Immunizations

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Introductions

- What is immunizations?
- What do you think is the importance of immunization?
- Do you have an experience of vaccinations?

At the end of this sessions you will be able to:

- Define immunizations
- Understand the target diseases of immunizations.
- Explain the delivery strategies of immunizations
- Identify the schedule of immunizations
- Realize the concepts and rates of immunizations
- Describe the principles (care of vaccine/cold chain monitoring)

Learning objectives

Immunizations

- **Immunity:-** is the resistance of the body against a disease producing agent.
- **Immunization:-** The production of immunity by artificial means.

  Or the process of becoming immune.
- **Vaccines: -** is an antigen design to induce immunity against the particular pathogen / production of Abs/.

Target diseases EPI to immunization

- There are 10 vaccine preventable diseases

- tuberculosis - pertusis /whooping cough
- measles - tetanus -Rota virus
- poliomyelitis - hepatitis -B - pneumonia
- diphtheria - heamophillus influenza type B

Schedule of immunizations

Contact	Vaccine	Age of child
• 1st vaccination	Polio-o & BCG	at birth
• 2nd. Vaccination	DPT1-HepB- Hib PCV -1& polio-1 Rota.v1	6wks
• 3rd Vaccination	DPT2-HepB- Hib PCV-2& polio-2, Rota .v2	10 wks.
• 4th vaccination	DPT3-HepB- Hib PCV-3 & polio-3	14 wks.
• 5th vaccination	Measles	9 month

Immunization Delivery strateges .

- **There are "4" types of vaccination delivery strategies.**
  1. **Static site: -** vaccination is given at the health facility.
  2. **Out reach -** the health staffs of the health unit go out & administer vaccine to the mothers & children in their catchments area.

3.Mobile - used in a single doss of vaccination.

- **used to control epidemic / such as meningitis & measles/**

4. Campain - conducted by mobilization of the community. e.g polio-vaccination.

Cont...

EPI strategies

- Increase and sustain high immunization coverage rates
- Increase the quality of immunization services
- Reduce missed vaccination opportunities and trace defaulters

- Improve public awareness and community participation in immunization programmes

- Ensure prompt reporting and improved control of vaccine-preventable diseases.

Types of vaccine

I. Killed vaccine (micro organism) e.g. pertussis

II. Live but weakened-attenuated e.g. measles, BCG, polio.

The organism in these vaccine are weakened so that no harm /no infected/ the child, rather than stimulate the child to produce Ab.

III. Toxoids e,g. Diphtheria & tetanus.

Toxides are harmless substances w/h are made from the toxins (Poisons) of bacteria.

_Target group for EPI.

- All <1 years of children &
- All women of child bearing age (15-49) years.

Acceptable proof for Immunization

- BCG scar
- Immunization card.

Contra indication (C/I)

I. Infants with clinical AIDS should not received BCG vaccination.

II. Do not give DPT to a child has developed convulsions or shock with in the previous does of DPT.

III. The child with diarrhea should be give oral polio vaccine. But this should not be counted.

Dose & route of administration of vaccine

Vaccine	Dose	No of dose	Route	Site	S/E
BCG	<1yr=0.05 >1yr=0.1ml	One	I.D	right upper arm	-Local inflammation or deep abscess.
Polio	2drops	4	Orally	Mouth	-Usually none
Penta PCV	0.5 ml	3	I.M	Anterior-thigh	-Fever -Local swelling -Convulsion
Measle	0.5 ml	One	SC.	left upper arm	-Fever &Rash

Tetanus immunization schedule for women.

Contact	Minimum interval	Duration of protection	S/E (Side effect)
TT1	At the 1st contact during pregnancy or all women child bearing age (15-49)	0	-Pain -Redness -Swelling a few days at the injection.
TT2	At least 4wks after TT1	3 Years	
TT3	A t least 6 month after TT2	5 Years	
TT4	at least 1 year's after TT3	10 Years	
TT5	at least 1 yr after TT4	Life long years	

What damages vaccines?

- **Vaccine can easily damage if not handle properly.**
- **If the vaccine is in good condition, and able to make a child immune is potent.**
- **If vaccine is damaged, and not able to make a child immune, then it has lost its potency.**
- **Vaccine has an expiry date.**

Heat, sun light and freezing

- **Heat and sunlight damage all vaccine, but (live vaccine) most sensitive**
- **Freezing damage DPT and TT vaccine.**
- **Keep all vaccine at the correct cold temp.**
- **If vaccine once damaged, you can't make potent it again.**
- **Chemicals (disinfectant, soap) e.t.c can damage the vaccine.**

Temperature

- The correct temperature to store all vaccine is between +2c⁰ and +8c⁰.(+2c⁰ to +8c⁰)
- Use thermometer in your refrigerator or vaccine carrier to measure the temperature of your vaccine.

Polio-Vaccine

- has clear pink or pale orange liquid.
- Has comes in small bottle with dropper cap.
- Has damaged very quickly by heat than other vaccines.
- Does not damage by freezing.

Measle vaccine

- It is freeze dried.
- To use the vaccine, mix the dry vaccine with diluent's water.
- This is called reconstituting the vaccine.
- is easily damaged by heat.
- Reconstituted vaccine losses its potency very quickly, you must use it in same immunization session, or throw it out.

BCG-Vaccine.

B=Bacillus C= Calmette G=Guerin:

- **has come as dry powder in container**
- **is damaged most easily by sun light.**
- **Damage by heat but not as quick as (polio and measles)**

DPT-HepB + Hib and TT Vaccine

- **Has contains "5" vaccine.**
- **Damaged by heat but not as quickly as the live vaccine.**
  - **Are liquid vaccine**

Summery

Precaution for vaccines

a. **All vaccine to be stored at +2c^0 to 8c^0.**

b. Vaccine storage time at health center is up to 1 month.

c. measles & polio be kept frozen.

d. Never freeze DPT or tetanus vaccine.

E. Keep diluents in refrigerator.

Or diluents must never be frozen.

Cold chain

is an equipment that ensure vaccine potency by keeping vaccine cold from the manufacturer to the mother /child?

Equipment for cold chain includes:

-Thermo-meter
-Refrigerator
-Vaccine carriers
-Cold boxes
-Ice packs

- Check the temperature twice daily at the morning & evening.
- Manufacturer →national airport → central vaccine stores → regional store → zonal stores → district - health center → health post or child & mother.

COLD CHAIN con,t...

Cold box:

- A cold box is an insulated container that can be lined with ice-packs to keep vaccines cold during transportation (from two to seven days).
- Cold boxes are used to collect and transport monthly vaccine supplies from district stores to the health facility.
- They are also used to store vaccines when the refrigerator is out of order or being defrosted and for outreach and mobile sessions.

Vaccine carriers

- **Similar definition Like cold boxes.**
- **They are smaller than cold boxes and are easier to carry if walking.**
- **But they do not stay cold as long as a cold box – maximum for 48 hours with the lid closed.**
- **Vaccine carriers are used to transport vaccines and diluents to outreach sites immunization sessions.**

- **Vaccine carriers are also used to store vaccines when the refrigerator is out of order or is being defrosted.**

COLD CHAIN con,t...

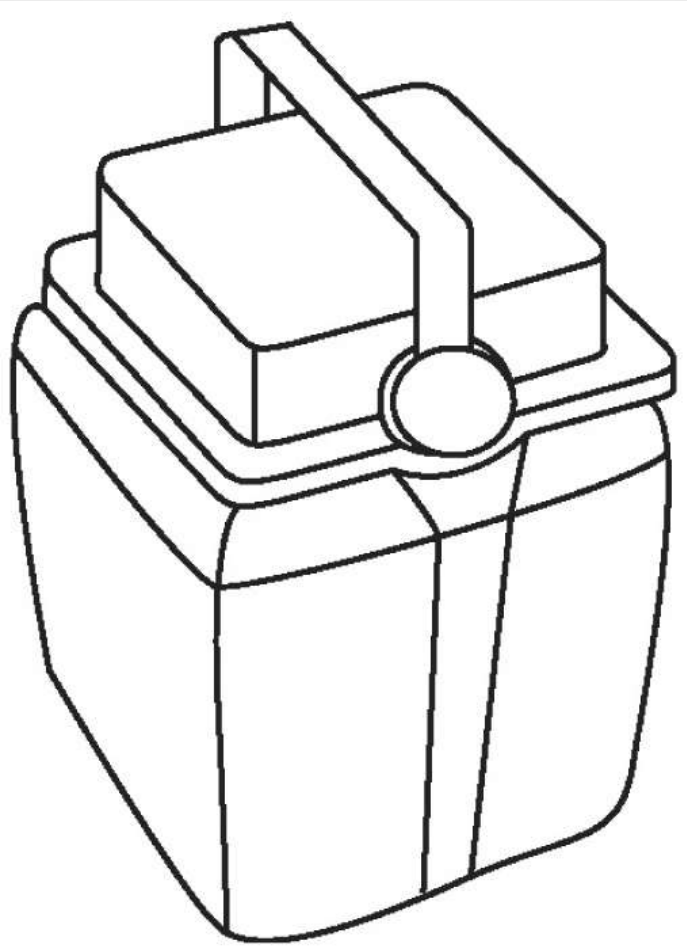


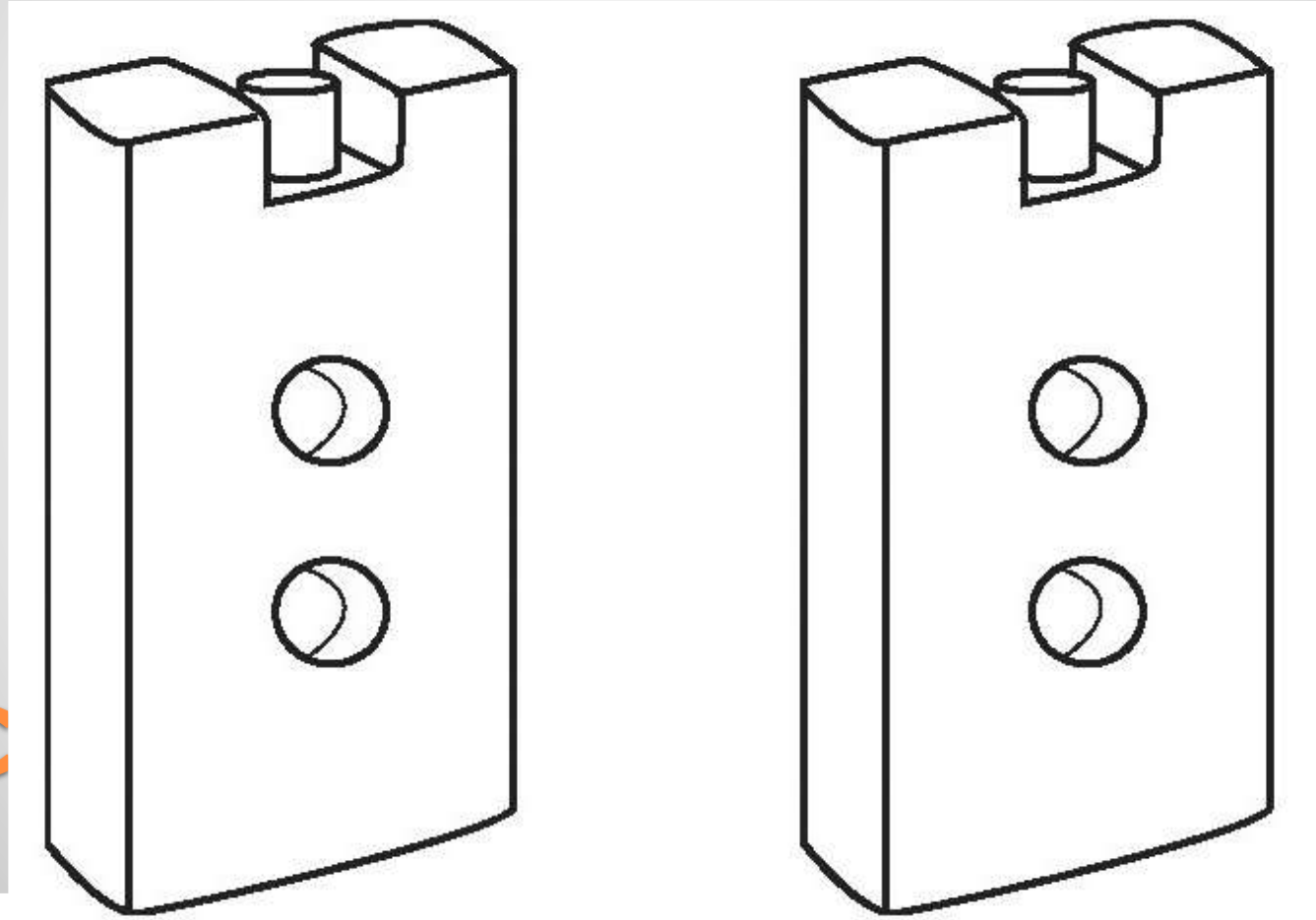
Figure-B: Vaccin

COLD CHAIN con,t...

Ice-packs

- Ice-packs are flat, square plastic bottles that are filled with water and frozen.
- Ice-packs are used to keep vaccines cool inside the vaccine carrier or cold box.
- The number of icepacks required for a cold box or vaccine carrier varies.

Figure-C



Cold chain monitoring equipment

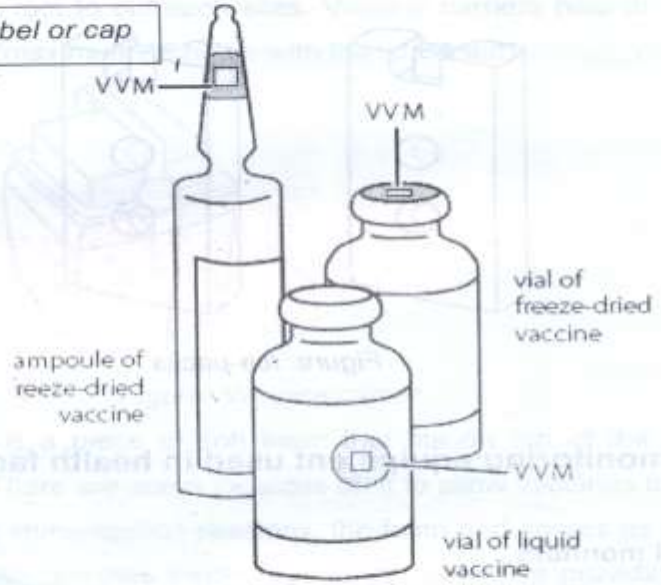
- vaccine vial monitors (vvm)
- thermometer
- the shake test etc.

vaccine vial monitors (vvm) test

- A vaccine vial monitor (VVM) is a label that changes color when the vaccine vial has been exposed to heat over a period of time.

vaccin

Figure: VVM on vial label or cap



Inner square lighter than outer circle.
If the expiry date has not been passed, USE the vaccine.

