Pediatrics for Midwifery

(Midw3132)

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OVERVIEW OF PEDIATRICS

Learning Objectives:

After completion of this unit, the students will be able to describe:

- Definition of pediatrics
- Origin and history of pediatrics
- Difference between adult and pediatric medicine
- Pediatrics history taking and physical examination

Introduction

Definition:

- **Child Health** is the concern of pediatrics.
  - I.e. Pediatrics ↔ Child Health.
- **Pediatrics:** the term pediatrics is derived from Greek words:
  - "***pedia***" meaning a child
  - "***iatrike***" meaning treatment (Rx.)
  - "***ics***" meaning a branch of science.

Definition…

- Thus, pediatrics is a branch of medical science that deals with the care of childhood from conception to adolescent in health and illness.
- It concern with prevention, promotion, curative and rehabilitative care of children

Definition…

- Pediatrics is concerned with the health of infants, children and adolescents, their growth and development, and their opportunity to achieve full potential as adults (Richard E. Behrman in Nelson's Textbook of Pediatrics)

Pediatric Nursing

- Pediatric nursing is the specialized area of the nursing practice concerning the care of children during wellness and illness, which includes preventive, promotive, curative and rehabilitative care of children.

Importance of Pediatrics

- Major consumers of health care
- 35 – 40 of total population are children below the age of 15
- More vulnerable to various health problems
- Majority of Child's morbidity & mortality are preventable
- Needs special care to survive & thrive
- Wealth of tomorrow society and nation

Origin and history of pediatrics

- The importance of childhood as a unique period of development was understood more fully in the 17th and 18th centuries by John Locke (English philosopher)- the newborn infant comes into the world with no inherited predispositions, but rather with a mind as a tabula rasa (Latin for “blank slate”) that is gradually filled with ideas, concepts, and knowledge from experiences in the world.
- He concluded that the quality of early experiences, particularly how children are raised and educated, shapes the direction of a child‘s life

Origin and history of pediatrics…..

- Jean Jacques Rousseau (French philosopher)- children at birth are innately good, not evil, and that their natural tendencies should be protected against the corrupting influences of society
- The sympathetic, romantic attitude toward children inspired by Rousseau had an important influence on society
- Arthur Jacobi- has been recognized as the father of pediatrics. Under his direction, several hospitals opened pediatric units. He helped to found the American Pediatric Society in 1888.

Origin and history of pediatrics…..

- Pediatrics became a medical specialty in the mid 19th century
- Before that time the care and treatment of childhood diseases was included with in general medicine and obstetrics
- Virtually all nations have practicing departments of pediatrics or child health

Origin and history of pediatrics…..

Pediatrics become an independent medical specialty:

- The health problems of children differ from those of adults
- Children response to an illness is influenced by age
- Management of childhood illness is significantly different with that of adults
- Worldwide, children represent a higher proportion of total population

Origin and history of pediatrics…..

- The health problems of children vary widely within populations
- Economic consideration, educational, social, and cultural considerations, prevalence and ecology of infectious agents, climate and geography, agricultural resources and practices, industrialization and urbanization; gene frequencies for some disorders; and health and social welfare infrastructure.

Definitions of some Terms (Age Classifications)

- **Infancy Period**
  - Neonate
    - Birth to 28 days
  - Infancy
    - 1 month to 12 month
- **Early Childhood**
  - Toddler
    - 1-3 years
  - Preschool
    - 3-6 years
- **Middle Childhood**
  - School age
  - 6 to 12 years
- **Late Childhood**
  - Adolescent
  - 12 years to approximately 18 years

Terms from child health indicators:

- **Still birth** - death of the fetus after 28 weeks of gestation
- **Neonatal death -** death of live born up to 28 days
- **Early neonatal death -** death of infant during first seven completed days
- **Late neonatal death -** death of live born infant after 1 w/k but up to 28 completed days of life
- **Post neonatal death** - infants death after 28 days but less than one years of age

Terms from child health indicators:

- **Infant mortality**: the probability of dying before the first birthday
- **Child mortality:** the probability of dying between the first and the fifth birthday
- **Under-5 mortality:** the probability of dying between birth and the fifth birthday

An overview Child health in Ethiopia

- < 5 years & < 1 years are 16-18% & 3-4 % of the total population respectively, in 2007.
- These counts 50% of total recorded death.

Cause: Infection and malnutrition are major cause.

- **Infection:** Diarrhea disease, ARI, measles, & malaria.
- **Malnutrition:**(PEM & micronutrient deficiency)

Overview of child health in Ethiopia

Ethiopian Demographic and health survey 2016 (EDHS 2016)

- NMR: 29 deaths per 1000 live births
- PNMR: 19 deaths per 1000 live births
- IMR: 48 deaths per 1000 live births
- CMR: 20 deaths per 1000 children surviving to age 12 months
- U5MR: 67 deaths per 1000 live births

Differences between a Child and an Adult

- **Size** - newborn to adolescent
- **Physical** - anatomy, growth & development
- **Cognitive** - communication & understanding
- **Needs** - emotional, psychological & social
- **Rights** - even a CHILD of all ages has rights!

United Nations convention on the Rights of The Child(1989)

All children need:

- To be free from discrimination
- To develop physically and mentally in freedom and dignity
- To have a name and nationality
- To have adequate nutrition, housing, recreation, and medical services

United Nations' Declaration of The Rights of The Child (2)

- To receive special treatment if disabled
- To receive love, understanding, and material security
- To receive an education and develop his or her abilities
- To be the first to receive protection in disaster
- To be protected from neglect, cruelty, and exploitation
- To be brought up in a spirit of friendship among people

The Art of Pediatric Nursing Philosophy of Care

- **Family centered care**
  - Family oriented yet individualized and coordinated.
  - Recognizes the family as the constant in a child's life
  - Considers the needs of all family members in relation to the care of the child.

The Art of Pediatric Nursing…

- **Atraumatic Care**
  - Therapeutic care in settings, by personnel, and through the use of interventions that eliminate or minimize the psychologic and physical distress experienced by children and their families in the health care system.

Atraumatic Care

- The overriding goal in providing atraumatic care is **first, do no harm**.
- Three principles:

1) Prevent or minimize the child's separation from the family
2) Promote a sense of control
3) Prevent or minimize bodily injury and pain

Role of the pediatric nurse

- Primary care giver
- Advocate
- Health educator
- Consultant
- Support and counseling
- Coordination and collaboration
- Social worker
- Researcher

Promotive, Preventive and Curative aspects of Child Care:

- **Promotive:** refers to increases healthiness through health education**.**
- **Curative:** refers to treatment of diseases through medication (drug use).
- **Preventive:** refers to prevention of diseases through: Health education, Immunization, and Environmental sanitation.

Promotive, Preventive and Curative…

- **Health maintenance**: refers to health care of children who have chronic illness or those who are well.
- Prevention is the best measure for maintaining health.
- **There are three levels of prevention:**
  - Primarily
  - Secondary
  - Tertiary types of prevention

Levels of prevention….

Primary prevention

- The aim is to avoid disease before its on set.
- **Growth monitoring**: a strategy to monitor the nutritional status of the children.
- **Oral re-hydration**: prevent dehydration
- **Promotion of breast feeding**
- **Immunization**: developing immunity against infection through vaccination
- **Health education** on sanitation

Levels of prevention….

Secondary prevention

- Aim: early detection and treatment of the precursors of the disease.
- Screening methods such as tuberculin surveys
- Vitamin A deficiency surveys etc
- Treating the respective health problem

Tertiary prevention

- Aim: - Rehabilitation (e.g. polio mellitus), to prevent deformities.

Pediatric History and Physical Examination

- Key elements in the history taking process include; **establishing a warm, caring atmosphere** and **asking questions in a no confrontational, unhurried manner**
- Use simple language
- Good **eye contact** and a sense of **undivided attention** should be maintained.

Pediatric History and Physical Examination…

- **Sit** opposite the caregiver and/or patient at a comfortable distance
- Outside **interruption** should be kept to a minimum
- Greet in a friendly manner and introduce your self
- Ascertain who is with the child, It may not be the mother but another family member
- Older child should be involved in the history

Pediatric History and Physical Examination…

- Even younger children should be asked simple things in words they can understand
- Remember that the mother is giving you her version of the problem, not the child's.
- Always take notice of what the mother is saying, and listen to her complaints.
- The mother will know what is worrying her about the child, and any interruptions should be to guide her rather than try and impose your diagnosis on her.

Pediatric History and Physical Examination…

- **There are so many differences between pediatric and adult history**

1. Content difference
2. Approach difference
3. Parents as primary informant

- **Content difference**
  - Perinatal history
  - Developmental history
  - Social history
  - Immunization history

History

- **Identifying data**
  - Name, age, sex, name of parents (informant), date of examination, date of admission, source of data
- **Chief complaint (CC):**
  - What is the reason for the health visit
  - Must be informant's own word and must include the **duration**.

History…

- **History of present illness (HPI):**
  - Onset of symptoms, duration, timing (intermittent vs. constant)
  - Progression of illness over time, Associated symptoms
  - Aggravating or alleviating factors;
  - Similar episodes in the past, treatment, outcome, complications
  - What the family has done so far to manage
- **Past medical history (PMH):**
  - Previous admission, surgery, trauma, asthma, diabetes

History…

Perinatal history:

- Antenatal follow up of the mother
- Any illness during pregnancy like hypertension, diabetes mellitus
- Immunization for tetanus
- The onset, duration of labor or ROM, the mode of delivery, place of delivery, who conducted the delivery, the birth weight, APGAR score or did the new born cried immediately after birth, any procedure immediately after birth ?
- Jaundice, cyanosis, convulsion during neonatal period

History…

Nutritional(dietary)history:

- Type of feeding
  - Duration of exclusive breast feeding, time of initiation, frequency, total duration of BF.
- Formula feeding
  - Animal milk, commercial infant formula, amount
- Complementary feeding
  - Start at 6 months with liquid and semisolid foods
- Current diet

History...

Immunization history:

- Up-to-date?
- Is the child/infant being immunized?
  - Was he immunized only during National polio campaigns?
- When was the last vaccination?
- Route of vaccine?

Allergies: Drug, food ?

History...

Developmental history:

- Age at attainment of important milestones (walking, talking, self-care).
- Relationships with siblings, peers, adults.
- School grade and performance, behavioral problems.

History...

- **Family history**:
  - Medical problems in family, including the patient's disorder; diabetes, seizures, asthma, allergies, cancer, cardiac, renal or GI disease, tuberculosis, smoking.
  - Genetic diseases, infant deaths
- **Social history**:
  - Family income, occupation of the parents, housing, school and play facilities available for the child.

History...

- **Review of systems:**
  - Check list of symptoms
  - Almost similar with adults

Pediatrics Physical Examination

IMPORTANT HINTS

- Avoid irritating the child and prevent him from crying (if possible)
- Examine the child in the most comfortable way according to his age (exam table, mother’s hands, mother’s lap, while playing with a toy…)
- Postpone the painful and/or irritating examination (temp/throat/ears)

Pediatrics Physical Examination….

- Specific techniques similar to adult
  - Inspection
  - Palpation
  - Percussion
  - Auscultation
- Approach and order different

Pediatrics Physical Examination….

General appearance

- ✓Facial expression (pain)
- ✓Cry (high pitched, weak cry)
- ✓Grunting (respiratory distress)

Does the child appear to be:

- Well, acutely ill/toxic, chronically ill, wasted, or malnourished
- Alert and active or lethargic/fatigued?
- Well hydrated or dehydrated?
- Unusual body odors?

