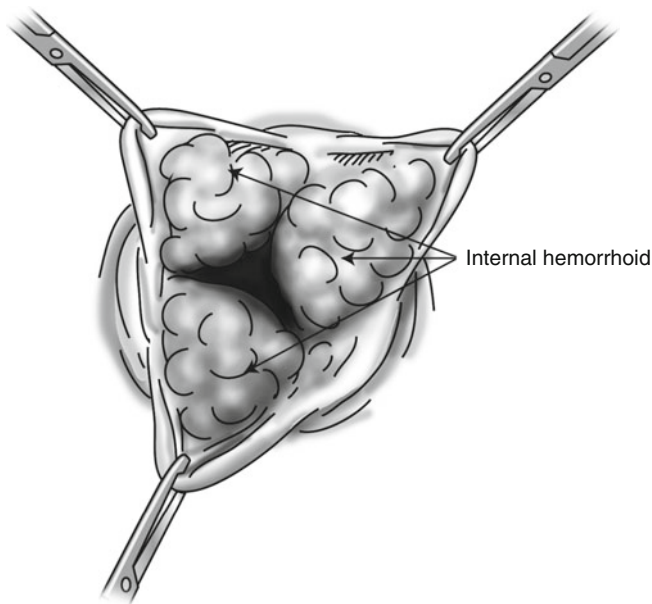


Fig. 8.10 Inspection of the main hemorrhoid pile (Reproduced from Sumikoshi Ukio. Hemorrhoid • fistula surgery, Health publisher, 1981. p. 9)

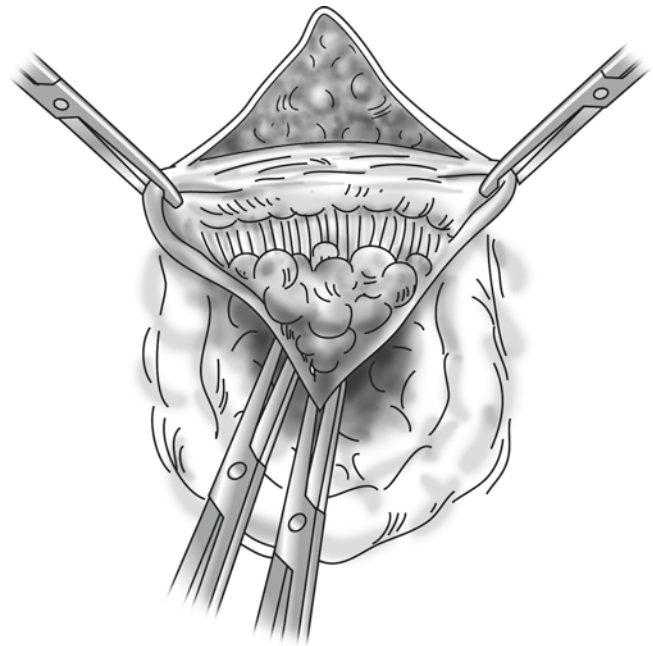


Fig. 8.12 Securing the surgical field (Reproduced from Sumikoshi Ukio. Hemorrhoid • fistula surgery, Health publisher, 1981, p. 11)

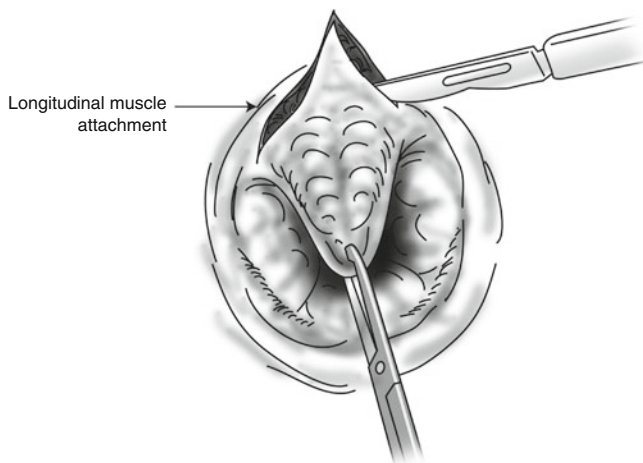


Fig. 8.11 Incision (Reproduced from Sumikoshi Ukio. Hemorrhoid • fistula surgery, Health publisher, 1981. p. 10)

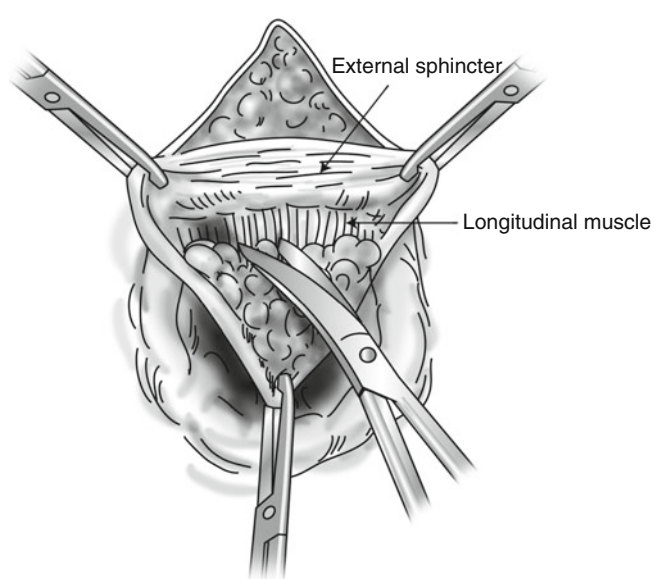


Fig. 8.13 Dissection (Reproduced from Sumikoshi Ukio. Hemorrhoid • fistula surgery, Health publisher, 1981, p. 11)

8.2.1 Surgical Technique

1. Sterilize the surgical area including in the anal canal with betadine.
2. Inspect the main hemorrhoid piles with the L-shaped retractor. (It also has the effect of anal dilatation.)
3. Pull three main hemorrhoid piles with a hemostat (Fig. 8.10).
4. Infiltrate about 2–3 cc of 1 % lidocaine solution mixed with epinephrine on the outer part of the clamp.
5. Make the incision in a triangle shape; it should not be too deep, at slightly outer point of the longitudinal muscle attachment as shown in Fig. 8.11. In other words, incise at about 1–1.5 cm outer from the anal verge.
6. Secure the operative field by holding the incised skin margins with a hemostat (Fig. 8.12).
7. Dissect the hemorrhoidal tissue and longitudinal muscle from the underlying sphincter by pulling with 3 hemostats in the interval of 120°. Good operative field is secured when the operator holds the middle hemostat and the assistant holds the other two lateral hemostats (Fig. 8.13). The width of the mucosal incision should be as narrow as possible (Fig. 8.14). Hemorrhoidal artery pulsation can be observed (Fig. 8.15). Dissect

Fig. 8.14 Dissection
(Reproduced from Sumikoshi
Ukio. Hemorrhoid • fistula
surgery, Health publisher, 1981.
p. 12)

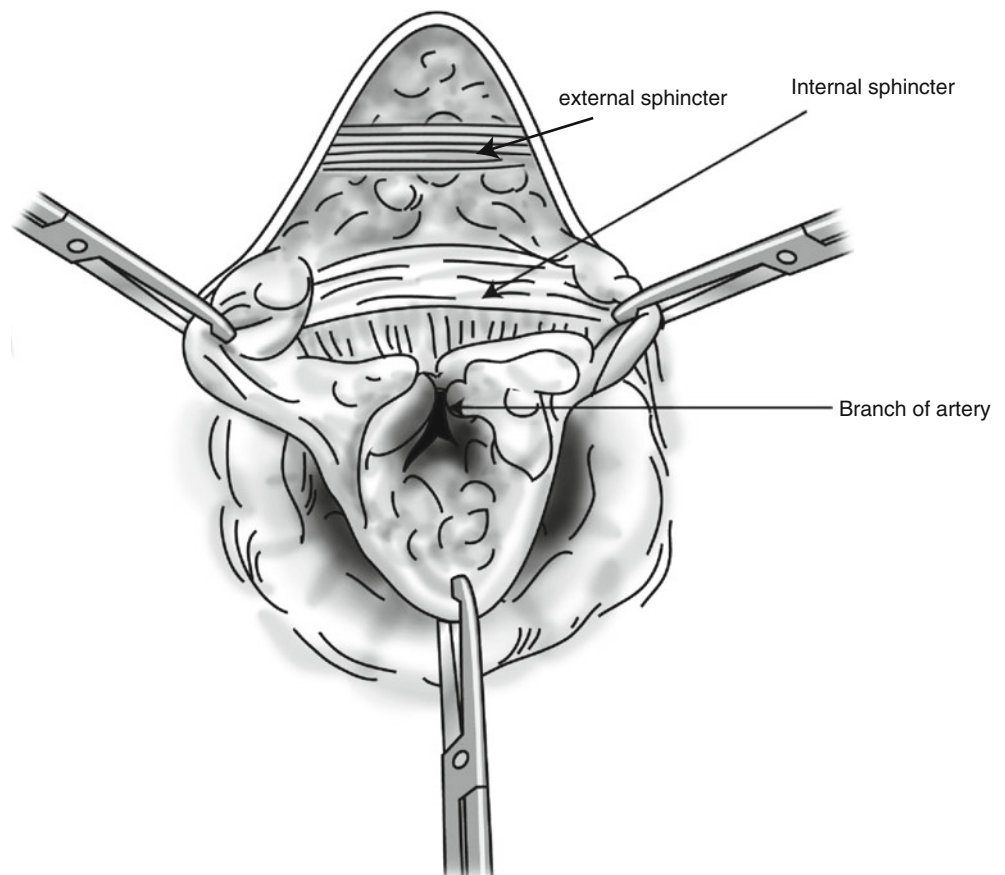
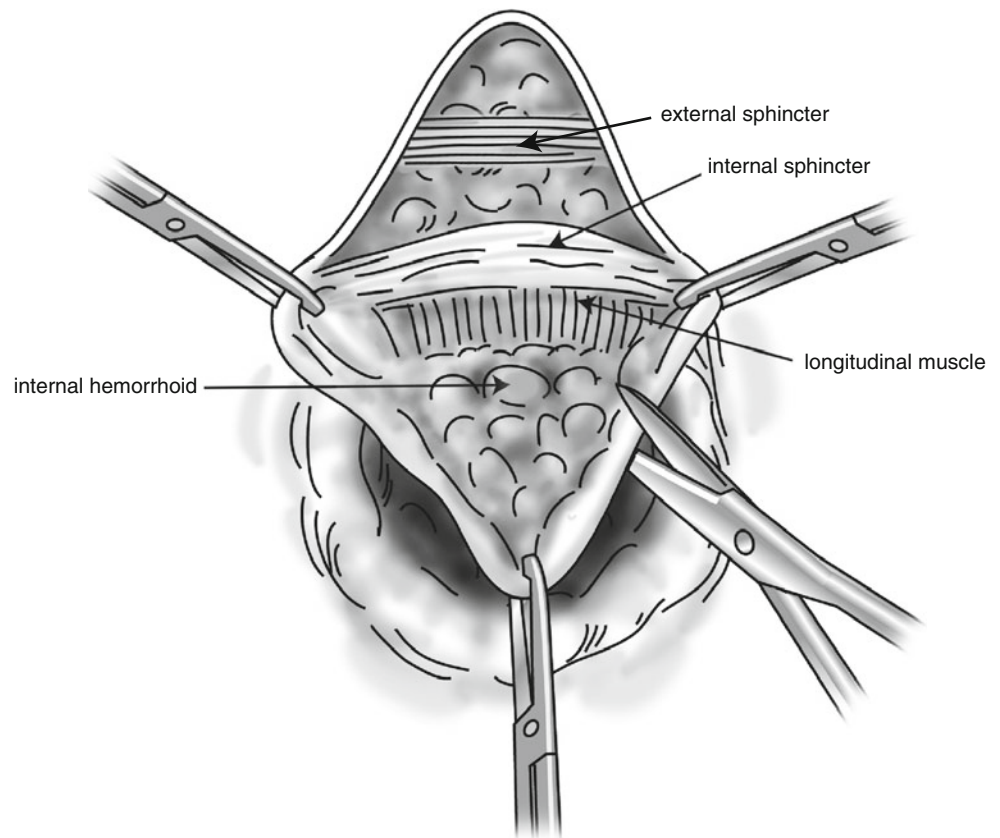


Fig. 8.15 Dissection
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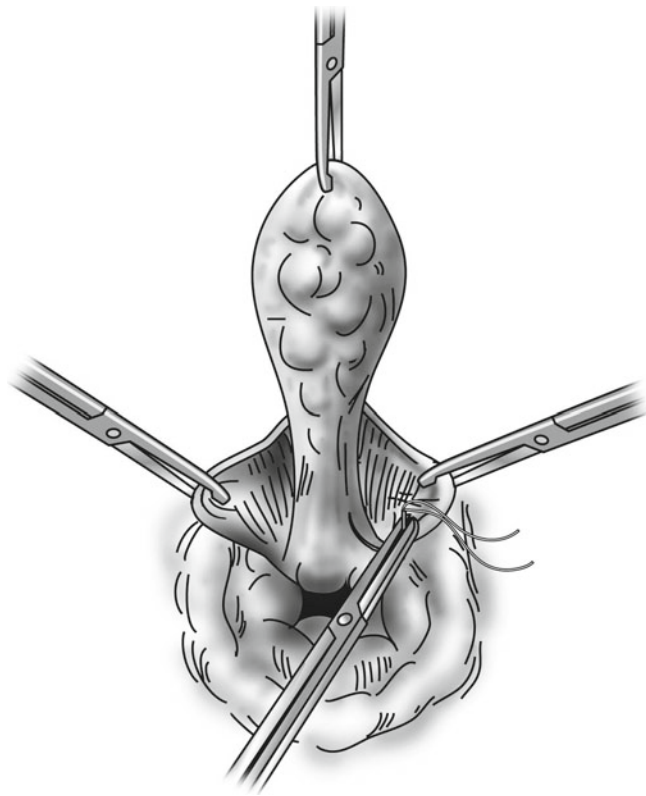


Fig. 8.16 Hemorrhoidal stump ligation (Reproduced from Sumikoshi Ukio. Hemorrhoid • fistula surgery, Health publisher, 1981. p. 13)

the hemorrhoidal tissue as if pushing inward with Metzenbaum scissors rather than excising.

8. Leaving mucosa of about 1 cm in width at 1–2 cm above the dentate line, transfixation (suture ligation) is done with 2-0 chromic catgut (Fig. 8.16).
9. Appearance of ligation with blood vessels (Fig. 8.17).
10. Cut the stump 3–4 mm distal to the ligation (Fig. 8.18).
11. The shape of the anus after excision of 3 hemorrhoid piles and the wounds are shown longitudinal to the anus (Fig. 8.19).
12. After excision of three hemorrhoid piles, turn over the mucosa and the skin to remove remaining hemorrhoid tissues (Fig. 8.20).
(Author thinks this procedure is unnecessary, because the hemorrhoidal tissue is considered to be normal tissue and preventing prolapse is sufficient enough.)
13. Final appearance after complete operation (Fig. 8.21).

8.3 Dakano's (高野 正博) Anoderm-Preserving Hemorrhoidectomy

Dr. Dakano, who is the master of Japanese benign anal disease, reported his anoderm-preserving surgery at *Disease of the Colon & Rectum* in 1982. Although this

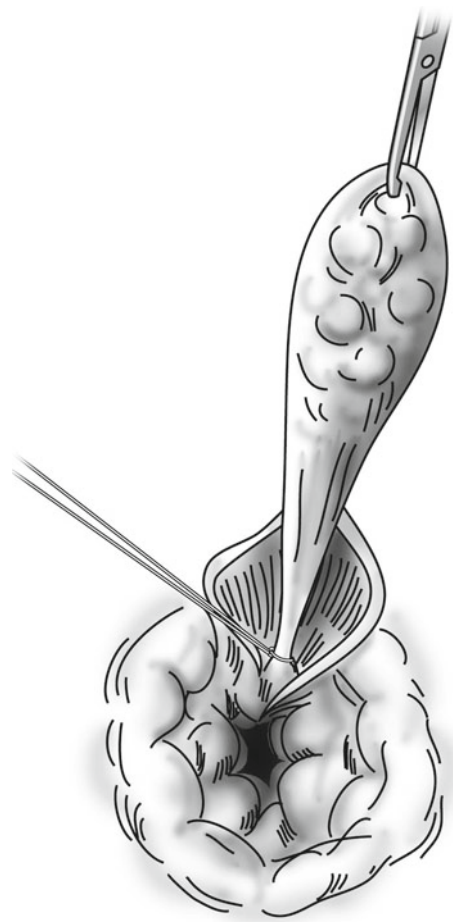


Fig. 8.17 The appearance of ligation (Reproduced from Sumikoshi Ukio. Hemorrhoid • fistula surgery, Health publisher, 1981. p. 13)

method is a kind of ligation and excision method, he tried to preserve anoderm as much as possible.

He made dumbbell-shaped skin incision and transfixed the mucosa to the hemorrhoidal stump using purse-string suture up to the midportion after excising the hemorrhoid pile (from the stump to the beginning of the anoderm), and the remaining anoderm was closed continuously.

8.3.1 Surgical Technique

There are skin tag on the outmost, external hemorrhoid following next, and internal hemorrhoid on the very inside of the anus. The external hemorrhoids are covered with skin, and the internal ones are covered with mucosa. The anoderm is prolapsed outside with the hemorrhoids.

Operation is started at perianal area. Excise the skin tag and create an external drainage wound (Figs. 8.22 and 8.23).

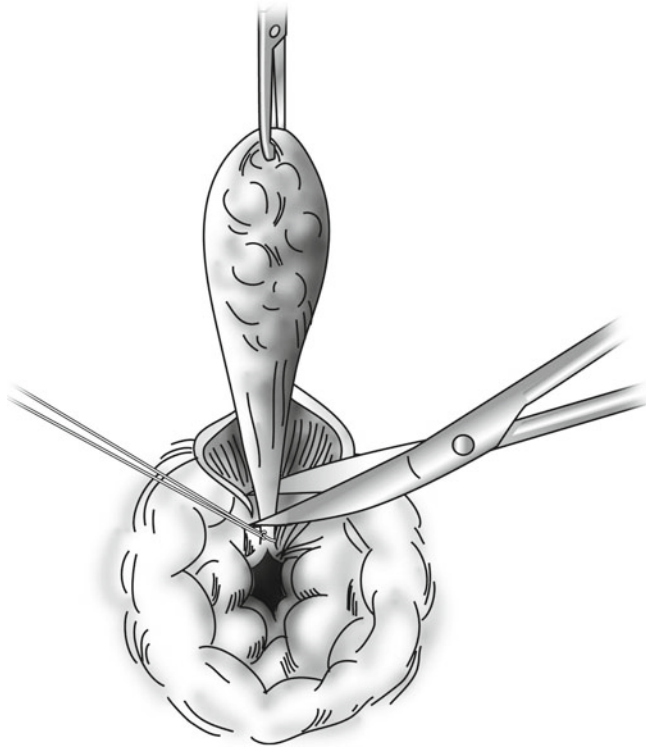


Fig. 8.18 Excision of the hemorrhoidal tissue (Reproduced from Sumikoshi Ukio. Hemorrhoid • fistula surgery, Health publisher, 1981. p. 10)

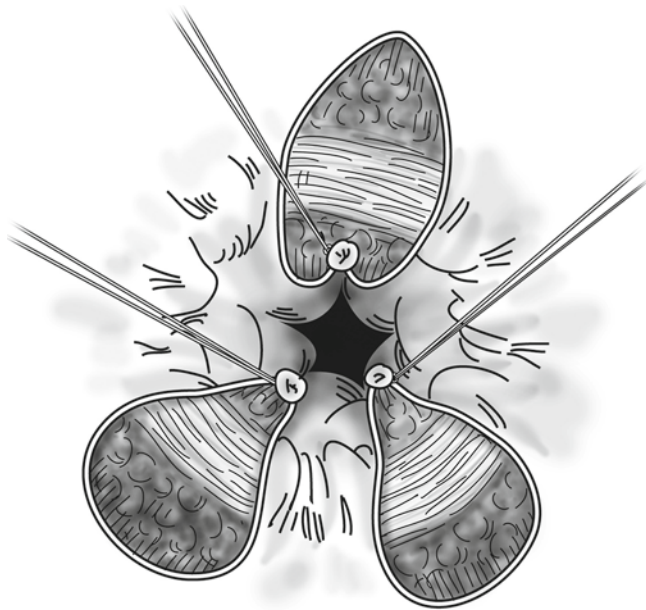


Fig. 8.19 The appearance after resection of hemorrhoids (Reproduced from Sumikoshi Ukio. Hemorrhoid • fistula surgery, Health publisher, 1981)

8.3.1.1 Decide the Width of Incision According to the Size of the Hemorrhoid Pile

1. Large-sized hemorrhoids: anoderm is also extended and too excessive for total preservation. Some of the anoderm is resected with the hemorrhoid pile by wide incision.

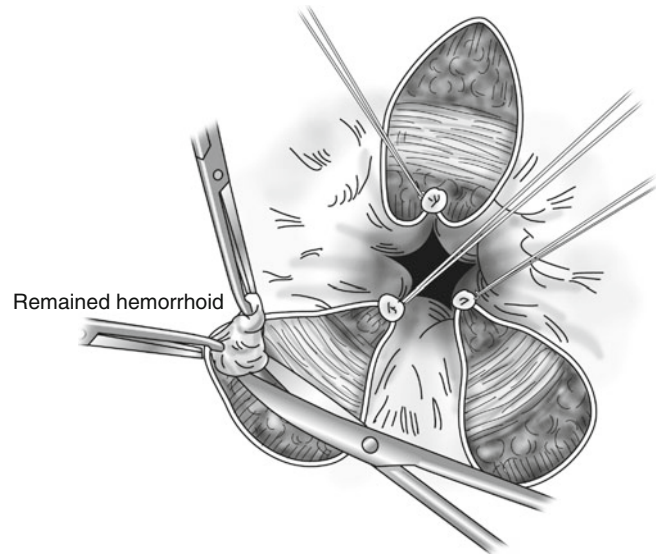


Fig. 8.20 Excision of the remnant hemorrhoid (Reproduced from Sumikoshi Ukio. Hemorrhoid • fistula surgery, Health publisher, 1981. p. 15)

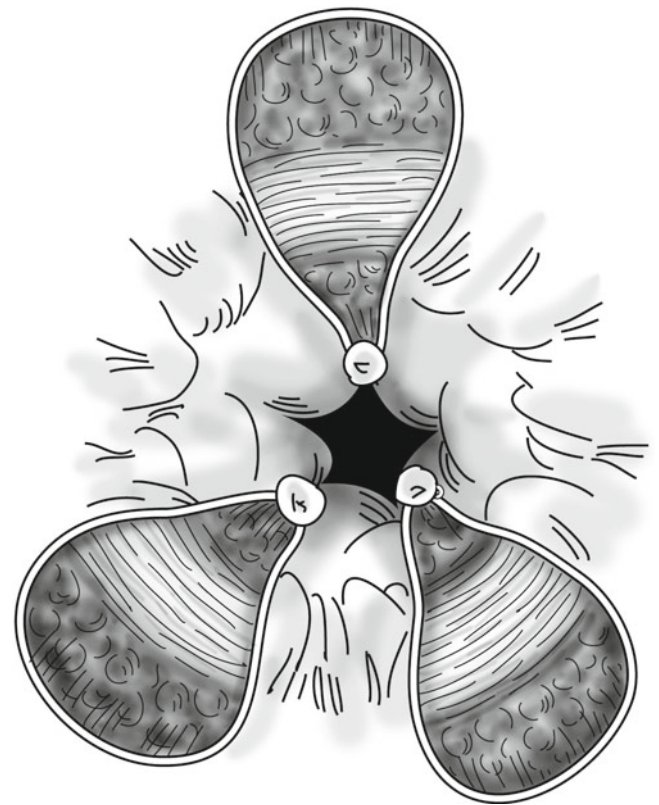


Fig. 8.21 Postoperative appearance (Reproduced from Sumikoshi Ukio. Hemorrhoid • fistula surgery, Health publisher, 1981. p. 5)

2. Medium-sized hemorrhoids: anoderm is resected as little as possible to preserve the anoderm.

3. Small-sized hemorrhoids: anoderm is just incised vertically to preserve all of the anoderm (Fig. 8.24).

On the internal hemorrhoids, the width of excision is again widened for complete resection of the prolapsing

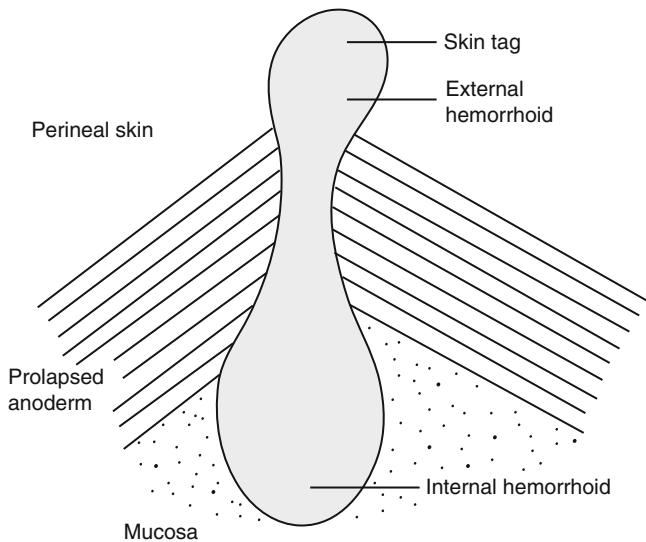


Fig. 8.22 Preoperative appearance of the hemorrhoid. The anoderm is facing toward outside of the anal canal

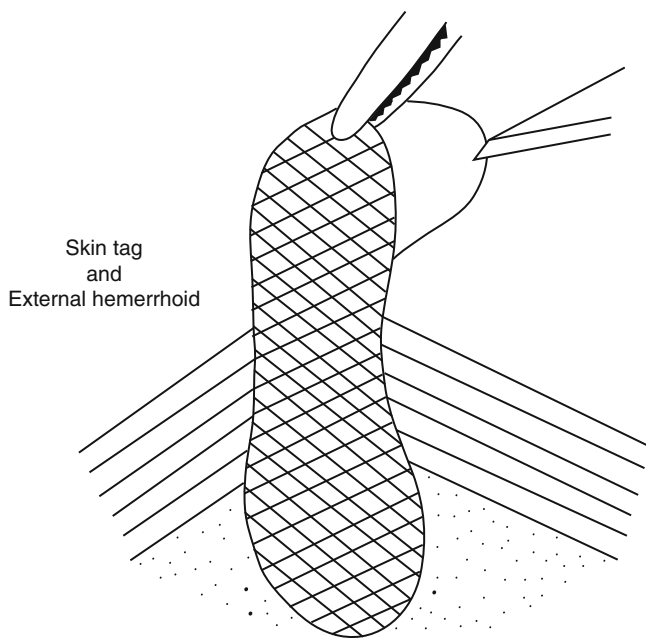


Fig. 8.23 Dumbbell-shaped incision

internal hemorrhoids. To make a dumbbell-shaped incision, the width of the excision should be narrow at the anoderm and wide at the internal hemorrhoid and external skin. The hemorrhoidal stump is ligated doubly with 1-0 chromic catgut. The anoderm is preserved as much as possible, and remove the remnant completely under the anoderm (Figs. 8.25 and 8.26).

Suture both edges of the mucosa in a purse-string manner, and fix them to the stump with 1-0 chromic catgut that was used for the hemorrhoid stump ligation. Dakano shortened the length of the longitudinal axis through this way.

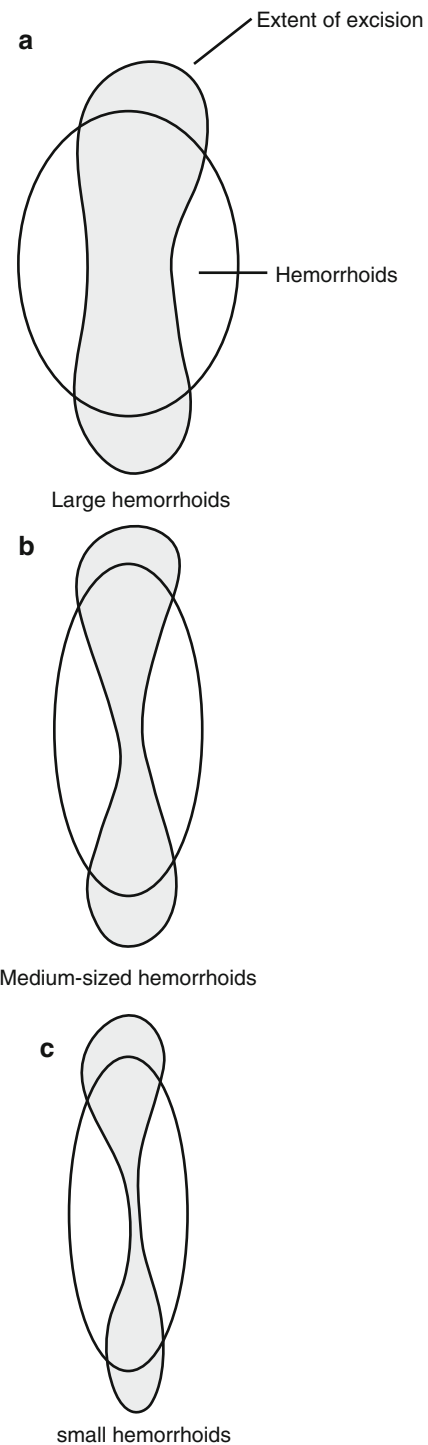


Fig. 8.24 Decide the width of incision according to the size of the hemorrhoid pile. (a) Large hemorrhoids (b) Medium-sized hemorrhoids. (c) Small hemorrhoids

If the hemorrhoids are large or if prolapse are severe, preserved anoderm can be excessive. In such cases, the anoderm is fixed to the stump while skipping the mid part of the edge from purse-string suture. This skipped edge should be sutured transversely again (Figs. 8.27 and 8.28).