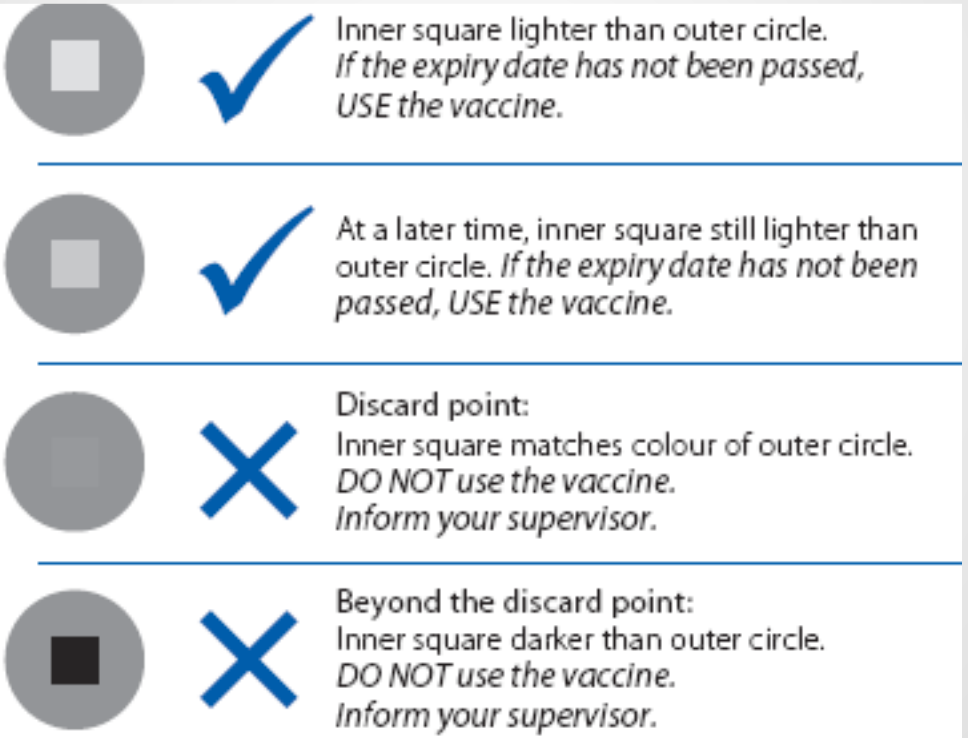
At a later time, inner square still lighter than outer circle. *If the expiry date has not beer passed, USE the vaccine.*

Discard point:
Inner square matches colour of outer circle.
DO NOT use the vaccine.
Inform your supervisor.

Beyond the discard point:
Inner square darker than outer circle.
DO NOT use the vaccine.
Inform your supervisor.

Figure: How to red a vaccine monitor(VVM)

VVL con't...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Inner square darker than outer circle.
DO NOT use the vaccine.
Inform your supervisor.

shake test

To find out if freezing has damaged DPT or TT vaccine, look for the following conditions after shaking it.

Cold chain monitoring equipment Cont…

Cont…

Time of observation:	Not frozen vaccine	A suspected frozen vaccine.
Immediately after shaking	-Smooth and cloudy for inspection	-Not smooth (granular particles are seen)
30 minutes after shaking	-Start to clear. -Not sediment.	-Thick sediment. - Don’t use it

- **N.B - Don't take out the vaccines from the refrigerator until the vaccine carrier is ready.**
- **Don't let DPT & TT vaccines touch the ice /cover them with news paper./**

Cont...

Task done at immunization session

- Arranging the flow of mothers & children
- registering
- weighting
- health education on immunization
- screening clients
- treating clients
- immunization

Vaccine supply period

Examples…

- **Central cold store…… 6 months**
- **Regional cold store…. 3 months**
- **District cold store……. 1 month**
- **Health center……. 1 month**
- **Health post…….. 1 week**

Looking vaccine at H.C refrigerator.

1.Load and use the refrigerator correctly.

a. In the main compartment store vaccine

-OPV & measles at the top shelf.

-BCG-At the middle comportment.

-Diluents, DPT & TT at the lower compartment

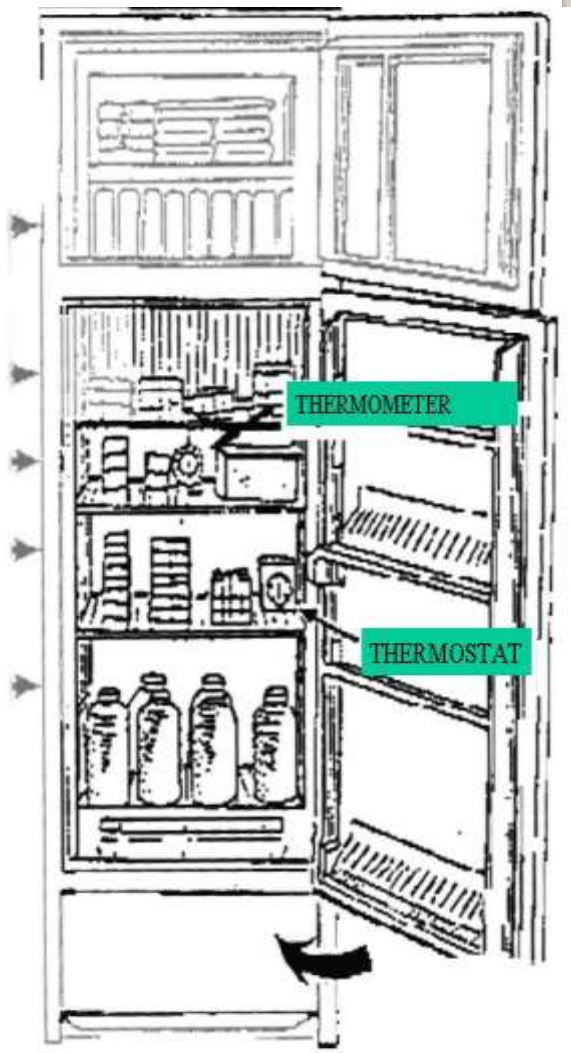
-Bottle of water at 4th comportment if the refrigerator consists 4 comportment.

-The freezing compartment "freezer" used to make ice packs, hence it's Tc^0 should be $<0c^0$.

Arranging Vaccine in the CC

Vertical refrigerators:

- Top: Ice packs
- Shelf 1: Live viral vaccines (OPV, Measles)
- Shelf 2: BCG, returned vials of other antigens
- Shelf 3: Penta, TT on lowest shelf away from freezer space
- Bottom: Water bottles
- Diluents: next to its vaccine or clearly marked



- All the vaccines should be stored in the basket provided with the refrigerator

1. Measles, BCG and OPV in the bottom only; and

2. Freeze-sensitive vaccines (DTP, TT, hepB, DTP-hepB, Hib, DTP-hepB+Hib,

Meningococcal and yellow fever, vaccines) in the top only.

Loading top-opening (chest) refrigerators

Calculation of target population & EPI coverage

- Target population /children under one years old/:
- Their proportion depends on the available recent demographic data of the area e.g. if it is k %
- yearly target children = total population X k/100
- monthly target children = yearly target children / 12

- **Immunization coverage with specific vaccine. e.g.DPT1**

-Monthly coverage =No of children who received

$$\frac{\text{DPT1 the specific month}}{\text{target popun for the month}} \times 100$$

-Annual coverage = No of children who received

$$\frac{\text{DPT3 in the specific year}}{\text{target popun for the year}} \times 100$$

Immunization problems & solution

Dropout: – a child or women who failed to return for subsequent doses of vaccine Possible cause of dropout.

1. **Unsure date of return.**
2. **Long wait at the vaccination center.**
3. **Failure to explain the need of completing vaccination.**
4. **Negative attitude of H.W to words the program.**
5. **Mother usually busy. e.t.c.**

6. **Missed opportunities**
7. **Culture beliefs.**
8. **Lack of accessibility (distance, cost of transportation) e.t.c**
9. **Lack of inter-sector collaboration.**
10. **The problem associated with the vaccine.**
 e.g. BCG :efficacy is uncertain .
11. **In effective management.**

Possible cause of dropout Cont...

Drop out rate calculation.

Over all drop out rate

= coverage with BCG - coverage with measles* 100
Coverage with BCG

or

$$\text{DROP OUT RATE} = \frac{\text{DTP1} - \text{DTP3}}{\text{DTP1}} \times 100$$

- **Drop out rate for single antigen e.g. (opv).**
  =Coverage with opv1- coverage with opv3* 100
  Coverage with opv1

- There is a **problem when ever the drop out rate is > 10%.** It is essential to determine why the failure occurred.

Drop out rate calculation con't...

Missed opportunities

- **All children & mothers at health facility for any reason should be screened for immunization status & vaccinated if eligible. If not vaccinated these eligible called Missed opportunities.**

Common cause

- **Lack of Acceptability**
- **Health worker (H.W) screen but tell pt,s to return later.**
- **H.W only open avail if there are enough client.**
- **logistical problem**

- * Drop out & missed opportunities are the major cause of low vaccination coverage.

Potential solution

-Social mobilization

-Drop out tracing mechanisms.

-Get commitment by the local leaders.

-Monitoring & supervision the program.

- In service training to community H.w.

-Ensure financial & logistic support for the health institutions.

Thank you

Chapter –six

Systemic disorders

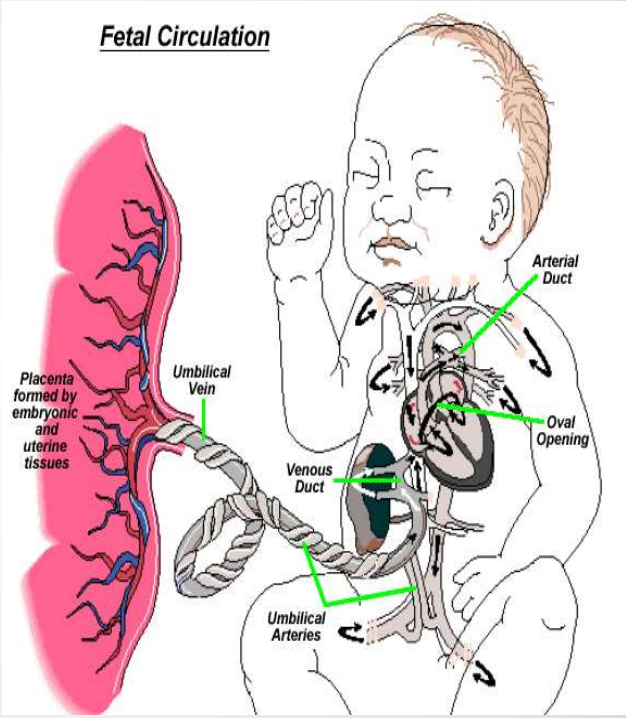
CARDIO VASCULAR DISEASE (CVS)

LEARNING OBJECTIVES: At the end of this topic the students will be able to:

- **Explain the physiological change of CVS in newborn**
- **Describe congenital heart disease**
- **Discuss common CHD**
- **Explain the common acquired heart diseases**
- **Discuss the mechanism, c/m and management of heart failure**

PHYSIOLOGY OVERVIEW

- Right-to-left shunting at atrial level (PFO) and at arterial level (ductus arteriosus)
- High pulmonary vascular resistance
- Little pulmonary blood flow
- Ventricles work in parallel



A. CONGENITAL HEART DISEASE (CHD)

- Globally, CHD affects over one million live births annually and is the leading cause of infant mortality attributable to birth defects.
- Critical congenital heart disease (CCHD) refers to lesions of the cardiovascular system, present at birth, which if left undiagnosed it will result in infant morbidity and mortality.
- Gross structural abnormality of the heart or great vessels that is actually or potentially of functional significance

CAUSE

- **Mostly unknown**
- **Multifactorial: Genetic-environmental interaction**

– Genetic/chromosomal

– Environmental: CMV, maternal hypoxia, hyperthermia, DM (10 ´ risk), drugs: like, phenytoin and other anticonvulsants, alcohol, thalidomide