Vital signs

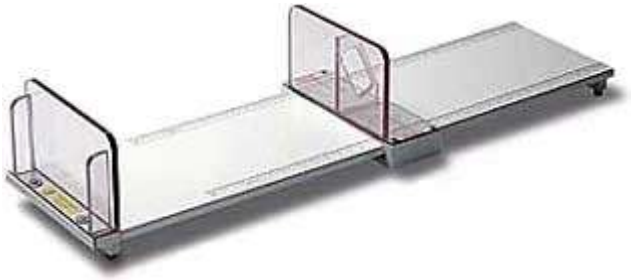
- Temperature
- Heart Rate
- Respiratory Rate
- Blood Pressure
- Pulse Oximetry

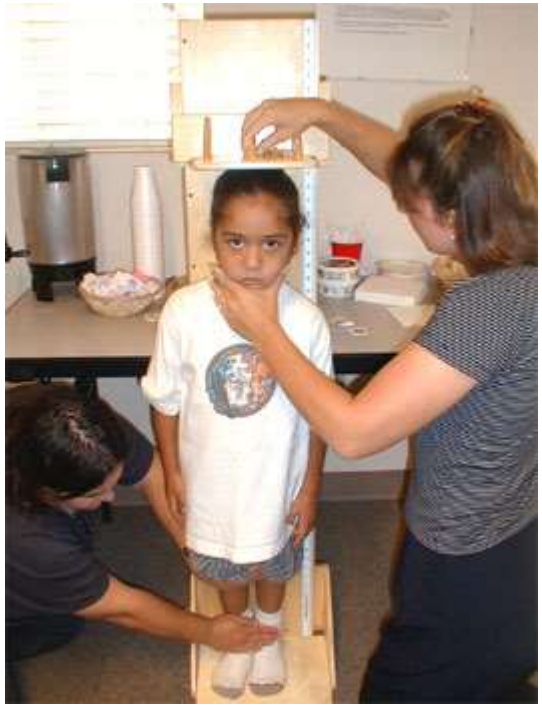
Pediatrics Physical Examination….

- Vital signs vary based on the age of the patient
- For newborns and infants take apical heart rate
- Take respiratory rate for full minute
- For measuring BP make sure the cuff covers no less than ½ and no more than 2/3 the length of the arm

Anthropometric Measurements

- Height, weight; head circumference in children ≤ 2 years;
- Always use (plot on) growth charts and determine the percentiles.
- Use appropriate scale for age to measure the weight.
- Naked weight (when possible)
- Measure recumbent length till 2 years of age and then standing length (height) after that





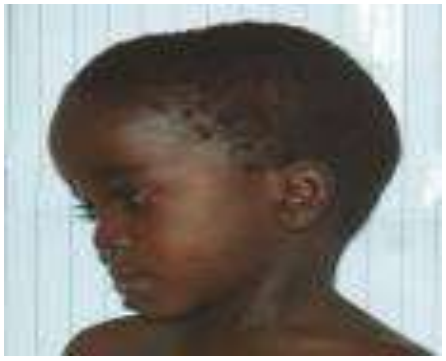
Stadiometers for Measuring Children and Adolescents

Skin, Hair, and nails

- **Skin**: Color, skin turgor, edema, texture, rash
- **Hair**: Texture, color, distribution, areas of hair loss.
- **Nails**: Color, texture, shape, capillary refill time (in seconds).

Head and neck

- **Head:** Size, shape, asymmetry, bossing, fontanels
- **Face**:- shape, complexion (pallor, cyanosis, jaundice), Edema.
- **Eyes**:- Pupils equal round and reactive to light and accommodation (PERRLA), sclera, eyelids, spacing, epicanthal folds, eyelashes, squint (eye deviation), sunken, sunset, discharge, redness. Red reflex



Pediatrics Physical Examination….

- **Ears**: Pinnas (size, position), deformity, discharge, ext. canal & Tympanic membranes (shape, color, position, light reflex)
- **Nose:** Shape, discharge, deviated septum, patency, polyp, flaring
- **Mouth**: Lips (fissures, cleft lip, herpes lesion), teeth, mucus membrane color and moisture, tongue, cleft palate
- **Throat:** Tonsils (erythema, exudate),hoarseness, stridor
- **Lymph node**: Location, size, tenderness, mobility and consistency of cervical, axillary, supraclavicular, and inguinal nodes
- **Neck:** Stiffness**,** torticollis, lymphadenopathy, thyroid nodules, position of trachea

Lungs/Thorax

- Inspection
  - Pattern of breathing
    - Abdominal breathing is normal in infants
    - Period breathing is normal in infants (pause < 15 seconds)
  - Respiratory rate
  - Use of accessory muscles: retraction location, degree/flaring
  - Chest wall configuration

Lungs/Thorax…

- Auscultation
  - Equality of breath sounds
  - Crackles, wheezes, rhonchi
  - Upper airway noise
- Percussion and palpation often not possible and rarely helpful

Cardiovascular

- Pulses
- Apical pulse - varies with age
- Rate and rhythm
- S3 common

Abdomen

Inspection

- look for scars, masses, skin lesions, asymmetry, visible pulsations
- Shape
  - Infants usually have protuberant abdomens, Becomes more scaphoid as child matures
- Umbilicus (infection, hernias)
- **Auscultation**: listen in all quadrants or until bowel sounds are heard as they will transmit throughout the entire abdomen

Abdomen…

Palpation

- Tenderness - avoid tender area until end of exam
- Liver, spleen, kidneys - May be palpable in normal newborn
- Rebound, guarding - Have child blow up belly to touch your hand

Genitalia

- Inspect external genitalia for abnormality, signs of abuse, or infection.
- **Male Genitalia:** Circumcision, hypospadias, phimosis, size of testes, cryptorchidism, hydrocele, hernia, inguinal masses.
- **Female Genitalia:** Imperforate hymen, discharge, labial adhesions, clitoral hypertrophy, pubertal changes.

Musculoskeletal

- Back
  - Sacral dimple, sacral hair tufts; tenderness over spine or costovertebral tenderness.
  - Kyphosis, lordosis or scoliosis
- Joints (motion, stability, swelling, tenderness)
- Muscles
- Extremities
  - Deformity, Symmetry, Edema, Clubbing

Musculoskeletal…

- Gait
  - Bow legs, knock knee -“Physiologic” bowing is frequently seen under 3 years of age and will spontaneously resolve
  - Limp

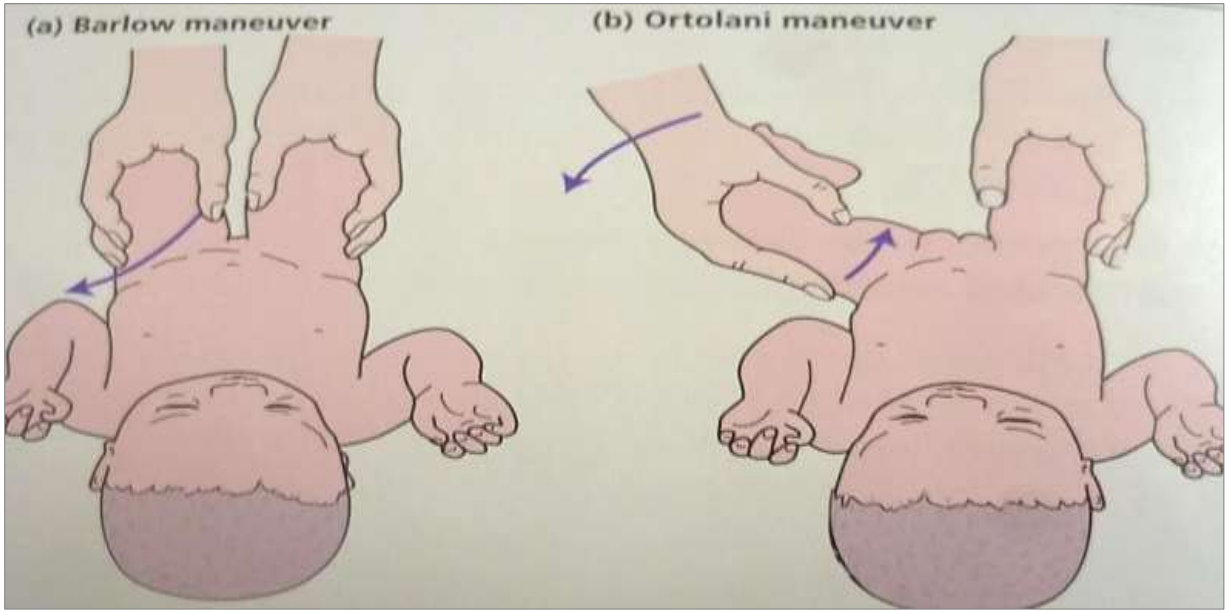
Musculoskeletal…

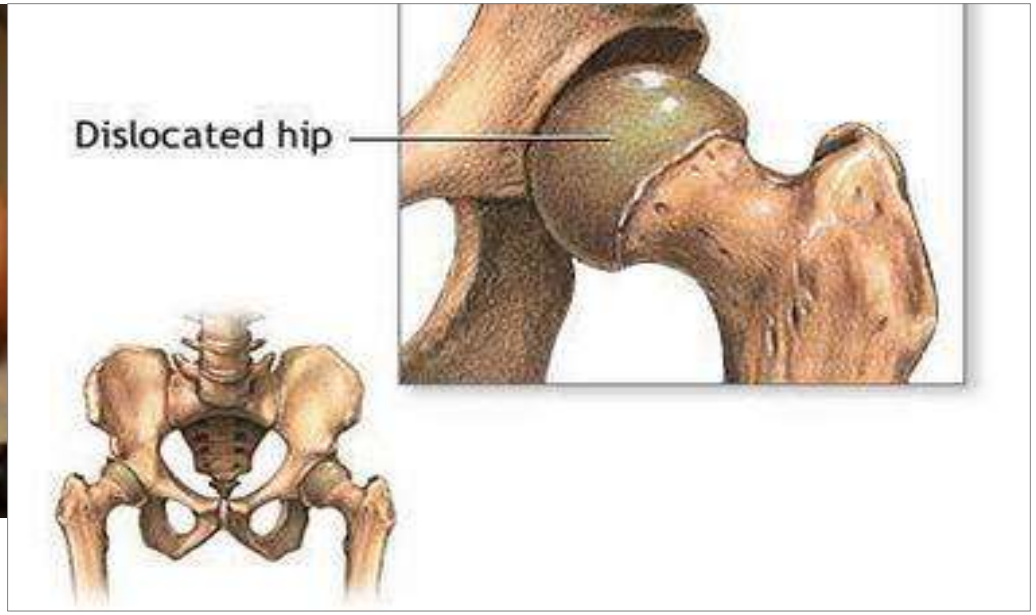
(a) **Test for dislocatable hip**

- Hip is held flexed and adducted.
- The femoral head is pushed downwards.
- If dislocatable, the femoral head will be pushed posteriorly out of the acetabulum.
- Barlow's sign is positive

(b) **Test for dislocated hip**

- Abduct hip with upward leverage of the femur.
- A dislocated hip will return with palpable '**clunk'** into the acetabulum.