The purse-string suture is transfixed to the stump of hemorrhoid to recover prolapsed anoderm to its original site.

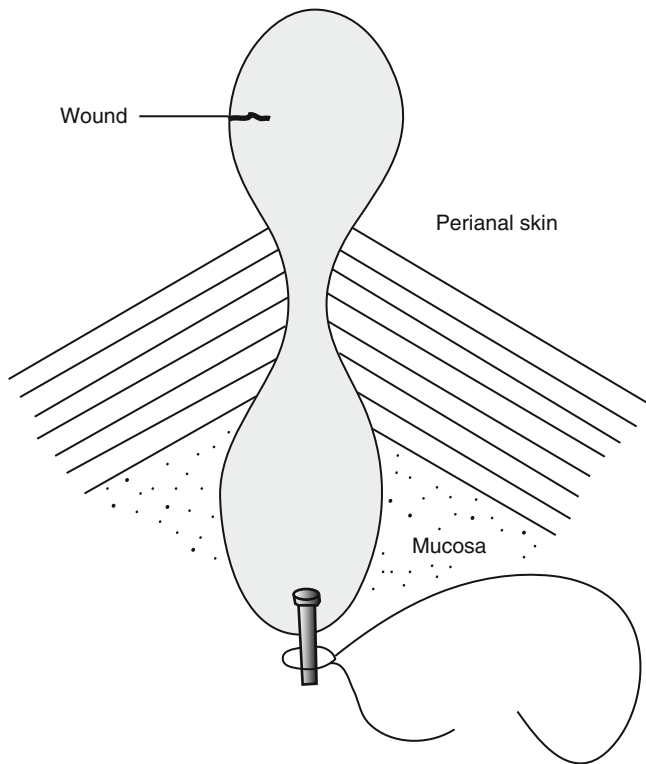


Fig. 8.25 Suture ligation of a hemorrhoidal stump

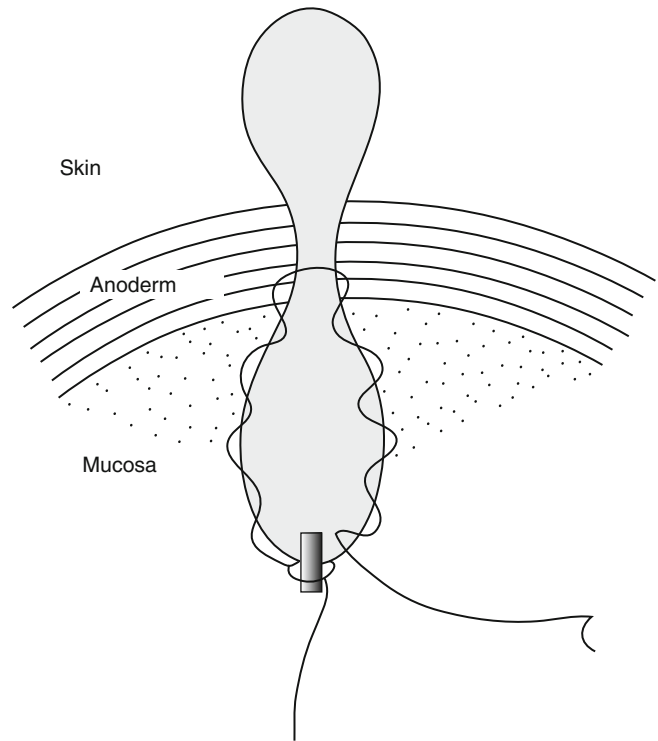


Fig. 8.27 Both edges of the mucosa are sutured in purse-string manner

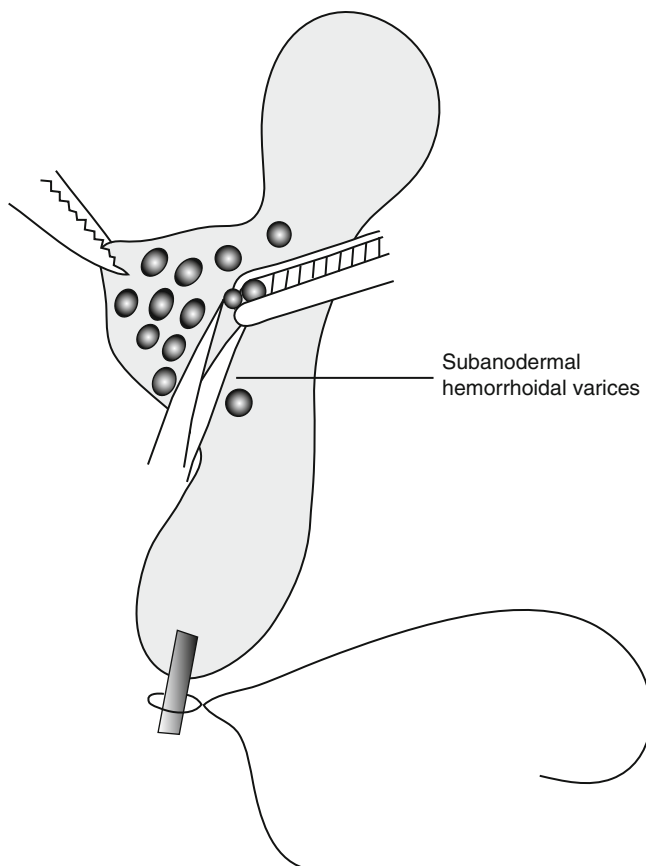


Fig. 8.26 Removal of the hemorrhoids under the anoderm

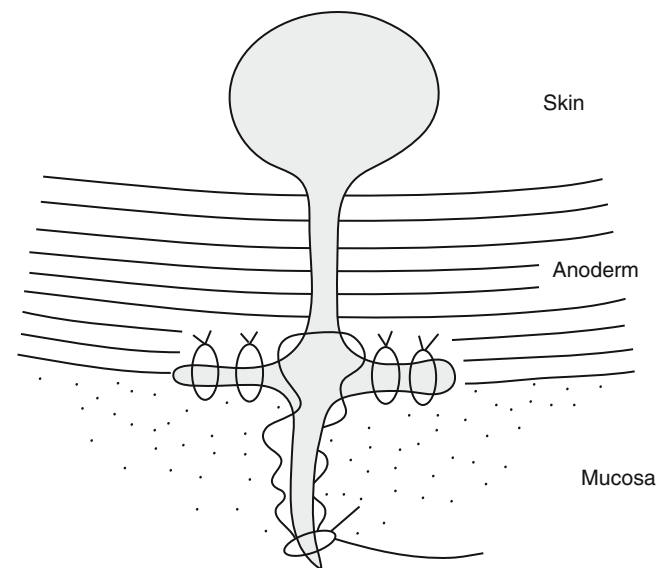


Fig. 8.28 In case of large hemorrhoid pile or severe prolapse, additional transverse stitches are performed after skipping the mid part of the edge from the purse-string suture

The anoderm facing outward (Fig. 8.22) changes its direction to face inward (Fig. 8.29). The anoderm is sutured continuously with the same catgut that ligated the hemorrhoidal stump (Fig. 8.30). The suture should include the underlying internal sphincter.

8.4 Closed Hemorrhoidectomy

Closed hemorrhoidectomy is a method that repairs surgical wound completely after ligation and excision. Since its announcement by Ferguson from Michigan, United States, in 1959, the Ferguson Clinic has operated over 30,000 patients in 40 years through this method. About 80 % of US physicians are said to use this method for hemorrhoidectomy.

The excision and ligation by St. Mark's Hospital in the United Kingdom, completed by Milligan and Morgan, leave the wound open after hemorrhoidectomy. On the contrary, the closed hemorrhoidectomy closes the wound completely after the operation.

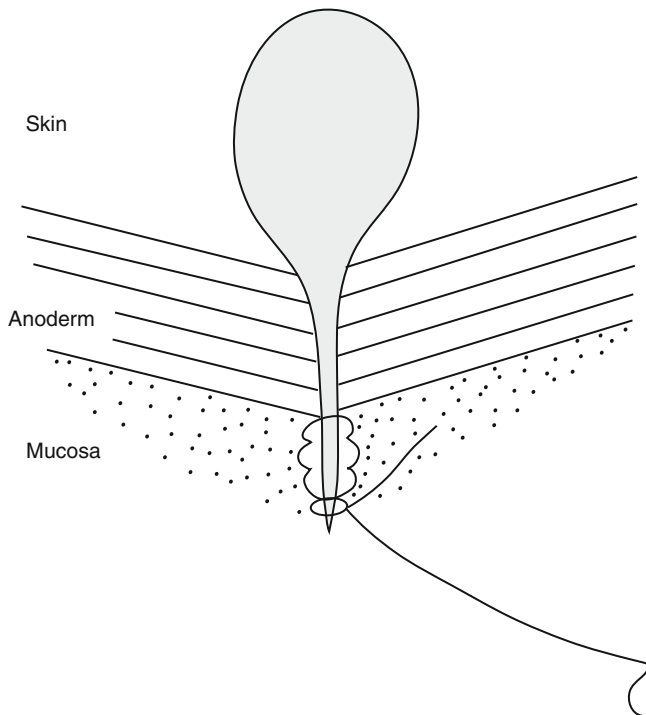


Fig. 8.29 Ligation of the purse-string suture. Anoderm faces inward after ligation

The author personally thinks closing the wound is better than leaving it open and also thinks less excision of the mucosa and anoderm is better than excising a lot in a closed hemorrhoidectomy.

8.4.1 Surgical Technique

8.4.1.1 Patient Position

Operate under modified left lateral position (Sims' position) (Fig. 8.31).

8.4.1.2 Skin Incision

Expose the field to be operated with a Hill Ferguson retractor.

Make an elliptical incision with a No. 10 blade around the external skin of anus and anoderm to the depth of the internal sphincter, along the dotted line in Fig. 8.32. Continue incision toward the inner side of the anal canal (Fig. 8.33).

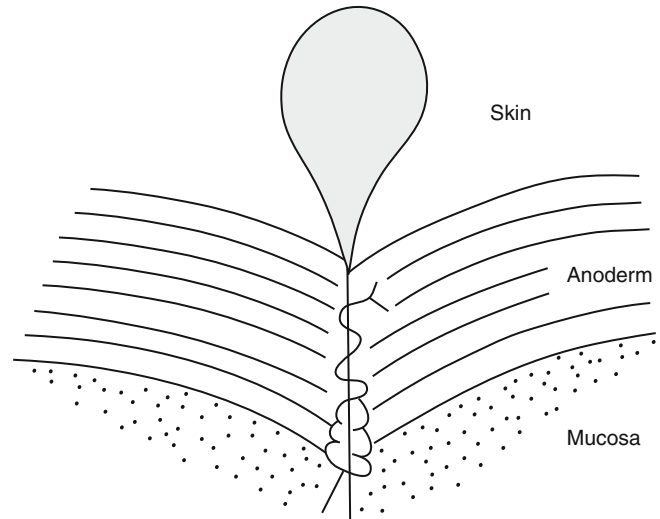


Fig. 8.30 Completion of anoderm-preserving hemorrhoidectomy. The anoderm is sutured continuously with the same catgut that ligated the stump of hemorrhoid

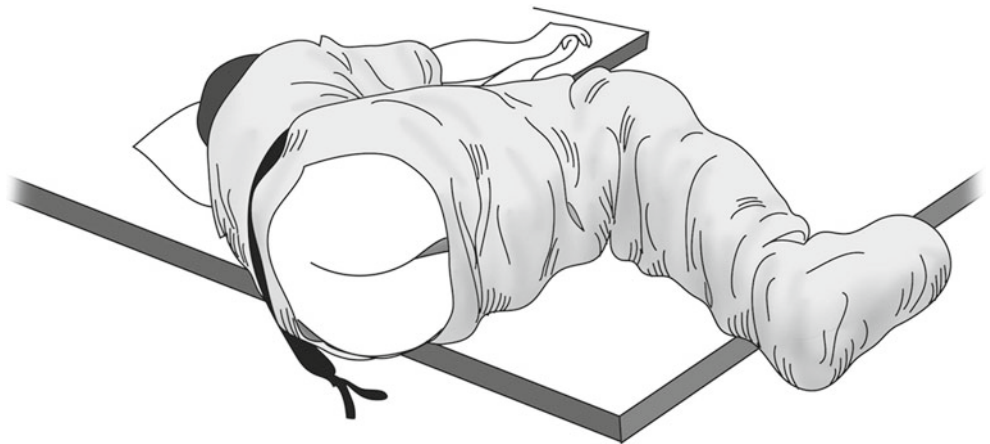


Fig. 8.31 Surgical position
(Reproduced from Ferguson
et al. (1971); 70(3):481)

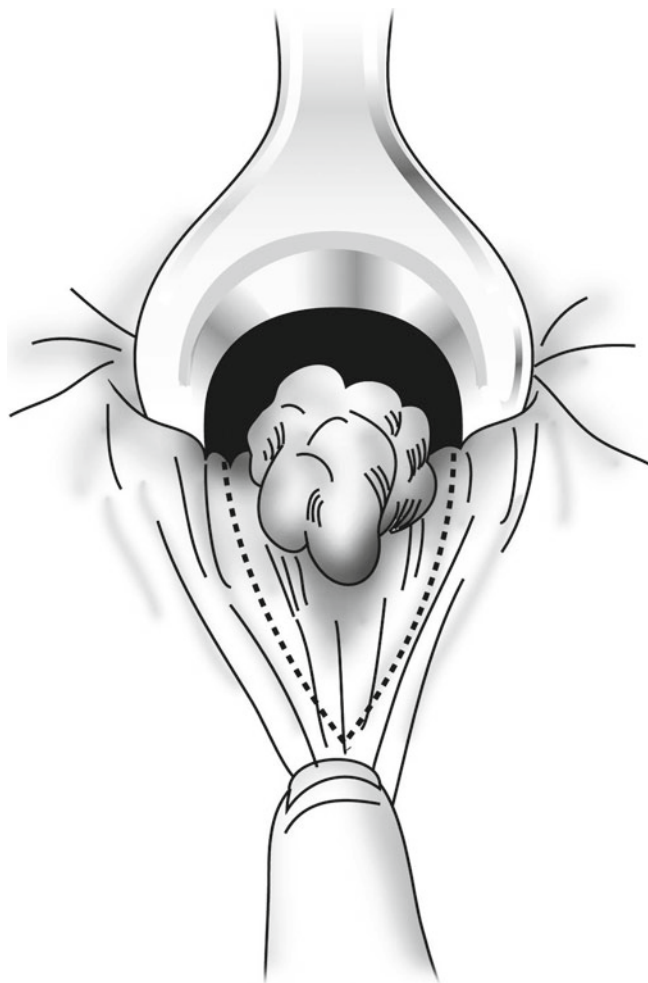


Fig. 8.32 Incision line of the skin (Reproduced from Ferguson et al. (1971), 70(3):481)

8.4.1.3 Dissection

Hemorrhoidal tissue is dissected from the underlying internal sphincter muscle, up to the proximal to the dentate line.

8.4.1.4 Excision of Hemorrhoidal Tissue

The hemorrhoid is excised after grasping the pedicle with clamp (Figs. 8.34 and 8.35).

8.4.1.5 Ligation of the Hemorrhoidal Stump

The hemorrhoidal stump is ligated with 2-0 or 3-0 chromic catgut (Fig. 8.36).

8.4.1.6 Removal of Accessory Piles and Suture

After removing accessory piles, the wound is closed continuously with chromic catgut which was ligated stump (Figs. 8.37 and 8.38).

8.5 Whitehead's Hemorrhoidectomy

Whitehead's hemorrhoidectomy had been the best curative operation for circumferential hemorrhoids until the 1960s. Despite the complications, such as postoperative anal

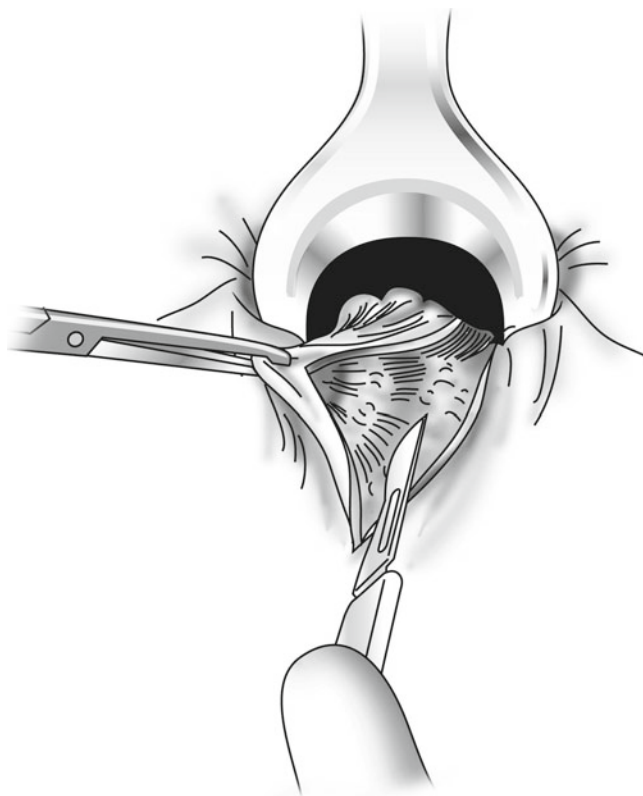


Fig. 8.33 Incision is made while grasping the pedicle of the hemorrhoid with a hemostat (Reproduced from Ferguson et al. (1971), 70(3):482)

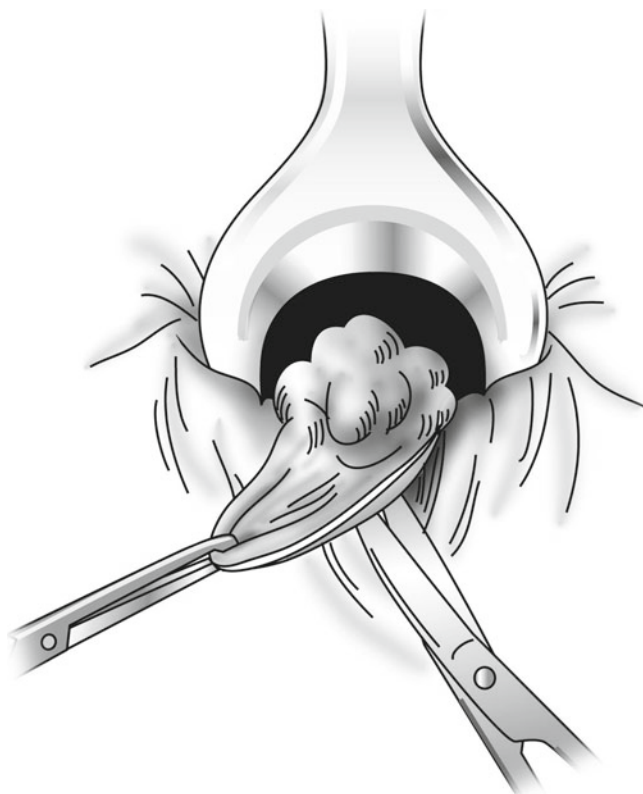


Fig. 8.34 Dissection of the hemorrhoidal tissue (Reproduced from Ferguson et al. (1971), 70(3):482)

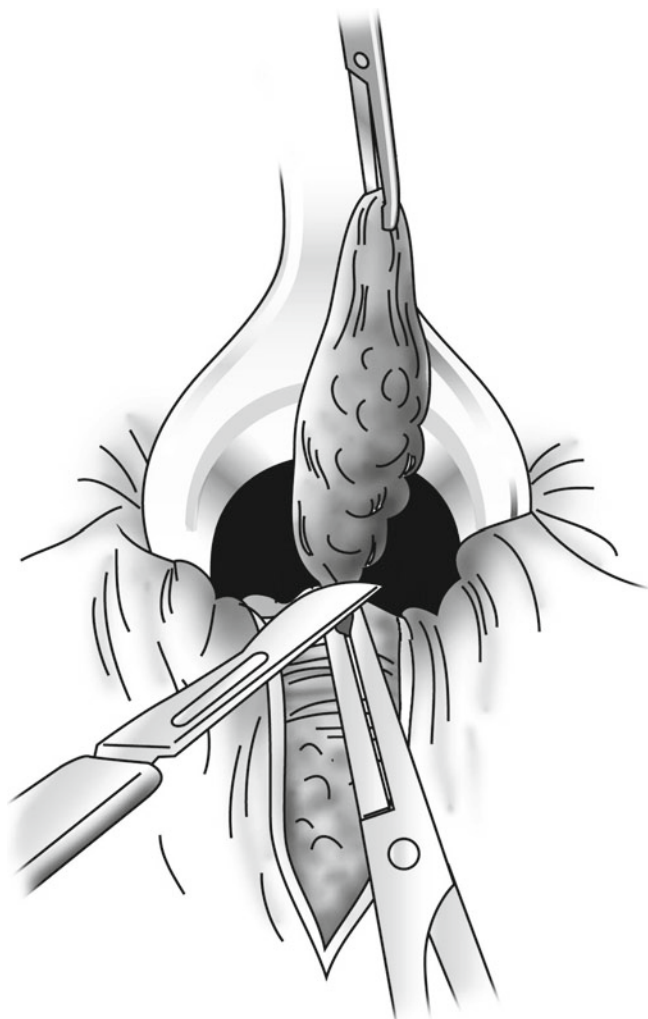


Fig. 8.35 Excision of the pedicle (Reproduced from Ferguson et al. (1971); 70(3):482)

stenosis, Whitehead's anus, and severe pain, a number of surgeons still use this method with some modification.

Since the hemorrhoid tissues were considered to be abnormal, surgeons tried to remove the entire tissue before. However, nowadays we consider them as normal tissue, removing them only up to the point where it can prevent prolapse is important.

The PPH, spotlighted method of the day, is a treatment method to reduce longitudinal axis by removing redundant mucosa of the upper part of the anus. Likewise, Whitehead's surgery could also be performed safely only if the extra mucosa would be removed and sutured at upper anal canal while the anal cushion is left intact.

In 1882, Whitehead presented a very extensive curative hemorrhoidectomy to remove all parts of hemorrhoids. It was a method of removing entire hemorrhoids after the transverse incision 1–2 cm above the dentate line and suturing with the squamous mucosa near the dentate line. Whitehead tried to leave three longitudinal bands, if possible. This method might prevent the rectal mucosa from being disrupted by tension, if not, disrupted wound can

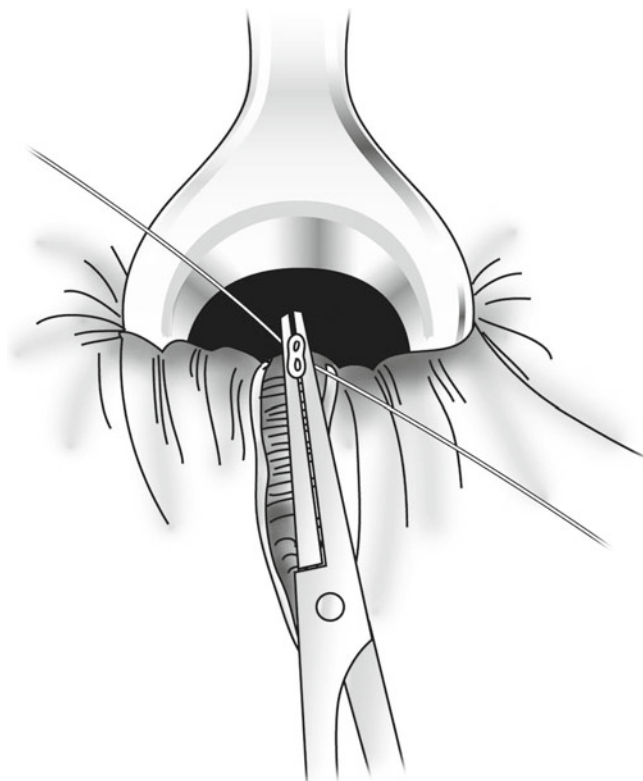


Fig. 8.36 Ligation of the hemorrhoidal stump (Reproduced from Ferguson et al. (1971), 70(3):482)

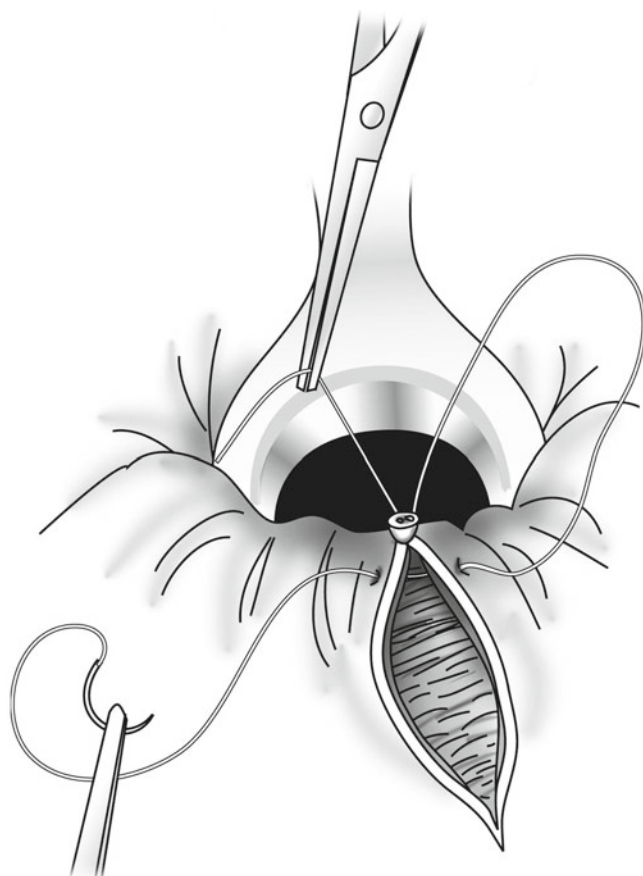


Fig. 8.37 Excision and suture of accessory piles (Reproduced from Ferguson et al. (1971); 70(3):483)

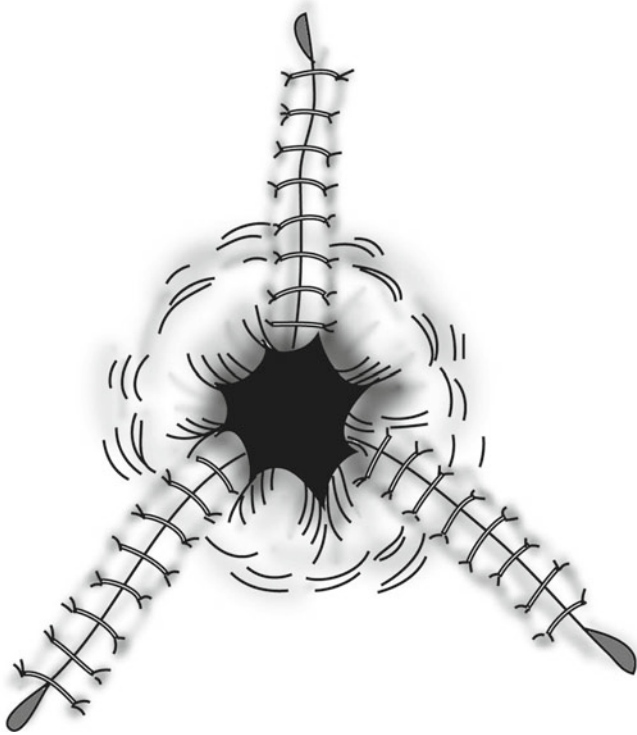


Fig. 8.38 The postoperative appearance (Reproduced from Ferguson et al. (1971), 70(3):483)

cause anal stricture. Whitehead intended to remove the mucosa proximal to the dentate line. Whitehead intended to remove the mucosa proximal to the dentate line. But in practice, the upper side of the anal canal was sometimes too deep and narrow for surgery, and when the hemorrhoids are in the lower rectum, it becomes a method of excising the anal mucosa or squamous mucosa to remove the hemorrhoids, and thus the hemorrhoidal tissue are removed around the anus.

If the rectal mucosa would be sutured on the lower anal canal, it would cause mucus secretion and bleeding, forming "Whitehead's anus." For this reason this surgical method has been prohibited by law in the United Kingdom.