ANATOMIC CLASSIFICATION

RIGHT TO LEFT SHUNT

- TOF
- TGA(transpositions of great artery
- Tricuspid Atresia

LEFT TO RIGHT SHUNT

- ASD
- VSD
- PDA

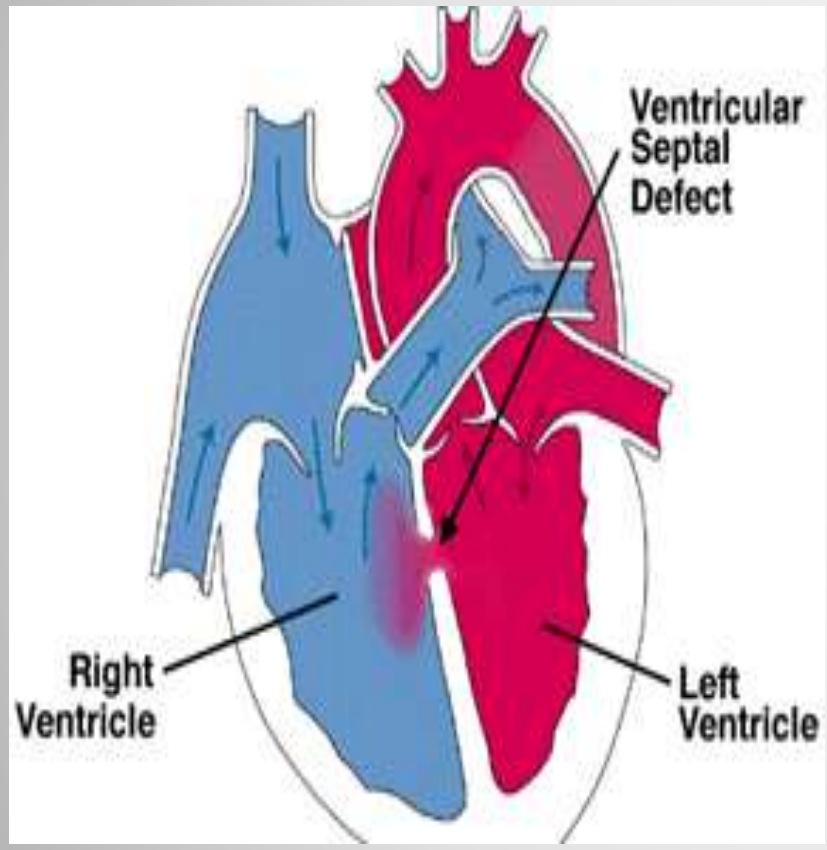
STENOTIC

- AVS
- PVS
- Aortic coarctation

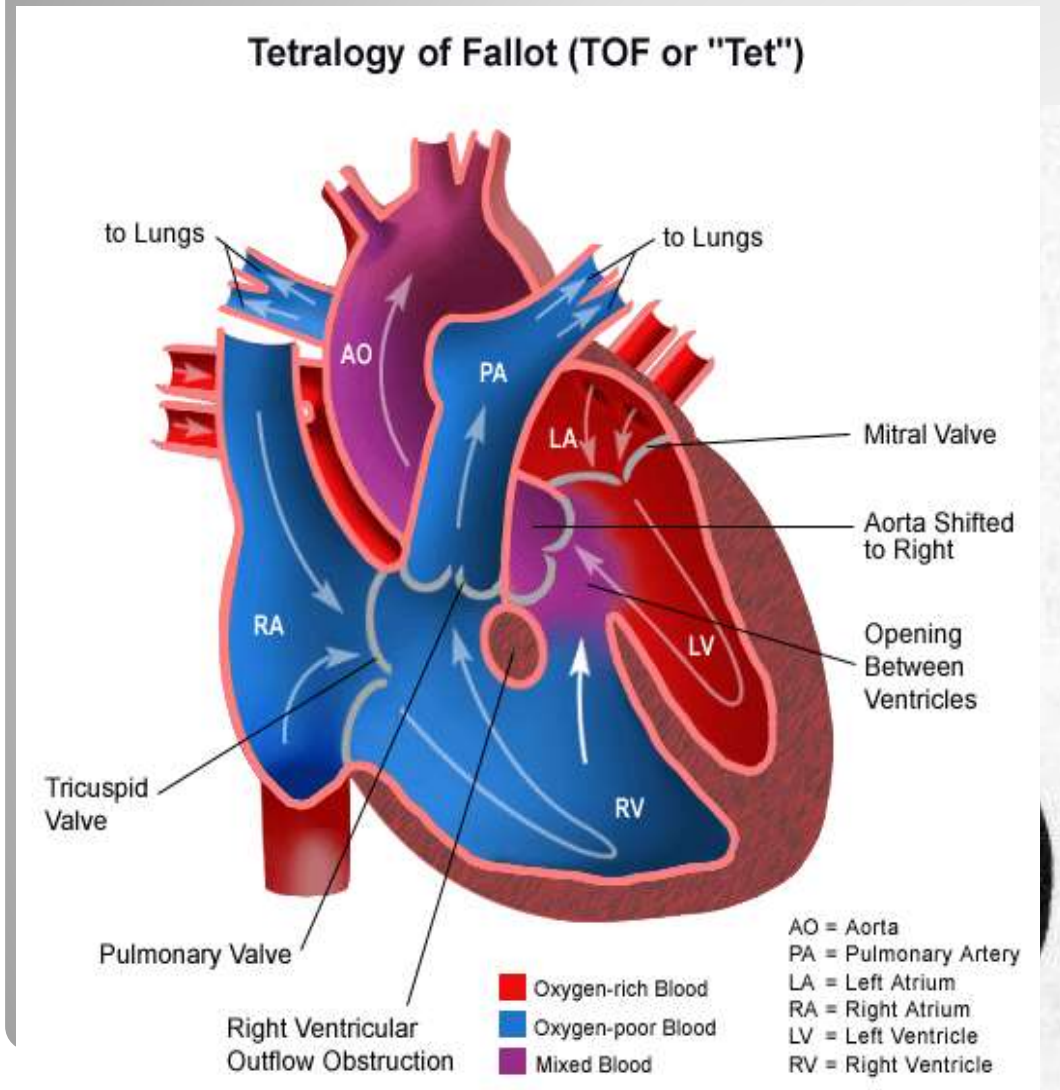
MIXING

- Total Anomalous Pulmonary Venous Return
- Hypoplastic left heart syndrome

VSD



- Most common congenital lesion
- Large VSD's may be silent and become symptomatic in first few weeks as pulmonary resistance ↓
- SOB and diaphoresis w feeds
- Poor weight gain
- Systolic murmur
- CXR demonstrates CHF



- RV outflow obstruction
- RVH
- VSD
- overriding aorta
- CXR reveals boot shaped heart with decreased pulmonary blood flow

Children with Tetralogy of Fallot exhibit bluish skin during episodes of crying or feeding.

TOF

Hypoxemic spells, also called cyanotic or Tet spells, are one of the hallmarks of severe ToF and are characterized by:

- Sudden onset of cyanosis or deepening of cyanosis
- Sudden dyspnea
- Alterations in consciousness, in a spectrum from irritability to syncope
- Decrease or disappearance of the systolic murmur.
- These episodes most commonly start at age 4–6 months

Evaluation for suspected congenital heart disease

- At birth, Nada's criteria are used to evaluate a newborn and the presence of one Major or two Minor Criteria indicates Presence of Congenital Heart Disease.

Nada's Major Criteria

- Systolic murmur with thrill
- Any diastolic murmur
- Cyanosis (central)
- Congestive cardiac failure

Evaluation cont'd

Nada's Minor Criteria

- Systolic murmur without thrill
- Abnormal P2 (accentuated P2)
- Abnormal BP (hypo / hypertension)
- Abnormal CXR
- Abnormal ECG
- If the Nada's criteria are positive then, send the baby where he can be definitely diagnose with echocardiography and evaluated further.
- All babies suspected to have CHD should be managed with cautions in IV fluid administration to avoid congestion.

Clinical evaluation

- History
  - feeding difficulties
  - tachypnea
  - diaphoresis
  - syncope
  - cyanotic episodes
  - failure to thrive
- Physical Examination
  - color: pink, blue, gray
  - vitals: tachypnea, tachycardia, BP
  - symptoms suggestive of infection
  - palpation and auscultation of precordium
  - chest auscultation
  - survey for organomegaly
  - pulses in all extremities

Major components of Evaluation

1. Presence or absence of cyanosis, which can be determined by **physical examination** aided by pulse oximetery.
   - Heart sounds - the presence and character of any murmurs.
2. **Chest radiograph-** Less informative but helps to see the heart size
   and shows evidence of increased, normal, or decreased pulmonary vascular markings
3. **Electrocardiogram –** To look for the rate, rhythm and chamber hypertrophy and axis. can be used to determine whether right, left, or biventricular hypertrophy exists.
4. **Echocardiography**
   - It's a definitive diagnostic method to evaluate the heart

Time of onset of congestive heart failure

Age	Lesions
Birth - 72 hrs	Pulmonary, Mitral, and Aortic atresia or critical stenosis
4 days - 01 week	Hypoplastic Lt and Rt heart, Transposition of great arteries
1wk - 4wks	VSD and PDA in premature infant and the lesions mentioned above
4 – 6 wks	Endocardic cushion defect (ECD)
6wk – 6 mo	Large VSD, large PDA

MANAGEMENT

- Strict cardio respiratory support and monitoring
- Supportive oxygen therapy
- Restrict fluid intake to one half to two third of daily maintenance.
- Treat or correct precipitating factors
- Treat metabolic derangements (hypoglycemia, hypothermia)
- After stabilization of the patient refer to a higher center for proper diagnosis and management.

I. RHEUMATIC HEART DISEASE (RHD)

Rheumatic fever (ARF) :- is an inflammatory disease affecting the heart , joint & subcutaneous tissue.

- ARF remains an important preventable cause of cardiac disease
- **Usually follow 2-6 wks after hemolytic streptococcal respiratory infection.**
- A family history of rheumatic fever and lower socioeconomic status are additional factors.

B. ACQUIRED HEART DISEASE

Jones Criteria for Diagnosis of Rheumatic Fever.

Major manifestation

- **Carditis**
- **Polyarthritis**
- **Chorea**
- **Subcutaneous nodules**
- Erythema marginatum

-N.B Two major or one major and two minor manifestations (plus supporting evidence of streptococcal infection) are needed

Minor manifestation

- Fever

- Arthralgia

- ↑ ESR

- ↑ WBC

- Anemia

- ECG abnormal

-*Clinical* Previous rheumatic fever or rheumatic heart disease

MANAGEMENT

- All patients with acute rheumatic fever should be placed on **bed rest and monitored closely for evidence of carditis**.
- They can be allowed to ambulate as soon as the signs of acute inflammation have subsided..

❖ **ANTIBIOTIC THERAPY**

- The patient should receive 10 days of orally administered penicillin or erythromycin, or a single intramuscular injection of benzathine penicillin to eradicate GAS from the upper respiratory tract.
- After this initial course of antibiotic therapy, the patient should be started on long-term antibiotic prophylaxis.

Mgt cont…

- **Anti-Inflammatory Therapy.**
- Aspirin is 100 mg/kg/day in 4 divided doses PO for 3–5 days, followed by 75 mg/kg/day in 4 divided doses PO for 4 wk.
- Prednisone is 2 mg/kg/day in 4 divided doses for 2–3 wk followed by a tapering of the dose that reduces the dose by 5 mg/24 hr every 2–3 days
- In the case of Sydenham Chorea Sedatives may be helpful early in the course of chorea;
- phenobarbital (16–32 mg every 6–8 hr PO) is the drug of choice.
- If phenobarbital is ineffective, then haloperidol (0.01–0.03 mg/kg/24 hr divided bid PO) or chlorpromazine (0.5 mg/kg every 4–6 hr PO) should be initiated

RHEUMATIC HEART DISEASE (RHD)

- **RHD is damage of the heart, particularly the valves by one or more attacks of RF.**
- **Pattern of valvular disease**
- Mitral stenosis
- Aortic insufficiency
- Tricuspid valve disease
- Pulmonary valve disease

HEART FAILURE

- HF is defined as the heart fail to pump sufficient amount of blood to supply blood to either systemic or pulmonary circulation at an appropriate rate of flow, or to receive venous return at an appropriate filling pressure

Four Basic Mechanisms

1. Increased Blood Volume (Excessive Preload)

Etiology

- Mitral Regurgitation
- Aortic Regurgitation
- Volume Overload
- Left to Right Shunts
- Chronic Kidney Disease

PATHOPHYSIOLOGY

Pathophysiology cont'd

2. Increased Resistant to Blood Flow (Excessive Afterload)

Etiology

- Aortic Stenosis
- Aortic Coarctation
- Hypertension

Pathophysiology cont'd

3. Decreased contractility

Etiology

- Ischemic Cardiomyopathy like, Myocardial Infarction, Myocardial Ischemia
- Myocarditis
- Toxins eg. Anthracycline, Alcohol, Cocaine

Pathophysiology cont'd

4. **Decreased Filling**

Etiology

- Mitral Stenosis
- Constriction
- Hypertrophic
- Cardiomyopathy

Clinical Features

- Fast breathing or interruption of feeding wit diaphoresis
- Tachycardia (heart rate >160/minute in a child under 12 months old; >120/minute in a child aged 12 months to 5 years).
- laboured respirations with intercostal and subcostal retractions
- Nasal flaring
- Feeding difficulties
- Failure to thrive
- weak cry

- Effort intolerance
- oedema of the feet, hands or face, or raised JVP
- Basal crackles on chest exam
- Gallop rhythm on auscultation with or without murmurs.
- Enlarged, tender liver
- If the diagnosis is in doubt, a chest X-ray can be taken and will show an enlarged heart

ROSS HEART FAILURE CLASSIFICATION FOR CHILDREN for dx purpose.

Class I

- Asymptomatic

Class II

- Mild tachypnea or diaphoresis with feeding in infants
- Dyspnea on exertion in older children

Class III

- Marked tachypnea or diaphoresis with feeding in infants
- Marked dyspnea on exertion
- Prolonged feeding times with growth failure

Class IV

- Symptoms such as tachypnea, retractions, grunting, or diaphoresis at rest

Diagnosis Modalities

- History taking
- Physical examination
  - ✓ Vital sign
  - ✓ Growth appearance
  - ✓ General appearance
  - ✓ cardio vascular exam
  - ✓ pericardial exam

Cont…

- Laboratory investigations
  - ✓ chest x-ray
  - ✓ electrocardiogram
  - ✓ urine test
  - ✓ blood test
  - ✓ echocardiogram

MANAGEMENT

- The underlying cause must be removed or alleviated if possible.
- Medical treatment is indicated to prepare the patient for surgery and in the immediate postoperative period.
- If the lesion is not reversible, heart failure management usually allows the child to return to normal activities

General measure

- **Strict bed rest** is rarely necessary except in extreme cases, but it is important that the child be allowed to rest during the day as needed and sleep adequately at night.
- **DIET**
- **Infants with heart failure may fail to thrive because of increased metabolic requirements and decreased caloric intake.**
- **Increasing daily calories is an important aspect of their management.**
- **In some circumstances, nasogastric feedings may be helpful .**
- **In many children with cardiac enlargement, gastroesophageal reflux is a major problem.**

Pharmacological Mgt

DIURETICS

- Most often used in conjunction with digitalis therapy in patients with severe congestive heart failure.
- Give furosemide (frusemide): a dose of 1 mg/kg should cause increased urine flow within 2 hours.
- If the initial dose is not effective, give 2 mg/kg and repeat in 12 hours, if necessary. Thereafter, a single daily dose of 1–2 mg/kg orally is usually sufficient.
- Supplemental potassium: when digoxin and furosemide are given, or if frusemide is given for more than 5 days, give oral potassium (3–5mmol/kg/day).

Pharmacological Mgt

- **Digitalis**

- **Digoxin is the digitalis glycoside used most often in pediatric patients.**

-↑ the force of myocardial

Contraction ⇒ ↑Co

- Diuretic effect (↓ edema)

- **Afterload-Reducing Agents and ACE Inhibitors (e.g catoproil)**
- **β-Blockers (e.g Metoprolol)**

Management cont'd

- **Oxygen:** Give oxygen if the child has a respiratory rate of ≥ 70/min, shows signs of respiratory distress, or has central cyanosis

SUPPORTIVE CARE

- Avoid the use of IV fluids, where possible.
- Support the child in a semi-seated position with head and shoulders

elevated and lower limbs dependent.

- Relieve any fever with paracetamol to reduce the cardiac workload.
- Avoid unnecessary movement and transportation

Prognosis

The outcome for patients experiencing HF depends largely on its cause.