(a) Barlow maneuver
(b) Ortolani maneuver


Dislocated hip

Neurologic

- Similar to adult
- Extent of neurologic exam dictated by history and index of suspicion
- Much of the usual neurologic examination is done by observation with respect to age

Neurologic…

- Level of consciousness
- Cranial nerve examination
- Sensory examination
- Motor examination
- Deep tendon reflexes

CHILD GROWTH AND DEVELOPMENT

Learning Objective

After studying the material in this unit, the student will be able to:

- Identify the difference between growth and development
- Describe milestones of normal growth and development
- Detect deviation from normal growth and development
- Use growth-monitoring chart to assess nutritional status of under 5 children
- Recognize needs of the growing child

Growth and Development

- What is Growth ?
- What is Development ?
- What is the difference and similarity in growth and development ?

Growth and Development

Growth:

- An increase in size of a living organism from a simple to a complex form.

Development:

- An increase in skill and complexity of function

- **Growth and development** go together but at different speeds.

Growth and Development…

- Growth is attributable to increased number of cells
- Development is intimately related to **maturation of the nervous system**, but may be profoundly modified by environment & experience

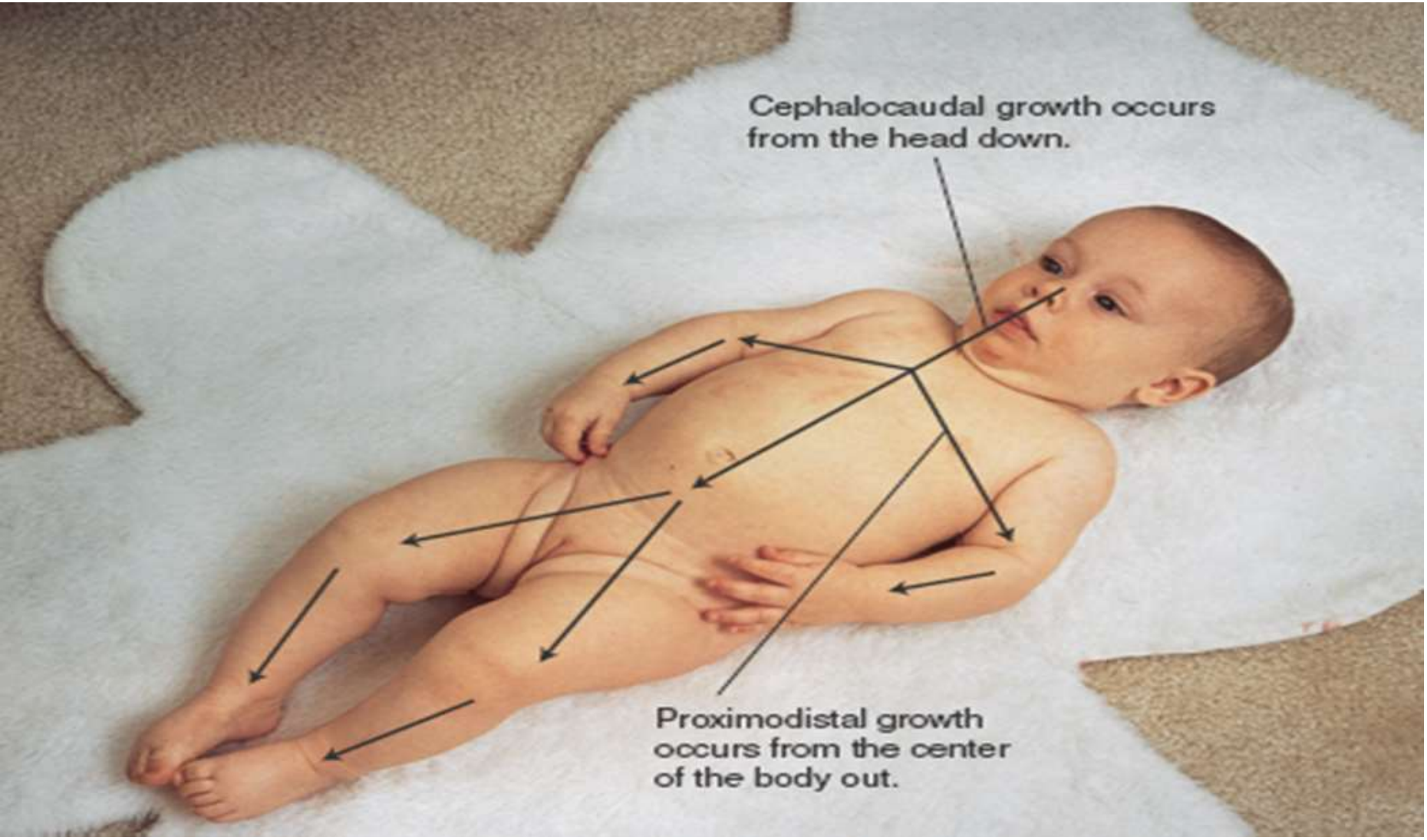
Principles of Growth & Development

- Continuous Process
- Predictable Sequence
- Don’t progress at the same rate (↑ periods of GR in early childhood and adolescents & ↓ periods of GR in middle childhood)
- Not all body parts grow in the same rate at the same time
- Each child grows in his/her own unique way

Principles of Growth & Development…

- Each stage of growth & development is affected by the preceding types of development
- Cephalocaudal (head down to toes)
- Proximodistal (center of the body to the peripheral)
- General to specific

Principles of Growth & Development…



Factors Affecting growth and development

- **What are the Factors Affecting growth and development?**

Factors Affecting growth and development

- ***Genetic factors***
  - The growth of a child is a result of complex interactions of genetic and environmental factors.
- ***Neural control of growth***
  - Growth center in brain that keeps the child in his or her genetically determined growth curve:
  - If a child deviates from a growth pattern for a period of time because of malnutrition or illness, a period of accelerated or ’catch-up‘ growth brings him or her back to the ’predetermined‘ curve, implying some sort of central control mechanism.

Factors Affecting growth…

- ***Hormonal influence***
  - Most of the endocrine glands influence growth significantly either by promoting protein synthesis, regulating substrate supply, or enhancing the effect of other hormones on specific organs.
  - E.g growth hormone, insulin, thyroid hormone, and sex hormones.
- ***Nutrition***
  - Adequate food to provide substrate for energy and synthesis of proteins is essential for normal growth.

Factors Affecting growth…

- ***Environmental and social factors***
  - The home, neighborhood, and school environments have profound effect on the child's psychosocial development.
  - Socio-economic status also significantly affects the growth of a child: thus, children in top socioeconomic groups are taller than children of lower socioeconomic class.

Types of growth and development

Types of growth:

✓Physical growth (Ht., Wt., head & chest circumference)

✓Physiological growth (vital signs …)

Types of development:

✓Motor development

✓Cognitive development

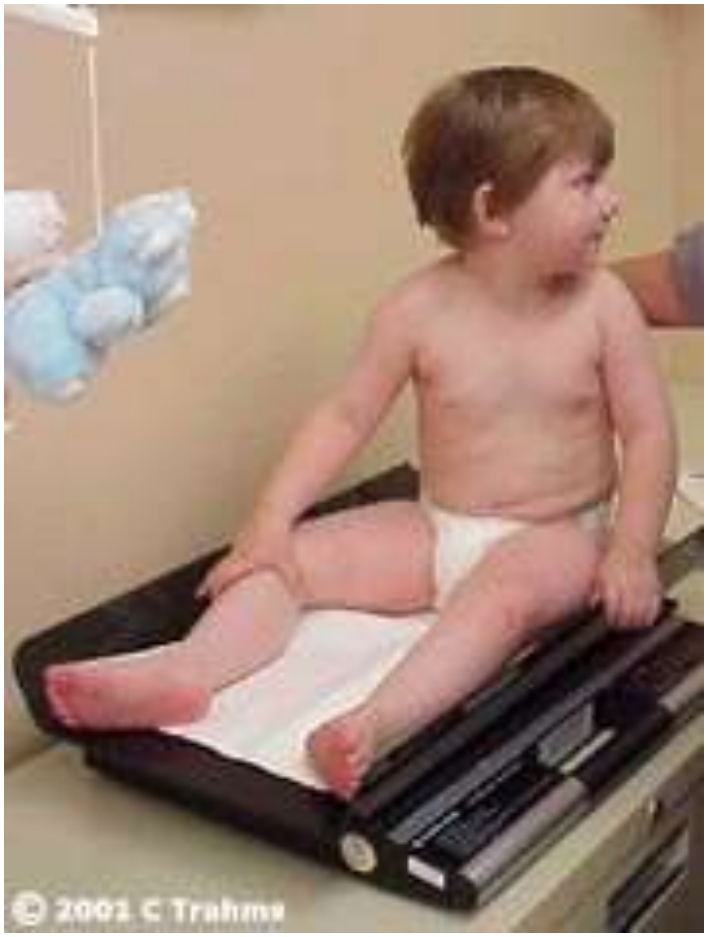
✓Emotional development

✓Social development

Weight:

- Normal birth weight is 3400gms (normal range : 2500 –4000gms).
  - Double birth Wt. at 4–7 months of age.
  - Triple birth Wt. at 10-12 months of age.
  - Quadruple birth Wt. at 2-2.5 years of age.
- Newborns lose 5-10% of body Wt. immediately after birth
- Newborns gain 30gm/day during the 1st 5-6 months and 2-3 kg/yearly after 1st year.

Weighing Infants and Toddlers



☑ Up to 36 months if unable to stand without assistance

Formula to Estimate Average Wt.

Age	**Wt (in Kg)**
At birth	3.5
1 –12 months	$\frac{\text{Age (in months)} + 9}{2}$
1 –6 yrs	Age (in yrs) x 2 + 8
6 –12 yrs	$\frac{\text{Age (in yrs)} \times 7 - 5}{2}$

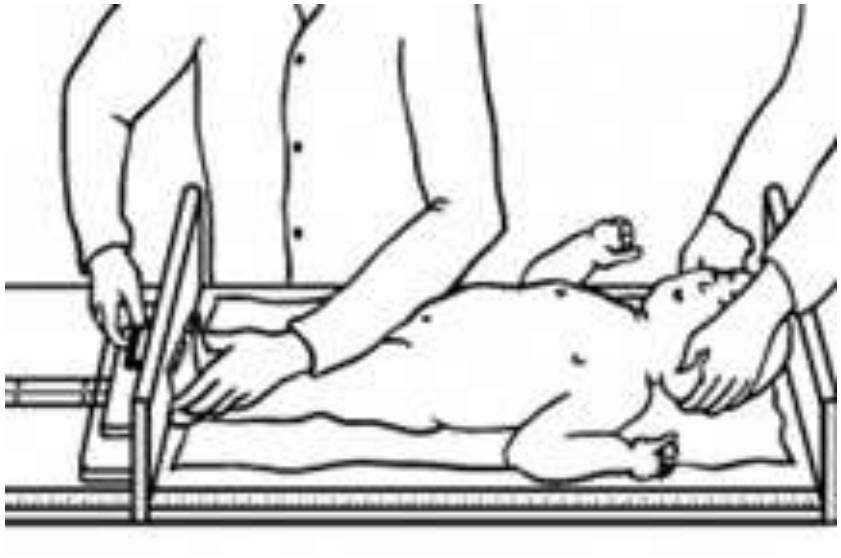
Height/Length

- Growth in stature progress less rapidly than Wt.
- Normal newborn length is 50 cm (range 46 –56cms).
- Increase 25 –30cms in first year of life.
  - After first year, gain 6 – 8cms yearly.
  - Birth length doubles by 3 –4 years.
- Eventual adult Ht can be approximated by doubling child's Ht by 2 years of age (i.e. Ht at 2 yrs of age half adult Ht).