Compared to PPH method, in the Whitehead's operation, as the suture of the mucosa and submucosa is conducted by hand, the resection is doomed to take place at the middle or lower portion of the anal canal. Therefore, it leads to resect the sensitive sensory tissue of the anal canal, which becomes a problem.

8.5.1 Surgical Technique

A transverse incision is made 2–3 mm proximal to or on the dentate line.

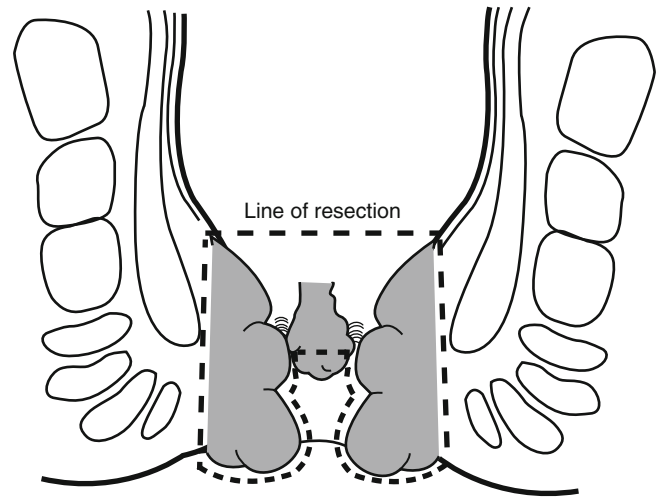


Fig. 8.39 Remove the tissue along the dotted line during Whitehead's hemorrhoidectomy

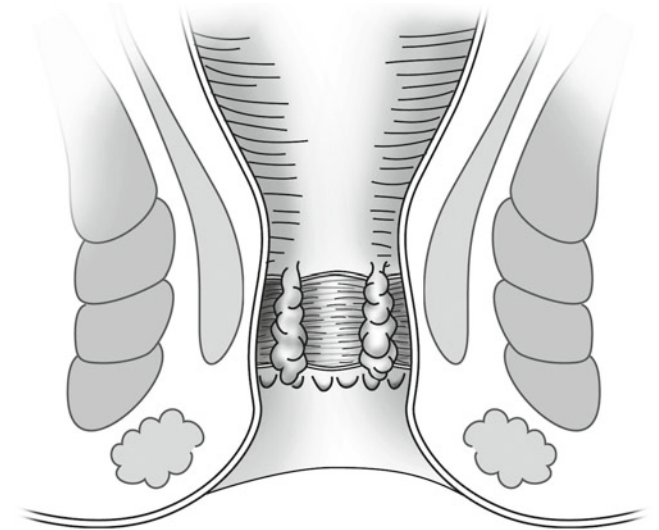


Fig. 8.40 Three longitudinal bands should be left in Whitehead's hemorrhoidectomy

On the upper area from the incision, the mucosa and submucosa containing the hemorrhoid tissue are dissected from the underlying internal sphincter. During this surgery, I recommend to dissect as if peeling off a thin layer of the mucosa and submucosa.

For the hemorrhoids on the lower part of dentate line, remove the hemorrhoids only under the mucosa by penetrating into the mucosa. (I think this process is not necessary) (Figs. 8.39).

After the dissection, an additional transverse incision should be placed proximal to the previous one, in order to form three longitudinal bands preventing stenosis and wound disruption (Fig. 8.40). The upper mucosa and lower anoderm is sutured with 3-0 Vicryl (Fig. 8.41)

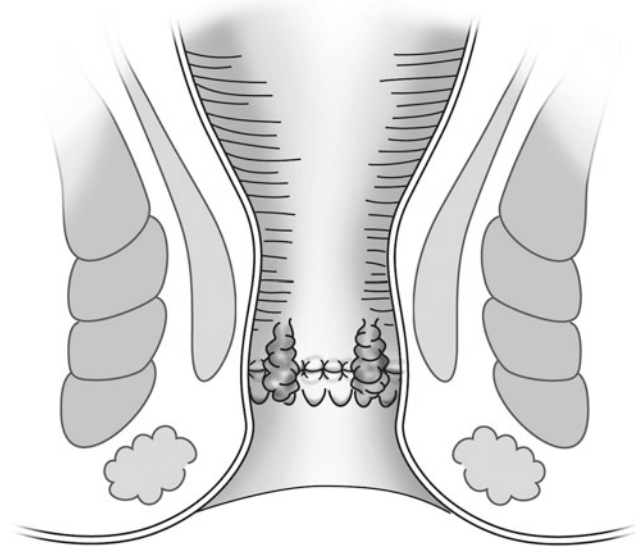


Fig. 8.41 The postoperative appearance of Whitehead's hemorrhoidectomy

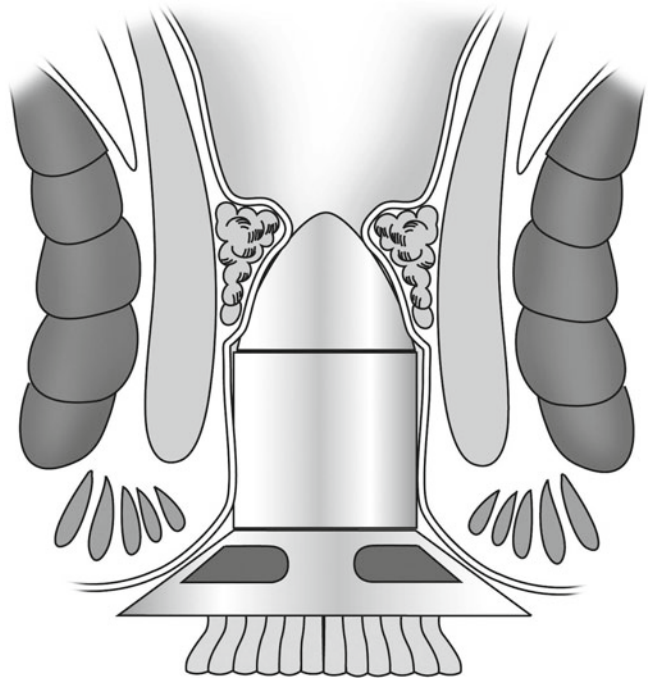


Fig. 8.42 Insertion of the CAD and anoscope

8.6 Hemorrhoid Surgery with Circular Stapler (PPH)

This is a method of removing mucosa in prolapsed hemorrhoids instead of removing the hemorrhoids itself, ranging from 2 to 4–5 cm proximal to the dentate line. It relocates the prolapsed hemorrhoids into its original site through mucosal excision and longitudinal lift-up procedure. It is why the term hemorrhoidopexy is often used rather than hemorrhoidectomy.

In 1993, Prof. Antonio Longo's operation on 23 patients was the first attempt of this method. It has developed and the procedure was published in 1997. Currently, more than 10,000 cases are operated all over the world.

The advantages of this surgery are that the technique is relatively simple which a novice surgeon can also easily operate, there are less pain by resecting the mucosa of the upper anal canal, and it enables patients to return to their daily life easily.

The disadvantages are follows; (1) not useful for external hemorrhoids (2) fecal incontinence due to sphincter injury (3) anastomosis site bleeding or hematoma formation (4) fecal urgency (5) strictures (6) urinary retention. Although unusual, serious complications such as rectal perforation, rectal obstruction, retropneumoperitoneum, pneumomediastinum, rectovaginal fistula, persistent severe pain, and pelvic sepsis are reported. These are probably due to blind resection and suture in the distal rectum. Other disadvantages of this method are lacking of long-term evaluation and the fact that the instrument is expensive.

8.6.1 Surgical Technique

1. Insert circular anal dilator (CAD) and an anoscope of about 35 mm diameter, and return prolapsed hemorrhoids and mucosa to their original site (Fig. 8.42).
2. Place the purse-string suture about 2 cm proximal to the upper border of the hemorrhoids, which is 4–5 cm proximal to the dentate line, and insert the circular stapler through the CAD after performing transverse purse-string suture for about 6–8 stitches (Fig. 8.43).
3. Pull the threads of the purse-string suture through both lateral openings of the stapler to take the excess mucosa into the body of the stapler (Fig. 8.44).
4. Fire the stapler for the staple line to be positioned at about 2 cm proximal to the dentate line, and remove the stapler.
5. Check the bleeding at staple line, and finish the procedure (Figs. 8.45 and 8.46).

There are controversies of long-term follow-up result of the stapled hemorrhoidopexy compared to conventional hemorrhoidectomy. The results show similar rate of recurrence in third-degree hemorrhoids in long term. But in the study including third- and fourth-degree hemorrhoids, high reintervention and recurrence rates were reported. Therefore stapled hemorrhoidopexy could be the ideal indication in third-grade hemorrhoids with the advantage of less pain and earlier return to work compared to conventional surgery, but more careful application is required in fourth-degree hemorrhoids.

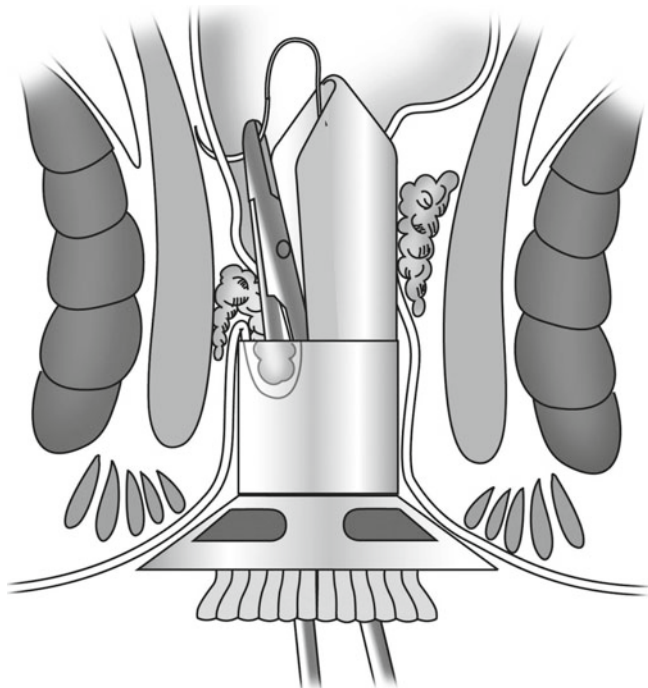


Fig. 8.43 Purse-string suture

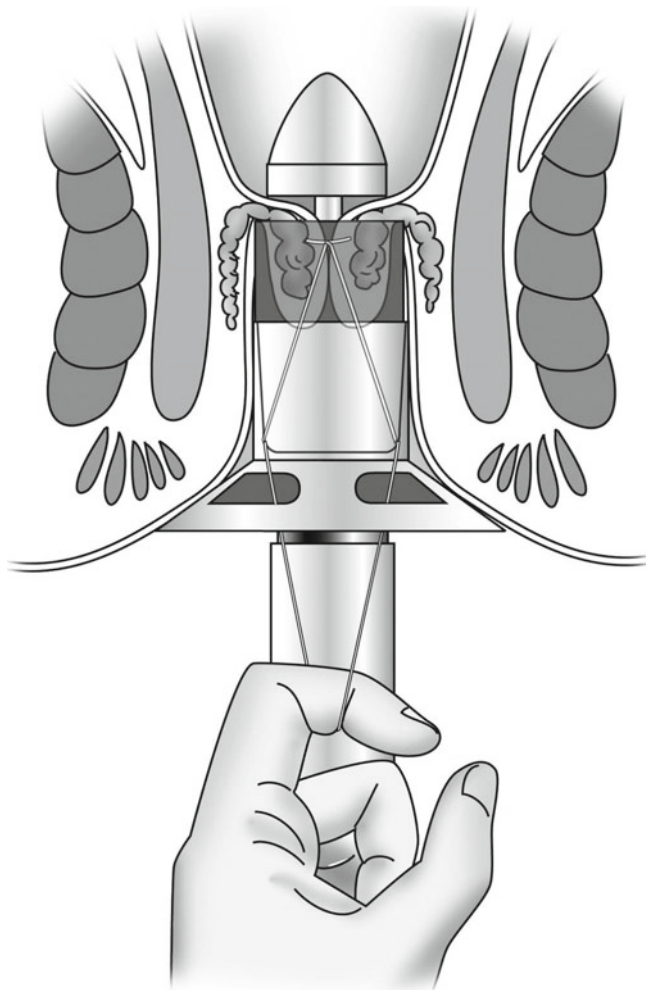


Fig. 8.45 Firing of the stapler

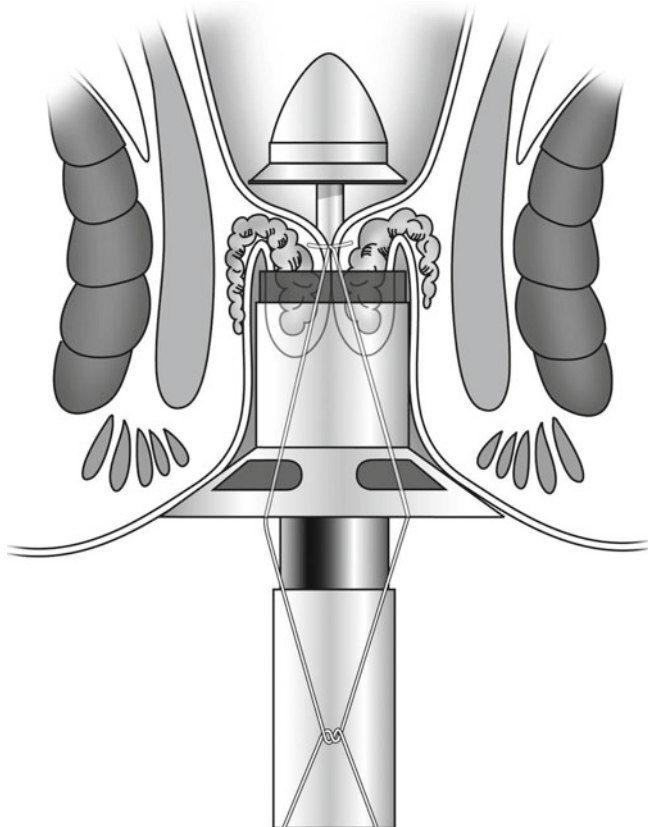


Fig. 8.44 After insertion of the stapler, pull the threads of the purse-string suture

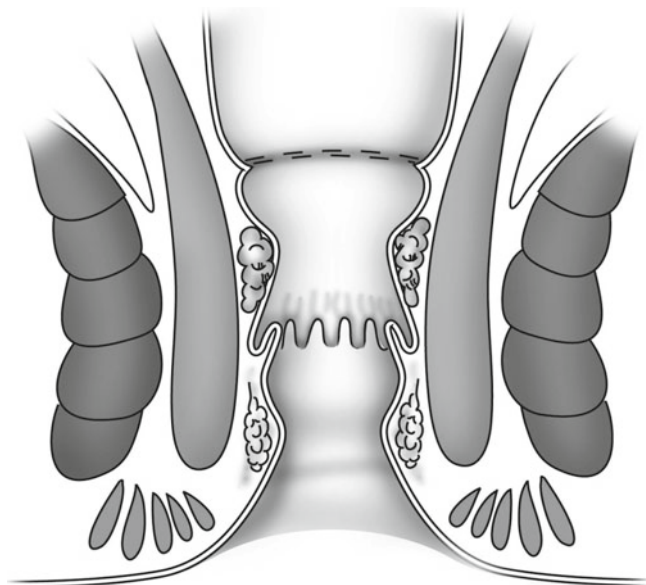


Fig. 8.46 The appearance after completion of the procedure

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Day-case hemorrhoidectomy is possible with appropriate facilities, proper patient selection, excellent anesthesia, and excellent surgical technique. It enables early discharge and reduction of nosocomial infection, cancelation of the surgery, waiting time, and the cost of operation and resolves the shortage of hospital beds. The most important problem to consider is the provision of safe anesthesia, and only well-equipped hospitals can perform day-case hemorrhoidectomy.

9.1 Preoperative Considerations

9.1.1 Social Conditions

1. Patient's residence should be within 1-h distance from hospital.
2. The patient should have the means of transportation (car, taxi, ambulance).
3. The patient does not live alone—a caregiver is needed.
4. The patient should have a telephone.
5. The residence should be equipped with lavatory facilities.
6. A qualified home visit physician should be available if necessary.
7. The patient should be able to get the help of the family physician.

9.1.2 Selection of the Patients

Large prolapsed hemorrhoids are not suitable for day-case hemorrhoidectomy. Middle-sized 2nd-degree hemorrhoids that cannot be treated with a rubber band ligation are the most suitable indication, and 3rd-degree hemorrhoids without skin tags are also possible. Drug allergic reaction should be evaluated, and for patients with drug abuse history, which prolonged for several years, it is a contraindication for this surgery. Patients with nervousness and hysteria or older men with benign prostatic hypertrophy are also contraindicated.

9.1.3 Consent Form

The consent should be in written form. The contents should include information about postoperative complications, progression of the treatment, and a phone number available for 24 h.

9.1.4 Preoperative Preparation

All patients are asked to have a bowel movement on the day of surgery. If necessary, give an enema at the hospital on operation day. Restriction of oral intake, including water, is needed 6 h prior to surgery. The patient should arrive at the hospital 1 h before the scheduled surgery.

9.1.5 Surgical Technique

There is no need to change the preexisting operative method, but few additional points should be noted:

- For the wound, closure method is better than the open one.
- Meticulous hemostasis is especially needed.
- Anal dilatation is forbidden. (Keep the anal sphincter tone normal to prevent postoperative bleeding).
- No anal packing.
- Surely ligate hemorrhoid stump.
- Have enough time for the surgery. (Do not rush the procedure).

9.1.6 The Postoperative Treatment

1. Pain

It is better to take a small amount of analgesics frequently, and the patient should take them before the pain reaches its peak. Diclofenac sodium (75–150 mg), ketorolac tromethamine, or acetaminophen is used frequently, and metronidazole (400 mg b.i.d.) is also helpful on relieving

pain. Topical anesthetic is not effective but frequent hot sitz bath is helpful. When strong analgesics are used, patients should be informed of the side effects such as dizziness to prevent accidents in advance.

2. *Return of Bowel movement*

With sensitive patients, use a small amount of sedatives (e.g., Valium, 2 mg b.i.d.). Magnesium sulfate (5–10 mg, b.i.d.) is a good stool softener. Until the patient leaves the hospital, the patients are advised to have regular meals, and an enema is helpful if there is no bowel movement until 72 h postoperatively.

3. *Prescription and treatment*

Provide a taking manual of prescribed drug to take at home for first few dots, and explain care of the wound. If there are large amount of bleeding, the patient should contact the hospital immediately, and if there is urinary retention, the patient may be catheterized.

9.2 Considerations for Anesthesia

9.2.1 Preoperative Patient Selection

- ASA grade I and II or stabled III are indicated.
- No family history for anesthesia complication.
- For obese patients (body mass index >30), day-case hemorrhoidectomy should be considered carefully.

9.2.2 Methods of Anesthesia

For early recovery from the anesthesia, an intravenous anesthesia with local infiltration without using sedatives is most commonly used. Propofol is the best anesthetic inducer.

Fentanyl is also available but can affect bowel movements. In order to avoid the problems of general anesthesia, spinal anesthesia, saddle block, caudal block, or local anesthesia is also used.

It is my opinion that spinal anesthesia should be avoided as much as possible in day-case hemorrhoidectomy because it has high rate of urinary retension and post spinal headache. My most favorite anesthesia type in day-case hemorrhoidectomy has been local anesthesia after intravenous anesthesia. After inducing sleep with intravenous anesthetic drug such as propofol, Midazolam®, and fentanyl, I usually infiltrate local anesthetic without pain. We can operate severe hemorrhoids with local anesthesia after intravenous anesthesia. We will discuss detailed anesthetic method of hemorrhoidectomy in Chap. 13.

9.2.3 Discharge After Surgery

Recovering from anesthesia in a straight supine position is more comfortable than in a posture lying down on a chair. Discharge is possible only after self-voiding. For patients with spinal or caudal anesthesia, voiding can be delayed than patients with general anesthesia. The status of medication, wound dressing, and hot sitz bath should be checked and reminded on phone call after discharge.

Day-case hemorrhoidectomy can be possible only when the surgeon can continue to take care of the patient, safe anesthesia, and when surgical techniques are available. The patient selection should be careful, and patients should be under the condition to get proper help. For day-case hemorrhoidectomy to be successful, patient must be able to recognize quickly when complications arise and receive proper treatment within golden time.

10.1 Perioperative Management

10.1.1 Preoperative Examination and Preparation

Recently, patients frequently visit the hospital after acquiring some information about their disease and the hospital from the Internet. Many people think that hemorrhoidectomy is a stumple operation therefore surgeon should explain the nature of disease, course and possibility of postoperative complications in detail. Furthermore, surgeon should evaluate the patient including high-risk group thoroughly before surgery.

Many hospitals and clinics in Korea receive payment for the treatment of hemorrhoids from the National Health Insurance Corporation in accordance with the diagnosis-related group (DRG) payment system. Depending on the duration of hospitalization after the surgery, there is a tendency to carry out day-case hemorrhoidectomy or short-term inpatient surgery (2–4 days). In addition, there are many hospitals and clinics that conform to the standard treatment guidelines (critical pathway) to improve the quality of patient care and to reduce costs.

10.1.1.1 Check the Presence of Systemic Disease

It would be good to find out in advance whether the patient has a history of heart disease, cerebral infarction, or other diseases through a questionnaire given on the first visit. It is also important to see whether the patient has prior experience of a hypersensitivity reaction or side effects to antibiotics and local anesthetics (especially lidocaine) and if there is any problem in the blood clotting system. When surgery is determined, patients should be classified as follows:

1. Normal, healthy patient
2. Patient in poor general condition associated with aging without systemic diseases such as diabetes and hypertension
3. Patient with systemic diseases

In the cases of (2) and (3), the operation should be decided carefully with the physician's opinion, if necessary.

10.1.1.2 Kinds of Preoperative Evaluation

Complete preoperative examination is required for anal surgery just like the abdominal surgery. Preoperative evaluation should include the following:

1. Peripheral blood test (Hb, Hct, WBC, platelet count)
2. Urine analysis
3. Biochemistry (blood sugar, GOT, GPT, total protein, albumin, creatinine)
4. Hepatitis B antigen and antibody test (HBsAg, HBsAb)
5. VDRL (qualitative method)
6. Anti-HCV
7. ABO and Rh blood type
8. PT and PTT
9. Chest X-ray
10. Electrocardiogram
11. Allergic test and skin test for antibiotics and anesthetics
12. Colonoscopy in patients with anal bleeding
13. Anorectal manometry in fissure, fistula, anal stenosis, etc.
14. Endoanal ultrasonography with perianal fistula or abscess (Table 10.1)

10.1.1.3 To Get Informed Consent

The patients cannot inspect their own anus. So many hospitals use a CCD camera connected to a monitor to show their anus. The doctor can explain the anal lesions of the patient by showing pictures. The doctor should give the following information to the patient prior to treatment.

1. Diagnosis and status of the disease
2. The necessity of the surgery
3. Methods of anesthesia and operation
4. The necessity of preoperative evaluation
5. Postoperative complications, period of hospitalization, follow-up period, and recurrence

This information should be explained sufficiently enough for the patient's complete understanding. It is good to use manuals to explain anesthesia and surgical methods. It can be an opportunity for the doctor to become familiar with the patient, and it will allow the patient's fear for surgery to subside (Table 10.2).

Table 10.1 Preoperative examination of anal disease**Basic tests**

CBC (Hb, WBC, platelet count)

Total protein

Glucose

SGOT, SGPT

Creatinine

HBsAg, HBsAb

VDRL (qualitative method), HIV(if necessary)

Anti-HCV

ABO and Rh blood type

PT, PTT

U/A

Chest P-A

EKG

Screening tests

Patients with anal bleeding → colonoscopy or sigmoidoscopy

Patients with fissure, fistula, or anal stenosis → manometry

Patients with perianal fistula or abscess → endoanal ultrasonography

Following are the information that the doctor should obtain from patient:

1. Familial background
2. Occupation and possibility of taking a sick leave
3. Means of transportation and required time for the follow-up after discharge

10.1.2 Preoperative Preparation and Management

It is desirable to hospitalize the patients 1 day before the surgery, but author hospitalizes the patients on the morning of the surgery in many hospitals.

10.1.2.1 Enema and Laxatives

Usually, laxatives or enema before the day of the surgery has not been used in my hospital. When an enema is used before

Surgery Guide

1. Diagnosis

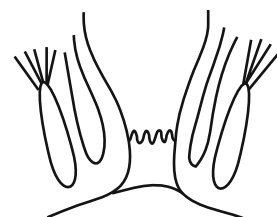
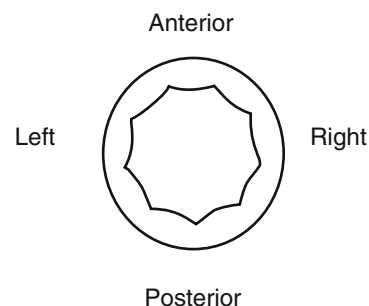
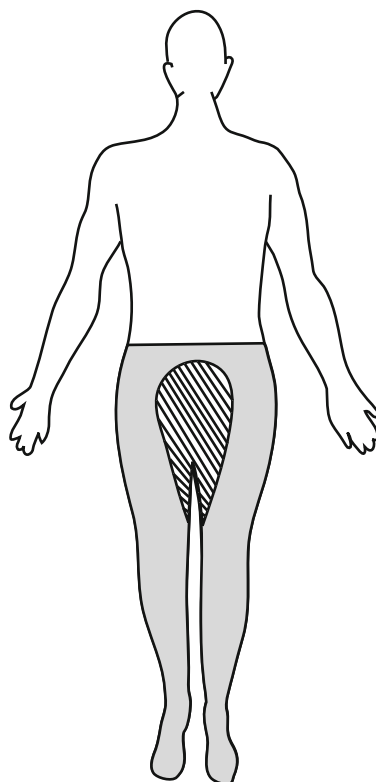
Hemorrhoids anal fissure perianal fistula others ()

2. Method of surgery:

3. Method of anesthesia:

Spinal anesthesia

Local infiltration

**Table 10.2** An example of a surgery guide

the surgery, the stool sometimes comes out during the surgery. However, it is good to prescribe laxatives containing sennosides the day before surgery for elderly or constipated patients.

10.1.2.2 Diet

Because most patients will be operated under spinal or local anesthesia, in case of morning operation, we order patient to keep NPO on the day of surgery, but in case of afternoon operation, we order to eat a light breakfast on the day of surgery.

10.1.2.3 Prophylactic Use of Antibiotics

Prophylactic antibiotics should be administered shortly before transferring the patient to the operating room.

10.1.2.4 Shaving

The shaving of the surgical site is performed in the operating room immediately before the surgery.

10.1.2.5 IV Fluids

When the patient is hospitalized, 1,000 cc of Hartmann solution should be injected slowly. The amount of the fluid should be restricted to prevent urinary retention after the surgery.

10.2 Monitoring During Operation

Blood pressure, electrocardiogram, and saturation of oxygen (SpO₂) should be monitored. Yawning under spinal anesthesia is a sign of hypotension.

10.3 Postoperative Management

Postoperative management refers to the management immediately after the surgery. There are some surgeons who only concentrate on the surgery itself and neglect postoperative management.

Good postoperative management gives good impression to the patient. Postoperative management after hemorrhoidectomy can be categorized as follows:

1. Check the vital signs
2. Pain management
3. Management of postoperative bleeding
4. Management of voiding difficulty
5. Wound management
6. Control of defecation
7. Diet management

10.3.1 Check the Immediate Postoperative Vital Signs

Respiration, blood pressure, and pulse rate should be checked at 1-h interval for several times. It is good to conform to the standard treatment guidelines (critical pathway).

10.3.2 Management of Pain

The transitional zone of the anal canal and the anoderm below it contain organized nerve endings, such as free nerve endings and genital corpuscle, which make these parts very sensitive on stimulations and cause severe pain.

The most fearful event for the patient is pain, and it is one of the main reasons why patients hesitate to get a surgery. Therefore, colorectal surgeon should concentrate on studying pain management after the anorectal surgery. If the pain management is successful, patient's satisfaction will increase, and it establishes trust on the hospital.

10.3.2.1 Kinds of Pain in a Time Sequences

There are personal and technical differences in postoperative pain where 25 % of patients feel intense pain, 50 % feel mild to moderate pain, and 25 % feel almost no pain. Posthemorrhoidectomy pain is generally divided into wound pain and defecation pain. The period for most severe pain is within 24 h after the surgery, which is wound pain, and 90 % of patients complain of the pain. The pain will be half on the second postoperative day, and it will decrease more on the third postoperative day.

Defecation pain is the pain experienced during or after defecation due to the irritation of the surgical site by feces or due to the contraction of the internal sphincter by fecal stimulation, and it lasts even after the bowel movement. Three weeks after the surgery, anal stricture can occur with mild pain, and delayed wound healing can develop anal fissure and induce pain later on.