- When noncardiac disorders are responsible, the improvement in HF is related to successful treatment of the systemic disease.
- For many cardiac malformations (preloading and afterloading conditions), surgical correction can be curative

DISORDER OF RESPIRATORY TRACT

Learning objectives

At the end of this topic the student will able to:

- Discuss the respiratory pathophysiology and regulation
- Analyze **Child presenting with an airway or severe breathing problem**
- Manage the selective respiratory disorders of childhood

Respiratory Pathophysiology and Regulation

- The age- and growth-dependent changes in **physiology and anatomy of the respiratory control mechanism, airway dynamics, and lung parenchymal characteristics** have a profound influence on the pathophysiologic manifestations of the disease process.

ACUTE pharyngo-tonsillitis

- Frequent upper airway infections in children and teenagers.
- Uncommon before 2-3 years old
- Peak incidence: 4-7 years old

ETIOLOGY

- usually viral, most often caused by the common cold viruses (adenovirus, rhinovirus, influenza, coronavirus, and respiratory syncytial virus), but occasionally by Epstein-Barr virus, herpes simplex virus, cytomegalovirus, or HIV.

Etiology

- In about 30% of patients, the cause is bacterial. Group A β-hemolytic streptococcus (GABHS) is most common but Staphylococcus aureus, Streptococcus pneumoniae, Mycoplasma pneumoniae, and Chlamydia pneumoniae are sometimes involved.
- GABHS occurs most commonly between ages 5 and 15 and is uncommon before age 3.
- Rare causes include pertussis, Fusobacterium, diphtheria, syphilis, and gonorrhea.

Clinical Feature

- Pain with swallowing is the hallmark and is often referred to the ears.
- Very young children who are not able to complain of sore throat often refuse to eat.
- High fever, malaise, headache, and GI upset are common, as are halitosis and a muffled voice.
- The tonsils are swollen and red and often have purulent exudates.
- Tender cervical lymphadenopathy may be present.

CHRONIC INFECTION

The tonsils and adenoid can be chronically infected by multiple microbes

Children with chronic or cryptic tonsillitis

- frequently present with halitosis
- chronic sore throats
- foreign body sensation
- or a history of expelling foul-tasting and smelling cheesy lumps.

Suppurative

- Peritonsillar abscess
- Retropharyngeal abscess
- Otitis media
- Sinusitis

Non-suppurative

- Acute rheumatic fever
- Acute glomeriolonephritis

MANAGEMENT

- Most untreated episodes of streptococcal pharyngotonsilitis resolve uneventfully in a few days, but early antibiotic therapy hastens clinical recovery by 12–24 hr.
- The primary benefit of treatment is the prevention of acute rheumatic fever, which is almost completely successful if antibiotic treatment is instituted within 9 days of illness

Mgt

-A variety of antimicrobial agents are effective.

-GABHS remains universally susceptible to penicillin, which has a narrow spectrum and few adverse effects.

- Benzanthine Penicillin 600,000 IU IM stat for children <27 kgs of weight and 1.2 million IU IM stat for children >27kgs of weight

  OR

- Amoxicillin 20- 40mg/Kg/ d po in three divided doses for 10 days
- For patients allergic to penicillin , Erythromycin 4o mg/kg/d in four divided doses for 10 days
- Follow up in two days if no improvement

CROUP (LARYNGOTRACHEOBRONCHITIS)

- The term croup refers to a heterogeneous group of mainly acute and infectious processes that are characterized by a bark-like or brassy cough and may be associated with hoarseness, inspiratory stridor, and respiratory distress resulting from upper airway obstruction.
- Usually have sudden onset
- The term is given mainly for viral origin

Etiology

- Viral
  - Para-influenza viruses (75% of cases).
  - influenza A and B, Measles, adenovirus & RSV
- Bacterial
  - Myco-plasma Pneumonia
- Allergy
  - Spasmodic croup

Clinical manifestation

Prior to obstruction

- upper respiratory tract infection with rhinorrhea
- pharyngitis
- mild cough
- low grade fever

After obstruction

- barking cough
- hoarseness
- inspiratory stridor
- fever
- coryza
- inflamed phary
- Tachypena

The modified Westley clinical scoring system for croup

- **Inspiratory stridor**:

  -Not present - 0

  -When agitated/active - 1

  - At rest - 2 points.

- **Intercostal recession**:
  - Mild - 1 point.
  - Moderate - 2 points.
  - Severe - 3 points.
- **Air entry**:
  - Normal - 0
  - Mildly decreased - 1
  - Severely decreased - 2 points

- **Cyanosis**:
  - None - 0 .
  - With agitation/activity - 4 points.
  - At rest - 5 points.
- **Level of consciousness**:
  - Normal - 0 point.
  - Altered - 5 points

<4 = mild croup,
4-6 = moderate croup
>6 =severe croup

Management

- Nebulized epinephrine
  - O.5mg/kg 1:1000 dilution inhaled over 15-20 minute PRN
- Corticosteroids
  - dexamethasone used a *single dose of 0.15- 0.6 mg/kg* IM/IV/Oral stat
- Antibiotic
  - Incase of bacterial croup

Management

In child with severe croup who is deteriorating, consider **Intubation and tracheotomy**

- Don’t disturb the child
- If the child has fever (≥ 39 ° C or ≥ 102.2 ° F) give paracetamol.
- Encourage breastfeeding and oral fluids.
- Encourage the child to eat as soon as food can be taken.

MONITORING

- The child’s condition, especially respiratory status, should be assessed by nurses every 3 hours
- The child should occupy a bed close to the nursing station, so that any sign of incipient airway obstruction can be detected as soon as it develops.

Supportive care

CHILDHOOD ASTHMA

INTRODUCTION

A chronic inflammatory disease of the airways with the following clinical features:

- Episodic and/or chronic symptoms of airway obstruction
- Bronchial hyper-responsiveness to triggers
- Evidence of at least partial reversibility of the airway obstruction
- Alternative diagnoses are excluded
- Most common childhood chronic disease

Usually has not been determined, contemporary research implicates a combination of :

- Environmental exposures
- Inherent biological and
- Genetic vulnerabilities

ETIOLOGY

Types of Childhood Asthma

Main types of childhood asthma:

- **Recurrent wheezing** in early childhood
- **Chronic asthma** associated with allergy that persists into later childhood and often adulthood.
- **Triad asthma** associated with hyperplastic sinusitis/nasal polyposis and hypersensitivity to aspirin and non-steroidal anti-inflammatory medications (ibuprofen), rarely has its onset in childhood.
- The most common persistent form of childhood asthma is that associated with allergy

Clinical manifestation

Wheezing is the most characteristic sign of asthma.

Wheezing with upper respiratory infections is very common in small children, but:

- Many of these children will not develop asthma.
- Asthma medications may benefit patients who wheeze whether or not they have asthma.

All that wheezes is not asthma

c/m cont'd

- cough and shortness of breath.

Consider asthma in children with:

- Recurrent episodes of cough with or without wheezing
- Nocturnal awakening because of cough
- Cough that is associated with exercise/play
- Cough without wheeze is often not asthma

Cough may be the only symptom present in patients with asthma.

- Symptoms may include "chest congestion," prolonged cough, exercise intolerance, dyspnea, and recurrent bronchitis or pneumonia.
- As the obstruction becomes more severe, wheezes become more high-pitched and breath sounds diminished
- Flaring of nostrils
- intercostal and suprasternal retractions
- Flushed, moist skin may be noted, and mucous membranes may be dry
- Cyanosis

C /f

Asthma Predictive Index

≥4 wheezing episodes in the past year
(at least one must be diagnosed)

PLUS

OR

<u>One major criterion</u>

- Parent with asthma
- Atopic dermatitis/eczema
- Aero-allergen sensitivity

- <u>Two minor criteria</u>
- Food sensitivity
- Peripheral eosinophilia (≥4%)
- Wheezing not related to infection

1. Regular assessment and monitoring
2. Control of factors contributing to asthma severity
3. Asthma pharmacotherapy
4. patient education

Four Components of Optimal Asthma Management

- Salbutamol
- Aminophylline
- Prednisolone

Pharmacologic

PREVENTION

- Investigations into the environmental and lifestyle factor
- Avoidance of environmental tobacco smoke (beginning prenatally)
- prolonged breastfeeding (>6 mo)
- An active lifestyle, and a healthy diet—might reduce the likelihood of asthma development.

PNEUMONIA

- **Pneumonia** is an inflammatory process of the lung **parenchyma** (the functional tissue of lungs) that is commonly caused by infectious agents.

EPIDEMIOLOGY

- Childhood pneumonia is the leading single cause of mortality in children aged less than 5 years.

Common pathogens of pneumonia according to their age

Age Group	Common Pathogens (in Order of Frequency)
Newborn	Group B *Streptococci, Escherichia coli,* Gram-negative bacilli, streptococcus pneumoniae, H. influenza *Listeria monocytogenes* Herpes Simplex Cytomegalovirus Rubella
1-3 months	*Chlamydia trachomatis,* streptococcus pneumoniae, H. influenza, Respiratory Syncytial virus Other respiratory viruses(rhino, para-influenza, influenza, adenoviruses
3-12 months	Respiratory Syncytial virus Other respiratory viruses *Streptococcus pneumoniae* *Haemophilus influenzae* *Chlamydia trachomatis* *Mycoplasma pneumoniae*

Common pathogens of pneumonia according to their age

Age Group	Common Pathogens (in Order of Frequency)
2-5 years	Respiratory Viruses *Streptococcus pneumoniae* *Haemophilus influenzae* *Mycoplasma pneumoniae* *Chlamydia pneumoniae*
5-18 years	*Mycoplasma pneumoniae* *Streptococcus pneumoniae* *Chlamydia pneumoniae* *Haemophilus influenzae* Influenza viruses A and B Adenoviruses Other respiratory viruses

Classification of pneumonia

Pneumonia can be classified based on the:

1. The cause
2. Area involved
3. Setting acquired
4. Clinical presentation
5. Severity of illness

Classification cont'd…

1. According to causes

- **Bacterial: the most common cause of pneumonia**
- **Viral pneumonia**
- **Fungal pneumonia**
- **Chemical pneumonia: ingestion of kerosene or inhalation of irritating substance**
- **Inhalation pneumonia (aspiration pneumonia)**

Classification cont'd...

2. According to areas involved

- **Lobar pneumonia;** if one or more lobe is involved
- **Broncho-pneumonia;** the pneumonic process has originated in one or more bronchi and extends to the surrounding lung tissue.

3. According to the setting:

- Community acquired pneumonia
- Hospital acquired pneumonia
- Healthcare associated pneumonia

Classification cont'd…

4. According to clinical features

- Typical pneumonia
- Atypical pneumonia

5. According to the severity of illness (used in IMNCI)

- No pneumonia or cough or cold
- Pneumonia
- Severe pneumonia

Mode of transmission

Pneumonia can be acquired from:

- **Naso-oral floras:** bacteria and viruses living in the nose, sinuses, or mouth may spread to lungs.
- **Droplets infection:** directly breathe in some of these germs into our lungs .
- **Aspiration:** breathe in (inhale) food, liquids, vomit, or fluids from the mouth into your lungs

RISK FACTORS

- **Definite risk factors**
- ✓ Malnutrition (weight-for-age z-score < –2)
- ✓ Low birth weight (≤ 2500 g)
- ✓ Non-exclusive breastfeeding (during the first 6 months of life)
- ✓ Lack of measles immunization (within the first 12 months of life)
- ✓ Indoor air pollution
- ✓ Crowding
- ✓ Immuno-suppresed patients (HIV patients)

Risk factors…

- **Likely risk factors**

✓ Parental smoking
✓ Zinc deficiency
✓ Mother's experience as a caregiver
✓ Concomitant diseases (e.g. diarrhea, heart disease, asthma, liver disease, DM…)
✓ Difficult swallowing (due to stroke, or other neurological conditions)
✓ Impaired consciousness
✓ Chronic lung disease (COPD, bronchostasis)

Risk factors

- **Possible risk factors**

✓ Mother's education
✓ Day-care attendance
✓ Rainfall (humidity)
✓ High altitude (cold air)
✓ Recent cold, laryngitis or flu
✓ Vitamin A deficiency
✓ Birth order
✓ Outdoor air pollution
✓ Frequent suction

CLINICAL MANIFESTATIONS

- Fast breathing
- Nasal flaring
- Grunting
- Lower chest wall indrawing
- Abnormal vocal resonance (decreased over a pleural effusion, increased over lobar consolidation
- Central cyanosis
- signs of pneumonia on auscultation (decreased breath sounds, bronchial breath sounds, crackles, pleural rub).

Diagnostic modalities

- History taking
- Physical examination
- Chest x-ray
- Blood test
- Sputum culture
- Lung ultrasound

Medical management

WHO guideline

- Children with fast breathing and chest in-drawing should be treated with
- Oral amoxicillin: at least 50mg/kg/day for five days.
- In areas with low HIV prevalence, give amoxicillin for three days.

- Children with severe pneumonia should be treated with
  - ✓ Ampicillin: 50 mg/kg, or benzyl penicillin: 50 000 units per kg IM/IV every six hours for at least five days
  - ✓ Gentamicin: 7.5 mg/kg IM/IV once a day for at least five days
- Ceftriaxone should be used as a second-line treatment

- For HIV-infected and exposed infants and for children under 5 years of age with chest in-drawing pneumonia or severe pneumonia.
- Ampicillin or penicillin plus gentamicin or ceftriaxone are recommended as a first-line antibiotic regimen
- Ceftriaxone alone is recommended for use as second-line treatment .

- Empiric cotri-moxazole treatment for suspected PCP is recommended as an additional treatment for HIV-infected and exposed infants aged from 2 months up to 1 year with severe or very severe pneumonia.
- However, it is not recommended for above 1 year of age with chest in-drawing or severe pneumonia.