Height/Length ….

- The required principles to measure the Height or Length include:
- **Length**
  - Measure length of children up to 2 years
  - Use supine position, which requires 2 people
    - Straight knees and keep ankles in neutral position
    - Record measurement to the nearest 0.1 cm

Measuring Length

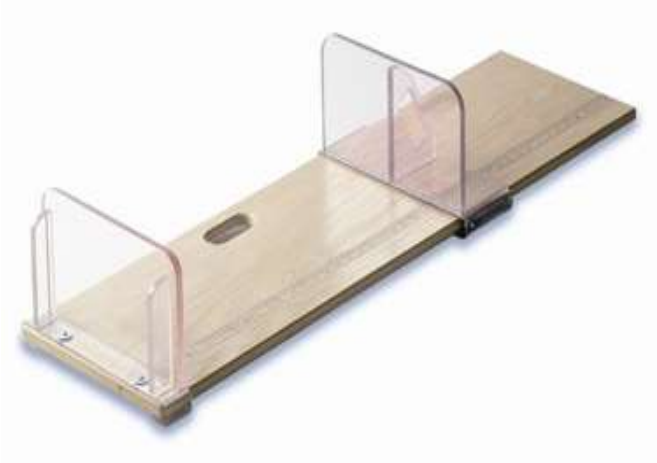


Height/Length ….

Height

- Measure Ht for children > 2 years old
- Use a tape meter or a measuring tape plastered on a wall
- Remove shoes
- Make sure the legs are close to each other and the heels, the buttock and the shoulder blade touch the wall and the head looks straight ahead
- Place a ruler or a hard paper on top of the head to perpendicular to the wall to take the measurement.
- If there is large hair, press gently

Measure Lying or Standing?



Length (Lying)

- Unable to stand without assistance
- Use Birth - 36 months growth chart

Stature (Standing)

- Able to stand without assistance
- Use 2-20 years growth chart

Formula to estimate Ht of children

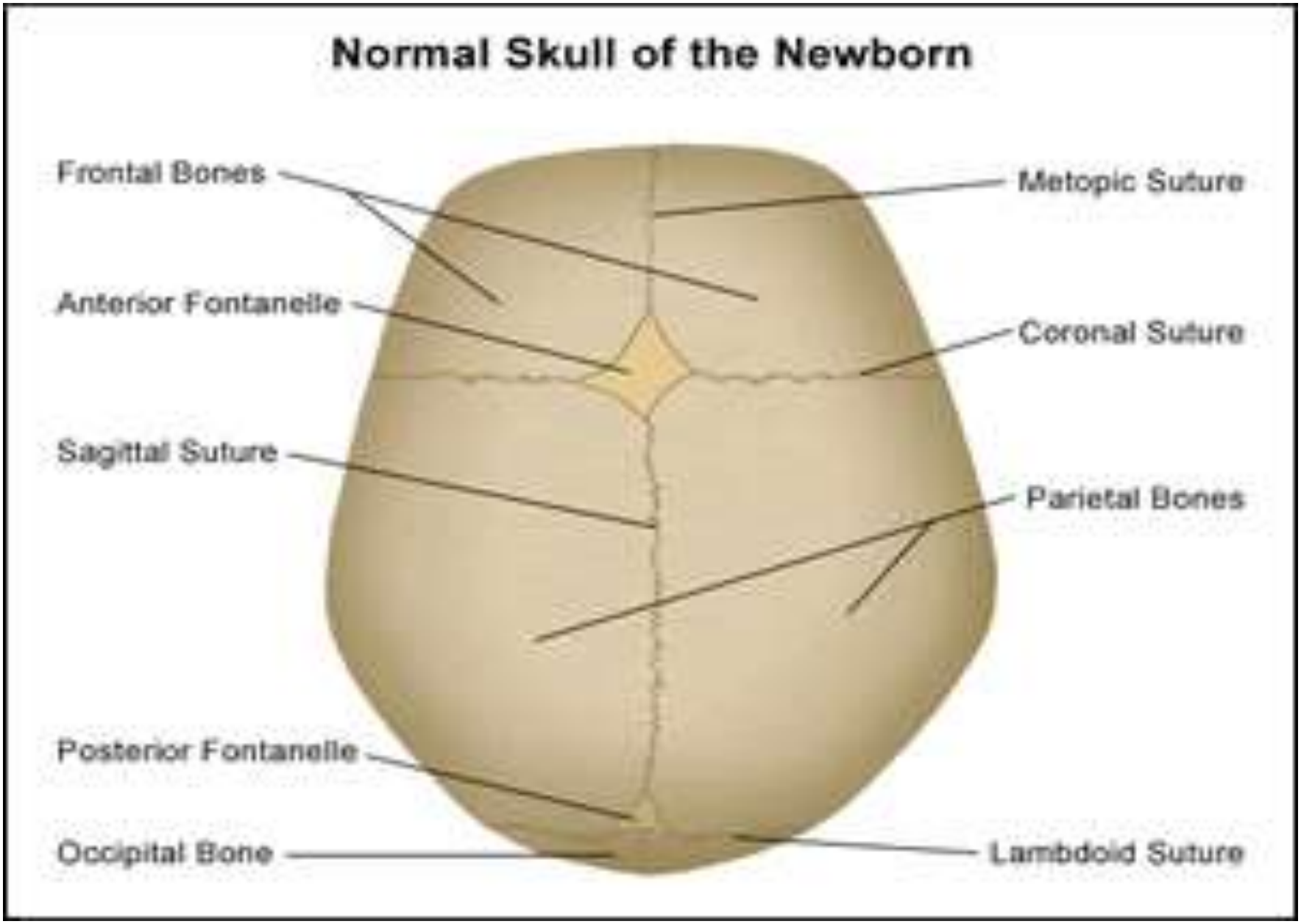
Age	**Ht (in Cm)**
At birth	50 cm
At 1 year	75 cm
2 –12 years	Age (in yrs) x 6 + 77

Head Circumference:

- It is an indirect way of measuring brain growth.
- Increases in HC parallel to the rapidly growing CNS.
- Average newborn HC is 35cms (normal range 32.6 – 37.2cms).
- The infant has relatively larger head than the adult
- At birth the head is **quarter** of the whole body length but in an adult it is only one eight
- Skull has 2 fontanels (anterior & posterior)

Anterior fontanel

- Diamond in shape
- The junction of the sagittal, corneal and frontal sutures forms it
- Between 2 frontal & 2 parietal bones
- 3-4 cm in length and 2-3 cm width
- It closes at 12-18 months of age


Normal Skull of the Newborn
Frontal Bones
Metopic Suture
Anterior Fontanelle
Coronal Suture
Sagittal Suture
Parietal Bones
Posterior Fontanelle
Occipital Bone
Lambdoid Suture

Posterior fontanel

- Triangular
- Located between occipital & 2 parietal bones
- Closes by 6-8 w of age.

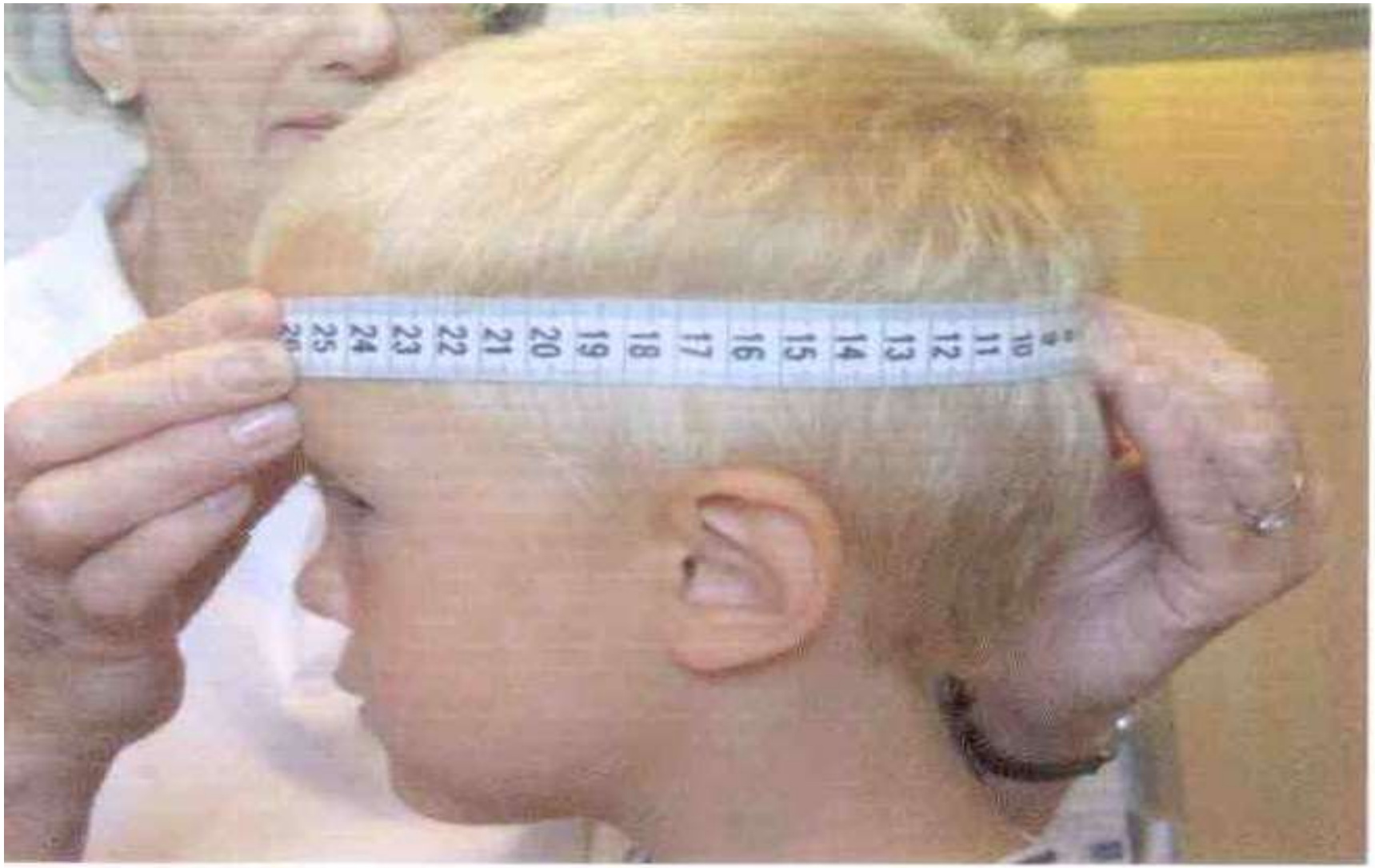
Head Circumference:

- The head grows **12 cm** (about 10 –12cms) in circumference in the first 12 months.
  - 6 cm of this is in the first three months.
  - 3 more cm during the next three months
  - the rest 3cm grow in the rest months.
- During second years, increases only **2 cms**
- Brain reaches adult size at about **12 years** of age.