Defecation pain occurs on the second or third postoperative day, which is the reason for reexperiencing the peak of the pain even after the wound pain is gone. Therefore, when patients ask question about how long the postoperative pain lasts, it would be suitable for the doctors to give an answer of about 10 days. Most patients experience severe pain on the day of surgery, and the pain shows tendency of slight reduction about 7 days after the surgery (Fig. 10.1).

10.3.2.2 The Causes of Pain

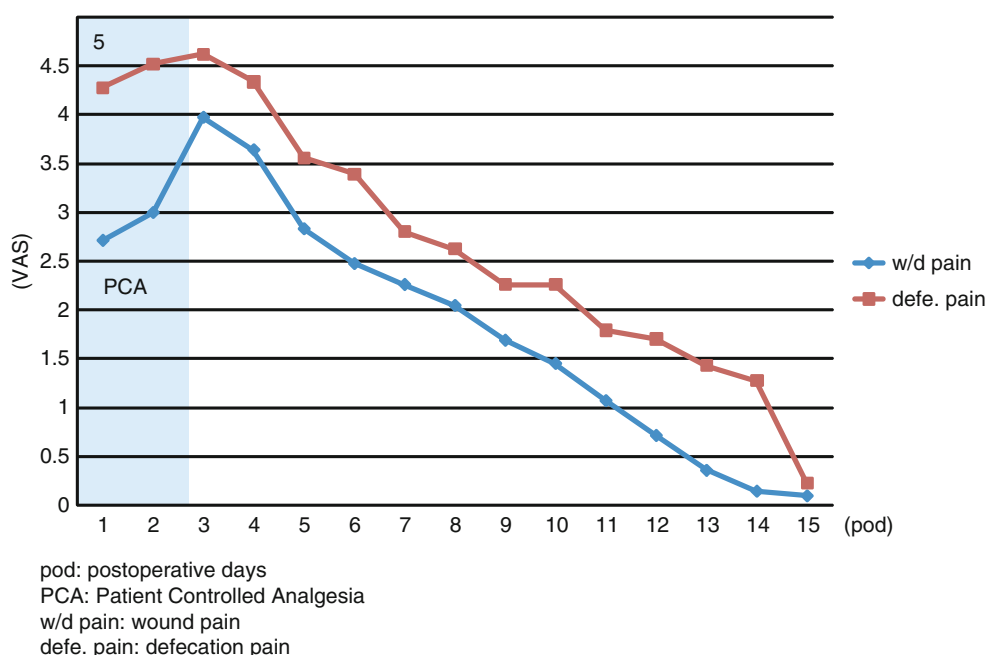
The cause of pain after hemorrhoid surgery is not entirely identified, but is considered to be caused by the following:

Spasm of the Internal Anal Sphincter

The postoperative spasm of the external anal sphincter may cause pain, but it is weak and short. The internal anal sphincter causes pain by reflex spasm which lasts persistently. The cause of the contraction of the internal anal sphincter is thought to be due to the exposure of the internal sphincter during surgery or the suture involvement. In addition, feces, secretions, or water can stimulate spasm of the internal sphincter.

To reduce the contraction of the internal sphincter, the partial internal sphincterotomy is sometimes performed along with hemorrhoid surgery. Although the efficacy of

Fig.10.1 Posthemorrhoidectomy pain curve. *POD* postoperative days, *PCA* patient controlled analgesia, *w/d pain* wound pain, *defe. pain* defecation pain (From Cheong Ho Lim. Posthemorrhoidectomy pain curve. 43rd The Korean Society of Coloproctology Conference. 2010)



combined internal sphincterotomy remains controversial, pain was definitely reduced in my experience. However, since it can cause incontinence to gas or liquid, I believe this method should only be restricted on patients with preoperative severe hypertonic sphincter.

Manual finger dilatation of the anus during the operation can also reduce the reflex spasm of the internal sphincter and relieve postoperative pain, but it can also cause incontinence to gas or liquid. So, this procedure should be carried out gently.

Besides the surgical method, 0.2 % GTN ointment or trimebutine, the relaxant of internal sphincter, can be applied on the surgical site, or bupivacaine or Tarasyn® (ketorolac tromethamine) can be injected directly into the internal sphincter to reduce pain.

Excessive Packing into the Anus After Surgery

Usually, gauze packing is used to control bleeding immediately after the surgery, and this can cause severe pain. To reduce pain, the surgeon should perform hemostasis meticulously, and it is better not to use anal packing.

Swelling of the Wound

Insufficient hemostasis of the wound or swelling due to secretions such as lymphatic fluids can cause pain. To reduce pain, the surgeon should avoid excessive manipulation and perform hemostasis meticulously.

Wound Infection

Pain is caused when abscess is formed by wound infection. A decisive incision and drainage of the abscess is necessary.

Anal Fissure Due to Delayed Wound Healing

An anal fissure may occur after hemorrhoid surgery. When it happens, conservative treatment should be tried first, but for incurable fissure, surgical treatment such as lateral internal sphincterotomy should be considered.

10.3.2.3 Posthemorrhoidectomy Management to Reduce Pain

Patients refuse surgery mainly because of the fear for postoperative pain. Although a lot of effort and progress have been made to alleviate the pain, there still are some patients who complain severe pain and even blame the doctor for it. Efforts to reduce this postoperative pain can be divided into two considerations: methods that can be applied during the surgery and after the surgery.

Considerations During the Operation

(a) Differences according to the methods of hemorrhoidectomy

1. Open hemorrhoidectomy (Milligan and Morgan) vs. closed hemorrhoidectomy (Ferguson): According to the reports by Arbmman et al. and Capareti et al., patients who underwent closed hemorrhoidectomy were expected to show faster wound healing and less pain than those who underwent open hemorrhoidectomy theoretically; however, not much difference was found. Based on this fact, Ho et al. reported that the pain after closed hemorrhoidectomy appeared to be caused by the wound disruption or delayed wound healing after the surgery. My preferred method is closed hemorrhoidectomy. In the case of open hemorrhoidectomy, I suggest to resect less mucosa as possible.

2. Submucosal hemorrhoidectomy: Parks suggested that the pain after ligation and excision is due to the defect of the anoderm in the anal canal which causes anal spasm and anal fissure and due to ligation or packing into the sensitive anal mucosa. And he also suggested that the submucosal hemorrhoidectomy, compared with the excision and ligation method, shows less mucosa removal, shorter hospitalization period, and early return to work. However, many reports later on suggested that there are no significant difference between the submucosal hemorrhoidectomy and other procedures. Nevertheless, I am convinced that submucosal hemorrhoidectomy causes much less pain than ligation and excision.
3. Stapled hemorrhoidopexy (PPH) is a surgical method that excises a circumferential strip of rectal mucosa from the upper anal canal to block the circulation to the hemorrhoids—superior hemorrhoidal vascular supply—and restores the prolapsed anal mucosa upward. It is reported that this procedure is less painful compared to the conventional surgery, because the mucosa is not exposed and mucosal resection is done more than 2 cm proximal to the dentate line. Therefore, only if the indications are suitable, such as prolapsed hemorrhoids, the operative result seems to be good. However, it may have the following disadvantages: (1) remaining of the external hemorrhoids or skin tags; (2) involvement of muscle layer or sphincter muscle injury; (3) complications such as urgency, bleeding, pelvic infection, stricture, and rectovaginal fistula; and (4) more expensive than other conventional surgical methods.
4. The skin incision should be narrow and should begin from the inside of the anal canal if possible.
5. If possible, surgical manipulation should be performed proximal to the dentate line.

Hemorrhoid tissue ligation and excision submucosal hemorrhoidectomy (Figs. 10.2 and 10.3)

- (b) There are some differences on the result of surgery depending on the surgical instruments such as LigaSure, Harmonic scalpel, or electrocautery. LigaSure causes minimal thermal damage to the surrounding tissue and has an excellent hemostatic effect. The Harmonic scalpel cuts and coagulates tissues simultaneously, and it has a hemostatic effect by destroying the protein bonds of blood vessels resulting coagulation of proteins. It maintains the temperature to be less than 100 °C and seems to reduce postoperative discomfort by minimizing lateral thermal injury to a depth of 0–1.5 mm compared to conventional electrocautery. However, this device is still not widely used since reports of outstanding result are insufficient, and it needs learning time to use the equipment. Also, it has disadvantages of leaving the wound open after the

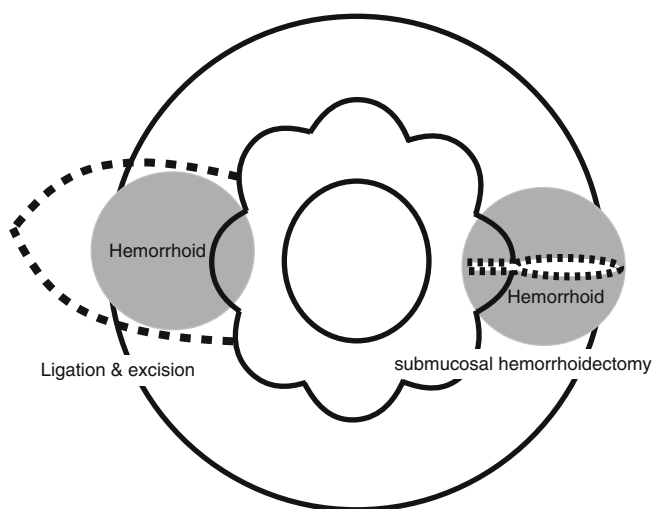


Fig. 10.2 The width of the skin incision depending on surgical methods

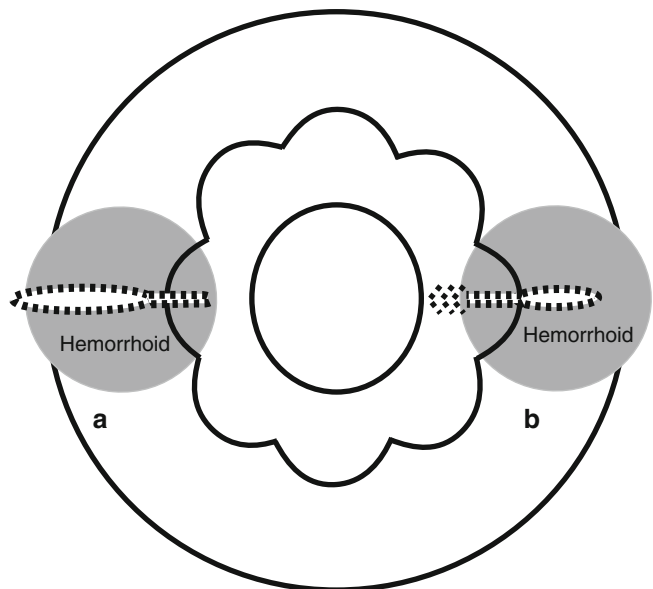


Fig. 10.3 The surgical technique in (b), which is manipulated at the proximal site of the hemorrhoidal pile, is more preferable than in (a)

surgery and expensive cost. Although long-term follow-up results are not enough, latest randomized controlled clinical trials reported that this procedure is better at reducing postoperative pain than the conventional electrocautery. Some reported that LigaSure reduced postoperative pain more than Harmonic scalpel. In addition, Andrews et al. and Seow-Choen et al. have reported that there were no differences between the use of surgical scissors and electrocautery in terms of the level of postoperative pain.

- (c) Lateral internal sphincterotomy or manual dilatation combined with hemorrhoid surgery: The anal pressure of hemorrhoid patients is usually increased before

surgery. Since pain is usually caused by the spasm of the internal anal sphincter after hemorrhoid surgery, postoperative pain can be reduced by decreasing the contraction of internal anal sphincter. Decreasing the contraction is also helpful on wound healing through improving circulation. Both manual dilatation of the anus and lateral internal sphincterotomy are ways to reduce the resting anal pressure caused by the contraction of internal anal sphincter. In 1810, Copeland argued that manual dilatation of the anus was effective, instead on hemorrhoids were caused by excessive tension of the anal sphincter, and in 1968, the procedure was reintroduced by Lord. Hemorrhoidal blood vessels are connected to the portal venous system through the submucosa of the lower rectum, and they are easily closed, regurgitated and engorged at the point where they pass through the submucosa by the increased rectal pressure or intra-abdominal pressure, so the hemorrhoidal plexus becomes congested and much larger. Hemorrhoids get more pressure by the pectin band of the internal sphincter. So theoretically, if the pectin band were dilated, the hemorrhoids could also be treated with prevention of the vascular engorgement. Watt et al. have reported that manual dilatation of the anus relieved postoperative pain. However, Goligher, Mortensen, and Mathai et al. have reported that the procedure was not effective in relieving the pain, but rather has possibility of provoking incontinence of gas or feces. In my experience, combined lateral internal sphincterotomy during a hemorrhoidectomy reduced the postoperative pain. Therefore, rather than performing on all patients, these procedures should be selectively performed on patients with a preoperative hypertonic anal sphincter or on patients concerned with anal stricture after the surgery.

- (d) Drugs injected into the surgical site at the time of operation: Injecting analgesics, such as ketorolac, directly into the anal sphincter before completing the surgery can be helpful on reducing the pain. It also enables day surgery or discharge on the day of surgery after local anesthesia. Moreover, ketorolac inhibits the contraction of the internal sphincter by suppressing the generation of prostaglandin and relieves postoperative pain with anti-inflammatory reaction. It also has the effect of reducing urinary retention. A long-acting local anesthetic, such as bupivacaine or ropivacaine, can also be injected into the skin around the anus.

Davies et al. reported the relief of postoperative pain by injecting 0.2 ml (10 U) of Botox on both two sides of the posterior internal sphincter at the end of surgery. He insisted that the wound healing process after hemorrhoidectomy becomes similar to that of an anal fissure, and Botox injection can promote the healing process. Therefore, in the early postoperative period, there is no

great difference on the pain and analgesic usage between the Botox injection group and others; however, Botox injection yields greater effect on pain reduction 6–7 days after the surgery.

- (e) A packing inserted into the anus after the surgery for hemostasis can cause pain, so it should be avoided. Anal packing used to be frequently performed, but is not generally used anymore.

Various Options to Reduce Pain After Surgery

Hot Sitz Bath

Hot sitz bath has a cleansing effect by removing the secretion of the wound, relaxes the sphincter to reduce anal pressure, and increases blood circulation helping wound healing and pain relief after a surgery. The author recommends only bidet after a defecation. I believe that since hot sitz bath makes edema and engorgement of anus, it worsens anal wound in spite of pain relieving effect.

Stool Softeners and Dietary Fiber

If a patient does not have proper bowel movements after the surgery, stool becomes hard that can causes pain on its way out. So the stool softeners or dietary fibers are prescribed after the surgery. In some cases, these can cause diarrhea and make the pain even more severe, so the dosage should be adjusted. If a patient cannot have a bowel movement for a long period of time, an enema may be used to induce a bowel movement, and it is helpful psychologically to alleviate patient's fear of defecation after surgery.

Use of Analgesics (Oral, Intramuscular, or Intravenous Administration)

NSAIDs (acetaminophen, diclofenac, ketorolac, etc.) or combined NSAIDs and narcotics are administered orally or intramuscularly. If the pain is more severe, narcotics such as Demerol or fentanyl can be used.

Patient-Controlled Analgesia (PCA) and Epidural Block

Patient-controlled analgesia (PCA) has the advantages of continuous administration and controlment of addictive administration by patients themselves. Epidural block can only block the nerves that transmit pain but preserve other sensory or motor nerves as normal, by using the appropriate concentration of local anesthetics (0.15 % bupivacaine or lidocaine). However, because large amounts of anesthetics should be administered; it is not suitable as a pain control method after hemorrhoid surgery.

Use of Antibiotics

Metronidazole is reported to relieve the pain during the fifth to seventh day after the surgery, which seems to be because of reduction of bacterial colonization at the surgical sites preventing secondary infection. In addition to bactericidal

effect, the anti-inflammatory effect, which is the mechanism for the treatment of skin diseases such as rosacea, also seems to play a role.

Use of MPFF (Micronized Purified Flavonoid Fraction: Venitol®)

It has anti-inflammatory effect reducing swelling and increases the lymphatic drainage along with interrupting microcirculation of inflammatory substances to treat swelling and pain. It is also effective in preventing postoperative bleeding.

Use of Topical Agents

1. Metronidazole ointment: The use of ointment optimizes the tissue concentration and reduces the systemic side effect compared to the use of oral medication. According to a report by Nicholson et al., when 2.5 cc of 10 % (250 mg) metronidazole ointment was applied three times a day, wound edema was reduced to a similar level of oral medication, and pain was relieved on the seventh day after the surgery. However, there was no difference in the amount of analgesics used.

2. GTN ointment

This is a kind of chemical sphincterotomy by using a drug, which relaxes the internal sphincter by NO (nitric oxide) and relieves anal pain by reducing the resting anal pressure. It is effective on relieving pain, reduces the amount of analgesics used, and normalizes the internal anal pressure only for patients with high resting anal pressures preoperatively. But for patients without preoperative high resting anal pressure, it is reported to be less effective. The oral administration of trimebutine is reported to reduce resting anal pressure, but makes no difference in pain reduction after the surgery or in the amount of analgesics used.

3. Sucralfate cream

This is usually used to treat ulcers and has antibacterial and angiogenic effects. It is also effective on radiation proctitis or keratoconjunctivitis. When used on second-degree burn, it promotes wound healing by accelerating epithelization, inhibiting aggregation and degradation of fibroblast. Gupta et al. reported that the topical use of a 7 % ointment reduced pain on the 7th to 14th day after the surgery and promoted wound healing.

In conclusion, I believe the following methods will be effective on reducing postoperative pain during the surgery: delicate dissection, prevention of internal sphincter injury, preserving anal mucosa as much as possible, tension-free suture, debridement of wound edges in cases of open wounds, and prevention of possible skin tags. Besides the usable methods during the surgery, active pain management after the surgery will reduce pain and complaints. Colorectal surgeon needs to study pain management thoroughly. When pain is managed well, it will increase the

patient's satisfaction and gain trust which will be eventually helpful on managing the hospital well.

10.3.3 Bleeding After Hemorrhoidectomy

Bleeding after hemorrhoid surgery is one of the most perplexing complications for both the patient and surgeon. Colorectal surgeons should make rapid decision and manage the bleeding because it usually worsens and becomes massive, triggering shock, which can create a serious situation to the patient. Regardless of the explanation given to the patients about possible postoperative bleeding in advance, surgeon may lose a good relationship with the patient and even get involved in a medical litigation.

As the causes of delayed hemorrhage are not clearly defined yet, various preventive methods are only suggested, where none of them are still not definite.

The bleeding usually occurs after hemorrhoidectomy; however, it also can occur after rubber band ligation or circular stapler (PPH) that has been in frequent use recently. Therefore, colorectal surgeons should acquire a lot of information to handle the posthemorrhoidectomy bleeding.

There are no definite classifications on bleeding after hemorrhoid surgery yet. However, according to most of the references, bleeding within 48 h after the surgery is classified as early bleeding or primary bleeding and bleeding from 3 days to 3 weeks after surgery as delayed bleeding, late bleeding, or secondary bleeding.

10.3.3.1 Early Bleeding (Primary Bleeding) Definition

Salvati defined early bleeding as a bleeding caused by technical error during surgery. So, early bleeding seems to be defined as "bleeding due to the surgery itself." Early bleeding is small in amount compared to late bleeding, and the patient rarely falls into a state of shock.

Cause

Early bleeding may be caused by insufficient intraoperative hemostasis and also can occur by inadequate pedicle management. Early bleeding occurs in approximately 2 % after hemorrhoidectomy, and they are most frequent during the immediate postoperative period. Sohn et al. have reported higher frequency of bleeding among patients with open hemorrhoidectomy than those with closed hemorrhoidectomy.

Treatment

If the blood loss is small, pressure dressing is enough. If the blood loss is heavy, suture ligation under anesthesia is necessary. Early bleeding can be prevented with thorough intraoperative hemostasis and should be frequently observed after the surgery.

10.3.3.2 Late Bleeding (Secondary Bleeding, Delayed Bleeding)

Definition

Ho et al. in Singapore have defined late bleeding as follows:

- (a) Bleeding which occurs more than 24 h after surgery
- (b) When the blood or blood clot evacuated from the anus amounts more than 200 ml at a time
- (c) When bleeding is confirmed with a digital rectal examination

Despite these definitions, late bleeding can be defined as “massive bleeding from the surgical sites under regular healing process, aroused by causes other than the surgical procedure itself.” Tsuji et al. in Japan reported that the drop of hemoglobin level in late bleeding is 3.45 g/dl on average (range, 1.5–6.9 g/dl), and the frequency of shock is 43.8 %. Slight bleeding which stains onto the gauze should be excluded from late bleeding. Late bleeding usually occurs from 3 days to 3 weeks after the operation, but, in most cases, it occurs during 7–11 days after the operation. In addition, 3 weeks after the operation, most surgical wounds are healed, and late bleeding rarely occurs after this period.

Frequency and Period of Bleeding

In spite of the differences depending on the references, the frequency of late bleeding ranges from 1 to 4 %. The frequency of late bleeding that needs a reoperation was reported to be 1.3 % by Ganchrow, 0.4 % by Buls, 1.2 % by Eu, and 0.9 % by Kang, thus averaging about 1 %. The different frequency rate of late bleeding is probably not only because of the various surgical methods but also the standard of defining bleeding. For example, in some reports, minimal bleeding is also regarded as late bleeding, and in others, only massive bleeding is regarded as late bleeding. Chicuba et al. of Japan reported that bleeding from the submucosal hemorrhoidectomy is less frequent than that from the ligation and excision, and the author also agrees with this report.

Causes of Late Bleeding

In most of the references, suggestions for the causes of late bleeding are as follows:

- (a) Low-grade sepsis of hemorrhoidal pedicle: This has not been definitively proved as a cause of late bleeding yet. But the hypothesis was based on Paula et al.'s finding that *E. coli* was mostly found on the surgical wound of open hemorrhoidectomy and Kang et al.'s report in Korea that late bleeding often occurs in the spring and summer. Thus, the hypothesis argues that softened vessel walls by low-grade sepsis of the hemorrhoidal pedicle result the vessel walls to rupture and to bleed. However, Hughes et al. reported that the use of antibiotics does not reduce the frequency of late bleeding.
- (b) Rupture of the surgical wound due to fecal impaction during defecation.

- (c) Direct stimulation due to diarrhea or frequent defecation.
- (d) Bleeding from the vessels where ligation is not performed.
- (e) Straining on bowel movement.
- (f) Strenuous activity after discharge.

Mecleod et al. pointed out that the period of frequent secondary bleeding has a relation with the breakdown period of absorbable suture; Rosen et al. opposed to this opinion though. From my own experience, in the cases of reoperation due to late bleeding, bleeding was observed to be originated from the surgical wound, rather than from the hemorrhoidal pedicle, where chromic catgut breaks down and widens. It seems to be the more mucosa is excised and the wider the surgical wounds become during a hemorrhoidectomy, the more the bleeding occurs. Therefore, the less bleeding after the submucosal hemorrhoidectomy seems to be from the less mucosal excision, but more research about this relation needs to be carried out.

Treatment of the Late Bleeding

The treatment of the late bleeding can be divided into conservative management and reoperation. Conservative management includes absolute bed rest, fluid therapy, blood transfusion, fasting, and compression on the wound. If the bleeding focus is found under anesthesia, suture ligation should be performed onto it, and if not, suture ligation should be done again on the disrupted wound where sutures have broken down.

The indication of reoperation after posthemorrhoidectomy bleeding:

- (a) The drop of Hb level >3 g/dl
- (b) Unstable vital sign
- (c) Gush out of fresh bleeding
- (d) The amount of bleeding >500 cc

Prevention of Late Bleeding

As the exact causes of late bleeding are not yet identified, its prevention is not certain. However, the following prevention methods are suggested:

- (a) Secure manipulation of the hemorrhoidal pedicle.

Some authors have reported that bleeding decreased after rubber band ligation on the hemorrhoidal pedicle. Others recommend suture ligations on the hemorrhoidal pedicles with slowly absorbable sutures. And they also suggest that hemorrhoidal pedicles should not be a lump ligation.
- (b) Meticulous hemostasis during operation.
- (c) Prevention of constipation and use of stool softeners.
- (d) Use of antibiotics.
- (e) Minimal excision of the mucosa: I believe minimal excision of the mucosa is the most important factor. The frequency of bleeding is high even in PPH. If bleeding

occurs, in PPH, I strongly recommend suture ligation on the bleeding sites, and keep the stapler pressed on for at least 30 s after firing to stop bleeding. If bleeding continues after removing the stapler, suture ligation must be done.

Bleeding after surgery is a complication that harasses the surgeon. I believe that early bleeding should be prevented with careful hemostasis during the operation, and the frequency of late bleeding can also decrease with secured surgical techniques. More research on late bleeding should be done in the future. When shock with bleeding occurs, it will be treated appropriately if the surgeon is not embarrassed and manages the patient properly.

10.3.4 Management of Bowel Evacuation After Surgery

The first defecation after hemorrhoid surgery is a fearful event for patients because it combines severe pain. First defecation after surgery is an event that colorectal surgeons usually ignore to manage.

10.3.4.1 Management of the First Bowel Evacuation After the Surgery

The first bowel evacuation usually occurs on the second or third day after hemorrhoid surgery. If the patients did not have bowel movement over 2–3 days after operation, it may cause anal pain especially patients with regular bowel habitus. In Korea, many patients are discharged on the second day after the surgery since the diagnosis-related group (DRG) payment system has been put in place. The author usually used to use a glycerin enema for patients who could not have a bowel movement until the third day after the operation, but now I recommend using a glycerin enema on the second day so that patients will be able to have their first defecation before their discharge. I also give patient guidebooks of “A guide about the first defecation after the operation” and “Effective ways to take in dietary fiber.” Before

patient’s discharge, I also give the patient explanation about taking in 20 g of dietary fiber and 2,000 cc of water a day (Tables 10.3 and 10.4).

10.3.4.2 Addition of Laxatives in the Postoperative Medications

The author includes laxatives in the postoperative medications as the following:

1. Magnesium oxide 250 mg PO t.i.d.
2. Bulk-forming fiber 2 g PO b.i.d.

If the patient complains of diarrhea after the surgery, bulk-forming fiber without magnesium oxide will be recommended. These medicines will be prescribed for 3–4 weeks after the surgery. In case of chronic constipation, however, the prescription continues even after 3–4 weeks, depending on the patient’s request, and the dose will be reduced gradually.

10.3.5 Skin Tag

Skin tag after hemorrhoidectomy is less critical complication than posthemorrhoidectomy bleeding. But it is a wearisome complication because of its relatively high frequency.

Patients may mistake skin tag for a recurrence or a residual hemorrhoid and make complaints. Skin tag can cause long-lasting pain after the surgery, which is one of the most significant reasons for the patients’ dissatisfaction on the results. Therefore, colorectal surgeon should be aware of the cause, treatment, and prevention of skin tag.

10.3.5.1 Definition

A skin tag is a prominence of the skin around the anus, which can be defined as “a stretched anoderm caused by the swollen skin that is close to the hemorrhoidectomy wound.”

10.3.5.2 Symptoms

A mass appears on the skin around the anus, and sometimes with severe pain. Furthermore, it causes foreign-body sensation, pruritus, and increased secretion.

Table 10.3 A guide for first defecation after the operation

A guide for the first defecation after the operation

1. Please take analgesics to relieve pain after defecation. (Included in oral medicines)
 - (i) Analgesics will be effective 40 min after the intake.
 - (ii) Please contact the nursing station if the pain continues for more than an hour after the medicine.
 2. More than 95 % of patients have the first defecation on the second day after surgery, but in some cases, defecation can be delayed.
 3. Stool softeners or laxatives will be served from the next day after surgery. (If you have hard stool with constipation, please let us know.)
 4. Please let us know as soon as possible, if the volume of stool is not enough or if you feel tenesmus sensation after defecation or if you cannot defecate by yourself.
 5. It is important to defecate completely. Insufficient defecation with remaining stool in the rectum can cause severe pain, bleeding, and stain of feces on the underwear.
 6. Make sure to take a hot sitz bath with a bidet for 1–2 min after defecation. Taking a shower around the anus will be available, too.
- ※ We wish you a speedy recovery and please call or visit us if you have any question.

Table 10.4 Information on ways to take in fiber**Nine ways to take in dietary fiber**

Constipation may be caused by many different factors, but drinking sufficient water can be very helpful. It is therefore highly recommended to drink approximately 1,000–1,500 ml of liquids (water, tea, hot water, juice, red tea, etc.) a day.