Pathogen	Inpatient	Out patient
Str. pneumoniae	Ampicillin 150-200mg/kg/d q8hr or penicillin Ceftriaxone 50-100mg/kg/d	Amoxicillin 90mg/kg/d Cefpodoxime, cefuroxime, levofloxacin
Group A streptococcus	Penicillin 100000-250000u/kg/d Ceftriaxone	Amoxicillin or penicillin Oral clindamycin
Staph.aureus	Cefazolin	Cephalexin 50-75mg/kg/d/ in 2 doses

Pathogens	Inpatient	Out patient
Haemophilus influenza, typeable (A-F) or nontypeable	ampicillin (150-200 mg/kg/day every 6 hours, ceftriaxone (50–100 mg/kg/day every 12-24 hours) cefotaxime (150 mg/kg/day every 8 hours); ciprofloxacin (30 mg/kg/day levofloxacin (16-20 mg/kg/day every 12 hours for	amoxicillin (75-100 mg/kg/day in amoxicillin clavulanate (45 mg/kg/day in 3 doses or cefdinir, cefixime, cefpodoxime, or ceftib
Mycoplasma pneumoniae	azithromycin (10 mg/kg erythromycin lactobionate (20 mg/kg/day every 6 hours) or levofloxacin (16-20 mg/kg/day every 12 hours;	azithromycin (10 mg/kg on day 1, followed by 5 mg/kg/day once daily on days 2–5); clarithromycin
Chlamydia trachomatis or Chlamydophila pneumoniae	azithromycin (10 mg/kg on days 1 and 2 of therapy; erythromycin lactobionate (20 mg/kg/day every 6 hours) or	azithromycin (10 mg/kg on day 1, followed by 5 mg/kg/day clarithromycin (15 mg/kg/day in 2 doses) or

OXYGEN THERAPY

- Give oxygen to all children with very severe pneumonia

- Where pulse oximetry is available, use this to guide oxygen therapy (give to children with oxygen saturation less than 90%,

- Where there is sufficient oxygen available Continue with oxygen until the signs of hypoxia (such as severe lower chest wall in drawing or breathing rate of ≥ 70/minute) are no longer present.

SUPPORTIVE CARE

- If the child has fever (≥ 39 ° C or ≥ 102.2 ° F), give Paracetamol.
- If wheeze is present, give a rapid-acting bronchodilator
- Remove by gentle suction any thick secretions in the throat,
- Ensure that the child receives daily maintenance fluids
- Encourage breastfeeding and oral fluids.

Tuberculosis

- A child with persistent fever for more than 3 weeks and signs of pneumonia should be evaluated for tuberculosis.
- If another cause of the fever cannot be found, **tuberculosis** should be considered and treatment for tuberculosis, following national guidelines, may be initiated and response to anti-Tb treatment evaluated

Genitourinary system disorder

Objectives

At the end of this chapter you will be able to

- Mention the common manifestations of GUT problems.
- Diagnosis common GUT disorders
- Manage common GUT disorders

- Consists of kidney ureters, bladder, urethra

Functions

- Regulating blood volume and pressure
- Regulating plasma concentrations of sodium, potassium, chloride and other ions
- Stabilising blood pH
- Conserving nutrients
- Detoxifying poisons (with the liver)

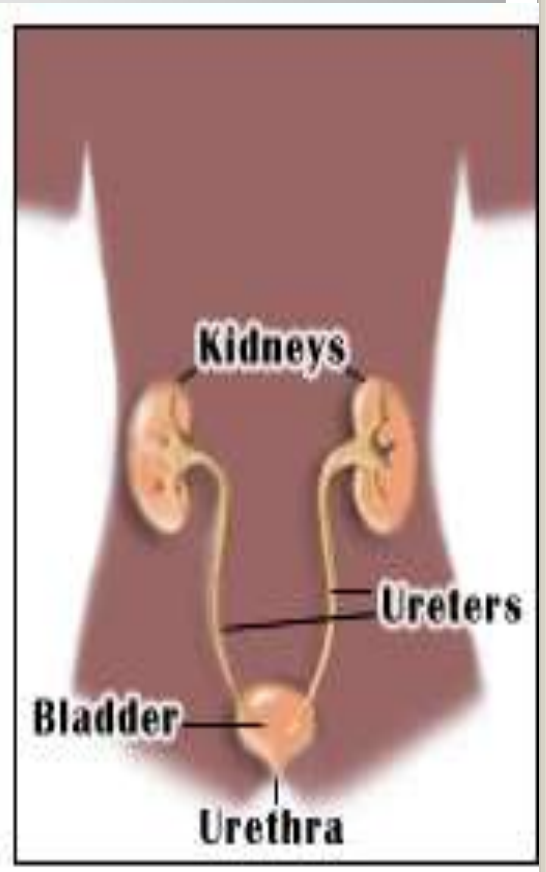
Anatomy and physiology

URINARY TRACT INFECTION

- Urinary tract infections (UTI) is common in the pediatric age group.
- Upper urinary tract infections (i.e, acute pyelonephritis) may lead to renal scarring, hypertension, and end-stage renal diseases.
- Difficult on clinical grounds to distinguish cystitis from pyelonephritis, particularly in young children (those younger than 2 years)

Types of UTI

- Urethritis – infection of the urethra
- Cystitis – an infection in the bladder that has moved up from the urethra
- Pyelonephritis – a urinary infection of the kidney as a result of an infection in the urinary tract



ETIOLOGY

- Bacterial infections are the most common.
- E coli is the most common causing 75-90% of UTI episodes.
- Other bacteria include:
  - Klebsiella species
  - Proteus species
  - Enterococcus species
  - Staphylococcus saprophyticus
- Adenovirus (rare)
- Fungal in immune compromised patients

CLINICAL PRESENTATION

- In young children, UTI often presents with non-specific signs

In young children (<2 yrs)

- Fever, vomiting, poor feeding, abdominal tenderness, irritability, failure to thrive.

Older Children

- Fever, urinary symptoms (dysuria, urgency, frequency, incontinence, macroscopic haematuria), and abdominal pain
- The constellation of fever, chills, and flank pain is suggestive of **pyelonephritis** in older children

Laboratory Investigations

- Urinalysis
  - Urine Microscopy
- Urine Culture
- Blood Culture
- Lumbar Puncture in a febrile child < 3 months

MANAGEMENT

The goals of Treatment

- Elimination of infection and prevention of urosepsis
- Prevention of recurrence and long-term complications
- Relief of acute symptoms

MANAGEMENT

Treat the child as an outpatient, but Hospitalization is necessary:

- when there is high fever and systemic upset (such as vomiting everything or inability to drink or breastfeed)
- Patients who are toxemic or septic
- Patients with signs of urinary obstruction or significant underlying disease
- Patients unable to tolerate adequate PO fluids or medications
- Infants younger than 3 months with febrile UTI (presumed pyelonephritis)
- All infants younger than 1 month with suspected UTI even if not febrile

MANAGEMENT

- Start antibiotics after urinalysis and culture are obtained.
- A 10-day course of antibiotics is recommended, even for uncomplicated infection.
- For cystitis, oral antibiotic therapy is adequate, but if pyelonephritis is suspected, a combination of parenteral antibiotics is recommended.
- Recent evidence indicates that oral antibiotics are adequate therapy for febrile UTI in young infants and children; short-term (fever) and long-term (renal scarring) outcomes are comparable to parenteral therapy.

MANAGEMENT

- Oral cotrimoxazole (4 mg trimethoprim/20 mg sulfamethoxazole per kg every 12 hours) for 5 days. Alternatives include ampicillin, amoxicillin and cefalexin.
- If there is a poor response to the first-line antibiotic or the child's condition deteriorates, give gentamicin (7.5 mg/kg IM once daily) plus ampicillin (50 mg/kg IM/IV every 6 hours) or a parenteral cephalosporin.
- Consider complications such as pyelonephritis (tenderness in the costo-vertebral angle and high fever) or septicaemia.

Supportive care

- The child should be encouraged to drink or breastfeed regularly in order to maintain a good fluid intake, which will assist in clearing the infection and prevent dehydration.

Follow-up

- Investigate all episodes of UTI in >1-year-old males and in all children with more than one episode of UTI in order to identify the underlying cause.
- This may require referral to a larger hospital with facilities for appropriate X-ray or ultrasound investigations.

Complications

- **DEHYDRATION** is the most common complication of UTI in the pediatric population. IV fluid replacement is necessary in more severe cases.
- Treat febrile UTI as pyelonephritis, and consider parenteral antibiotics and admission for these patients.
- Untreated UTI may progress to renal involvement with systemic infection (e.g. urosepsis).
- Long-term complications include renal parenchyma scarring, hypertension, decreased renal function, and, in severe cases, renal failure.

ACUTE POSTSTREPTOCOCCAL GLOMERULONEPHRITIS

(APSGN)

INTRODUCTION

- PSGN is caused by prior infection with specific nephritogenic strains of group A beta-hemolytic streptococcus.
- The clinical presentation of PSGN varies from asymptomatic, microscopic hematuria to the full-blown acute nephritic syndrome, characterized by red to brown urine, proteinuria, edema, hypertension, and acute kidney injury.

CLINICAL PRESENTATION

- Abrupt onset of hemutaria (100%)
- Proteinuria (80%)
- Edema (90%)
- HTN (60-80%)
- Mild to moderate renal insufficiency (25-40%)
- Latent period → (1-2 wks, throat infection , 3-6 wks skin infection)
- Subclinical to clinically overt dx → 4-5:1

LABORATORY FINDINGS

- Urinalysis
- Serology
- Culture
- Because PSGN presents weeks after an antecedent GAS infection, only about 25 percent of patients will have either a positive throat or skin culture.
- In patients with impetigo, there is an increased likelihood of obtaining a positive skin culture

DIAGNOSIS

- PSGN is usually diagnosed based upon clinical findings of acute nephritis and demonstration of a recent group A beta-hemolytic streptococcal (GAS) infection.
- The clinical findings of acute nephritis include hematuria with or without red blood cell casts, variable degrees of proteinuria, edema, and hypertension.
- Documentation of a recent GAS infection includes either a positive throat or skin culture or serologic tests (eg, ASO or streptozyme test).

MANAGEMENT

- Management is directed at treating the acute effects of renal insufficiency and hypertension.
- Although a 10-day course of systemic antibiotic therapy with penicillin is recommended to limit the spread of the nephritogenic organisms, antibiotic therapy does not affect the natural history of glomerulonephritis.
- Sodium restriction, diuresis usually with intravenous Lasix, and pharmacotherapy with calcium channel antagonists, vasodilators, or angiotensin-converting enzyme inhibitors are standard therapies used to treat hypertension.

NEPHROTIC SYNDROME

NEPHROTIC SYNDROME (NS)

- It is primarily a pediatric disorder
- 15 times more common in children than adults.
- The incidence is 2-3/100,000 children per year; and the majority of affected children will have steroid-sensitive minimal change disease.
- NS defined by the clinical triad of
  - Oedema
  - Nephrotic range proteinuria and
  - Hypoalbuminaemia
    - Typically accompanied by
      - Dyslipidaemia with elevated plasma cholesterol and triglycerides.

Etiology

- Nephrotic syndrome may occur as a result of any form of glomerular disease and may be associated with a variety of extra renal conditions.
- Approximately 90% of children with this condition have some form of the idiopathic nephrotic syndrome.
- In the remaining 10%, the syndrome is secondary to some form of glomerulonephritis.

Clinical Manifestations

- It usually presents with pitting edema, initially noted in periorbital area and in the lower extremities. The edema becomes generalized with time.
- Some children present with hypotension secondary to significant shift of fluid from intravascular to third space and they may rarer develop renal failure
- Abdominal pain
- Diarrhea (intestinal edema) or respiratory distress (pulmonary edema or pleural effusion) may be present

DIAGNOSIS

- Urinalysis reveals proteinuria (+3or +4 on dipstick).
- Serum albumin level is generally < 2.5g /24 hr.
- The serum cholesterol and triglyceride levels are generally high

MANAGEMENT

- **Diet**
- Normal protein intake
- Salt restriction during relapses
- **Antibiotics**
- Oral penicillin should be given during both initial illness and relapses.
- **Diuretics** Careful use of frusemide only in the absence of hypovolaemia, if fluid restriction (e.g. 70% maintenance) and salt restriction alone not effective in controlling oedema formation.

Steroid therapy for first presentation:

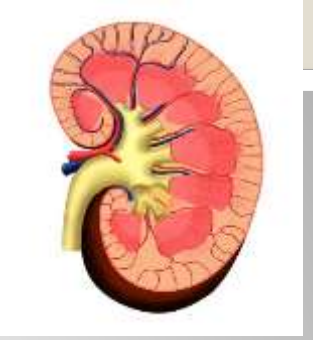
STEROID THERAPY

- This is the mainstay of treatment and should be commenced once the diagnosis is established
- Prednisone or Prednisolone - start at 60mg/m2/day (max 80mg) in a single daily dose to complete a total of 42 days.
- Then switch to alternate day therapy at 40mg/ m2/day (max 60mg) for further 42 days.
- Then wean steroid dose gradually over 8-10 weeks and stop.
- Total treatment duration of first presentation for at least 20 weeks.

Complications of Nephrotic Syndrome

- Spontaneous bacterial peritonitis
- Bacteremia
- Steroid-related toxicity
- Immunosuppression-related toxicity
- Acute renal failure
- **Thrombosis**

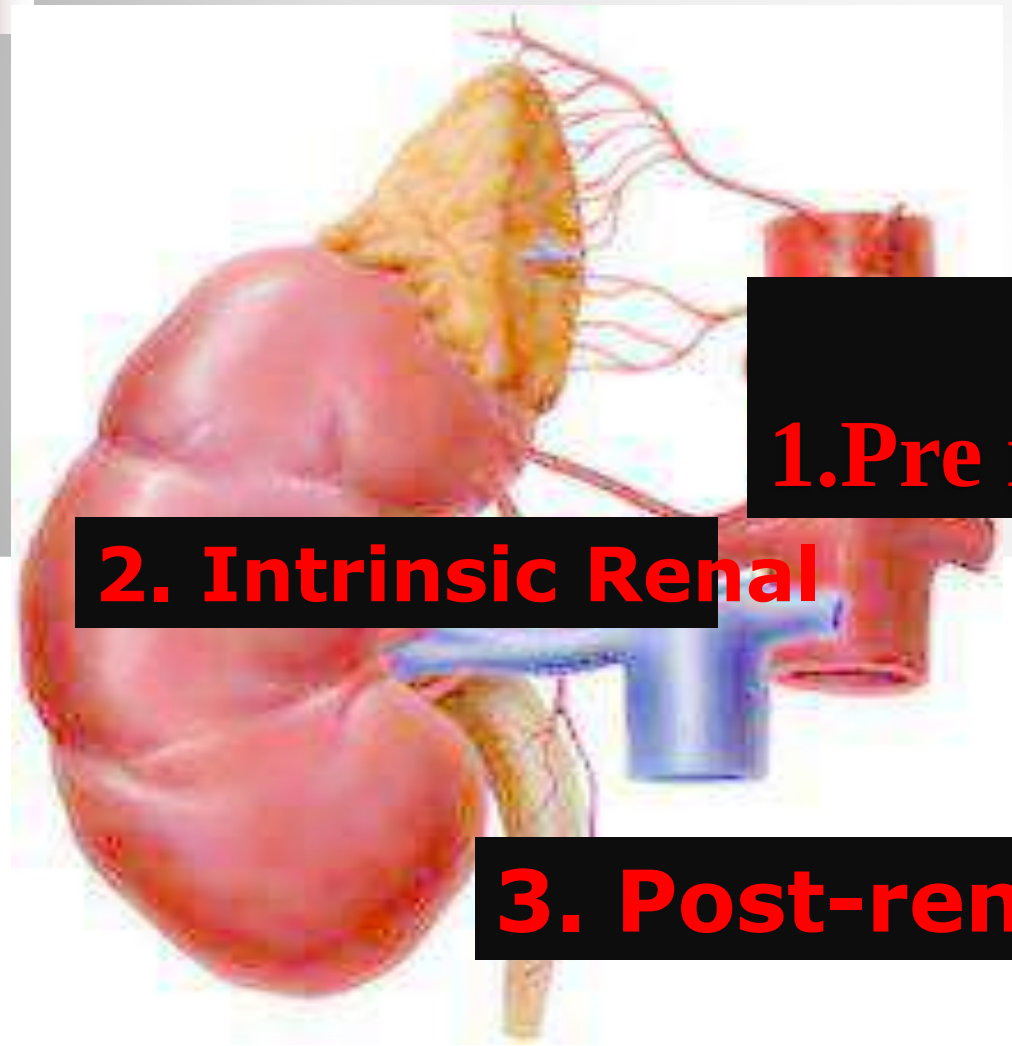
Acute kidney injuries



- ✓ It is a Rapid deteriotion of renal function resulting i retention of nitrogenous wastes and inability of kidney to regulate fluid and electrolyte homeostasis. Nelson 20 ed

Table 535-1	Pediatric-Modified Rifle (pRIFLE) Criteria	
CRITERIA	**ESTIMATED CCL**	**URINE OUTPUT**
Risk	eCCl decrease by 25%	<0.5 mL/kg/hr for 8 hr
Injury	eCCl decrease by 50%	<0.5 mL/kg/hr for 16 hr
Failure	eCCl decrease by 75% or eCCl <35 mL/min/1.73 m^2	<0.3 mL/kg/hr for 24 hr or anuric for 12 hr
Loss	Persistent failure >4 wk	
End-stage	End-stage renal disease (persistent failure >3 mo)	

CCl, creatinine clearance; eCCl, estimated creatinine clearance; pRIFLE, pediatric risk, injury, failure, loss, and end-stage renal disease.