Cont'd

- HC is measured by taking the greatest distance around the mid forehead-above the ears to the most prominent-occiput (maximal occipitofrontal circumference(OFC)).
- Record measurement to the nearest 0.1 cm.
- **The result may:**
  - Below normal range-abnormally small = micro-cephalous
  - Above normal range-abnormally large head = usually hydrocephalus
  - **Chest circumference**
    - It is 30.5 to 33cm (usually 2–3cm less than head circumference)

OFC



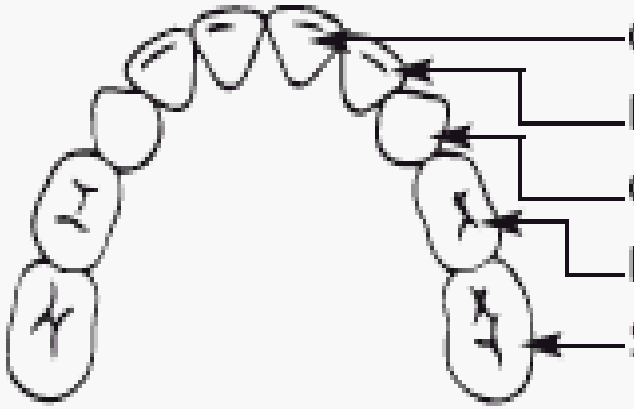
Other indices of Growth:

- Body Proportions
- Skeletal maturation
- Dental eruption

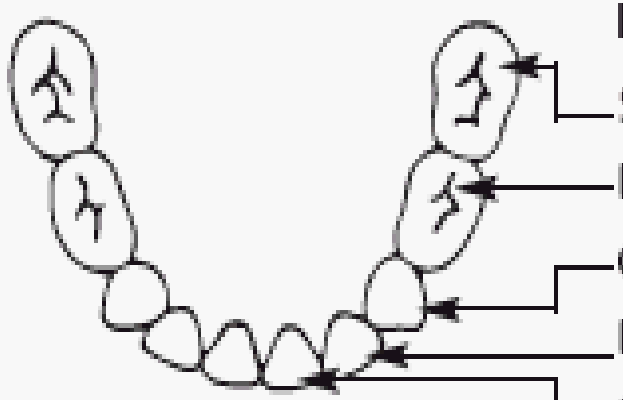
Dental Eruption

- Eruption of teeth starts by 5–6 months of age. It is called "Milky teeth" or "Deciduous teeth" or "Temporary teeth".

PRIMARY DENTITION



Upper Teeth	Erupt	Exfoliate
Central incisor	8-12 months	6-7 years
Lateral incisor	9-13 months	7-8 years
Canine (cuspid)	16-22 months	10-12 years
First molar	13-19 months	9-11 years
Second molar	25-33 months	10-12 years



Lower Teeth	Erupt	Exfoliate
Second molar	23-31 months	10-12 years
First molar	14-18 months	9-11 years
Canine (cuspid)	17-23 months	9-12 years
Lateral incisor	10-16 months	7-8 years
Central incisor	6-10 months	6-7 years

Developmental milestones

Age periods and developmental milestones:

- The development of a child can be accessed from different points of view.
  - What he can do in the way of moving around?
    - (motor development)
  - How he talks and makes his wants known?
    - (language)
  - How he fits into his family and community?
    - (social behavior)

Developmental milestones…..

- The various skills the baby learns are called ***Millstones***.
- In watching development we notice at what age the child learns to do certain things, such as smiling at his mother, sitting without support, grasping objects with his hands, walking and talking

The Average age of Children and Developed Milestones

Average age	Motor Development	Language & social behavior
1mon	Lift head when prone	Fix with eye, smile
3-6mon	Head control	Follow with eye, play with hands
6-9mon	Unsupported sit	Grasp, makes noise
9-12mon	Able to stand	Understand few words, try to use
12-18mon	Able to walk	Finger grasp small things
2years	Able to run around	Can say words or sentences
3years	Active play, climb, jump	Talking much

- **Red Flags!**
- **AGE** **Warning sign**
- **1 month** **Does not regard face, no eye contact, no smile, poor suck, floppy**
- **2 months** **Does not look at you with both eyes at least for a few moments, and does not follow with eyes if you move your face slowly from side to side**
- **3months** **Does not respond to sound by quieting**
- **4months** **Does not hold head steady for a few moments when you sit him up, does not grasp rattle that you put into his palm**
- **5months** **Does not raise head and support weight on arms when in prone position**
- **6 months** **Cannot reach for objects with both hands, Floppy, no response to sound, Poor social response to people**
- **9 months** **Unable to sit unsupported , hand preference, fisting, persistence of primitive reflexes**

Age **Warning signs**

- **12months:- Unable to bear weight on legs**
- **15 months:- Does not walk alone, is not using at least one word meaningfully**
- **18 months:- Does not use at least 3 words, and does not point to what he wants**

Developmental Assessment

- **Gross motor development**
    - Gross muscular activity and neurodevelopment including posture, independent mobilities and progress from head control to running
- **Fine motor development (Manipulation)**
    - The ability to reach for, grasp and manipulate objects
- **Cognition and Social skill**
    - Social smile, watching a mirror, waving goodbye, general alertness and curiosity about the surrounding
- **Language**

Milestones at different ages

Infancy (0-12 months)

- **Physical**:
  - Weigh an average of 10 Kg at 12 months, length increases by 25 cm, and head circumference by 12 cm
- **Gross and Fine Motor**
  - at 3 M support head, at 6 M sit without support, at 8 M crawl and at 12 M stand without support
  - 3-4 M grasp objects, 5-6 M transfer objects from hand to hand, at 9 M thumb-finger grasp and at 12 M scribble

Infancy…

- **Cognition & Social skill:**
  - at 6-8 Week social smile, at 4 Month laugh, 6-8 Month stranger anxiety and at 9-12 Month ,object permanence.
- **Language**
  - first 6 Month vowels, at 7 Month start with consonants, at 8-9 Month papa & mama, at 12 Month few words.

Toddlerhood (12-24 months)

- **Physical:**
  - Gain average Wt of 2 Kg, Ht 12 cm & HC 2 cm
- **Gross Motor:**
  - Walk at 12-15 M, at 18 M run stiffly, walk upstairs with one hand held, at 24 run well and walk up and down stairs one at a time
- **Fine Motor:**
  - at 15 M make a line, insert pellet in a bottle, at 18 M imitate vertical stroke and at 24 M imitate horizontal stroke

Toddlerhood…

- **Cognition & Social skill:**
  - at 15 M indicate desire by pointing, at 18 M feeds self, complain when wet or soiled, at 24 M helps undress and listens to stories with picture
- **Language:**
  - at 15 M start to speak in jargons, at 18 M 10-15 words and at 24 M two word sentence.

Preschool (2-6 years)

- **Physical**:
  - Gain 2 Kg/yr and Ht 7 cm/yr; by end of 3 yr all primary teeth have erupted
- **Gross & Fine Motor:**
  - at 2 & half yr walk upstairs alternating feet, at 3 yr ride tricycles & copy circle, at 4 hop on one foot, throw ball over head & copy cross; at 4 & half yr copy square; at 5 yr skip & copy triangle

Preschool…

- **Cognition & Social skill:**
  - at 2 & half yr Know full name and pretend plays; at 3 yr know age and sex, count 3 objects, wash hands & put shoe; at 4 yr tell a story; at 5 yr name 4 colors, count 10 objects correctly and dress & undress; think in prelogical operations.
- **Language**
  - language develop most rapidly between 2-5 yr, vocabulary increases from 50-100 to about 2000 words; number of words in a sentence equals age in years

School age (6-12 years)

- **Physical:**
  - Average weight and height gain per year is 3-3.5 kg and 6 cm respectively, HC increase by 2-3
- **Motor:**
  - Coordination and stamina increase progressively, and are able to perform complex movements such as dancing
- **Cognition & Language:**
  - Start thinking in concrete logical operations

Value of Play and Selection of Play Material

- Play is defined as behaviour that is freely chosen, personally directed (process of trial and error) and intrinsically motivated.
- ***A successful, well-run play program needs to***:
  - Increase the child's ability to cope with a hospital environment.

Value of Play and Selection of Play Material

- Facilitate appropriate channels of communication
- Reduce developmental regression
- Promote confidence, self esteem and independence
- Relieving fear and anxiety
- Help professionals to assess development
- Provides opportunities to engage in meaningful activities that enhance physical, language, social, and cognitive development

Play & Skill Development:

- Play can be an effective way for Children to develop skills:
  - **Language** - name games, sing songs, rhymes/same sound.
  1. **Thinking** - build towers, puzzles, follow directions
  - **Small-muscle** - string beads, cut with scissors
  - **Large-muscle** –running, play ball, race, roller-skate etc.
  - **Creative** – clay, paper, make-up stories, dress-up puppets.
  - **Social** – decisions, playing with others e.g. parts of a play, which team going to play in etc.

Growth monitoring

- The most powerful tool in growth assessment is the growth chart (Growth monitoring chart); used in combination with accurate measurements of height, weight, and head circumference.
  - Measurement
  - Plotting
  - Interpretation

Growth monitoring….

- **Growth Charts/Curves:** are Graph that records changes in the child's growth with time compared to normative growth rates.
- Growth parameters should be standardized and compared with age related norms.

Why do we use growth curves?

- Easy and systematic way to follow changes in growth over time.
- Height, weight and head circumference should be at regular intervals.
  - Monthly till 6 months of age and continues accordingly.

Types of growth curves/charts:

- ***WHO growth charts:*** Is age and gender specific, and extend from birth to 5 years.
  - Wt for age → boys and girls
  - Ht/length for age → boys and girls
  - Wt for Ht/length → boys and girls
- ***CDC growth curves:*** is age and gender specific, and extend from birth to 18 years.
  - Wt for age → boys and girls
  - Ht/length for age → boys and girls
  - Wt for Ht/length → boys and girls
  - Head circumference → boys and girls

Parameters of Growth Assessment

- **Weight for age** “growth faltering”
- **Height for age** "stunting"
- **Weight for Height** "wasting"
- **Head circumference**

Parameters of Growth Assessment…

- **N.B:** Use CDC growth curves to monitor HC for < 3 yrs and Growth for > 6 yrs of age.
- **Procedures for accurate measurement**:
- Accurate measurement is a key component of assessing growth. Weight, in pounds or kilograms, must be determined using an accurate scale.
- **Head circumference** is determined using a flexible tape measure run from the supra-orbital ridge to the occiput in the path that leads to the largest possible measurement.

Parameters of Growth Assessment…

- The data obtained from samples for standard preparation are presented in 5 standard gender-specific charts:

1. *weight for age;*
2. *height (length and stature) for age;*
3. *head circumference for age;*
4. *weight for height (length and stature)-infants;*
5. *BMI for children over 2 years of age.*

Parameters of Growth Assessment…

How to plot the chart:

- Measure variables using same method at each visit.
- Use age and sex appropriate charts
- Plot measurement on “Y” axis against age on “X” axis.
- Compare growth point with previous points.
- Assess growth percentile.

What are percentiles?