1. Traditional food rather than Western-styled fatty food!	Traditional food uses many ingredients containing fiber (e.g., seaweed, root vegetables, bean products).
2. Boiled vegetables rather than raw ones!	You cannot take in as much plant fiber as you might think through raw vegetables. Blanched or boiled vegetables, on the other hand, decrease in volume so that they can be eaten in larger quantities.
3. Regular meals, three times a day!	The recommended daily intake of plant fiber is 20 g. Having regular meals with three times a day is the basic principle.
4. Modify your staple foods to suit your taste!	You can modify your staple foods by changing to multigrain rice or whole wheat, to take in a greater amount of plant fiber.
5. Have a lot of dried food!	Chinese dried radish, seaweed, and brown algae have abundant plant fibers.
6. Have cooked potatoes everyday!	Cooked potatoes can be a good source of fiber. A variety of recipes for cooking potatoes are recommended (potato gratin, baked potatoes, etc.).
7. Have lots of soybeans!	Soybeans are called “the meat of the field” because they are a good source of protein. Eating lots of soybeans through many different dishes is highly recommended.
8. Have mushrooms and seaweed everyday!	Mushrooms and seaweeds are plentiful in plant fiber. With low calories with them, taking a large amount will be no problem.
9. Use the coats and stems of plants in cooking!	Since coats and stems of plants contain lots of plant fiber, use them in cooking.

10.3.5.3 Causes

The mechanism of skin tag development has not yet been cleared, but skin tag is thought to be caused by the following factors:

1. Most often, skin tag is caused by slack skin on the process of absorption of the wound swelling or hematoma.
2. Disruption of the suture site or granulation tissue formation of the drainage site of a semiclosed hemorrhoidectomy.
3. Excessive skin remaining during the hemorrhoidectomy.
4. The incidence is high when the skin incision is created in a different direction to the skin wrinkle.

10.3.5.4 Classification

Skin tags can be classified as follows depending on their cause:

1. Primary skin tag, without definite cause
2. Secondary skin tag, associated with anal fissure, pruritus ani, and hemorrhoidectomy (Table 10.5)

10.3.5.5 Frequency

The frequency of the skin tag depends on the criteria of the degree of swelling and skin wrinkle. Skin tags after hemorrhoidectomy usually develop about 1.5–6 % of patients, according to references. Submucosal hemorrhoidectomy especially has a relatively high rate of incidence, reported by up to 20 %, since it preserves a lot of mucosa.

10.3.5.6 Treatment

If a skin tag causes severe pain, resection is needed any time under local anesthesia. But when the resection after surgery

Table 10.5 Causative factors for postoperative skin tags

Surgical factors
1. Redundant anoderm
2. Inadequate drainage
3. Combined with thrombosed hemorrhoids
4. Rough handling
5. Wound dehiscence
Concomitant with another disease
1. Anal fissure
2. Thrombosed hemorrhoids
3. Pruritus ani
4. Inflammatory bowel disease
General factors
1. Hypoalbuminemia
2. Malnutrition
3. Anemia
4. Immunocompromised patients

is done too early, it could lead to reformation of a skin tag due to swelling. In my own experience, except the skin tag with severe pain, 3 months after the operation is an adequate time for resection because the healing response is finished. Make sure that there is no bleeding from the wound after resection under local anesthesia. If bleeding continues, electric cauterization is needed. Hospitalization after resection is not necessary. To prevent stenosis, the excision is performed only around the anus, not into the anal verge, and the wound remains open without suture.

10.3.5.7 Prevention

1. Avoid excessive manipulation to prevent swelling.
2. Precise hemostasis is necessary to prevent thrombosed hemorrhoids and hematoma.
3. Excise redundant skin at the time of the operation. After removing the adhesive tape that separates the buttocks apart, check for the redundant skin carefully.
4. In the case with high anal pressure, sphincterotomy or manual dilation should be performed concurrently.
5. Avoid excessive mucosal resection to prevent excessive tension, which may lead dehiscence of the suture site.
6. Apply a compressive dressing or T-band dressing to reduce swelling after the operation.
7. A check for inflammatory bowel disease, AIDS, and constipation should be carried out preoperatively.

10.3.5.8 Skin Tags Associated with Delayed Wound Healing

The delayed wound healing lasting over than 3 months after the operation is frequently caused by the development of fissure postoperatively. Such a postoperative fissure may require an additional procedure like internal sphincterotomy or a sliding skin graft. The posthemorrhoidectomy skin tag can drive the patient into anxiety, so it is better to resect it under local anesthesia 3 months after the operation, and

precise surgical technique is needed to prevent the formation of the skin tag.

10.3.6 Anal Stenosis

Anal stenosis is one of the most serious complications of hemorrhoidectomy, and it annoys the patient for a long time, and it is usually associated with the surgical technique. Therefore, surgeons should make an effort to reduce this complication and provide appropriate treatment when it develops. Anal stenosis may develop after excessive removal or destruction of the anoderm. Excessive loss of anoderm is replaced by excessive fibrous connective tissue, called scar tissue, which causes abnormal narrowing of the anal canal.

10.3.6.1 Cause

The cause of anal stenosis can be divided into two forms, malignant and benign. In abroad, benign anal stenosis is said to develop mostly (up to 80 %) after hemorrhoidectomy. According to the references in Korea, 70–80 % of benign anal stenosis is caused by corrosive or sclerosing agent injection therapy, and the remaining 20–30 % is caused by hemorrhoidectomy. The most common reason for the anal stenosis after hemorrhoidectomy is the excessive removal of the anoderm (Tables 10.6, 10.7, 10.8, and 10.9).

Table 10.6 The rate of hemorrhoidectomy among the causes of anal stenosis

	Total number of anal stenosis	Sclerosing agents	Hemorrhoidectomy	Year of publication
Milsom et al.	212	–	186 (87.7 %)	1986
Yang et al.	11	10 (91 %)	1 (9 %)	2001
Park et al.	44	28 (63.6 %)	8 (18.1 %)	1994

Table 10.7 Incidence of anal stenosis after hemorrhoidectomy

	Total number of hemorrhoidectomy	Number of anal stenosis	Year of publication
Lee et al.	332	6 (1.8 %)	1998
Kim et al.	222	83 (37.4 %)	1998
Jang et al.	52	4 (7.6 %)	1997

Table 10.8 Relationship between anal stenosis and methods of hemorrhoidectomy

	Methods of hemorrhoidectomy	Number of anal stenosis	Total number	Year of publication
Lee et al.	Submucosal hemorrhoidectomy	0 (0.0 %)	221	1998
	Ligation and excision	6 (5.4 %)	111	

Table 10.9 Relationship between anal stenosis and ligation and excision

	Chuji et al. (什順行)		Sumikoshi et al. (隅越 幸男)	
	Number of anal stenosis (%)	Total number	Number of anal stenosis (%)	Total number
Number of ligation and excision (LE)				
LE 1	0 (0.0 %)	4	0 (0.0 %)	11
LE 2	1 (2.6 %)	39	4 (11.8 %)	34
LE 3	14 (7.0 %)	119	9 (28.1 %)	32
LE 4	8 (14.3 %)	56	–	

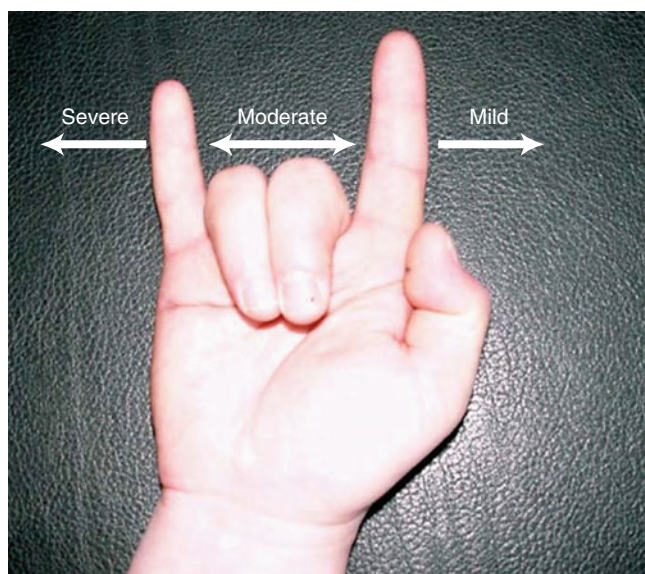


Fig. 10.4 Degree of anal stenosis

10.3.6.2 Symptoms and Classification

The subjective symptoms of the anal stenosis are defecation difficulty, pain on defecation, constipation, and decreased stool caliber.

Anal stenosis may be classified as mild, moderate, and severe based on its degree and clinical symptoms, although its objective evaluation is difficult. The mild stenosis has less subjective symptoms and is defined as a stricture that could permit the insertion of the index finger or an anal dilator (Hega, No 16) with resistance. The moderate stenosis has subjective symptoms and is defined as a stricture that permits the insertion of the little finger (but does not permit the insertion of the index finger or Hegu, No 16). The severe anal stenosis has serious subjective symptoms and is defined as a stricture that does not permit the insertion of the little finger (Fig. 10.4).

10.3.6.3 Treatment

The treatment of the anal stenosis is divided into conservative and operative methods. The mild stenosis is treated with conservative management with high-fiber diet, laxatives, dilatation (manual or device), and steroid suppositories. Patients with no effect through conservative treatments or patients with moderate to severe anal stenosis require appropriate surgical intervention such as anoplasty.

Surgical treatment is performed differently depending on the degree of stenosis, cause, and other accompanying disease. The goal of various surgical treatments is to widen the narrowed anal canal and to reduce the tone of anal sphincter. Current surgical treatments include internal sphincterotomy, rotation flap, advancement flap, and island flap, which are developed in the way to decrease the disadvantages and increase the merits of each method. The internal sphincterotomy is a proper surgical option for mild anal stenosis, but

is not effective for severe anal stenosis. Therefore, the internal sphincterotomy combined with other surgical options are often used for severe anal stenosis. S-type anoplasty and C-type anoplasty are representative methods of the rotation flap. The S-type anoplasty was first described by Ferguson in 1959 and the C-type anoplasty by Oh in 1982. Rotation flap methods were used to be used, but since they caused wide wound, tissue necrosis with excessive tension and transient fecal incontinence postoperatively, island flap is used more nowadays. Island flap includes Y-V type, diamond-type and house-type flap.

10.3.6.4 Surgical Methods

Mild anal stenosis can be treated with internal sphincterotomy, but for the severe anal stenosis, anoplasty is needed. Among the island flap techniques, although the Y-V type, diamond type, or rectangular type has its own merit, I primarily use the house flap because of its technical simplicity.

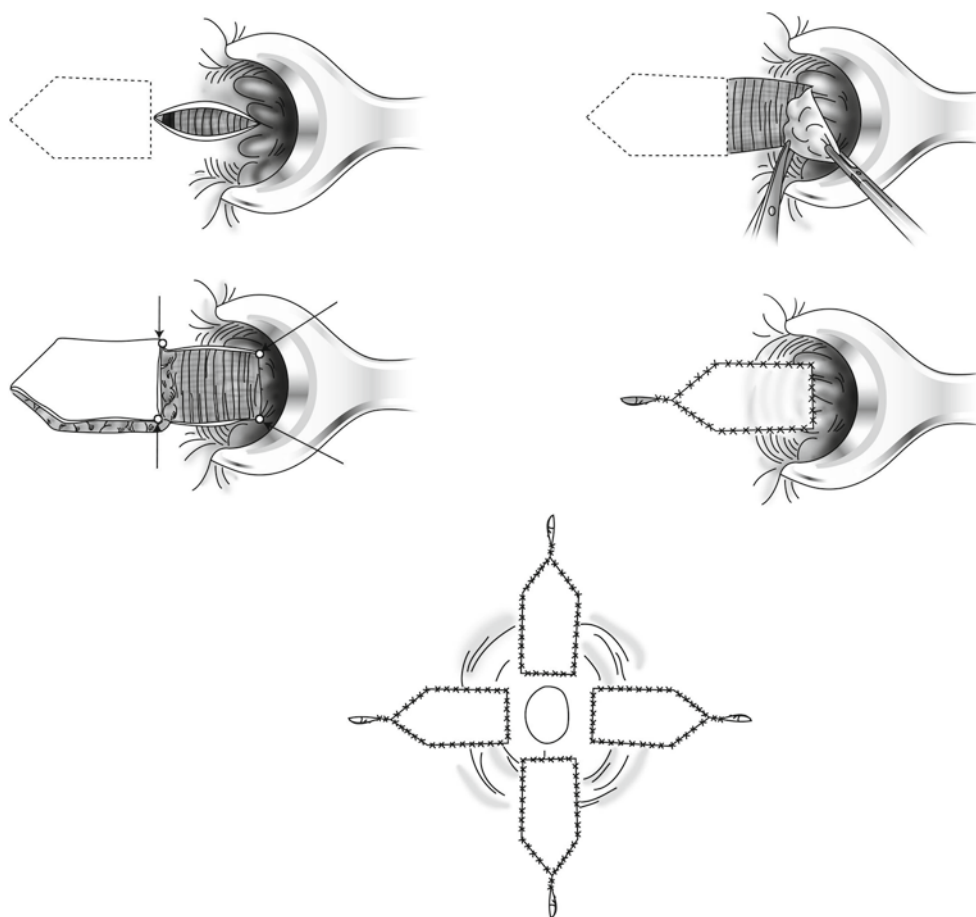
The advantages of the house flap are as follows. First, this method can provide a wide range of flaps to the involved anal canal. Second, it permits the primary closure of the donor site. Third, the operating time is short because of its technical simplicity. The house flap does not require a wide range of dissection. Therefore, extensive tension or dehiscence occurs less frequently. Fourth, there are rare complications like tissue necrosis or wound infection after the operation. Fifth, it allows two to three sites of house flap concurrently, up to four sites. If anal dilatation is not enough after one or two site of house flaps, additional flap may be applied to allow adequate anal dilation.

Christensen, who first invented the house flap, made an incision on stricture site of anal canal and applied the house flap without removing the scar tissue. The disadvantage of this procedure is that the scar tissue remains. My preference is to remove the scar tissue and replace it with normal house flap tissue. After excising scar tissue (Fig. 10.5), make the incision to be a house shape, pentagon shape. The width of A'-B' (flap area) should be wider than that of A-B (removed area) because the flap usually shrinks after dissection. I prefer it to be 1.5 times wider. Furthermore, a broad flap allows enough anal dilation postoperatively. It is desirable that the length of D-B' is longer than that of B-F. A slightly round shape of C-E-D is also desirable. It is a kind of the island flap. A pentagon-shaped flap is made and advanced, lining the entire length of the anal canal, and sutured into place. I prefer to use 3-0 chromic catgut for the suture material.

Perpendicular direction advancement of the flap is usually performed, but 45° oblique advancement is sometimes used to reduce tension.

As shown in Fig. 10.6, the advancement toward arrows makes less tension than that of perpendicular advancement. Sometimes, it can be advanced with flap of wide V shape with remaining 2 mm at both ends.

Fig. 10.5 House advancement flap. (a) Scar tissue is excised. (b) Incision is made in a pentagon shape. The width of A'-B' is wider than that of A-B. The length of D-B' is longer than that of B-F. (c) Advanced and sutured into place. (d) It allows up to four flap sites. (e) Christensen only incised, but it has disadvantage of remaining scar tissue



Minimal resection of the anoderm and anal mucosa during hemorrhoidectomy is an important factor to prevent anal stenosis. This is the reason why I insist the submucosal hemorrhoidectomy to be the main method for hemorrhoidectomy. It is also adequate with the ligation and excision method if the mucosa is resected as small as possible. For the treatment of anal stenosis, the island advancement flap is more desirable than the invasive rotation flap such as S- or C-type anoplasty. The house flap is recommended because of its technical simplicity.

10.4 Critical Pathway

Apartments in Korea have different-sized windows depending on the construction company and apartment complex, whereas Japanese apartments have uniformed window size regardless of the construction company. Therefore, it is easy to change the window when it's broken. This is called standardization, and in hospital system, it prevents waste and promotes efficient treatment. Although the surgical method for hemorrhoids may vary depending on patients, the pre- and postoperative management is similar. The standardization of these procedures is called critical pathway.

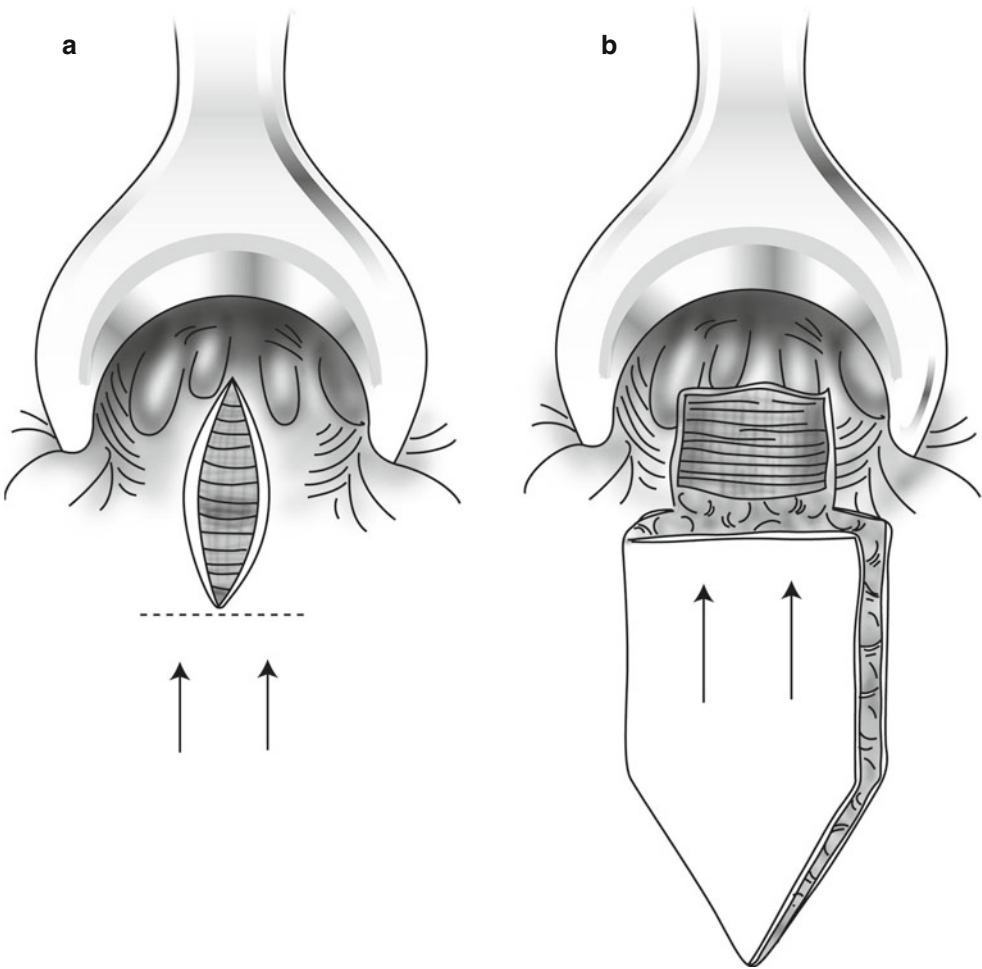
Under the aggravating hospital management condition nowadays, the treatments need to be efficient. Especially for the hemorrhoids, since more than 70 % of the hospitals are under the management of DRG system, the efficient management is becoming inevitable. The critical pathway is demanded to minimize the manpower and consumption of medicine and supplies, but to maintain high-quality treatment.

The definition of the critical pathway is "Already made standardized process of management for treatment sequence and timing for a certain disease." It is synonymous with clinical pathway, care guideline, and care map. Originally, it is used to standardize the main process of large-scaled construction field, and the critical pathway concept in medical field was first introduced at the New England Medical Center, Boston, in 1985.

The critical pathway consists of vertical and horizontal axis. The vertical axis contains components of the patients such as patient's condition evaluation, labs, medication, diet, injection, and treatment. The horizontal axis contains the sequence of time.

Each hospital makes their own sheet of critical pathway through numbers of meeting with doctors, nurses, and other staff members. The advantages of the critical pathway are the standardization of the quality of medical treatment, reduced

Fig. 10.6 (a) The location and size of the flap are designed. (b) The house flap is advanced after removing the scar tissue



Time sequence →

Components of treatment ↓		Outpatient	Day of operation	POD #1	POD #2	POD #3
	Patient Assessment					
	Examination					
	Medication					
	Injection					
	Anesthesia					
	Surgery					
	Diet					
	Education plan					

Table 10.10 Form of critical pathway

admission period, cost reduction, and decreased work load of doctors and nurses. On the other hand, ethical issue may arise when treatment of the patient is considered as one of the many cases, and hospital may be neglectful on education and studying. Also, it may increase chance of malpractice for its uniformity.

Table 10.11 Hospitalization planning sheet for hemorrhoidectomy (for patients)

	The day before surgery	The day of surgery		
		Before	After	POD #1 (postoperation day)
Pt. status confirmation	Check blood pressure, body temperature, pulse rate, respiration			
Patients assessment	Interview with doctor in charge Sign a consent form for operation		Pain assessment	Pain assessment
			Check bleeding from op. wound	Check wound
			Check self-voiding (after 4–6 h)	Check self-voiding
Lab.	Re- or additional examination if necessary			
Nursing treatment	Cleansing and shaving	Check items (remove denture, glasses, contact lens, deaf-aid, wiggery, accessories, manicure, makeup)	Maintain position	Sitz bath (four times/day)
	Enema (after dinner)	Check gown, name tag	Check voiding (volume, time)	Check voiding (volume, time)
		Enema (6 AM)	Urethral catheterization if needed	Urethral catheterization if needed
Diet	NPO from midnight including water	NPO	Sips of water and regular diet	Regular diet
Medication		IV hydration IM for sedation and induction	Keep IV hydration Analgesics (PRN)	Oral pill Analgesics (PRN)
Education	Hospitalization life education	Operation time and guardian waiting	Oral medications	Check discharge nursing records Cautions after discharge
	Explanation of operation method and potential complications		Encourage deep breathing exercise (if needed)	Discharge medication
	Postoperative care		Pain control	Check outpatients F/U date

Regardless of these disadvantages, patient's level of satisfaction is high because the patient or their guardian themselves can be aware of the overall schedule and cost of the treatment in advance. Critical pathway is a blueprint in medical field, and it is better to manage patients with this pathway.

Following are some examples of the critical pathway at some hospitals (Tables 10.10, 10.11, 10.12, 10.13, and 10.14).

10.5 Day Surgery

After simple surgery under local anesthesia, such as thrombosed hemorrhoids or skin tags, the patients have to rest for 10–30 min; discharge after checking if there is no bleeding from wound. In the cases of day surgery with caudal anesthesia, spinal anesthesia, or perianal block with IV sedation, start the operation around 8:30 AM, and let the patient discharge after rest and checking at the hospital until 4:00 PM.

Discharge checklists are as follows:

1. Check abnormalities in vital signs including blood pressure, heart rate, and respiratory rate.

2. Check the status of mentality and presence of GI symptoms (nausea or vomiting).
3. Check bleeding from the wound.
4. Check the presence of voiding difficulty after adequate hydration.
5. Check normal gait.

When patients are discharged, phone number of the nurse station and doctor written at emergency contact paper should be provided. Additionally, making a phone call at patient's accommodation around 9:00 PM can be helpful (Tables 10.15 and 10.16).

10.6 Outpatients (OPD) Treatment

I usually ask the patients to visit hospital 3–5 days after the operation and every 5–7 days thereafter. If the patients stay too far from the hospital, they are advised to receive treatment at a local hospital nearby. However, I still ask these patients to visit our hospital 3 weeks after the operation to check the presence of skin tag, anal stenosis, and the status of defecation. If a skin tag occurs, it is resected under the local anesthesia. Oral antibiotics are prescribed for 10 days. In the case of delayed anal bleeding, severe pain, or urinary

Table 10.12 Hospitalization planning sheets for hemorrhoidectomy (for staff)

■ Surgeon check lists □ Nurse check lists

	HOD#1		HOD#2				HOD#3	
	AD		OP Day(/)				POD#1	
	(/)	Note	Pre-op	Note	Post-op	Note	(/)	Note
Vital sign	<input type="checkbox"/> BWt <input type="checkbox"/> BP <input type="checkbox"/> T.P.R.		<input type="checkbox"/> BP <input type="checkbox"/> T.P.R.		<input checked="" type="checkbox"/> BP(q30*4, q1hr until stable) <input type="checkbox"/> T.P.R.		<input type="checkbox"/> BP <input type="checkbox"/> T.P.R.	
■ evaluation	<input type="checkbox"/> Check OPD chart <input type="checkbox"/> Interview <input type="checkbox"/> Physical exam <input checked="" type="checkbox"/> Make nursing record <input checked="" type="checkbox"/> Check preanesthetic lab. <input type="checkbox"/> CBC <input type="checkbox"/> UA <input type="checkbox"/> LFT(OT/PT) <input type="checkbox"/> EKG <input type="checkbox"/> PT/PTT <input type="checkbox"/> Chest pA <input type="checkbox"/> Consent of operation Dr. _____		<input checked="" type="checkbox"/> Check items <input type="checkbox"/> Patient's ID <input type="checkbox"/> NPOI <input type="checkbox"/> Remove denture, glasses, contact lens, deafaid <input type="checkbox"/> Check artificial eye <input type="checkbox"/> Remove accessories <input type="checkbox"/> Wear patient gown Dr. _____		<input type="checkbox"/> Pain <input type="checkbox"/> OP site bleeding <input checked="" type="checkbox"/> Self voiding Y <input type="checkbox"/> N <input type="checkbox"/> Dr. _____		<input type="checkbox"/> Pain <input type="checkbox"/> OP site bleeding <input checked="" type="checkbox"/> Self voiding Y <input type="checkbox"/> N <input type="checkbox"/> Dr. _____	
Management	<input type="checkbox"/> Skin prep <input type="checkbox"/> S-S enema x 2				<input type="checkbox"/> No head elevation <input type="checkbox"/> Check voiding time & volume <input type="checkbox"/> Nelaton catheterization(PRN)		<input type="checkbox"/> H.S.B. qid <input type="checkbox"/> Check voiding time & volume <input type="checkbox"/> Nelaton catheterization(PRN)	
Lab.	<input type="checkbox"/> Supplementary-or re-exam							
Medication			<input type="checkbox"/> H/S 1L IV (18G) <input type="checkbox"/> Premedication		<input type="checkbox"/> IV fluid (1L) <input type="checkbox"/> Oral medication <input type="checkbox"/> Analgesics, IM (PRN)		<input type="checkbox"/> Oral medication <input type="checkbox"/> Analgesics, IM (PRN)	
Diet	<input type="checkbox"/> GD>MN NPO		NPO		GD		GD	
Education	<input type="checkbox"/> preop. education <input checked="" type="checkbox"/> Operation method and potential complications		Operation time and guardian waiting		<input type="checkbox"/> Postoperative education		<input checked="" type="checkbox"/> Cautions on diacharge <input type="checkbox"/> Check OPD F/U date <input type="checkbox"/> Discharge medications	
● sign	D _____ E _____ N _____		D _____ E _____ N _____		D _____ E _____ N _____		D _____ E _____ N _____	

Table 10.13 Critical pathways for hemorrhoidectomy

Hemorrhoids					
	OPD	AD	OP day	POD #1	POD #2
Assessments	Physical exam Pill checklists	- Bwt, BP, TPR, Ht - Check OPD chart - Make nursing record - G.O.P	- Check V/S - Check self voiding	- Check V/S - Check self voiding	- Check V/S - Check self voiding
Lab.	Routine Lab EKG X-ray Manometry	- Check Lab			
Medication		- H/S 1000cc IV - Premedication	- H/D 1000cc IV - AMK 2A #2 IV Cefradine 1.5g Tylenol 3T Varidase 3T Mgo1 + 1 /2T - Zespan 3T / #3 p.o. x 1day - Mutacil 2p #2p.o	- H/D 1000cc IV - AMK 2A #2 IV Cefradine 1.5g Tylenol 3T Varidase 3T Mgo1 + 1 /2T - Zespan 3T / #3 p.o. x 1day - Mepharen 1A IM (PRN) - Mutacil 2p #2 - Proctocedyl oint	- H/D 1000cc IV - AMK 2A #2 IV Cefradine 1.5g Tylenol 3T Varidase 3T Mgo1 + 1 /2T - Zespan 3T / #3 p.o. x 1day - Mepharen 1A IM (PRN) - Proctocedyl oint
Nursing treatment		- Cleansing & shaving perianal area	- Saline enema	- H.S.B - Dressing	- H.S.B - Dressing
Diet		- NPO	- Tolerable diet	- Tolerable diet	- Tolerable diet
Education		- Bed rest - Full voiding - Preop. education - Operation and potential complications	- Bed rest - Self voiding - ECDB - Supine position - Explain op result & Tx process - Explain postop. cautions	- Education about H.S.B - Exercise in hospital - Explain op result	- Exercise in hospital - Explain op result - Cautions after discharge - Check OPD F/U date - Discharge medication

Table 10.14 Critical pathways for hemorrhoidectomy (Takano Hospital, Japan)

	HD	The day before operation	OP day		POD #1	POD #2	POD #3	POD #7	POD #14
Date(m/d)	__/__/__	__/__/__	__/__/__		__/__/__	__/__/__	__/__/__	__/__/__	__/__/__
Explanation	Orientation for hospitalization (from nurse)	Preoperative Lab Anesthesia and operation	Operative results (from doctor) *from POD#1to #7		Postop. Medication (from Pharm)	H.S.B, dressing (from nurse)			Care after discharge (from Dr, nurse)
	Program for treatments (From doctor)		Postop. Pain control, medication, IV fluid (from Pharm)						Medication (from Pharm) *Discharge date: consult with Dr.
Lab.	Preoperative : CBC, UA, Chest X-ray, EKG Add exam if necessary				Add exam if necessary				
Diet	Regular diet	Soft diet	Breakfast (Bread and juice) No lunch or dinner		Soft diet	Regular diet	Regular diet		
Bath	Possible		Impossible		Dry with towel (bed)	Shower only	Possible		
Rest	No limitation (In hospital only)		Bed rest till following day		Permit ambulation to bath room	Permit ambulation in ward	No limitation (In hospital only)		
Defecation	Check facilities in rest room		Preop.: use suppository, 7AM. Enema at2 hours before surgery		Permit regular defecation (Encourage bidet use) Toilet in short time and avoid excessive straining. Contact nurse if any problems with defecation				
Nursing treatment		Shaving perianal area	Postop.: call nurse for voiding or defecation		Check wound and apply ointment on ward rounds (during 1-2 weeks)				
Injection and Administration	Stool softner (8AM)	Stool softner (4PM) Give ointment for postop. Use	Pain control (injection if necessary) Preop: hydration, 2L Postop: hydration 1L with IV antibiotics		Stool softner (oral pill if necessary) Enema if necessary				

* Please contact us if have any questions.