1.Pre renal

2. Intrinsic Renal

3. Post-renal

- vomiting, diarrhea, poor fluid intake,
- fever, use of diuretics
- hemorrhage
- cardiac failure
- liver dysfunction, or
- septic shock

Pre-renal

I. **Renal Major vessel obstruction**

-renal vein thrombosis , renal arterial obstruction, hemolytic uremic syndrome , HSP , polyarteritis and other vasculitis.

II. Glomerular

- Acute glomerulonephritis (post streptococcal , other infections).

III. Acute tubulointerstitial nephritis

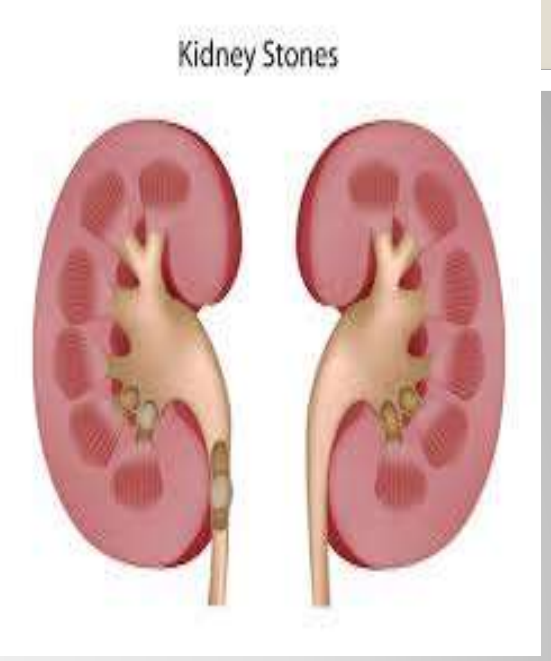
IV. Acute tubular necrosis

- Prolongation of pre-renal insult , intravascular hemolysis , sepsis , nephrotoxic agents , multiorgan failure , snakebite etc.

Intrinsic renal

Cited by Up to date 21.2

- ✓ Posterior urethral valves
- ✓ Ureteropelvic junction obstruction
- ✓ Ureterovesicular junction obstruction
- ✓ Ureterocele
- ✓ Tumor
- ✓ Urolithiasis
- ✓ Hemorrhagic cystitis
- ✓ Neurogenic bladder



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Post renal

Clinical presentation

Pre renal

There may be history of volume loss from vomiting, diarrhea, or blood loss and may present with dehydration , hypotension , tachycardia , pallor , and **decreased urine output ..**.

Renal

- ✓ Hematuria, edema, and hypertension indicates a glomerular etiology for AKI.
- ✓ Dysentery, petechiae and pallor- HUS
- ✓ Presence of rash, arthritis might suggest SLE
- ✓ History of prolong hypotension or with exposure to nephrotoxic medication most likely have ATN.
- ✓ Allergic interstitial nephritis should be suspected with fevers, rash, arthralgia, and exposure to certain medications

Nelson Textbook of PEDIATRICS

Post renal

- History of interrupted urinary stream and palpable bladder or kidney suggest obstructive uropathy.
- Abdominal colic hematuria and dysuria suggest urinary tract calculi.

History and

Physical examination:-Obtaining a thorough physical examination is extremely important when collecting evidence about the etiology of AKI.

Skin :- **P**alpable purpura - Systemic vasculitis

Maculo papular rash - Allergic interstitial nephritis

Eye :- Evidence of uveitis may indicate interstitial nephritis and necrotizing vasculitis.

Ear :- Hearing loss - Alport disease and amino glycoside toxicity

Mucosal or cartilaginous ulcerations – Wegener granulomatosis.

Diagnosis

Pulmonary system :- Respiratory rate , pattern

On Auscultation of lungs creptation

Cont..d

Cardiovascular examination may reveal the following:

- Murmurs - Endocarditis
- Pericardial friction rub - Uremic pericarditis
- Increased jugulovenous distention, S_3 - Heart failure

Abdomen

- Abdominal or costovertebral angle tenderness - Nephrolithiasis, papillary necrosis, renal artery thrombosis, renal vein thrombosis
- distended bladder – Urinary obstruction

Laboratory investigation

- ✓ Blood urea and S. creatinine level
- ✓ Serum electrolyte and C3 level
- **Urinary indices** may be useful in differentiating prerenal AKI from intrinsic AKI.
- **Ultrasound** - evaluates renal size, able to detect masses, obstruction, stones
- **Renal biopsy** - Patient in whom the etiology **is not identified**

Clin J Am Soc Nephrol. 2014 Feb 7

Metabolic

- Hyponatremia
- Hyperkalemia
- Hypocalcemia, hyperphosphatemia
- Hyperuricamia

Pediatrics lecture note

Complication of AKI

Con..d

Metabolic acidosis

Cardiovascular

- Pulmonary edema
- CHF
- Hypertension
- Arrhythmias
- Pericarditis

Neurologic :- Coma and Seizures

Hematologic :-Anemia and Coagulopathies & bleeding diathesis E.T.C

Pediatrics lecture note

Medical Management

- In infants and children with urinary tract obstruction, such as in a newborn with suspected posterior ureteral valves, a bladder catheter should be placed immediately to ensure adequate drainage of the urinary tract.
- however, precautions to prevent iatrogenic infection should be

TREATMENT

Maintain fluid

- Determination of the volume status is of critical importance when initially evaluating a patient with AKI.
- If there is no evidence of volume overload or cardiac failure, intravascular volume should be expanded by intravenous administration **of isotonic saline, 20 mL/kg over 30 min.**

- Determination of the central venous pressure may be helpful if adequacy of the blood volume is difficult to determine.
- After volume resuscitation, hypovolemic patients generally void within **2 hr**; failure to do so suggests intrinsic or postrenal AKI.
- Hypotension caused by sepsis requires vigorous fluid resuscitation followed by a continuous infusion of nor - epinephrine.

Cont…d

Nelson 20 ed

Chronic kidney disease

Patient has CKD if either of the following criteria are present:

1. Kidney damage for ≥3 mo, as defined by structural or functional abnormalities of the kidney, ***with or without*** decreased GFR, manifested by 1 or more of the following features:
   - Abnormalities in the composition of the blood or urine
   - Abnormalities in imaging tests
   - Abnormalities on kidney biopsy
2. GFR <60 mL/min/1.73 m_2 for ≥3 mo, with or without the other signs of kidney damage described above

National Kidney Foundation K/DOQI(2002)

STANDARDIZED TERMINOLOGY FOR STAGES OF CHRONIC KIDNEY DISEASE (K/DOQI(2002)

STAGE	DESCRIPTION	GFR (mL/min/1.73 m^2)
1	Kidney damage with normal or increased GFR	>90
2	Kidney damage with mild decrease in GFR	60-89
3	Moderate decrease in GFR	30-59
4	Severe decrease in GFR	5-29
5	Kidney failure	<15 or on dialysis

GFR, glomerular filtration rate.

- Result of congenital, acquired, inherited, or metabolic renal disease.

- **in children <5 yr old is**
  - most commonly a result of congenital abnormalities such as **renal hypoplasia, dysplasia, or obstructive uropathy**
- **After 5 yr of age**
  acquired diseases (various forms of glomerulonephritis including lupus nephritis) and inherited disorders (Alport syndrome) predominate.

Etiology

- The clinical presentation of CKD is varied and depends on the underlying renal disease
  - Children and adolescents with CKD can present with
  - edema,
  - hypertension,
  - hematuria, and
  - proteinuria

Clinical Manifestations

On P/E:-Pallor and **a sallow appearance**.

- ***short stature and the bony abnormalities of renal osteodystrophy*** (length/height-for age <3rd percentile).
- Children with CKD due to chronic glomerulonephritis (edema, hypertension and fluid overload)

Laboratory Findings(Elevated BUN and serum creatinine, hyperkalemia, hyponatremia, hypernatremia Acidosis, hypocalcemia, hyperphosphatemia, and an elevation in uric acid, hypoalbuminemia, hematuria and proteinuria.

Diagnosis

Nelson Textbook of PEDIATRICS

Management

GENERAL PRINCIPLES

- *Treat reversible kidney dysfunction*
- Prevent or slow the progression of kidney disease
- Treat the complications of CKD
- Identify and adequately prepare the child/family in whom renal replacement therapy will be required

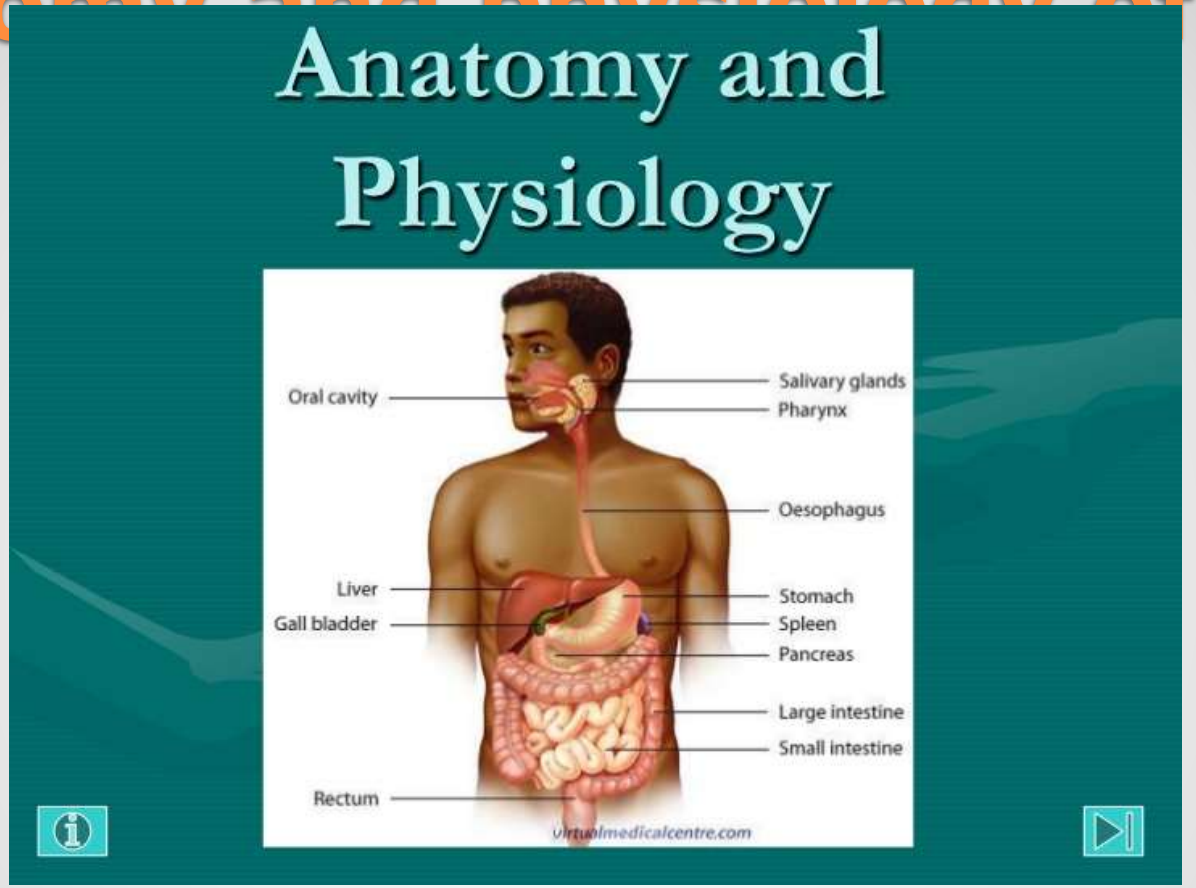
COMMON GASTRO-INTESTINAL DISORDER

LEARNING OBJECTIVES

By the end of this topic the student will able to:

- Mention the common manifestation of GID
- Recognize the evaluation of abdominal pain and vomiting
- Discuss the common problems of GI obstruction in children
- Discuss appendicitis in childhood

Anatomy and physiology of the GIS



Anatomy and physiology

- It consists of the mouth/oral cavity, esophagus, stomach, intestine, rectum and anus and other accessory glands like liver, gallbladder, pancreas and salivary
- **Functions**
- The main function of GIS is Ingestion digestions and absorptions of foods and eliminations of food ruminants

Common Manifestations of GID in the Child

- ABDOMINAL PAIN
- VOMITING AND REGURGITATION
- DIARRHEA
- CONSTIPATION
- ABDOMINAL DISTENTION AND ABDOMINAL MASSES

FUNCTIONAL GASTROINTESTINAL DISORDERS WITH ABDOMINAL PAIN

- Abdominal pain in a child is one of the most common presentations with both trivial and life threatening etiologies, ranging from functional pain to acute appendicitis.
- Diagnosing abdominal pain in children is also a challenging task.
- The majority of pediatric abdominal complaints are relatively benign
- But it is important to pick up on the cardinal signs that might suggest a more serious underlying disease.