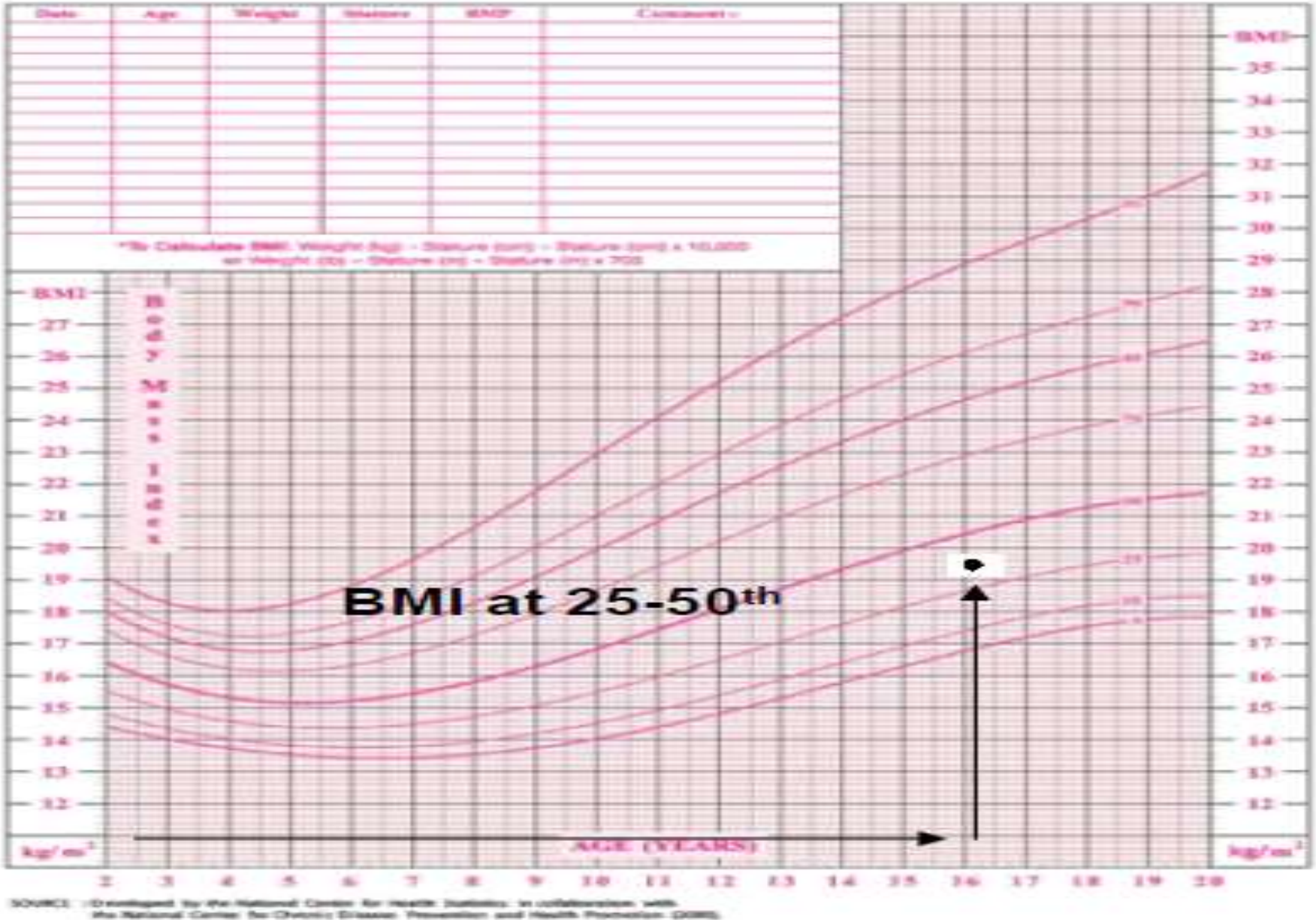
- **The percentile curve** indicates *the percentage of children at a given age on the x-axis whose measured value falls below the corresponding value on the y-axis.*
- The percentiles speak to the general population and address the question "***what percentage of the population is of the same weight and height?***".
- The median, or 50th percentile, is also termed the ***standard value***.

What are percentiles…

- **E.g.** If a child is on the 5%, the growth chart tells you that the child is small relative to other children of the same age; → 95% of children of the same age are heavier than him.
- On the weight chart for boys 0–36 mo of age, the 9 mo age line intersects the 25th percentile curve at 8.6 kg, indicating that 25% of the 9 mo old boys in the National Center for Health Statistics sample weigh less than 8.6 kg.

Continu…

- **The weight-for-height charts** are constructed in an analogous fashion, with length or stature in place of age on the *x*-axis; the median or standard weight for a girl measuring 110 cm is 18.2 kg.
- **Body mass index (BMI)** is added to the standard growth charts for children over 2 year of age. BMI can be calculated as wt. in kg/(height in meters)^2 with expression of decimals.
- BMI percentile varies with age over childhood: a 6 yr old girl with a BMI of 21 is overweight, while a 16 year old girl with the same BMI is just above the 50th percentile.



SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000).

continue…

- Specialized charts have been developed for children with various conditions, including very low birth weight and prematurity; Down, Turner, Klinefelter syndromes, and achondroplasia.

What to measure?
1. Weight – for – age:

1. Weight for age: weight of the child (in kg) is compared with that of a healthy child of the same age from a reference population.

Wt for age = (Actual wt./standard wt. of the same age)*100

Analysis…

- When growth parameters fall below the 5th percentile, it is necessary to express values in percentages
  - E.g. Harvard Standard
- Nutritional insufficiency must be differentiated from:
  - Congenital, constitutional, familial and endocrine causes of decreased linear growth

Wellcome classification

Weight for Age (Gomez)	With Edema	Without Edema
60-80%	kwashiorkor	underweight
< 60%	marasmic-kwashiorkor	marasmus

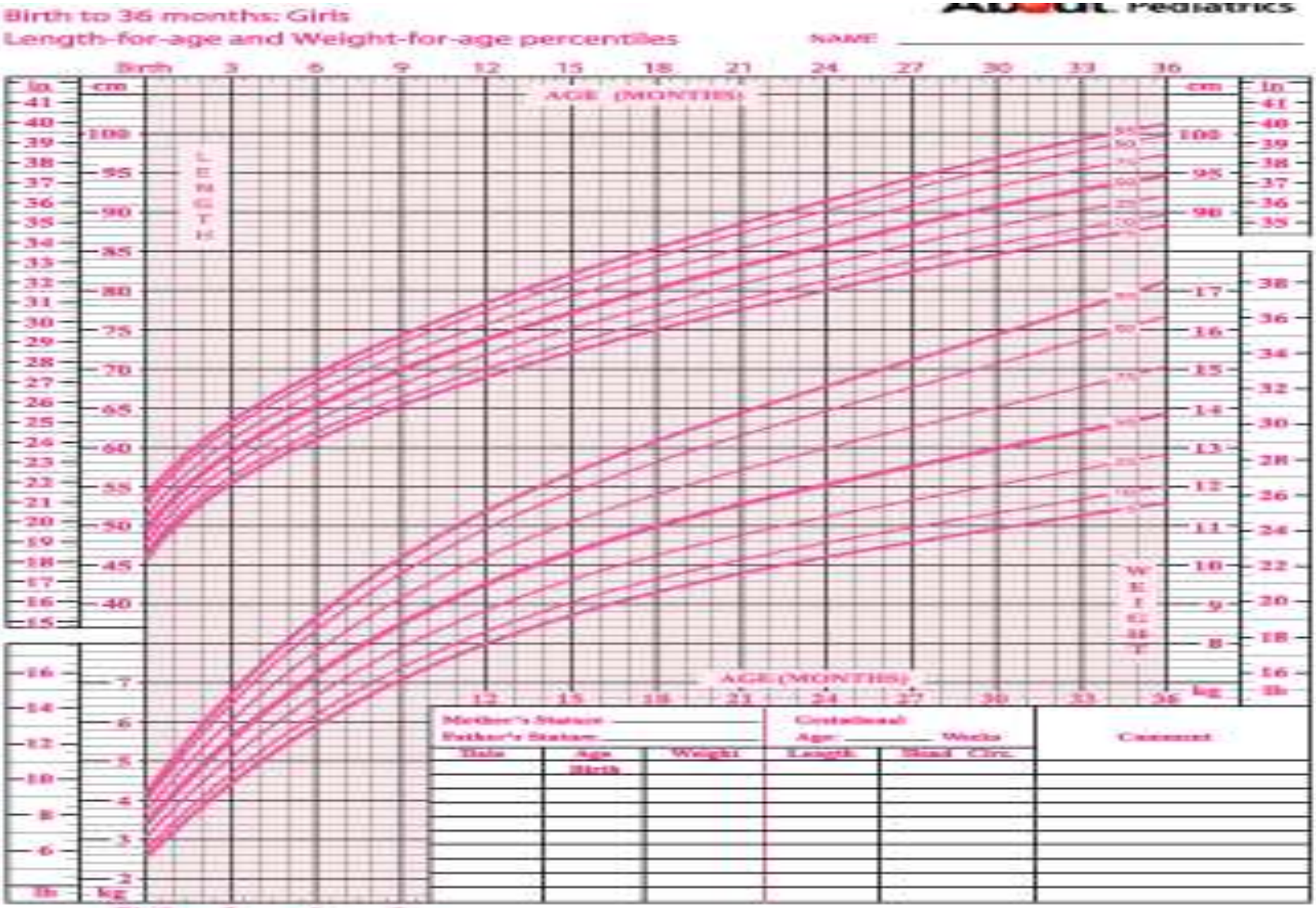
2. Length for age

- Compares height/length with the expected height of a healthy reference child of the same age.
- Used to assess **stunting** which may be an **index of long-term nutritional deprivation.**

3. Weight for length/height

- Degree of wasting assessed by comparing the child's **weight with the weight that would be expected for a healthy child of the same height**.
- A child who is < 70% of the expected weight for height is classified as **severely wasted.**

Percentile curves



4. Head circumference

- Increases in size during the 1st year of life, but little increment between 1 and 5 years of age.

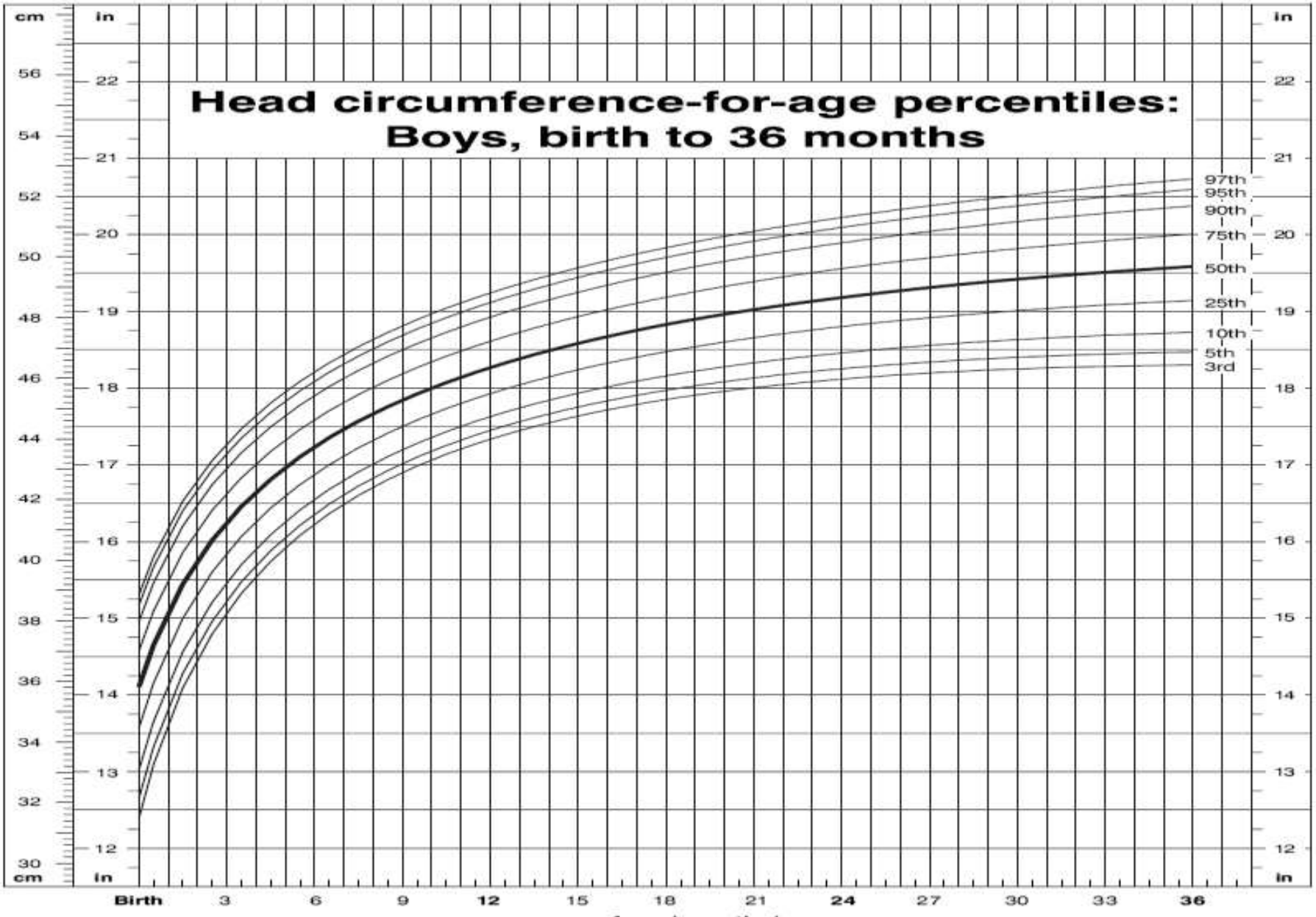
Average Head circumference (cm) at birth = 35 (33 – 37)