Table 10.15 Emergency report

<p>Emergency Report</p> <p>In case of voiding difficulty, pain, or bleeding, please contact 000 Hospital right away. If you live too far from our hospital, call your local hospital's emergency room.</p> <p style="text-align: right;">000 Hospital Hospital ward Phone No: Night duty doctor Phone No:</p>

difficulty, they are encouraged to contact our hospital at any time. In patients with severe pain after discharge, I recommend readmission for additional few days. Discharge medi-

cation includes ointments, oral antibiotics, NSAID, analgesics, and stool softener (MgO).

Table 10.16 Clinical information

Clinical Information							
Dear Dr. _____ (name of ER doctor in charge of outpatients)							
Zip code 00-000							
Address:							
Name of hospital: _____, Phone No: _____							
Patient	Name		Occupation		Blood type		M
	Date of birth						Sex
Purpose		Postop. Bleeding, etc.					
This patient had _____ operation, at _____ (time), on _____ (date), _____ (month), _____ (year) in 000 Hospital. Since the hospital is located in 000 city, patients who live far from the hospital are recommended to have a checkup at their nearest hospital, when they experience bleeding or other unstable conditions. We would appreciate your examination of this patient. We can also provide you with a more detailed explanation if you contact our hospital.							
Operation opinion:							
Current Prescription:							

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Although strict contraindication for hemorrhoid surgery is rare, conditions to postpone the operation or to choose other treatment options are mentioned in this chapter.

11.1 Age

1. Consider conservative treatment in patients over 70 years
 - Highly possibility of complication after anesthesia
 - Voiding difficulties after operation
 - Possibility of fecal incontinence after operation due to decreased sphincter function
 - Less long-term benefit on the aspect of life expectancy
2. Beware of the high recurrence rate in patients below the age of 35

11.2 Concomitant Chronic Disease

Hemorrhoidectomy is not recommended for patients over 70 years old who are accompanied with chronic disease.

1. Cardiovascular disease and cerebrovascular disease
 - Myocardial infarction within recent 6 months is an absolute contraindication for hemorrhoidectomy.
 - Both the risks for the operation and recurrence of CVA are high in patients with cerebrovascular attack history.
 - Hypertension should be controlled before the operation.
2. Lung disease
 - Avoid general anesthesia for patients with chronic lung disease.
 - Left lateral position is better than the prone and supine position for patients with chronic lung disease.
3. DM
 - DM is not the subject for contraindication but should be controlled during the operation (especially for the patents with insulin injections).

4. Spinal disease

- Remind the patients about the possibility of aggravation of spinal symptoms due to the operation in advance.

5. Obesity

- Obesity is not a contraindication for hemorrhoidectomy but should consider inadequate operative field and hemorrhage due to venous engorgement.

6. Blood disorder

- Anemia, polycythemia, leukemia, and hemophilia should be considered.

7. Medication

- Medications such as aspirin, NSAID, for rheumatoid or chronic arthritis should be cut off a few days before the surgery because of their tendency to promote bleeding.

11.3 Pregnancy and Delivery

Pregnancy and delivery are relative contraindications. In case of severe prolapsed and incarcerated hemorrhoids, perianal abscess, and anal severe bleeding, surgeons should consider surgical treatment (you can see detail explanation in Chap. 12).

11.4 Gastrointestinal Disease

- Crohn's disease or acute ulcerative colitis involving the rectum and anus
- Persistent diarrhea or chronic constipation

11.5 Drug Addiction and Alcoholism

- Drug addiction: addicted to cocaine, narcotics, or psychiatric medicine (difficult cooperation during the operation)
- Overuse of laxatives for a long period of time
- Presence of symptoms related to alcohol intoxication

11.6 Immune Deficiency

- AIDS
- Drugs: on the use of steroids and cytotoxic agents
- Radiation exposure (therapeutic or accidental), infection (sepsis), or congenital disease

11.7 Weakness of Anal Sphincter

If hemorrhoidectomy is performed on patients with weak anal sphincter, defecation regulatory function of the hemorrhoids is lost, so fecal incontinence, recurrence of hemorrhoids, or mucosal prolapse may occur easily.

11.8 Anal Canal Deformity

- For the funnel anus, the removal of the mucosa and anal cushion could get rid of plug function, resulting to incontinence.
- In the case of keyhole deformity after the operation of high-type fistula, the anus results in high recurrence after hemorrhoidectomy and even can cause incontinence just like in the case of funnel anus.

11.9 Mucosal Inflammation

In patients with inflammatory bowel disease, the wound healing after hemorrhoidectomy would be slow. In Crohn's disease, the wound frequently may not even heal completely.

The possibility of postoperative bleeding or anal stenosis is also high. The risk is high especially during the period of active inflammation. Therefore, hemorrhoid operation is recommended after the treatment of active inflammation.

11.10 On the Specific Disease Status

1. Tuberculosis

The wound healing is difficult in the anus with tuberculosis and apt to lead anal fistula.

2. Lymphogranuloma venereum (Chlamydia trachomatis A, type 1–3)

It is frequent in tropical region and the hemorrhoid operation is postponed until the treatment of infection.

3. Venereal disease

For the patients with gonorrhea or syphilis around anorectal region, hemorrhoid operation is postponed until the treatment of the venereal disease.

4. Malignancy

- In the case of hemorrhoidectomy with uncovered malignant mass at lower rectum:
 - The undiagnosed cancer can progress to the incurable state.
 - The cancer cell spreads to the anal wound which can lead to the abdominoperineal resection.
- Preoperative colonoscopic examination is necessary for the patients with suspected malignancy.

12.1 Thrombosed External Hemorrhoids

Thrombosed hemorrhoids are hematoma from venous rupture and clotting caused by excessive squeezing during defecation. Although it may occur on internal hemorrhoids, it usually occurs on external hemorrhoids. Strictly speaking, it is a hematoma rather than a thrombus. The thrombus refers to blood clots within the blood vessels, but thrombosed hemorrhoids are not formed within the blood vessels.

Since the term thrombosed hemorrhoids can cause confusion, the author believes it is more appropriate to name this condition as anal hematoma.

Thrombosed hemorrhoids occur more frequently in patients who have constipation and who sit too long in the toilet. They usually show high anal pressure, which is frequently accompanied with anal fissure.

The symptom is a painful palpable lump around the anus. The size of the lump varies, and in severe cases, incarceration involving the entire circumference of the anus has been noted. The smaller size of lump, the more easily pain subsides. Pain itself should be differentiated from perianal abscess and anal fissure. Anal ultrasound is often used for differential diagnosis.

The treatment is divided into conservative and surgical treatment. If the lump is less than the size of a pea, it can be treated conservatively. Sitz bath, laxatives, anti-inflammatory drugs, and ointments are used for the conservative treatment. Usually pain settles down within 3–4 days, and the hematoma, sometimes ruptures spontaneously, can last for more than 1 month to dissolve completely (Fig. 12.1).

After complete dissolution of the hematoma, the residuals often can remain as a skin tag. Surgical resection is more suitable for a hematoma that comprises more than 30 % of the anal circumference. If it continually recurs, even with a smaller thrombosed hemorrhoid, it is usually combined with an increased anal pressure or an anal fissure. Therefore surgical removal of blood clots accompanied with a technique to decrease anal pressure, i.e., manual dilatation or lateral internal sphincterotomy, is recommended.



Fig. 12.1 Thrombosed external hemorrhoids

12.1.1 Operative Methods

- Remove surgically under local anesthesia with lidocaine or bupivacaine or spinal anesthesia.
- If it is small in size, remove it as a procedure of incision and drainage in outpatient clinic under local anesthesia. Suture is not necessary. However, if it is large in size, surgical resection with bleeding control and suture in the operation room is recommended. Since the anal pressure is usually high, manual dilatation or LIS can be done if necessary.
- After the operation, provide laxatives and ointment, and recommend outpatient treatment for about two or three times every 3–4 days.

12.2 Incarcerated Hemorrhoids

Incarcerated hemorrhoids are strangulated, irreducible state of the internal hemorrhoids involving the entire or partial circumference of anus which have a long history of repeated



Fig. 12.2 Incarcerated hemorrhoids

protrusion and reduction. It is called 4th-degree hemorrhoid or an anal prolapse. Venous congestion and soft tissue edema are usually accompanied to cause swelling. Symptoms include severe pain, bleeding more than moderate in amount, foul-odored discharge, and defecation difficulties. With aggravation, tissue necrosis and ulcer can be combined.

Sometimes it is confused with prolapsed hemorrhoids and circumferential hemorrhoids. Prolapsed hemorrhoids refer to 3rd- or 4th-degree internal hemorrhoids regardless of whether they are reducible or not. Circumferential hemorrhoids refer to those that involve the entire circumference of the anal verge. The term strangulated or irreducible prolapsed hemorrhoids is used together with incarcerated hemorrhoids.

Treatment options are generally classified into four kinds:

1. Emergency operation.
2. Operation on the next day after reduction with local anesthesia.
3. Delayed operation after conservative treatment.
4. The restrictive operation: Heald R. J. et al. of the United Kingdom insisted the conservative treatment after excising the one largest pile only (Fig. 12.2).

Ackland reported the results of the operation for 25 incarcerated hemorrhoids that was equally safe and effective compared with those with chronic internal hemorrhoids. I prefer emergency operation with submucosal hemorrhoidectomy. However, in the traditional ligation and excision method, much of the mucosa could be removed, which results in anal stricture or damage to a part of the internal sphincter, causing weakness of the sphincter function. With submucosal hemorrhoidectomy, anal stenosis and other complications can be prevented since the anal mucosa is not

overly resected. Additionally, in incarcerated hemorrhoids, the operation tends to be easier to perform and causes less bleeding.

But nonincarcerated 4th-degree internal hemorrhoids with weak sphincter are apt to bleed much in amount, which need ligation of feeding vessels at proximal pedicle before the operation to reduce the bleeding.

Shieh and Gennaro reported the results of urgent operations on 23 patients. They showed no specific complications except 1 case of early bleeding, 1 case of late bleeding, and urinary retention. They operated 1 day after injecting a mixed solution (1:200,000 epinephrine, 0.5 % bupivacaine, and 300U of hyaluronidase 1 mg) at the intersphincteric space with a compression dressing (refer the part of local anesthesia). Under local anesthesia, the injection releases the spasm of the internal sphincter and often causes reduction of the incarcerated hemorrhoids. Eisenstat et al. reported good results after incision and removal of blood clot with rubber band ligation under local anesthesia.

12.3 Hemorrhoids in Pregnancy

During pregnancy, constipation and hemorrhoids are likely to appear frequently under the influence of progesterone. In the early stage of pregnancy, drugs should be avoided as much as possible, increase the intake of fiber, and take a sitz bath. During the middle stage of pregnancy, the occurrence of hemorrhoids is rare, but during the last stage, increased abdominal pressure and awkward posture cause the hemorrhoids to prolapse easily. Under the local anesthesia, if the incarcerated hemorrhoids are not able to be reduced, premature labor is possible because of pain.

Spinal anesthesia is recommended for operation of the incarcerated hemorrhoids during the pregnancy. The operation should be simple procedures rather than removing the hemorrhoid completely. After the delivery, hemorrhoids can aggravate into incarcerated hemorrhoids. In this case, a simple excision is much better than conservative treatment. Spinal anesthesia is better than local anesthesia because it uses less amount of lidocaine and blocks pain completely.

12.4 Hemorrhoids in Portal Hypertension

When nonabsorbable antibiotics are injected to treat hepatic coma for patients with portal hypertension, it can cause diarrhea, which increases bleeding in prolapsed hemorrhoids. The bleeding occurs around the dentate line and is copious and continuous. Once the bleeding area is identified with an anoscope, perform local anesthesia with bupivacaine

mixed with 1:200,000 epinephrine solution, and suture with 3-0 absorbable material including mucosa, submucosa, and internal sphincter in a figure of eight. Patients should be treated for diarrhea and coagulation disorder at the same time. Also, among patients with portal hypertension, secondary bleeding is frequent even after the primary closure because of the congestion and friable tissues. If another trial of suture fails to control secondary bleeding, hemorrhoidectomy should be considered.

In the patients with portal hypertension, the bleeding from anorectal varicose vein should be distinguished from the bleeding from hemorrhoids. It comes from three sites such as the perianal area, anal canal, and rectum, which can be controlled by suturing continuously at 3–4 points from the upper rectum to the perianal area. If bleeding is not controlled, TIPS (transjugular intrahepatic portosystemic shunt) may be necessary.

12.5 Hemorrhoids in IBD

Hemorrhoids from the IBD itself are rare. But the irritation around the anus or edema due to diarrhea usually causes hemorrhoids. Conservative treatment is effective in treating hemorrhoids combined with UC; however, hemorrhoids with Crohn's disease need an operation because of severe complications.

12.6 Hemorrhoids in Leukemia

In the immune-deficient state such as leukemia, hemorrhoidectomy involves a risk of developing an extensive surgery, delayed wound healing, and abscess formation. Although the operation does not increase the mortality rate directly, it should only be considered as the last treatment option to treat pain or sepsis. It is important to treat coagulopathy along with antibiotics therapy. When leukemia is combined with anal infection only, fever and localized pain are noted with no typical inflammatory reaction. Only the necrotic tissues are observed at the infected site without pus.

12.7 Others

Hemorrhoids combined with other anal diseases such as anal fissure or fistula can be treated with a hemorrhoidectomy concomitant with lateral internal sphincterotomy or fistulectomy.

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The following three types of anesthesia are applicable for anal surgery: local, regional (spinal, caudal), or general anesthesia. They all have their own merits and demerits, and it is why the surgeon or anesthesiologist should administer different types of anesthesia depending on the patient's medical condition.

In America and England, the lithotomy position under general anesthesia is preferred. Spinal anesthesia is generally used in Japan, which is frequently performed by coloproctologist. It is also a job of the first-year residents. Caudal or spinal anesthesia is currently in wide use in Korea.

There is preference of the type of anesthesia on operative posture. Spinal or caudal anesthesia is usually used on patients in jackknife position, and general anesthesia tends to be used on patients in lithotomy position. In Korea and Japan, since surgeons usually perform anesthesia by themselves, local anesthesia, spinal anesthesia, and caudal block seem to be proper choices of anesthesia.

Although the spinal anesthesia, which is used frequently in Korea, can cause complications such as urinary retention and PDPH (post-dural puncture headache), it is preferred by many surgeons because it allows complete relaxation of the anal sphincter and block the pain during the operation.

Caudal block is a convenient anesthetic method for anal surgery except the time needed for its completion of blocking after procedure. On admission of patients, it is helpful to know patients' medical history, generalized condition, bleeding tendency, and allergies via preanesthetic questionnaire for safe anesthesia administration and preventing anesthetic complications (Table 13.1).

13.1 Local Anesthesia

Local anesthesia is used frequently for anal surgery; it shows unexpectedly good results.

Advantages

1. Procedure is simple and easy for surgeons to perform themselves.
2. Relatively safe.

Disadvantages

1. It is not suitable for procedures that take a long operation time.
2. The operation field is poor due to insufficient muscle relaxation.
3. It needs to be prepared in the case of complications.

Since spinal anesthesia has possibility of complications also, many anal surgeries can be performed under local anesthesia, if used properly.

13.1.1 Drugs

Usually 1.0–2.0 % lidocaine or 0.25–0.5 % bupivacaine, mixed with epinephrine or not, is used. The action duration of bupivacaine is longer than lidocaine. If a patient has a heart problem, use drugs without epinephrine.

Sometimes we use lidocaine mixed with bupivacaine. We should pay attention to the lethal dose of individual drug.

13.1.2 Indication

The local anesthesia is indicated for the thrombosed external hemorrhoids, 2nd- and 3rd-degree internal hemorrhoids, intersphincteric fistulas, and fissures. But regional anesthesia, spinal anesthesia, and caudal block are better for severe fistulas or 4th-degree internal hemorrhoids.

13.1.3 Induction of Local Anesthesia

The patient used to bear the pain on local anesthesia, but it is better to inject the intravenous anesthetics and induce short sleeping before the injection of the local anesthetics.

After the posture of the patient, inject some intravenous anesthetics. Once the patient is asleep, inject local anesthetics. Emergency kits should be prepared for respiratory and circulatory accidents.

Table 13.1 Preanesthetic questionnaire

Date:	Name:	Sex: M/F	Age:
<p>※ Please fill in the questions for safe anesthesia and operation.</p> <div style="display: flex; justify-content: space-between;"> <div style="width: 70%;"> <ol style="list-style-type: none"> 1. Do you have any coagulation disorder? 2. Have you had a headache or dizziness lately? 3. Have you experienced chest pain lately? 4. Have you experienced palpitations or dyspnea lately? 5. Have you experienced fever above 37°C in the last week? 6. Do you have back pain history? 7. If any, what was the diagnosis? () 8. Do you have any allergies? drug () food () others () 9. Have you had a colonoscopy within a year? 10. Have you been treated for any of the diseases below? (cerebral disease, heart disease, pulmonary disease, liver disease, kidney disease, DM, asthma, hypertension, others () 11. Are you being treated for any disease recently? Disease () Hospital () Since when () 12. Have you ever had an operation? When () Name of operation () 13. Have you ever had any problems with anesthesia? OO colorectal clinic Doctor () Nurse () </div> <div style="width: 25%;"> <div style="display: flex; justify-content: space-between;"> <div><input type="checkbox"/> Yes</div> <div><input type="checkbox"/> No</div> </div> <div style="display: flex; justify-content: space-between;"> <div><input type="checkbox"/> Yes</div> <div><input type="checkbox"/> No</div> </div> <div style="display: flex; justify-content: space-between;"> <div><input type="checkbox"/> Yes</div> <div><input type="checkbox"/> No</div> </div> <div style="display: flex; justify-content: space-between;"> <div><input type="checkbox"/> Yes</div> <div><input type="checkbox"/> No</div> </div> <div style="display: flex; justify-content: space-between;"> <div><input type="checkbox"/> Yes</div> <div><input type="checkbox"/> No</div> </div> <div style="display: flex; justify-content: space-between;"> <div><input type="checkbox"/> Yes</div> <div><input type="checkbox"/> No</div> </div> <div style="display: flex; justify-content: space-between;"> <div><input type="checkbox"/> Yes</div> <div><input type="checkbox"/> No</div> </div> <div style="display: flex; justify-content: space-between;"> <div><input type="checkbox"/> Yes</div> <div><input type="checkbox"/> No</div> </div> <div style="display: flex; justify-content: space-between;"> <div><input type="checkbox"/> Yes</div> <div><input type="checkbox"/> No</div> </div> <div style="display: flex; justify-content: space-between;"> <div><input type="checkbox"/> Yes</div> <div><input type="checkbox"/> No</div> </div> <div style="display: flex; justify-content: space-between;"> <div><input type="checkbox"/> Yes</div> <div><input type="checkbox"/> No</div> </div> </div> </div>			

If an intravenous injection is troublesome, a cooling spray or 4 % lidocaine gel can be used before local anesthetic injection.

13.1.3.1 Local Anesthesia After Intravenous Anesthetics

With the recent increase of day surgery, many surgeons now use local anesthesia, and many reports show similar effect between local anesthesia and spinal anesthesia. However, there are obstacles to local anesthesia: the pain caused when the drug is injected and insufficient relaxation. To manage these problems, various drugs, such as propofol, midazolam, pethidine, fentanyl, local anesthetic cream (EMLA cream), cold spray, and lidocaine spray, are used. In our hospital, we reported a prospective study about anesthetic difference between the spinal anesthesia and local anesthesia in 52 hemorrhoidectomy cases. The local

anesthesia after intravenous anesthesia using thiopental injection did not show any difference in anesthetic effect and even showed local anesthesia has lower complication rate than spinal anesthesia.

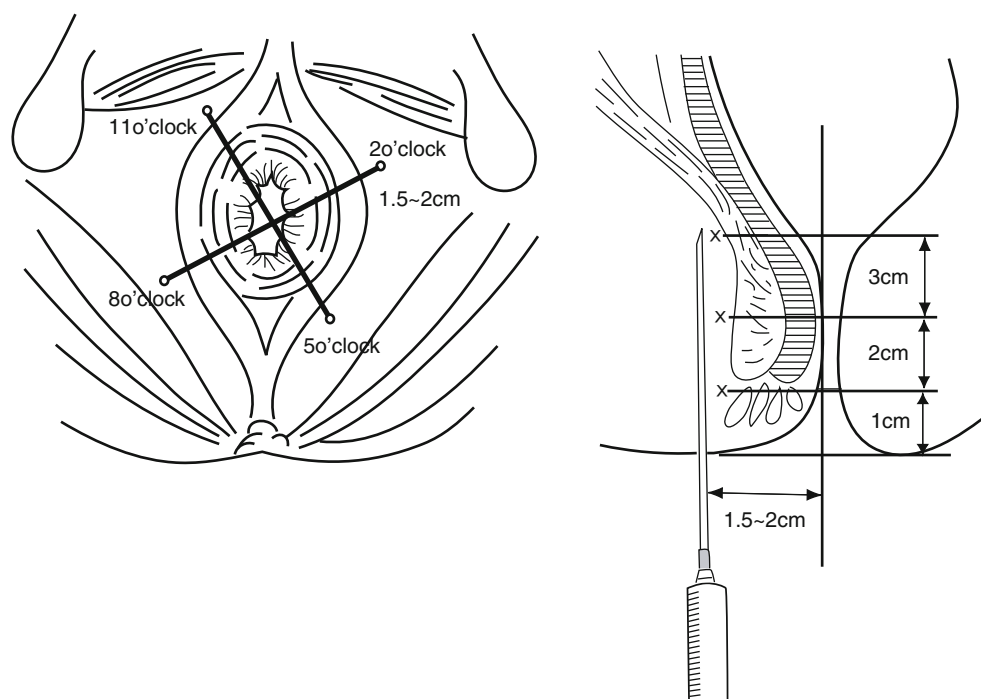
Here are some examples of local anesthesia after inducing intravenous anesthesia.

Type and dosage of drugs for intravenous injection

1. Propofol: 1.2–2 ml/kg (60–100 ml for 50 kg body weight) (sometimes used with fentanyl 50 ug, together).
2. Thiopental (3.3 mg/kg) and midazolam can be used.

Matters that require attention

Intravenous anesthetics can cause serious complications such as respiratory depression and hypotension. Therefore, it needs to be monitored intensively, and cardiopulmonary resuscitation set should be prepared. Because the patients are kept in prone position during the operation, patients with obesity or short fasting time should be selected cautiously.

Fig. 13.1 Sakada's field block*Method of local anesthesia*

With the patient in jackknife position, inject adequate dosage of intravenous anesthetics to induce sleep. When the patient is asleep, inject the local anesthetics (e.g., 15 ml of 2 % lidocaine + 5 ml of 0.5 % bupivacaine) in a fan shape to the direction of 3 and 9 o'clock (1–2 cm outer of the anal verge) with 1, 2, and 3 cm in depth, respectively. Additional injections should be done on the directions of 6 and 12 o'clock (Fig. 13.1).

When injecting on the direction of 12 o'clock, it should be kept shallow to avoid urethral injury. EKG, SpO₂, and blood pressure should be monitored because local anesthesia may induce systemic toxicity such as dizziness, nausea, muscle spasms, seizures, and respiratory paralysis. Bupivacaine especially should be in careful use for its cardiac toxicity.

Indication

1. Failure of spinal or caudal anesthesia
2. Day surgery
3. Patient with back pain
4. Patient's refusal
5. Unskillful surgeon for spinal anesthesia
6. Patients with hemorrhoids or anal fissures

Disadvantages

1. Needs more time before operation because the surgeon injects by himself
2. Costs more

Patients who need more attention

1. Obese patients
2. Patients who have difficulty of maintaining their airway in a prone position: short neck, dentures, upper respiratory infection, and severe rhinitis
3. Abnormality on cervical vertebrae
4. Complex anal fistula

Required equipment

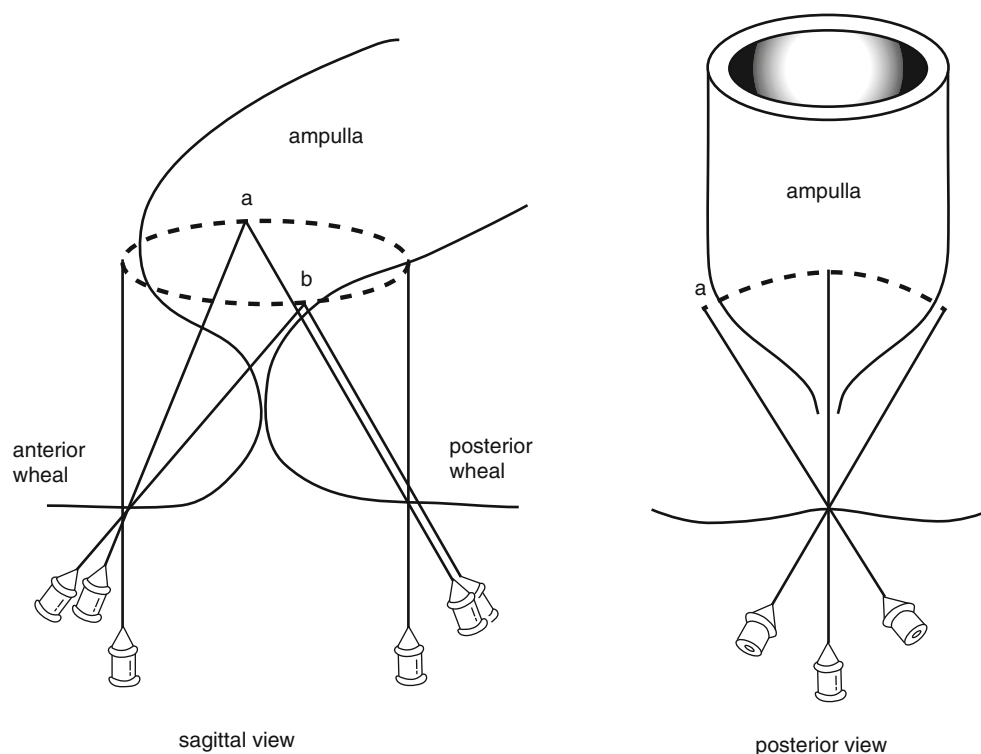
1. Equipment for general anesthesia
2. EKG monitor (at least, SpO₂ monitor)

Conclusions

Local anesthesia after intravenous anesthetic injection in anal surgery has shown similar or better effectiveness, complication rate, and patient's satisfaction. We think local anesthesia after inducing intravenous anesthesia is better than spinal anesthesia for patients who require day surgery or who have difficulties in accepting spinal anesthesia.

13.1.4 Method of Local Infiltration

With a 25-gauge fine needle, the field block is done after injecting 10 ml of 0.5 % lidocaine around the anal subcutaneous tissue. The field block is performed by injecting the lidocaine at 1.5–2 cm outer of the anal verge, toward four directions of 2, 5, 8, and 11 o'clock, and injecting 2 cc of lidocaine in 3 cm depth (deep level) and additional 1 cc each

Fig. 13.2 Bacon's field block

in 2 cm depth (middle level) and 1 cm depth (superficial level). The total amount of lidocaine to be used is about 20 cc. Index finger is inserted into the anus as an indicator during the injection. The anal sphincter will be relaxed enough for an operation in about 4–5 min after the injection. When injecting into deep level, as shown in the figure, an alternative method is to insert the needle only at both lateral sides of the anus combined with additional anterior and posterior injections. Care should be taken for the urethra and vagina in the anterior approach and pubococcygeal ligament in the posterior approach.