- The majority of children with recurrent or chronic abdominal pain have a **functional** gastrointestinal disorder.
- **Functional disorders** are defined as conditions in which symptoms are present in the absence of any readily identifiable structural or biochemical abnormality.

Common Causes of Abdominal Pain

NEWBORN	INFANT (<2 YEARS)
Intestinal obstruction (ie. volvulus, pyloric stenosis), GE Reflux, Hernia, Peritonitis (i.e. GI perforation), Trauma (i.e. during birth)	Constipation , Toxin ingestion, Acute gastroenteritis , Trauma, Hernia, volvulus, intussusception, Colic, Respiratory illness
CHILDREN (2 – 18 YEARS)	**ADOLESCENTS (12 – 18 YEARS)**
Acute gastroenteritis, UTI / Pyelonephritis, Constipation, Toxin ingestion, food poisoning, Intestinal obstruction Trauma, Testicular torsion, Respiratory illness, pneumonia,	Trauma ,Toxin ingestion, food poisoning Dysmenorrhea , Pregnancy (i.e. ectopic) Pelvic inflammatory disease, Testicular torsion, Ovarian

PRESENTATION AND EMERGENT CONSIDERATIONS

- Acute pain lasts several hours to days
- While chronic pain can last from days to weeks to months.

RED FLAG SIGNS INCLUDE:

- Bilious vomiting
- Bloody stool or emesis
- Night time waking with abdominal pain
- Hemodynamic instability
- Weight loss

Evaluation of the Child with Vomiting

- Vomiting is a complex, coordinated reflex mechanism that may occur in response to a variety of stimuli and results in forceful expulsion of gastric contents.
- The differential diagnosis is not limited to the gastrointestinal tract and includes conditions that are pediatric emergencies.
- Assessment of the child with recurrent vomiting starts with a complete history, physical examination, and description of the vomits .

THE RED FLAGS OF AN ACUTELY PRESENTING CHILD WITH VOMITING

- Any child who has vomiting blood or bile or severe abdominal pain or abdominal signs needs immediate investigation in a hospital emergency room setting.

❖ **OTHER RED FLAGS INCLUDE**:

- projectile vomiting
- abdominal distension, tenderness
- high fever
- persistent tachycardia or hypotension
- neck stiffness and/or photophobia.

GASTRO-OESOPHAGEAL REFLUX DISEASE(GERD)

- **GER** is defined as the effortless retrograde movement of gastric contents upward into the esophagus or oropharynx with or without regurgitation and vomiting.

-Most episodes of GER in healthy individuals last <3 minutes, occur in the postprandial period, and cause few or no symptoms.

- In contrast, **GERD** is present when the reflux of gastric contents causes troublesome symptoms and / or complications.

- GE reflux is common in young infants and usually resolves spontaneously by the age of walking.
- Infants, in particular, are predisposed to GER because they **have a short intra-abdominal esophagus and an immature LES.**
- Postprandial regurgitation, which ranges from effortless to forceful, is the most common symptom in infants with GE reflux.

CLINICAL MANIFESTATIONS

⟹ Symptoms associated with GERD are quite vast

- However, within infants regurgitation is the classic symptom.
- As the child becomes older, particularly within the second to third years of life, substernal or epigastric pain becomes the predominant presenting complaint of GERD.

C/M

Other symptoms associated with GERD vary and include:

- **Symptoms due to regurgitation** such as emesis and weight loss
- **Symptoms due to esophagitis** such as chest pain, irritability, feeding aversion, choking, gagging, anemia, hematemesis, and esophageal obstruction due to stricture
- **Respiratory symptoms** including pneumonia, wheezing, bronchospasm , apnea, cyanotic episodes, stridor, cough, hiccups, and hoarseness;
- **Neurobehavioral symptoms** including seizure-like events,

EVALUATION

- Barium radiography (Upper GI) allows for evaluation of whether anatomy is normal and is typically chosen in children with vomiting and dysphagia
- Endoscopy is also indicated in children whom the clinician suspects erosive esophagitis

Management

- Treatment of GERD has classically been divided into the following three discrete phases:

1) Lifestyle modification/Conservative therapy
2) Pharmacologic treatment
3) Antireflux surgery

Management

- **Conservative Therapies**
- Towel on caregiver's shoulder
- Thickened feedings
- Enhances nutrition Smaller, more frequent feedings
- Some benefit Positional therapy-upright in seat, elevate head of crib or bed Prone positioning with head up.

Mgt cont’d

- **Pharmacologic treatment :** involves the use of cytoprotective agents including H2 receptor blockers, or proton-pump inhibitors (PPI).
- **Surgical intervention** is reserved for patients who fail aggressive medical therapy and continue to have life-threatening complications of reflux.

ETIOLOGY

- The cause of pyloric stenosis is unknown, but many factors have been implicated.
- Pyloric stenosis has been associated with eosinophilic gastroenteritis, trisomy 18.
- Abnormal muscle innervation, elevated serum levels of prostaglandins
- A deficiency in inhibitory neuronal signals, mediated by nitric oxide, may contribute to the pathogenesis of pyloric stenosis

Clinical manifestation

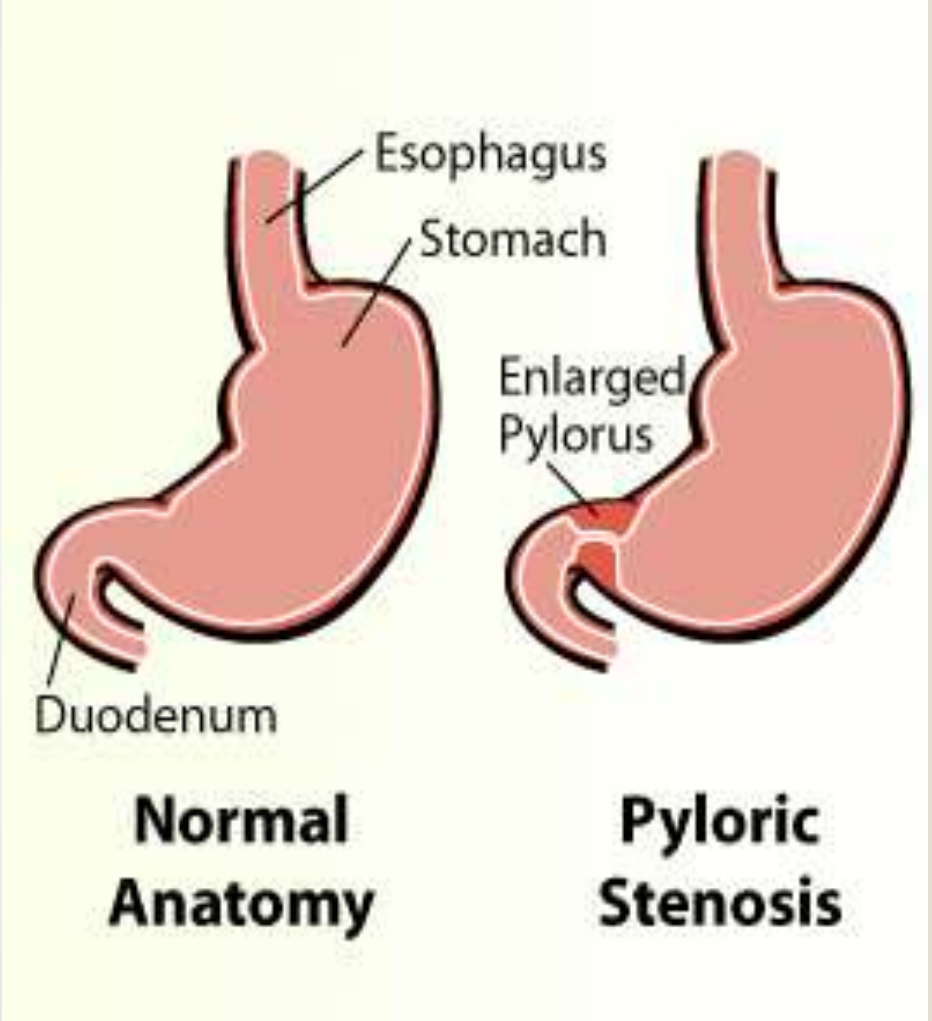
- Non-bilious vomiting is the initial symptom of pyloric stenosis.
- The vomiting may or may not be projectile initially but is usually progressive, occurring immediately after a feeding.
- Emesis may follow each feeding, or it may be intermittent. After vomiting, the infant is hungry and wants to feed again.
- Jaundice

c/m

- The stomach becomes massively enlarged with retained food and secretions, and gastric **peristaltic waves** are often visible in the left upper quadrant
- As the illness progresses the child becomes progressively thinner and more dehydrated.
- **Greater awareness of pyloric stenosis has led to earlier identification of patients with fewer instances of chronic malnutrition and severe dehydration.**

Pyloric Stenosis

- The classic presentation of IHPS is the three- to six-week-old baby who develops immediate postprandial, non-bilious, often projectile vomiting and demands to be re-fed soon afterwards (a "hungry vomiter").



Diagnosis

- Criteria for diagnosis include pyloric thickness >4 mm
- Ultrasound examination confirms the diagnosis in the majority of cases and allows an earlier diagnosis in infants with suspected disease.

TREATMENT

- Definitive management is surgical corrections
- Correcting the fluid volumes
- Correcting the electrolytes
- Feeding

ILEUS

- Ileus is the failure of intestinal peristalsis without evidence of mechanical obstruction.
- Ileus can be caused by:
- Systemic infections/Diseases
- Metabolic abnormalities,
- Anti-motility drugs

C/M

- Increasing abdominal distention, emesis, and initially minimal pain.
- Pain increases with increasing distention.
- Bowel sounds are minimal or absent,

Treatment of ileus

- Nasogastric decompression.
- Ileus after abdominal surgical procedures usually results in return of normal intestinal motility in 24–72 hr.
- Prokinetic agents such as metoclopramide can stimulate the return of normal bowel motility and be of assistance to children with prolonged ileus.

Adhesions

- Adhesions are fibrous bands of tissue that are a common cause of postoperative small bowel obstruction after abdominal surgery.
- The risk not well studied .
- Diagnosis and C/M
  - Abdominal pain,
  - constipation,
  - emesis, and
  - A history of intra-peritoneal surgery.
- Nausea and vomiting quickly follow the development of pain.

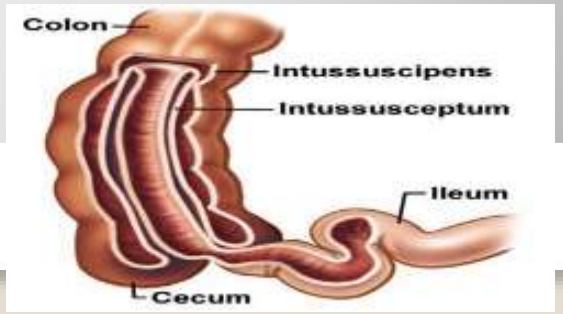
Treatment

- Patients with suspected obstruction should have
  - **Nasogastric decompression,**
  - **Intravenous fluid resuscitation, and**
  - **Broad-spectrum antibiotics in anticipation of surgery.**

Adhesions

INTUSSUSCEPTIONS

- Intussusception is the "telescoping" of a segment of proximal bowel (the intussusceptum) into downstream bowel (the intussuscipiens)
- It is the most common cause of intestinal obstruction between 3 mo and 6 yr of age.
- A few intussusceptions reduce spontaneously, but if left untreated, most will lead to intestinal infarction, perforation, peritonitis, and death.



- The proximal segment of bowel telescopes into the distal segment, dragging the associated mesentery with it.

Leads to the development of venous and lymphatic congestion with resulting intestinal edema, which can ultimately lead to ischemia, perforation and peritonitis.

CLINICAL MANIFESTATIONS

- Severe, crampy, progressive abdominal pain.
- Inconsolable crying, Guarding and knees drawing up
- Bloody stool
- Feedings are refused.
- Bilious vomiting
- **lethargy or altered consciousness**.

MANAGEMENT

- **Reduction of an acute intussusception is an emergency procedure and performed immediately after diagnosis in preparation for possible surgery**
- Therapy must begin with placement of an IV catheter and a nasogastric tube.
- Child must have adequate **fluid resuscitation** to correct the often severe dehydration caused by vomiting and third space losses.

Closed-Loop Obstructions

- Intestinal obstruction can be caused by defects in the mesentery (“internal hernias”) through which loops of small bowel may pass and become trapped.
- Symptoms
- bilious vomiting, abdominal distention, and abdominal pain. Peritoneal signs suggest ischemic bowel
- Supportive management includes intravenous fluids, antibiotics, and nasogastric decompression.
- Prompt surgical intervention is needed

APPENDICITIS

- Appendicitis is the most common surgical emergency in childhood.

POSITIONS OF APPENDIX

Right lower quadrant of the abdomen.

CLINICAL MANIFESTATIONS

- Visceral pain, localized to the periumbilical region.
- The pain localizes to the right lower quadrant.
- Nausea and vomiting
- Anorexia
- Diarrhea and urinary symptoms are also common,
- low-grade fever unless perforation has occurred

- Voluntary guarding is present initially, progressing to rigidity, then to rebound tenderness with rupture and peritonitis
- Rebound tenderness and referred rebound tenderness (Rovsing sign) are also consistent findings in acute appendicitis but not always present.
- Rectal examination when a pelvic appendix or abscess is suspected, or in adolescent females when ovarian pathology is suspected

- Treatment of appendicitis is surgical.
- Simple appendectomy is curative if performed before perforation.
- With perforation, a course of postoperative IV antibiotics is required.
- Broad-spectrum coverage is necessary to cover the mixed bowel flora.