As shown in figure 13.2, Bacon has injected into the anterior and posterior directions, but injecting on both lateral sides is better. Nivatvongs reported an improved method of local anesthesia in 1981. This method was developed based on the fact that mucosa proximal to the dentate line is less sensitive to pain. Minor tranquilizer can be used, but 2 % lidocaine jelly is used more often. A digital rectal examination is done, and a small anoscope is inserted into the anal canal after lidocaine jelly application. Then, 2–3 ml of the lidocaine is injected into four directions at 2 mm proximal to the dentate line, and the injected anesthetic is squeezed down to the distal part of the dentate line. After this procedure, Ferguson anoscope is inserted into the anal canal injecting anesthetic in four directions, 2 mm distal to the dentate line. Lastly, anesthetics are injected into the anal verge and anoderm (Fig. 13.3).

13.1.5 Precautions

Sometimes, lidocaine can cause complications with following symptoms:

1. Tinnitus.
2. Numbness of tongue.
3. Consciousness change.
4. Seizure: If this happens, inject 10 ml of valium intravenously with oxygen mask and observe the respiration. During the operation, it is safe to monitor patients continuously.

13.1.5.1 Proper Seizure Control for Methods

1. Keep the airway with intubation or oxygen mask.
2. Supply oxygen.
3. Supply intravenous fluid.
4. Stop seizure by injecting midazolam or thiopental.
5. Increase blood pressure with vasoconstrictors.
6. With cardiac arrest, start cardiopulmonary resuscitation.

13.2 Spinal Anesthesia (Saddle Block)

Spinal anesthesia is the most widely used method in anal operations. Saddle block, low-level spinal block, is the safest one. Since saddle block does not need much amount of fluid administration, it has low urinary retention rate.

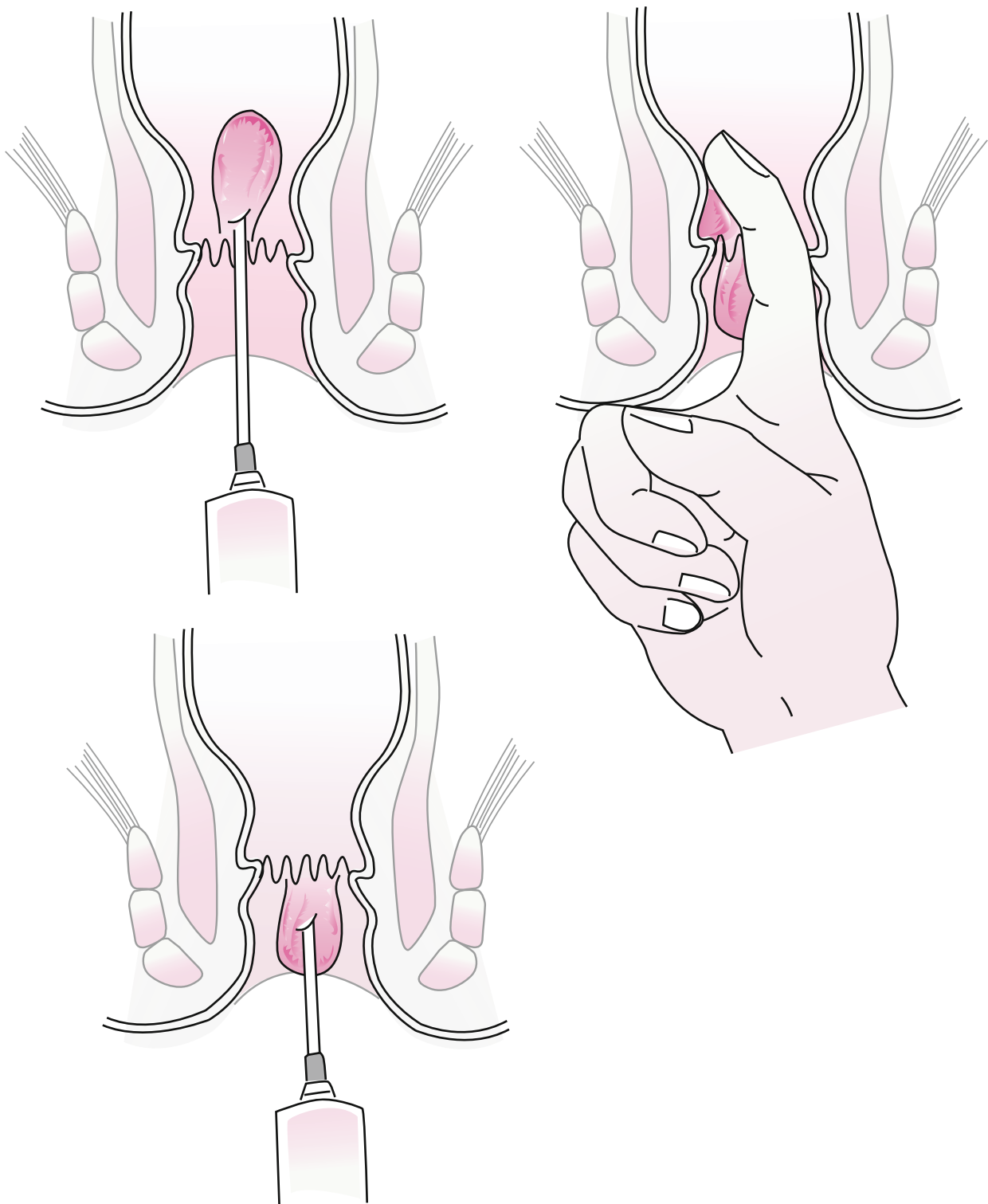


Fig. 13.3 Nivatvongs method of local anesthesia

The most difficult aspect of spinal anesthesia for a surgeon is the performance of lumbar puncture. Spinal anesthesia involves the injection of local anesthetics into the subarachnoid space. Generally, patients fall into anesthesia

within a few minutes. The supply of fluid should be increased because of the hypotension caused by blocked sympathetic nerve system, which can cause high rate of the urinary retention. When the patients are kept sitting for 1–2 min after

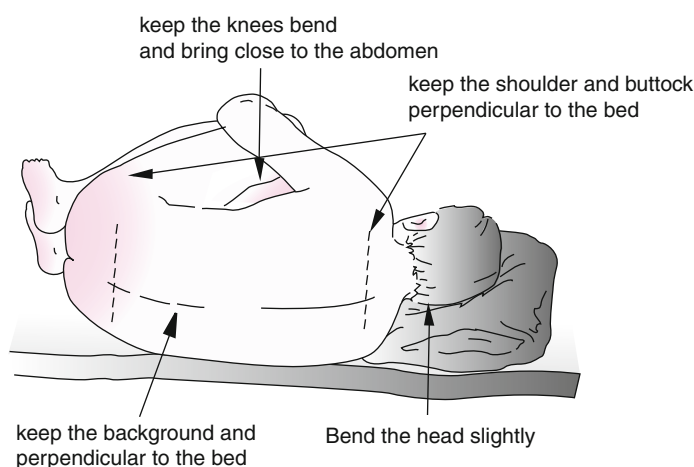


Fig. 13.4 Positions for the spinal puncture

injecting anesthetics in the saddle block, anesthetic level can fix low, the risk of hypertension is low, and fluid loading is not necessary; therefore, the risk of urinary retention decreases.

13.2.1 Drugs

Hyperbaric tetracaine and bupivacaine are the most widely used anesthetics. Anesthetic duration in tetracaine or bupivacaine is about 1.5–2 h. If epinephrine is mixed, it doubles the time of duration.

13.2.2 Positions for the Lumbar Puncture

The patient's position is the most important factor for the success of spinal puncture. Left lateral decubitus is common, but sitting position is also used. In the sitting position, care should be taken since patient may fall down because of the postural hypotension or dizziness. In the lateral decubitus position, the procedure can be easy by bending the body forward, with the knees flexed, and placing a pillow under patient's head. When the operator is right-handed, left lateral decubitus position is more convenient for spinal puncture, and when left-handed, right lateral decubitus position is more convenient.

- A. Keep buttocks vertical to bed/pull the knees toward abdomen/keep shoulders vertical to bed
Keep the back round and vertical to bed/keep the head bend slightly
- B. Iliac crest (Fig. 13.4)

13.2.3 Setting the Puncture Site

After skin sterilization, choose the site for puncture. Generally, the puncture site is between L4–5 and L5–S1

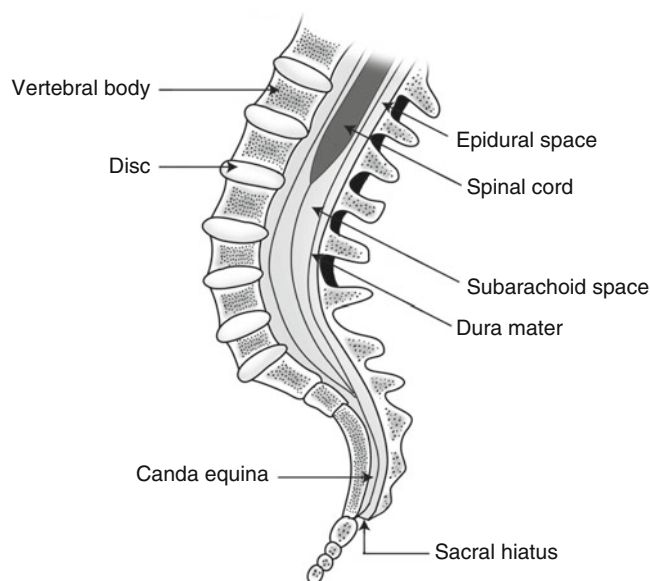
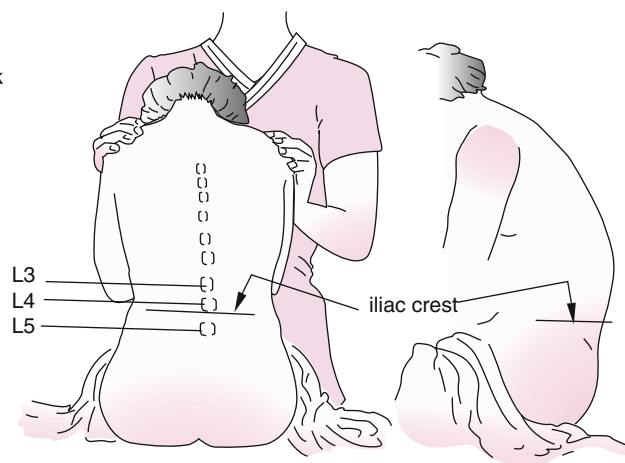


Fig. 13.5 Relationship between vertebral body and the terminal of the spinal cord

because the spinal cord usually ends about in L1 level. The puncture site is estimated with spinous process of L4, which is located on the Jacoby's or Tuffier's line (the line connecting both iliac crests) (Figs. 13.5 and 13.6).

13.2.4 Approach Methods of the Lumbar Puncture

13.2.4.1 Midline Approach

After marking the expected puncture site with a fingernail, infiltrate the skin with local anesthetic drugs. The finer needle is the better, and 25- or 27-gauge needle is suitable. The midline approach is the most common method which inserts the needle keeping 10°–15° upward. The needle reaches the subarachnoid space through the subcutaneous

Fig. 13.6 Spinal position-lateral decubitus position

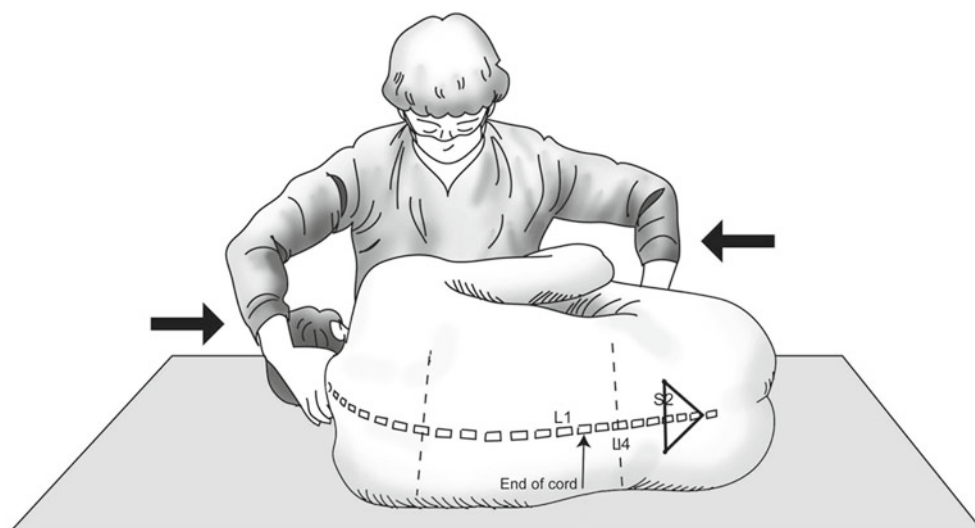
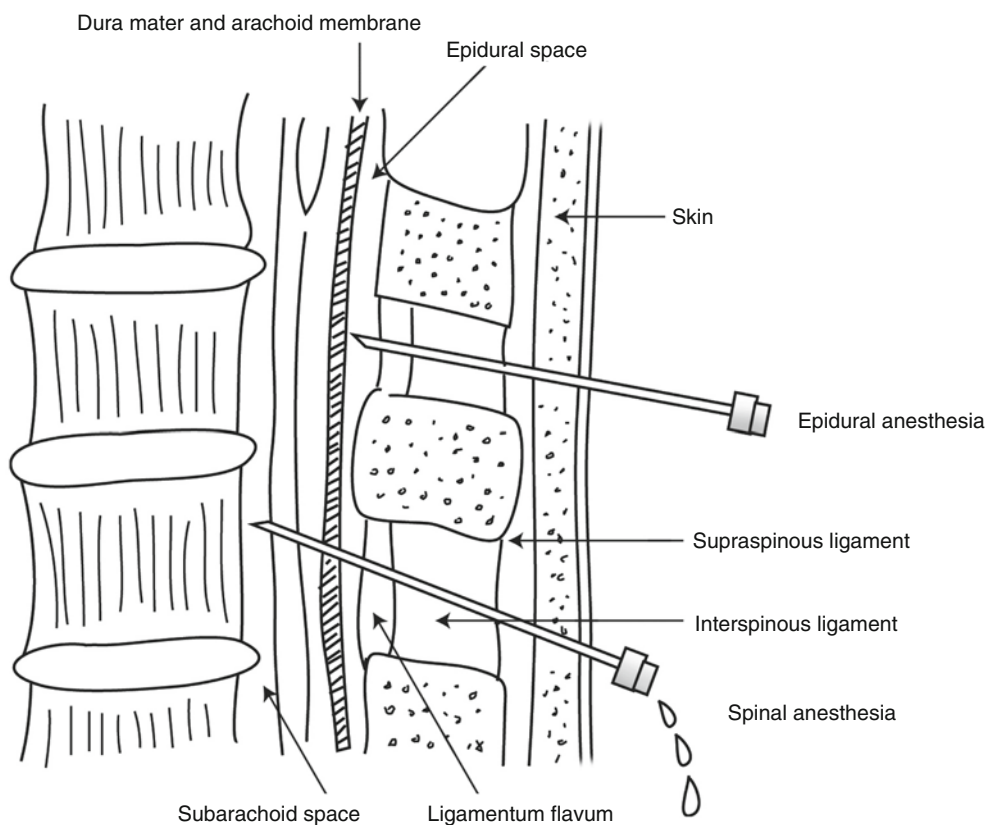


Fig. 13.7 Longitudinal section of the spine

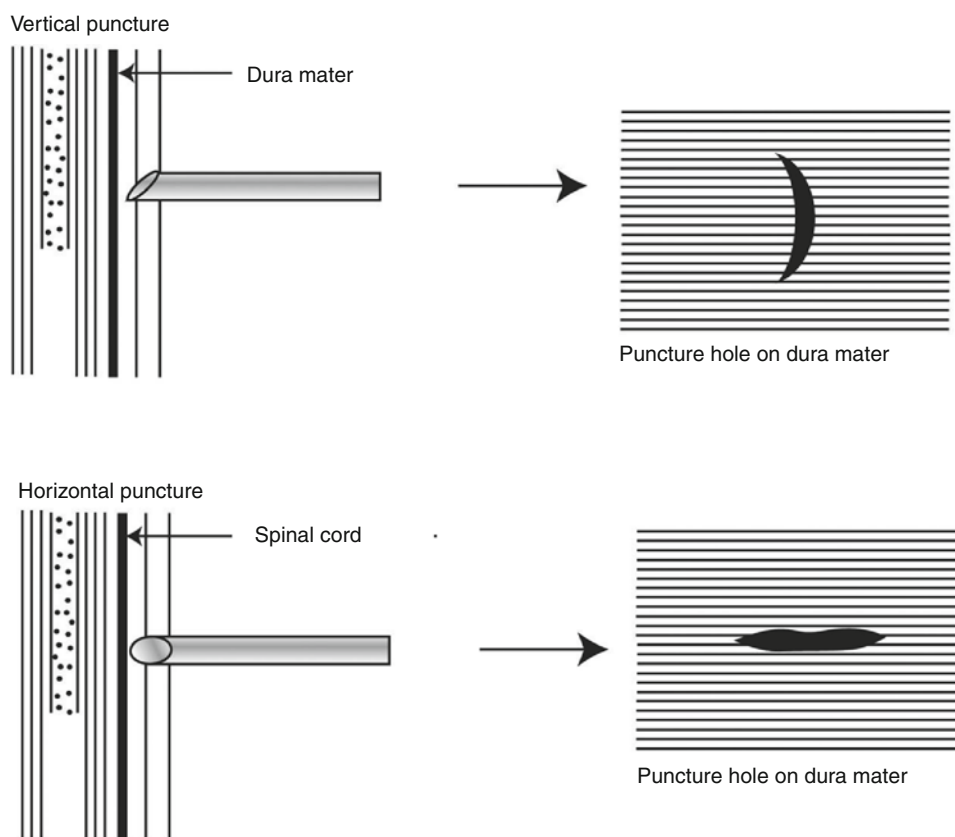


tissue, supraspinous ligament, interspinous ligament, ligamentum flavum, epidural space, dura mater, and subarachnoid space. When the needle passes a ligament, resistance should be felt; you can feel a “pop,” which is an important sense to catch the moment of the puncture of the dura mater. It is better to keep the bevel of the puncture needle longitudinal to the fiber of the dura mater to decrease the incidence of post-dural puncture headache. After the puncture of the dura mater, remove the stylet and check the outflow of the CSF. If the CSF does not appear to flow free, the needle is rotated to 90° step by step, until the CSF

appears or is pushed in 1–2 mm more to avoid the bevel being placed on the edge of the dura mater. This happens frequently with the pencil-tip needle because the infusion hole is located laterally. Especially when fine needle is used, slight aspiration is often helpful. When CSF does not appear or the needle encounters a bone, which means it is not in the subarachnoid space, the needle should be withdrawn to the subcutaneous tissue and proceed to the other direction again (Fig. 13.7).

This is usually caused by the needle tip straying from the midline. And even a minimal change of direction at the

Fig. 13.8 Damage of dura mater according to direction of puncture. The bevel penetrating along with the direction of the fiber causes less damage



subcutaneous tissue level makes a great difference on locating the needle tip. The direction should proceed about 10° – 15° upward.

Route to subarachnoid space: skin → subcutaneous tissue → supraspinal ligament → interspinal ligament → ligamentum flavum → epidural space → dura mater → arachnoid membrane → subarachnoid space → (pia mater → spinal cord).

The arachnoid membrane is firmly attached to the inner side of the dura mater, and the pia mater is a thin membrane which is firmly attached to the surface of the spinal cord. The cerebrospinal fluid is filled between the arachnoid membrane and pia mater (Fig. 13.8).

13.2.4.2 Paramedian or Lateral Approach

In this approach, the needle does not penetrate through the interspinous ligament. This approach will be more successful than that of midline approach when the lumbar puncture is done by an expert. It is because the needle can approach without disturbance of the spinous process above and below. Also, it is especially effective on elderly patients of their calcified ligament. The puncture site should be 1.5–2 cm lateral to the midline approach, and the height should be the same as midline approach or a little higher and should proceed the needle to the midline and 10° – 15° upward (Figs. 13.9 and 13.10).

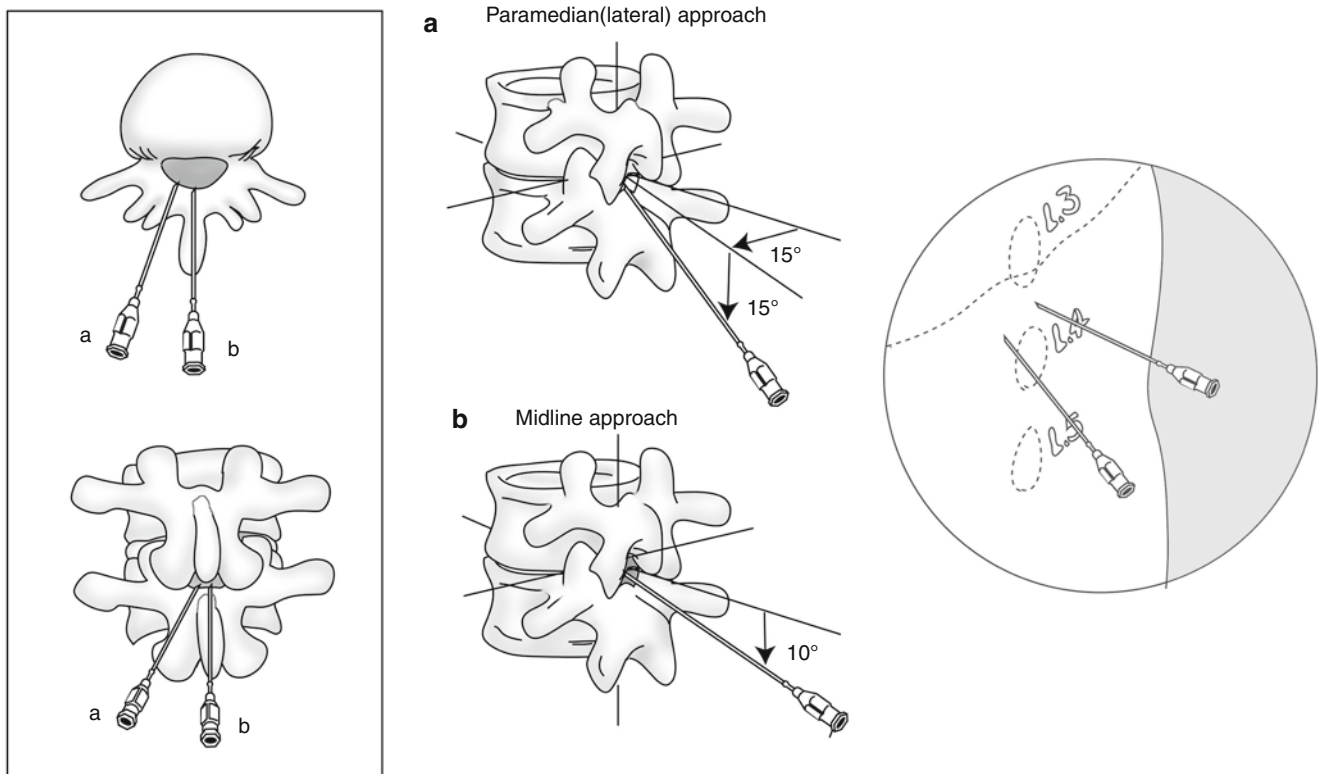
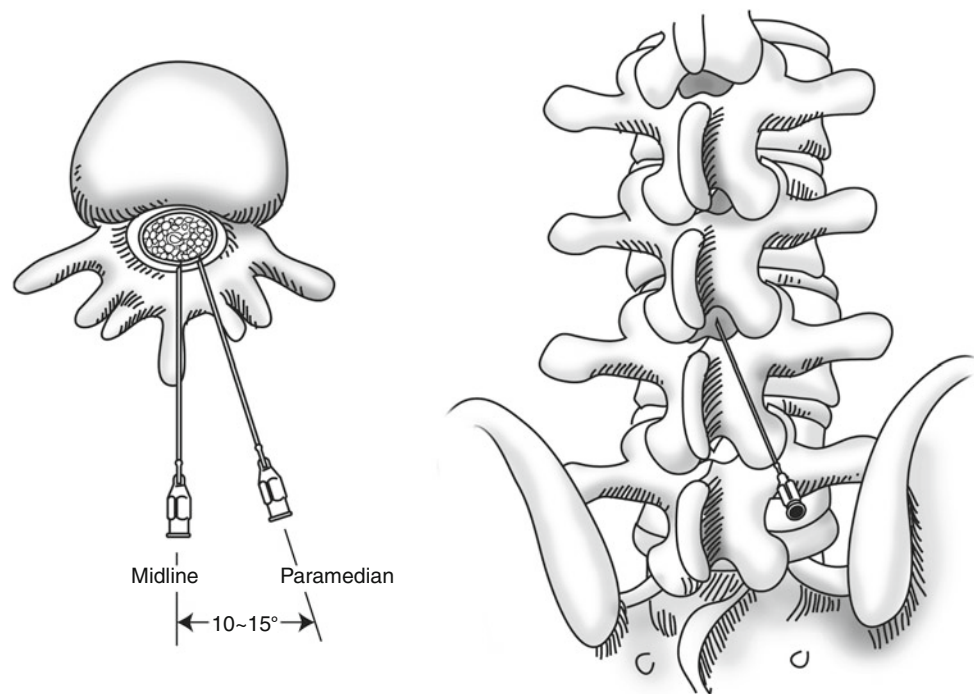
13.2.5 Saddle Block

This method is a kind of low-lumbar anesthesia of the spinal anesthesia, and the block is confined to the perineal region (below L4–5, strictly saying below S2) where the sacral nerves are innervated. The patient should keep a sitting position for about 30–60 s after the injection of high-density anesthetics to result the effect of saddle block.

During puncture, patients feel more comfortable in the decubitus position than in sitting position. After injecting anesthetics in decubitus position, the patient changes to sitting position instantly and remains so for about 2 min. In our hospital, we use this method and would like to recommend since it is safe.

13.2.6 Complications of Spinal Anesthesia

Complications include hypotension, headache, voiding difficulties, and back pain after anesthesia. Headache with the frequency of 3–16 % is the main problem which is more frequent in young, female patients. Headache is frequent on the 2nd day after the procedure and subsides spontaneously on the 5th or 6th day. The cause may be drainage of the CSF to the outside of the dura mater through the puncture hole.

Fig. 13.9 Spinal block-paramedian technique**Fig. 13.10** Spinal puncture approach. (a) Paramedian or lateral approach. (b) Midline approach

Characteristics of this symptom are that the patients feel pain with their head up, when standing, or in a sitting position and subside in a supine position. The pain is moderate to severe in the frontal area and posterior neck and can radiate

to the shoulder in severe cases. Analgesics usually show no effect, and drinking enough is recommended. The headache generally responds well with the conservative treatment, but sometimes the epidural autologous blood patch (injects

Table 13.2 Preventive methods of headache after spinal anesthesia

Use a fine needle
Keep the bevel to parallel insertion
Use pencil-tip needle
Prevent preoperative dehydration and supply sufficient hydration

10–15 cc of patient's blood into epidural space) is needed for persistent cases. Please refer to the following to prevent such headache (Table 13.2).

13.3 Caudal Block

Caudal block is a kind of epidural anesthesia, which infuses anesthetics into the sacral or caudal canal through sacral hiatus. The amount of required anesthetics is large (about 15–20 ml). Lidocaine is usually used as anesthetics.

Advantages of the Caudal Block

1. No headache because caudal block does not puncture the dura.
2. No position change is required because it is carried out in the jackknife position.
3. Relatively simple.

Disadvantages of the Caudal Block

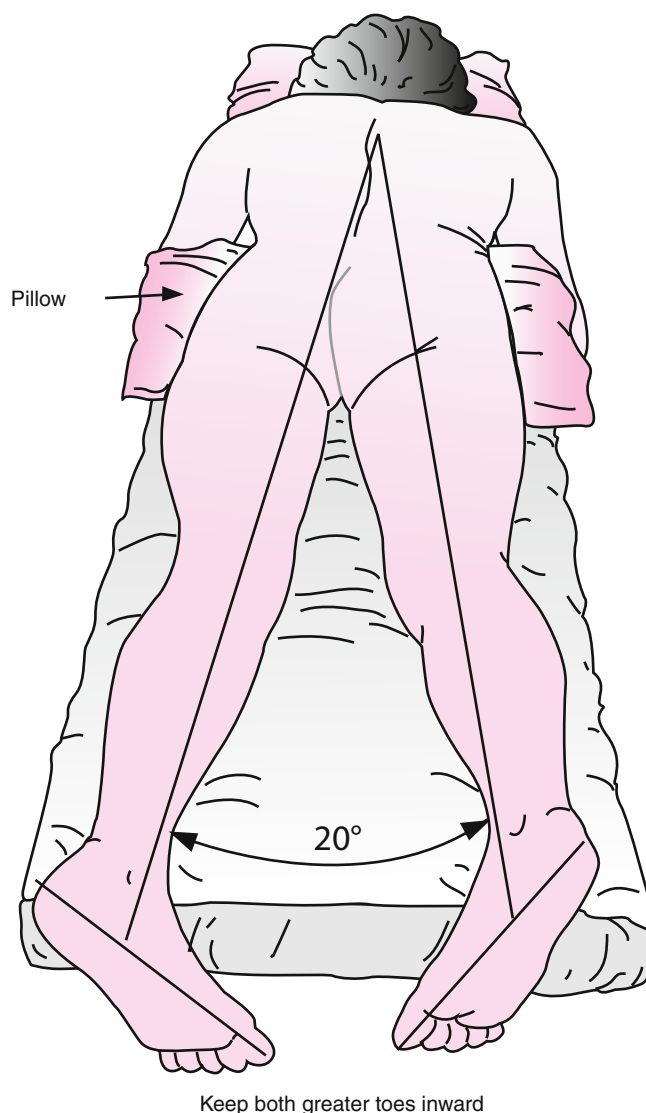
1. Failure rate is high, about 5–10 %.
2. Variable range of anesthesia.
3. Needs about 10 min to take effect.
4. Causes bleeding or intravascular injection in sacral or caudal canal.
5. Sometimes leads to seizure because of the large amount of anesthetics or accidentally intravascular injection.

13.3.1 Position of Patient

With the prone position, a pillow is placed under the abdomen to keep the sacrum flat. Both legs should be spread 20° apart, keeping both greater toes inward (rotating both heels outward) and relaxing both buttocks musculature. This posture is easy to expose the sacral hiatus (Fig. 13.11).

13.3.2 Puncture Site on the Caudal Block: Identification of the Sacral Hiatus

In caudal block, identifying the sacral hiatus is important. The five sacral vertebrae are in the state of fusion, whereas the posterior part of the 5th sacral vertebra, which is sacral hiatus, is opened and covered with sacrococcygeal ligament. The identification of the sacral hiatus is possible by palpating

**Fig. 13.11** Prone position for the caudal block

the sacral cornua located on both sides of the sacral hiatus. The sacral hiatus exists on this area where it forms a triangle with both posterior superior iliac spines as base line. Another technique of identifying is palpating the point 7–8 cm above the tip of the coccyx (Figs. 13.12, 13.13 and 13.14).

Once the sacral hiatus is identified, this area should be disinfected, and local anesthetic infiltration anesthesia should be done. With the bevel of the needle heading upward, caudal block needle should be inserted at the angle of 60° to the sacrum, until it punctures the sacrococcygeal ligament. Then, rotate the needle 180° for the bevel to face downward. Advance the needle until it reaches the bone, and then withdraw slightly. The needle is then redirected so that the angle of insertion relative to the skin surface is decreased.

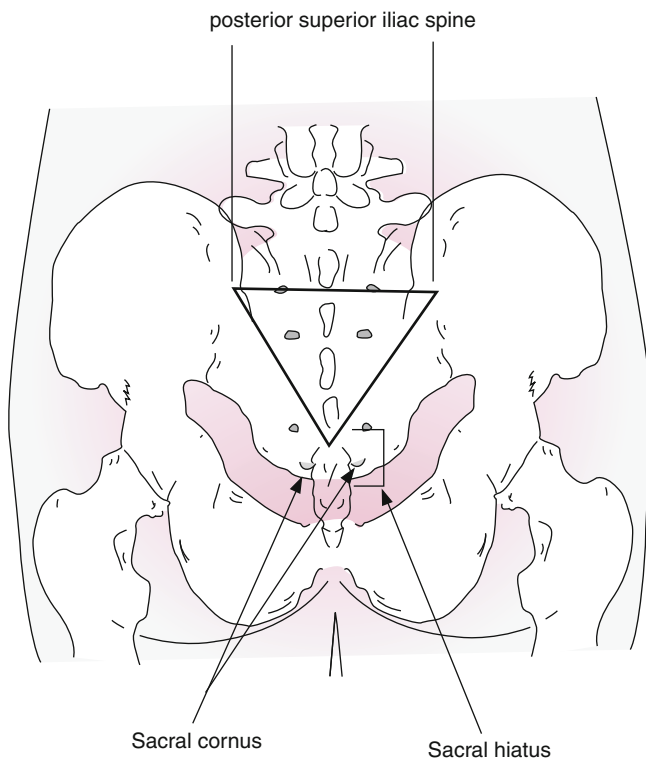


Fig. 13.12 Anatomical structure of the sacrum on caudal block

This angle should almost be parallel to the coronal plane for male; for females, a slightly steeper angle (15°) is needed. During redirection of the needle, the needle is advanced approximately 1–2 cm into the caudal canal once loss of resistance is again encountered. Check for the regurgitation of blood or CSF. Methods of correct caudal block needle placement are injecting 2–3 ml of air or injecting 2–3 ml of saline through the caudal block needle while palpating the skin overlying on the tip of the needle. If no “bulge”

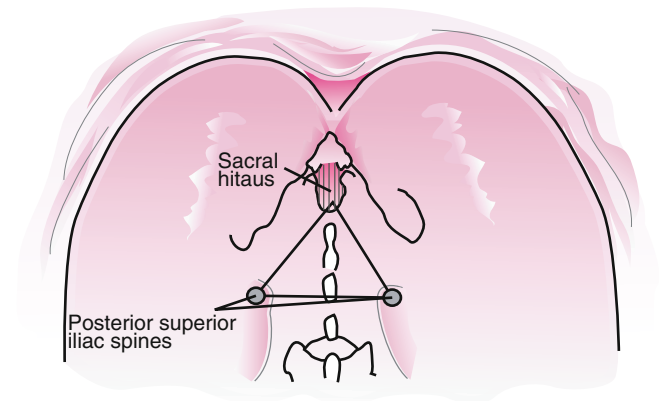


Fig. 13.13 Surface anatomy on caudal block

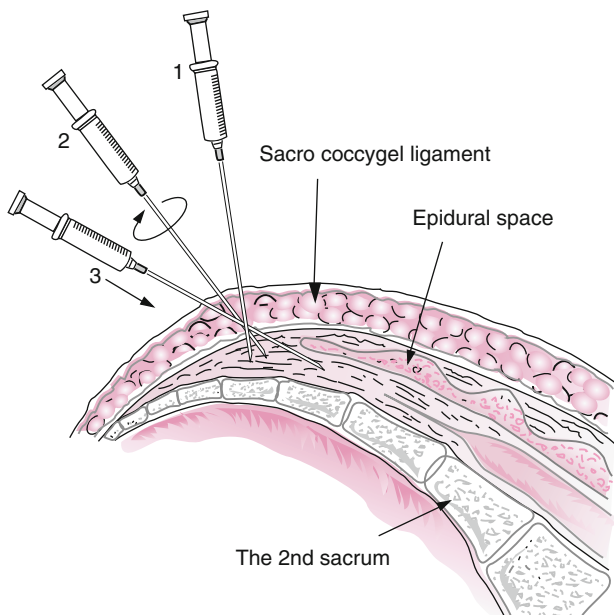


Fig. 13.14 Puncture technique on caudal block

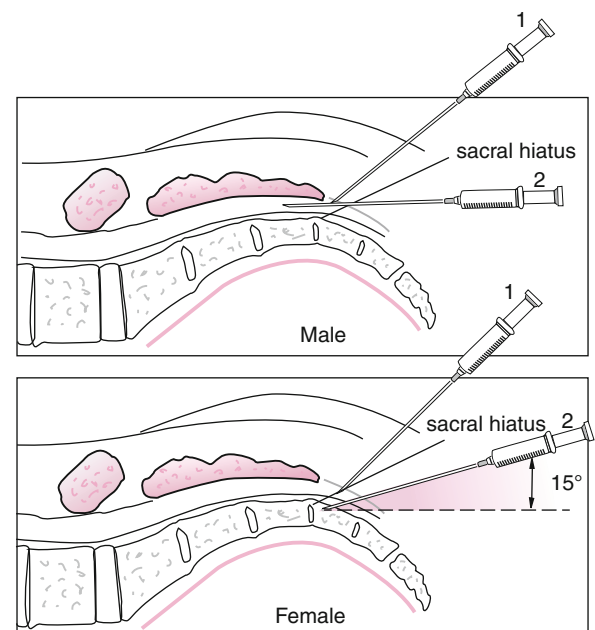
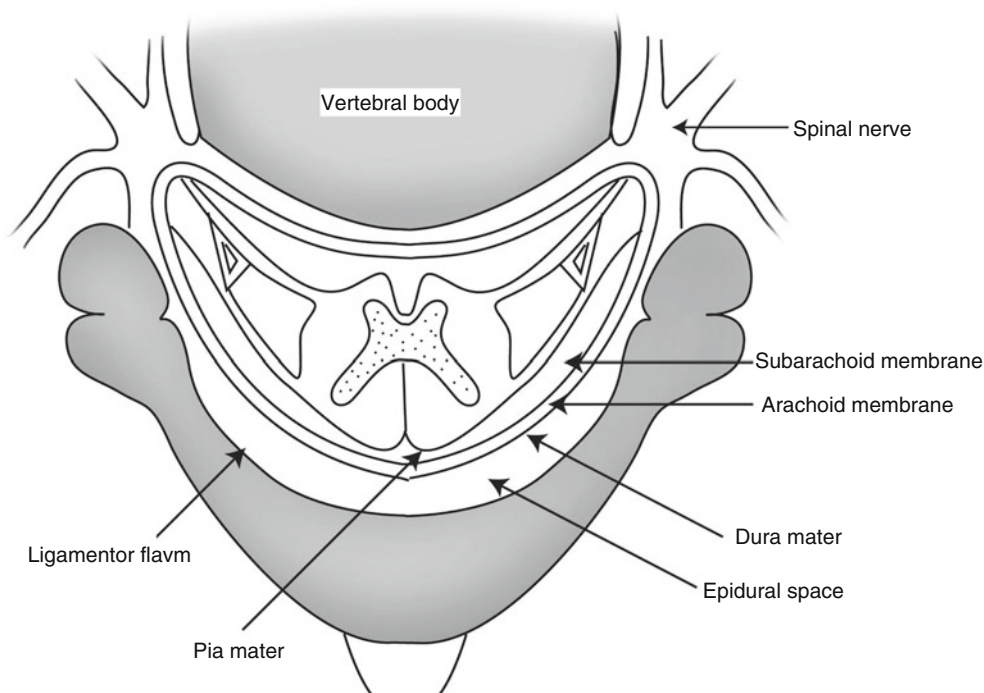


Fig. 13.15 Anatomy of the epidural space (cross section)



or “resistance” is detected, the needle is probably correctly positioned. After ensuring the position of a needle, aspiration and a test dose (5 ml) should be administered (as in lumbar epidural anesthesia) prior to injecting adequate dose of caudal anesthetics, since a vein or subarachnoid space can enter unintentionally.

The failure rate is high for adults because of the deformity of the sacral hiatus (5–15 %). Prediction of anesthetic range is also difficult because the volume of the sacral canal varies (10–27 ml in MRI). Drugs used are 10 cc of 2 % lidocaine or a mixture of 10 cc of 0.25 % bupivacaine and 5 ml of 2 % lidocaine.

13.4 Epidural Anesthesia

It is an anesthetic method to block the anterior and posterior roots of spinal cord by injecting anesthetics into epidural space. The anesthetic effect is slower in the beginning than that of spinal anesthesia, so epidural anesthesia has relatively low risk of sudden decrease of blood pressure. When used with epinephrine-mixed anesthetics, the duration of anesthesia is increased, and the risk of complication is decreased (Fig. 13.15).

The advantage of this method is its maintenance of anesthetic effect through continuous infusion of anesthetics by positioning the catheter at epidural space. It enables the long-time surgery, postoperative pain control, therapeutic nerve block, and painless labor. But the epidural anesthesia requires skillful expert to perform because anesthetic injection can be

Table 13.3 Comparisons of spinal anesthesia with epidural anesthesia

Items		Spinal anesthesia	Epidural anesthesia
Procedure		Easy	Moderate
Range of anesthesia		Predictable	Easy to control
Segmental anesthesia		Hard	Easy
Differential anesthesia		Hard	Easy
Anesthesia	Onset	Fast (within 5 min.)	Slow (10–25 min.)
	Effect	Complete	Sometimes incomplete
	Duration	Long	Relatively short
Volume of anesthetics		Small	Large
Complications	Hypotension	Fast, profound	Late, slight
	Systemic reactions	Rare	Easy to occur
	Headache	Many	Few

made into the vessel of epidural space or subarachnoid space by mistake. The following are the comparisons of spinal and epidural anesthesia (Table 13.3; Fig. 13.16).

13.5 General Anesthesia

General anesthesia is performed for the patients who have fear for surgery. Under general anesthesia, the prone or jackknife position causes problems related to the management of the endotracheal tube and increased frequencies of complications related to anesthesia such as cardiopulmonary

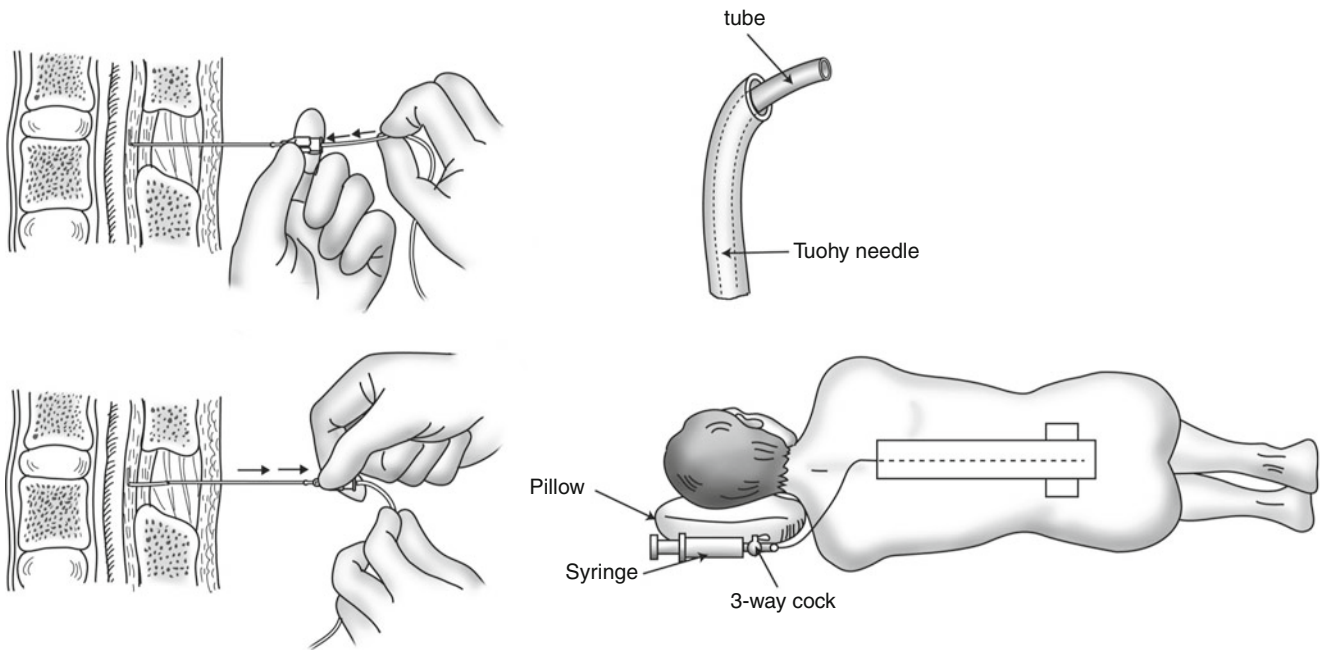


Fig. 13.16 Puncture technique for epidural anesthesia

insufficiency. General anesthesia is the choice of anesthesia for patients who have contraindication for local anesthesia or regional anesthesia, lumbar injury, or the use of anticoagulants, etc.

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Index

A

Abel, 9
Acetaminophen, 97, 104
Adams, J., 17
Albright, 3, 58
Albright method, 58, 60
Allingham, W., 2, 17
ALTA (Ziohn®), 55, 57–59, 68
Alum, 3, 49, 50
Aluminum potassium sulfate and tannic acid (ALTA), 3, 55–59, 68, 73
Anal column of Morgagni, 6
Anal cushions, 10, 15–23, 41–43, 47, 52, 65, 68, 91, 120
Anal dilatation treatment, 61–62
Anal lining (cushion) sliding theory, 15–22, 41, 66
The Anal mucosa and anoderm, 5–6
Anal mucosal wrinkle, 18
Anal pain, 7, 17, 25, 31–33, 58, 105
Anal stenosis, 1, 2, 53, 56, 62, 65, 73, 74, 76, 99, 100, 109–111, 113, 120, 122
Anal stricture, 53, 55, 66, 71, 92, 101, 104, 122
Anal suspensory ligament, 9, 10
An anal intermuscular septum, 8, 9
An intravenous anesthesia with local infiltration, 98
Anoplasty, 43, 110, 111
Anoscopic examination, 32–35, 37, 69
Aragawa's bilobar, 32, 35
The Arteriovenous communication, 15, 17
Ayoub, S.F., 12

B

Bacon's field block, 128
Barron, J., 3, 52–55
Blaisdell, P., 3
Bleeding, 1–3, 17, 25, 27, 28, 30, 32, 36–38, 42–44, 47, 48, 52, 53, 55, 56, 58–62, 65, 68, 70, 92, 93, 97–103, 105–108, 113–116, 119–123, 125, 134
Botox, 104
Bourger, J.M., 17
Bowel movement education, 52
Brodie, 2
Bupivacaine, 70, 102, 104, 121, 122, 125, 127, 130, 136

C

Calman, 3
Caudal block, 98, 125, 134–136
The Causes of hemorrhoids, 22–24
Celsus, 1
Central tendon, 8

Change of bowel habit, 31
Cheselden, W., 2
Chirurgie, 1
Chloral hydrate, 3
Circumferential hemorrhoids, 41, 73, 75, 90, 122
Closed hemorrhoidectomy, 89–90, 102, 105, 108
 Ferguson, 48, 102
Colonoscopic examination, 30, 31, 36–38, 120
Conjoined longitudinal muscle, 5–10, 18, 21, 65
Contraindications, 53–58, 62, 97, 119–120, 137
Cooper, A., 2
Cooper, S., 2
Copeanal, 3
Copeland, 2, 104
Corpus cavernosum recti, 15, 17
Corrugator cutis ani, 8, 9
Courtney, H., 9, 10
Critical pathway, 99, 101, 111–115
Cryosurgery, 48, 59
C-type anoplasty, 110, 111
Cylindrical anoscope, 34–35

D

Dakano's anoderm-preserving hemorrhoidectomy, 85–88
Dakano's method, 60
Deep external sphincter, 7, 10, 12
Defecation
 pain, 101, 102
 test, 69–70
Delayed hemorrhage, 105
Delayed wound healing, 101, 102, 109, 123
Dentate line, 2, 3, 6, 8, 18, 30, 31, 33, 35, 37, 41, 43, 53, 57, 58, 61, 67, 71, 72, 77, 79–81, 85, 90–93, 103, 122, 128
Diagnosis-related group (DRG), 99, 107, 111
Diclofenac sodium, 97
A Dictionary of Practical Surgery, 2
Dietary fiber, 51–52, 104, 107, 108
Dietary treatment-high fibers, 48, 51–52
Digital rectal examination (digital examination), 26, 32–34, 37, 43, 106, 128
Discharge, 27, 28, 31, 36, 45, 59, 62, 77, 97, 98, 100, 104, 106, 107, 113–115, 122
Dittel, 3

E

Early bleeding (primary bleeding), 105, 107, 122
Enema, 25, 36, 43, 97, 98, 100–101, 104, 107, 113–115
Epidural anesthesia, 134, 136–137
Epidural block, 104

Excision and ligation, 1, 2, 6, 7, 48, 65, 66, 70–72, 89, 103
The External anal sphincter, 5, 10–11, 18, 101

F

Fenger, C., 6
Fentanyl, 98, 104, 126
Fiber, 8–12, 16, 18, 23, 24, 48, 51–52, 104, 107, 108, 110, 122, 131, 132
Finger dilatation, 69, 102

G

Galen, 1, 16
Gass, O.C., 17
Gemsenjäger, E., 6, 7, 72
Gjöres, J.E., 17
Goligher, J.C., 9–11, 41, 42, 58, 104
Goodsall, 2
Graham-Stewart's excision of hemorrhoids, 3
GTN ointment, 102, 105

H

Harmonic scalpel, 48, 103
Hartmann, 16
Heister, L., 1
Hemorrhoidal artery ligation (HAL), 61
Hemorrhoids
 in IBD, 123
 in leukemia, 123
 only in one direction, 20
 in portal hypertension, 122–123
 in pregnancy, 122
 stump, 72–75, 81, 87, 97
 surgery with circular stapler (PPH), 67, 93–94
The Hiatal ligament, 13
Hippocrates, 1, 16
The History, 1–4, 27, 30, 37, 97–99, 119, 121, 125, 126
Holl, V., 10
Hot sitz bath, 47, 48, 98, 104, 107
House flap, 110–112
Houston, 3
Hughes, E.S.R., 17, 18, 106
Hunter, J., 2, 16
Hyperactivity of the internal sphincter theory, 15
Hypertrophied anal papillae, 37

I

Iliococcygeus, 11, 12
Incarcerated hemorrhoids, 33, 44, 58, 62, 76, 119, 121–122
The Incidence of hemorrhoids, 4
Indication, 41–45, 53, 56, 62, 93, 97, 103, 106, 125, 127
Infrared coagulation, 43, 48, 60
Instruments of rubber band ligation, 54
Internal sphincter, 3, 5–11, 15, 18, 33, 59, 62, 69, 72, 79, 81, 82, 88–90, 92, 101–105, 109, 110, 122, 123
Internal sphincterotomy, 69, 101–104, 109, 110, 121, 123
Intersphincteric groove, 6
Interview, 25, 30–32, 113, 114
Iron sulphate, 3, 55
Ischiococcygeus, 11, 12

Island flap, 110
Itching sensation, 27, 31, 48

J

Jackson, C.C., 16
Johanson, J.F., 4
John of Arderne, 1

K

Ketorolac, 104
Ketorolac tromethamine, 97, 102
Knee-chest position, 26, 28–29, 36

L

The Lacunar ligament, 13
Lanfrank, 1
Laser, 4, 48, 61
Late bleeding (secondary bleeding, delayed bleeding), 55, 59, 65, 105–107, 113, 122, 123
Lateral internal sphincterotomy (LIS), 69, 102–104, 121, 123
Laxatives, 48, 51, 100–101, 107, 110, 119, 121
Left lateral position (Sims position), 26, 29, 36, 89, 119
Levator ani muscles, 11, 12
The Levator ani tunnel, 12–13
The Levator hiatus, 12, 13
Lift-up, 65–68, 72–75, 93
 submucosal hemorrhoidectomy, 3, 65–79
Ligation, 48, 103
Ligation and excision method, 1, 68–69, 76, 82, 85, 111, 122
 by Sumikoshi Yukio, 82–85
Ligation of internal hemorrhoids, 2
Lithotomy position, 26, 28–29, 125
Local anesthesia, 57, 58, 61, 98, 101, 104, 108, 109, 113, 121, 122, 125–129, 137
 after intravenous anesthesia, 98, 126
 after intravenous anesthetics, 126–127
Longo, A., 3, 4, 67, 93
Dr. Longo's circular stapler (PPH), 3, 67, 93
Lunniss, P.J., 8, 9

M

Magnesium, 3, 51, 52
Magnesium sulfate, 98
Malgaigne, 17
Manual dilatation, 65, 69–70, 103, 104, 121
Manual of day surgery, 28
Manuals for hospitalization, 113, 114
The Mechanism of anal cushion contraction, 21
Metronidazole, 97, 104
 ointment, 105
Micronized purified flavonoid fraction (MPFF), 105
Miles, W.E., 2
Milligan and Morgan's excision and ligation, 2
Milligan, E.T.C., 2, 8–11, 89, 102
Morgagni, 1, 6, 16
Morgan, C.N., 2, 8–11, 89, 102
Morgan, J., 3
Mucocutaneous junction, 6, 80–82
Mucosal prolapse syndrome (MPS), 38, 39
Mummery, L., 2

N

The Nitric acid application, 3
Nivatvongs method of local anesthesia, 129

O

OC-108, 3
Oh, C., 10, 11
Ointment, 25, 32, 33, 48, 49, 102, 105, 115, 121
Open hemorrhoidectomy (Milligan & Morgan), 82, 102

P

Packing, 97, 102–104
Pain, 1, 2, 6, 7, 17, 25, 27, 28, 31–33, 36, 43, 44, 47, 48, 53, 55, 57–59, 61, 66, 69, 70, 91, 93, 97–98, 101–105, 107, 108, 110, 113–115, 121–123, 125–128, 132, 133, 136
Parks, A.G., 3, 8, 12, 17, 18, 48, 65, 71, 79–82, 103
Parks' submucosal hemorrhoidectomy, 65, 79–82
Patey, 17, 18
PEC classification, 42–43
Pectin, 6, 43, 51, 52, 62, 104
The Pelvic floor muscles, 5, 10–12, 21
Petit, J.C., 3, 79
Petit, J.L., 1, 2
Phenol almond oil
 Paoscle®, 58–59
Phenol-almond oil, 3, 68
Phillips, R.K.S., 8, 9
Piles, 1, 32, 53, 61, 65, 67, 69, 76, 83, 85, 90, 91
Posthemorrhoidectomy pain, 101, 102
Postspinal headache, 98
The Posture for examination, 26–29
Pott, P., 2
Preanesthetic questionnaire, 125–126
Pregnancy and delivery, 43, 119
Prolapse, 3–6, 10, 13, 15–18, 20–23, 27, 30–39, 41–44, 47, 52, 53, 55–60, 62, 65–70, 72–74, 76, 77, 79, 81, 82, 85, 87, 88, 91, 93, 97, 103, 119, 120, 122
A prolapse test, 32
Prolapsed hemorrhoids, 5, 6, 20, 21, 30–34, 37, 43, 44, 55, 59, 60, 73, 74, 76–77, 93, 97, 103, 122
Propofol, 98, 126
Pubococcygeus, 11–13, 128
Puborectalis, 10–12
 muscle, 7, 8, 13

Q

Quenu, 16
Questionnaire for anal disease, 27
Quinine, 3, 55, 56

R

Rectal mucosa, 2, 5, 18, 30, 36, 37, 42, 43, 65, 91, 92, 103
 ectropion, 37
Rectal polyp, 31, 37, 53
 and cancer, 38
Rectal prolapse, 6, 10, 21–22, 31, 33, 37–39, 41, 73, 76
Rectocele, 33, 38
The Relationship between hemorrhoids and rectal prolapse, 21–22

Rigid sigmoidoscopy, 35–36
Riverius, 3
Roberson, E., 16
Ropivacaine, 104
Rotation flap, 110, 111
Roux, 8, 9
Rubber band ligation, 3, 31, 35, 44, 47, 48, 52–55, 66–68, 73, 97, 105, 106, 122
Rudinger, 8

S

Saddle block, 98, 128–134
Saint Mark's Hospital, 2, 3
Sakada's field block, 127
Salmon, F., 2
Santorini, 10
Sclerosing method, 3
Second degree hemorrhoids, 97
Shafik, A., 7, 9, 10, 12, 13
Skin tag, 18, 38–39, 41, 43, 44, 62, 71, 75, 85, 97, 103, 105, 107–109, 113, 121
The Sliding anal lining (cushion) theory, 17–22
Smith, 2
Sonnenberg, A., 4
Spasm of the internal anal sphincter, 101–102, 104
Specular anoscope, 33, 35, 36
Spinal anesthesia, 82, 98, 101, 113, 121, 122, 125–134, 136
The 4-Stage method of Ziohn injection, 58
Stapled hemorrhoidopexy (PPH), 48, 67, 93, 103
Staubesand, J., 17
Stool softner, 115
Straining test, 32
Strauss proctoscope, 36
S-type anoplasty, 110
Submucosal hemorrhoidectomy, 2, 48, 65–82, 103, 106, 108, 109, 111, 122
Sucralfate cream, 105
Suppositories, 28, 48, 50, 110
Suspensory sling, 12, 13
Swelling, 1, 58, 102, 105, 108, 109, 122

T

The Theory of internal anal sphincter hypertonia, 17
Third degree hemorrhoids, 31, 97
Thomson, W.H.F., 7, 10, 11, 15–18
Three main cushions, 18
Thrombosed external hemorrhoids, 31, 33, 121, 125
Thrombosed hemorrhoids, 33, 41, 44, 56, 76–78, 108, 109, 113, 121
Thulesius, O., 17
Topical agents, 105
Transitional epithelium, 6, 41
Treitz's muscle, 5–7, 10, 15, 17, 18, 20–22
 preserving hemorrhoidectomy, 6
Trimebutine, 50, 102, 105
Tuberculosis, 120
Two main components of the anal canal, 5

U

Ultroid, 48, 60–61
Urethane, 3

V

Varicose vein theory, 1, 15–17, 66
Vascular hyperplasia theory, 15–17, 41, 66
Velpeau, 17
Venitol®, 105

W

Wet anus, 6
Whitehead's hemorrhoidectomy,
2, 90–93
Wound pain, 101, 102

X

Xiaozhiling®, 56, 58, 60, 68
injection, 60
Xiaozhiling, 3, 57

Y

Yawning, 101

Z

Ziohn, 3, 55–59, 68