MANAGEMENT

- **Volvulus**
- **RECTAL PROLAPSE**
- **Acute Gastro Entritis**
- **ANORECTAL MALFORMATIONS**

Read and take short note

Nervous system disorders

Objectives

At the end of this session you will be able to:

- Assess, diagnose and manage common nervous system problems in children

Anato

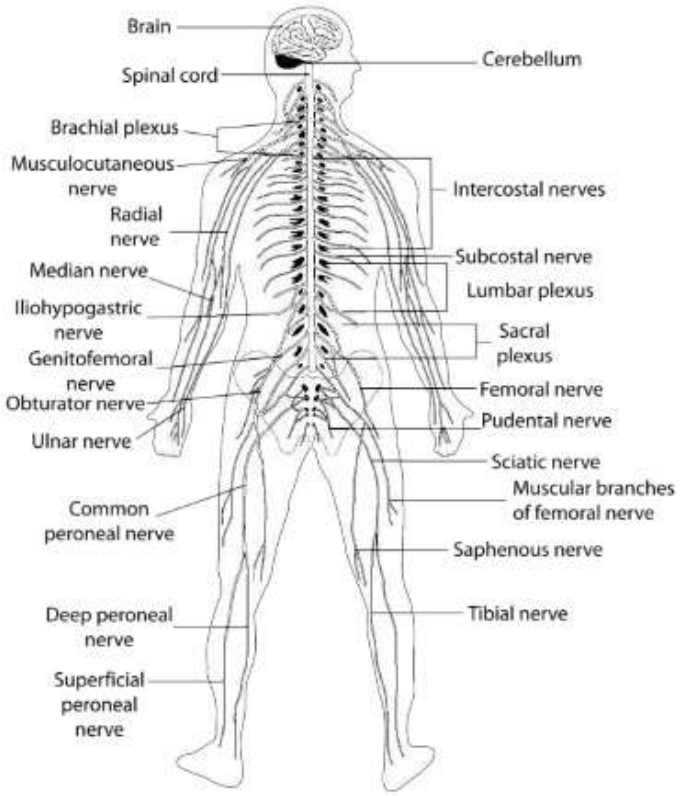
Organs

CNS:

- Brain
- Spinal Cord

PNS:

- Nerves



- Control and coordinates all parts of the body
- Receives stimuli from body's interior and from the external environment through the system.
- Determines the body's responses to these impulse-messages-through the motor system.
- Contains the human higher functions e.g. memory and reasoning.

Functions

MENINGITIS

INTRODUCTION

- **Meningitis**, inflammation of the meninges
- Caused by
  - bacteria
  - Virus
  - Fungus
- The most common bacterial infections

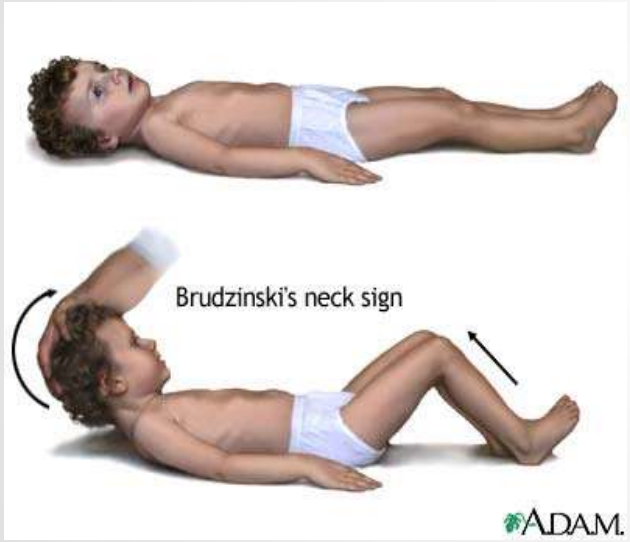
Age Group	Causes
Newborns	Group B ***Streptococcus, Escherichia coli***, *Listeria monocytogenes*
Infants and Children	***Streptococcus pneumoniae, Neisseria meningitidis***, *Haemophilus influenzae* type b
Adolescents and Young Adults	***Neisseria meningitidis, Streptococcus pneumoniae***

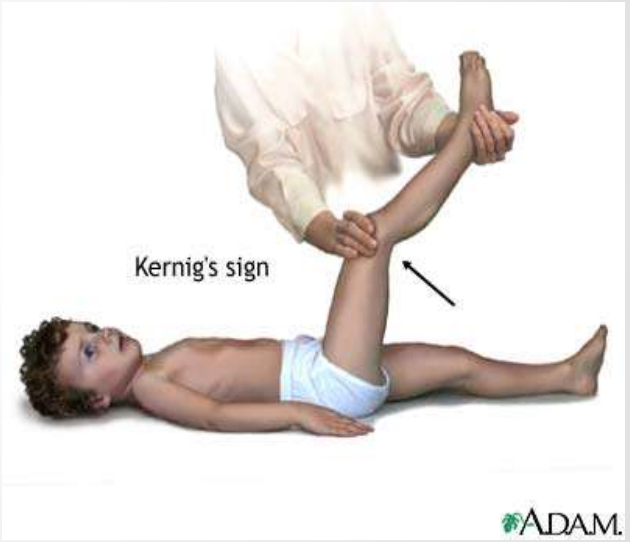
CLINICAL FEATURES

- Preceding upper respiratory tract symptoms are common.

Rapid onset is typical of *S. pneumoniae* and *N. meningitidis*.

- Fever
- Altered consciousness, irritability, photophobia
- Vomiting, poor appetite
- Seizures 20 - 30%
- Bulging fontanel 30%
- Stiff neck or nuchal rigidity
- Meningismus (stiff neck + Brudzinski + Kernig signs)

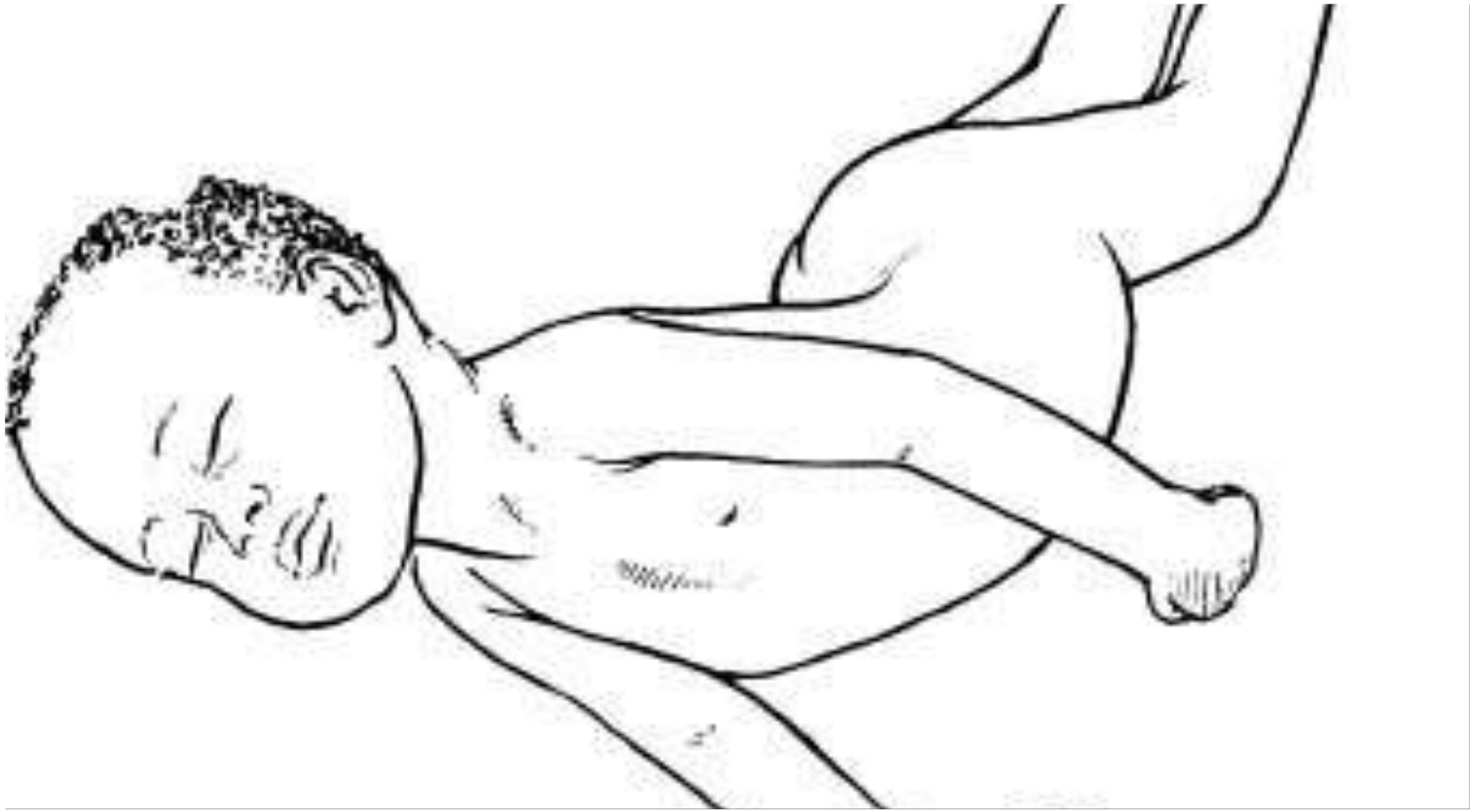




Clinical signs of meningeal irritation

CLINICAL FEATURES

- In young infants, signs of meningeal inflammation may be minimal with only irritability, restlessness, depressed mental status, and poor feeding.
- Focal neurologic signs, seizures, arthralgia, myalgia, petechial or purpuric lesions, sepsis, shock, and coma may occur.
- Increased intracranial pressure is reflected in complaints of headache, diplopia, and vomiting.
- A bulging fontanel may be present in infants.



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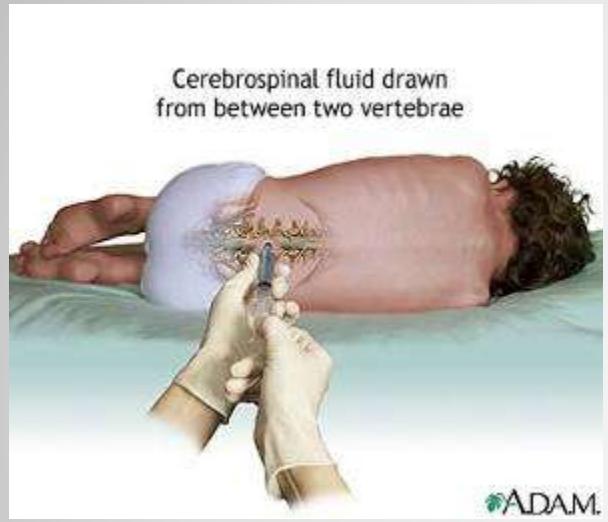
Diagnosis – lumbar puncture



- **Contraindications:**
  - Respiratory distress (positioning)
  - ↑ ICP reported to increase risk of herniation
  - Cellulitis at area of tap
  - Bleeding disorder

CSF EVALUATION

Condition	WBC	Protein (mg/dL)	Glucose (mg/dL)
Normal	<7, lymphs mainly	5-45	>50
Bacterial, acute	100 – 60K PMN's	100-500	Low
Bacterial, part rx'd	1 – 10,000	100+	Low to normal
TB	10 – 500	100-500	<50
Fungal	25 – 500	25-500	<50
Viral	<1000	50-100	Normal

Consider tuberculous meningitis if:

- Fever persists for 14 days
- Fever persists for more than 7 days and there is a family member with tuberculosis
- chest X-ray suggests tuberculosis
- patient remains unconscious
- CSF continues to have moderately high white blood cell counts (typically, <500 white cells per ml, mostly lymphocytes), elevated protein levels (0.8–4 g/l) and low glucose levels (< 40 mg/dl).
- In children known or suspected to be HIV-positive, tuberculous or cryptococcal meningitis should also be considered.

TREATMENT

- If there is any suspicion, treat immediately with antibiotics before the results of laboratory CSF examination are available.
- If the child has signs of meningitis and a lumbar puncture is not possible, treat immediately.

Antibiotic treatment

- Give antibiotic treatment as soon as possible.

Choose one of the following two regimens:

- Crystalline penicillin loading dose of 250,000IU/ kg IV. Stat followed by 500,000IU/kg/24 hours IV divided in 8 doses (Q3hourly) **PLUS**
- Chloramphenicol, 50 mg/kg IV stat followed by 100mg/kg/day IV Q6 hourly .
- Duration of treatment depends on the etiology but in general course of treatment ranges between 10-15 days.

- Haemophilus Influenza B: Chloramphenicol, 100mg/kg/day i.v. Q6hourly for 10 days
- Pneumococcus : penicillin G 500,000IU /kg/day i.v. Q 3 hourly for 14 days
- Meningococcus: penicillin G 500,000IU /kg/day i.v. Q 3hourly for 7 days OR
- Ceftriaxone, 100mg/kg IV , in two divided doses for 10 days for all cases
- Adjunct therapy: Dexamethasone, 0.6mg/kg/day div Q6 hours for two days.

SUPPORTIVE CARE

- Examine all children with convulsions for hyperpyrexia and hypoglycemia.
- In unconscious child:
- Maintain a clear airway.
- Nurse the child on the side to avoid aspiration of fluids.
- Turn the patient every 2 hours.
- Do not allow the child to lie in a wet bed.
- Pay attention to pressure points.

Fluid and nutritional management

- Give half to two third of the daily fluid requirement.
- Monitor IV fluids very carefully and examine frequently for signs of fluid overload.
- Fluid restriction is not appropriate in the presence of systemic hypotension because reduced blood pressure may result in reduced cerebral perfusion and CNS ischemia.
- Feed the child as soon as it is safe.
- Breastfeed every 3 hours, if possible, or give milk feeds of 15 ml/kg if the child can swallow.
- Continue to monitor the blood glucose level and

- **Hypoglycaemia**
- Give 2 ml/kg of 10% glucose (dextrose) solution IV rapidly.
- Recheck the blood glucose in 30 minutes and if the level is low (<2.5 mmol/litre or <45 mg/dl), repeat the glucose (2ml/kg)
- Prevent further hypoglycaemia by feeding; where possible
- **Convulsions -** If convulsions occur, give anticonvulsant treatment with rectal diazepam.

COMPLICATIONS

- Neurologic complications include seizures, increased ICP, cranial nerve palsies, brain abscess, hydrocephalus, stroke, herniation and subdural effusion.
- Sensorineural hearing loss is the most common sequelae of bacterial meningitis.
- Other common sequelae include mental retardation, seizures, and delay in the acquisition of language and visual impairment.

PREVENTION

- Routine **immunizations** against Hib and *S. pneumoniae* are recommended for children beginning at 2 months of age.
- Vaccines against *N. meningitidis* are recommended for young adolescents and college freshmen as well as military personnel and travelers to highly endemic areas.
- **Chemoprophylaxis** is recommended for close contacts of *N. meningitidis* infections and the index case and for close contacts of Hib and the index case; rifampin, ciprofloxacin, or ceftriaxone is recommended

Thank you