At 6mo = 44

At 1 yr = 47

At 2 yr = 49

Percentile curves



5. Mid Upper Arm Circumference (MUAC)

- at birth, average MUAC= 10.5cm
- by the age of 1 year, MUAC=16.5cm
- between 1 and 5 years of life, average increment is only about 1cm, to reach 17.5cm at 5 years.
- between 1 and 5 years of age, MUAC of <12.5cm, considered malnourished.
- low MUAC is more closely associated with acute malnutrition (wasting) than stunting.

MUAC…

- ✓Useful as method of screening large number of children, during nutritional emergencies.
- ✓less useful in long – term growth monitoring.

Meeting the needs of the normal children through the stages of development and parental guidance

- ***Nutrition*:** Good nutrition is the base for normal growth and development. The first six months of life are extremely important as the brain may suffer for the rest of life, if the child is not getting enough food.

Cont'd

- ***Emotional Support:*** It is very important to realize that a child is a growing and developing human being and he ought to be treated very carefully with love and respect by everyone so he can develop in harmony.
- ***Love*****:** a child who does not feel loved will not develop properly, and will not learn as quickly as normal children. He/she may be sad, lonely and no longer interested in what goes on around him.

Cont'd

- ***Security*****:** a child can only feel safe if his parents show that they love him and take good care of him.
- He must know that his parents will look after him, feed him when he is hungry, play with him and keep him happy and comfortable.
- The love and security he/she gets from family helps him to feel friendly to people outside his family when he grows up.

Cont'd

- ***Acceptance as individual***: the young child needs to know that his mother and family love him for what he is.
- They should not compare him with other children and tell him that he is slow to do this or that, he is not as good as some other child.
- ***Recognition of achievement*****:** the young child needs to know that his parents are happy and pleased when he has learned to do something new.

Cont'd

- ***Wise and consistent use of authority***: children need to know what they can and what they cannot do. Parents must teach children how they are expected to behave.
- ***Independence*****:** as the child grows he needs to be allowed to decide more and more things alone.

Cont'd

- ***Playing*:** Encourage playing even if it may be noisy sometimes. It helps physical, mental and social development and is also good for health.
- ***Language training*:** adults should talk with small children and encourage them to talk about what they are thinking
- Do not laugh when children are talking; try to understand and be happy when they involve you in their world.

Nutrition in Children

Learning objectives

- **At the end of this chapter, students are expected to**
  - Describe nutritional need and feeding of infant and children
  - Describe common forms of malnutrition

Feeding of infant and children

In Ethiopia (EDHS 2016)

- Stunted (too short for age) - 38%
- Wasted (too thin for height) - 10%
- Underweight (too thin for age) -24%
- About 76% of the mothers breast feed up to two years

(91% → suboptimal)

- Exclusive breast-feeding is 58% (0-6 months)

Feeding of infant and children

Breastfeeding

- Breast milk provides immunological, nutritional, and psycho social advantages
- It is an ideal food for normal growth and development of infants
- Compared to cows milk, breast milk contains more iron, sugar, vitamin A and C, and niacin
- It has less protein and calcium than cows milk, but the amounts present are better utilized by the baby

Feeding of infant and children…

- Breast milk is more digestible because its fat globules are smaller and it is pure
- It provides the baby with greater immunity to certain child hood diseases
- Breast fed babies are less prone to intestinal upset
- Infants should be exclusively breast fed for the first six months to achieve optimal growth and development

Why is breast feeding so important

- **Practical factors in favor of breast milk are:**
- It saves time and money
- Delivered to the baby in proper quantity and quality
- Helps the uterus to return to its normal size and reduce post-partum bleeding.
- Gives emotional satisfaction to the mother
- Enhance bonding and attachment

Why is breast feeding so important

- Has contraceptive benefits
- Contains the necessary nutrients needed by an infant
- Nutrients are easily digestible and absorbable
- Provides all the water an infant needs, even in a hot, dry climate
- Protects an infant against infection

Why is breast feeding so important

Disadvantages of artificial feeding

- Interferes with bonding and attachement
- More diarrhoea and persistent diarrhoea
- More frequent respiratory infections
- Malnutrition; Vitamin A deficiency
- More allergy and milk intolerance

Disadvantages of artificial feeding

- Increased risk of some chronic diseases
- Obesity
- Lower scores on intelligence tests
- Mother may become pregnant sooner
- Increased risk of anemia, ovarian cancer, and breast cancer in mothers

Exceptionally difficult circumstances

- Emergency situations
- Malnourished children(needs support from formula milks)→ risks of malnutrition
- Low-birth-weight babies (Gavage feeding)
- Infants of HIV-infected mothers (AFASS)
- Orphans
- Infants requiring tube feeding
- Infants/ children with chronic illnesses etc are conditions where formula milk is as important as mother’s breast milk.
- Breast milk not adequate after 6 months

Contra indications of BF:

- Active maternal tuberculosis
- Maternal HIV
- Poor physical or mental cooperation of the mother

Instructions for the mother during BF:

- Wash hands before proceeding
- Wash nipples with warm water
- Positioning- semi-upright position
  - Comfortable seated in chair with back and arm supported
  - Side lying with pillow beneath head, arm above head
  - Mother should experiment the most comfortable position
  - Entire body of infant turned to the mother’s breast

Instructions for the mother during BF:

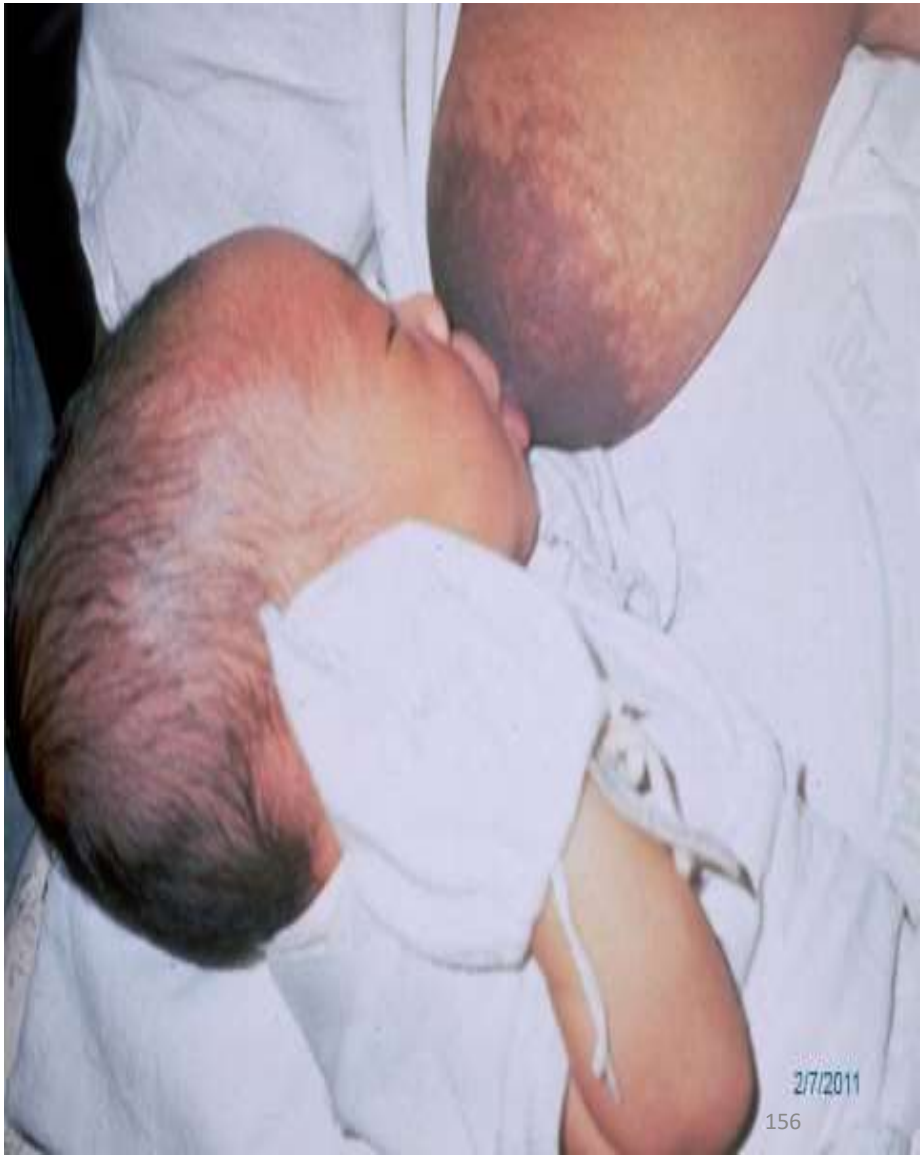
- Both breasts are used at each feeding
- Avoid break suction by placing finger in corner of baby's mouth, but support breast from baby's nose
- If a very sick infant cannot take the nipple in to his mouth and keep it there to suck, he/she has no attachment at all
- If not good attachment, either breast engorgement or infant unsatisfaction has occurred

Signs of good attachment:

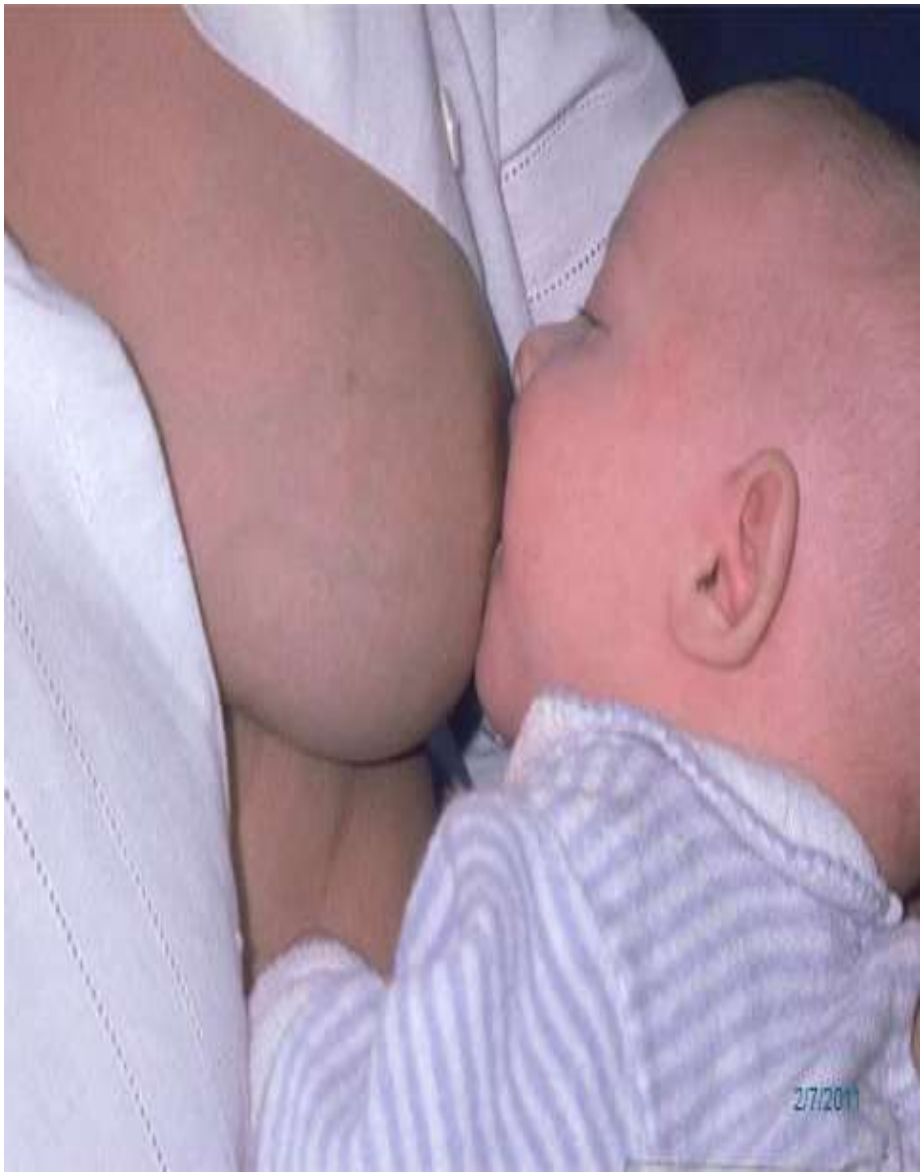
- Wide opened mouth of the baby
- Chin of baby touched the mother's breast
- More areola seen above baby's mouth than below
- Lower lip of baby turned out ward

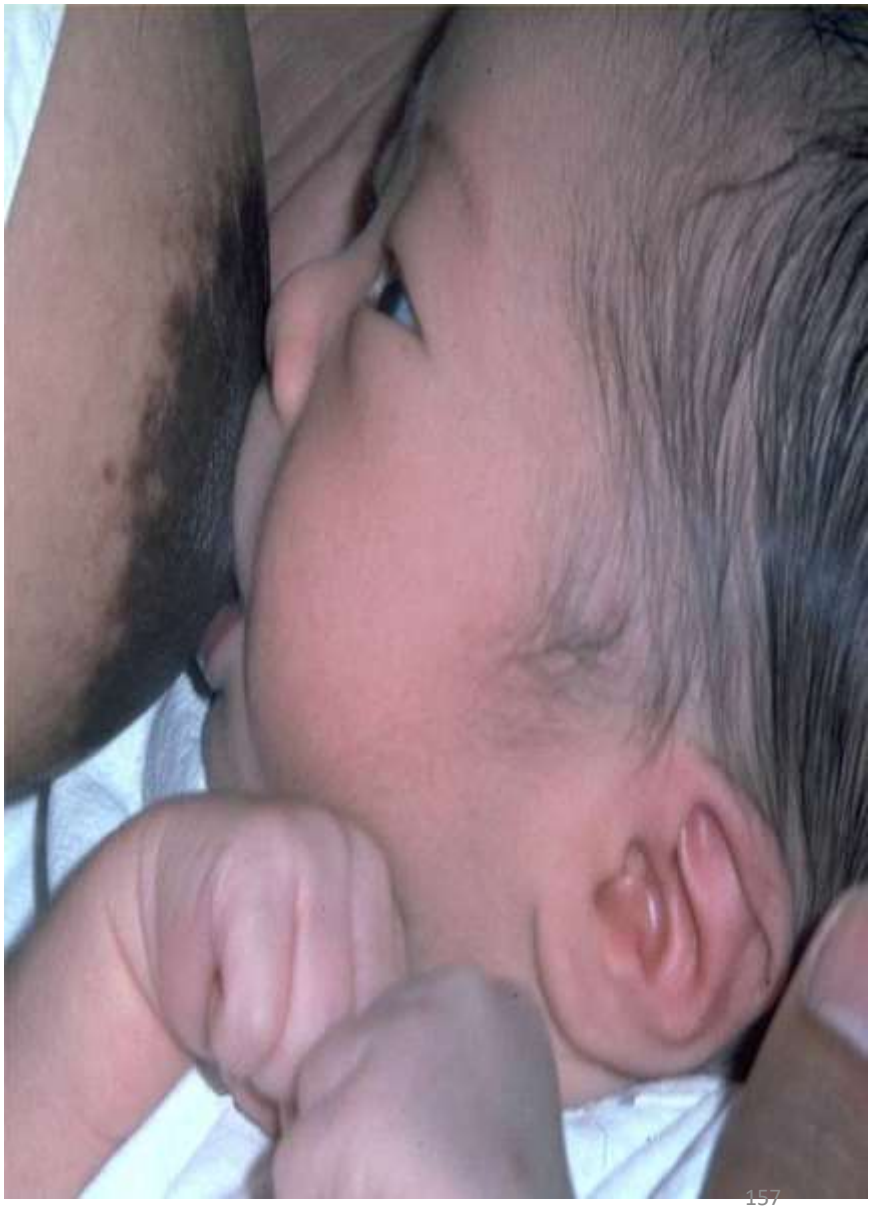
Good attachment

Signs of good attachment



Signs of attachment





Signs of Good Positioning

- Infant's head and body straight
- Head and body facing breast
- Infant's body close to mother's
- Supporting infant's whole body

Signs for adequate breast feeding

- At least 3-5 strong suckling before pausing for breath or rest
- Dimpling of cheeks may be seen while suckling
- Hearing of swallowing gurgle
- Milk may be seen around the mouth leaking out when it is excess

2. Complementary Feeding

- Breastfeeding is not enough for a child over 6 months of age
- A variety of nutritious foods are needed to prevent malnutrition
- Appropriate CF promotes growth and prevents stunting among children between 6 and 24 months of age
- Infants are particularly vulnerable to malnutrition and infection during the transition period when complementary feeding begins

Complementary Feeding

- Energy needs from complementary foods for infants with “average” breast milk intake in developing countries are approximately:
  - 200 kcal per day at 6-8 months
  - 300 kcal per day at 9-11 months
  - 550 kcal per day at 12-23 months

Recommended Complementary Feeding Practice:

- Introducing complementary feeding at 6 months.
- Frequent feeding, Adequate food, appropriate Texture and Variety, Active feeding, Hygienically prepared (FATVAH)
- Continuing frequent and on-demand breast feeding until 24 months
- Increasing food quantity and frequency as the child grows.
  - A healthy breastfed child needs:
    - 2-3 meals/day at 6-8 months.
    - 3-4 meals/day at 9-12 months and 1-2 snacks.
    - 3-4 meals/day at 12-24 months and 2 snacks.

Recommended Complementary Feeding Practice

- Gradually increasing food consistency and variety as the child gets older
- Practicing active Feeding
- Frequent and active feeding during and after illness
- Practicing good hygiene and proper handling of foods

Good complementary foods:

- Good complementary foods are energy-rich, nutrient-rich, and locally affordable
- E.g. Soft cereal or legume-porridge mixes with oil or milk; fruits, vegetables, meat, eggs, fish, and milk products
- Mashed potatoes softened with milk, shiro fitfit, merek fitifit, and porridge made of cereal and legume mixes with butter or oil added are foods to start in a child 6-12 months of age

Good complementary foods:

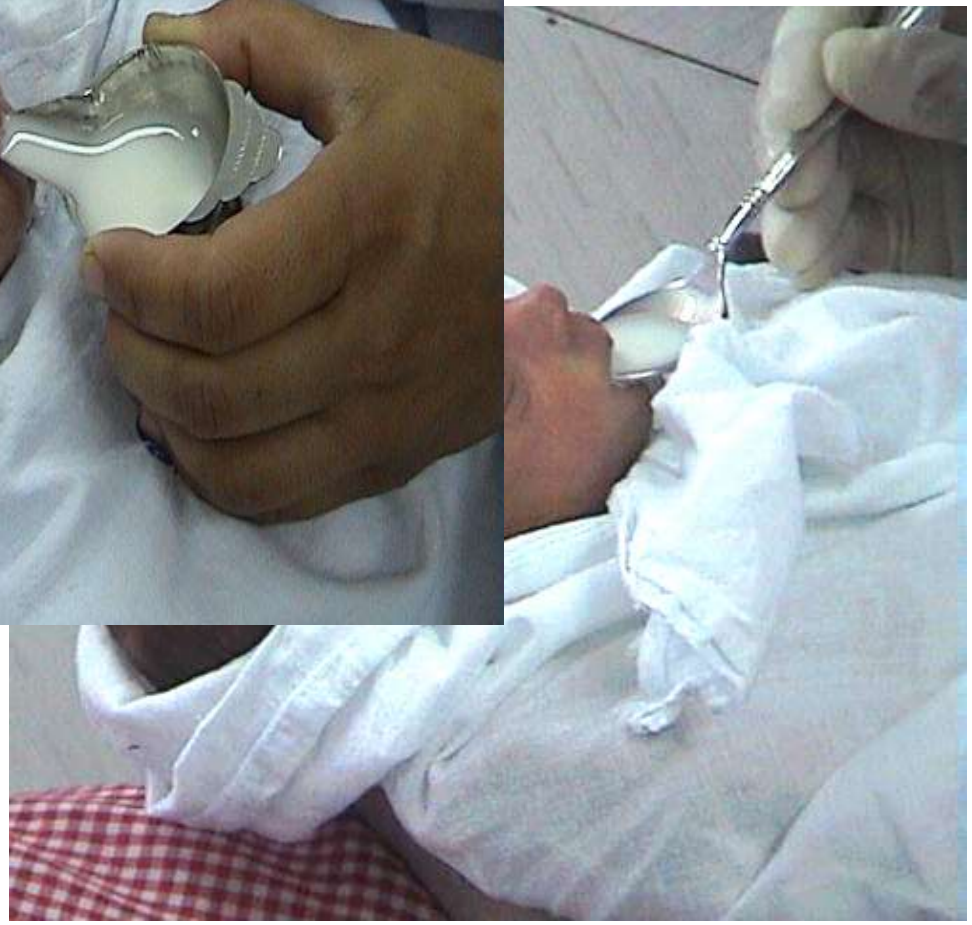
- Kitta, softened in milk or prepared soft with oil or butter and or Eggs added, is another good alternate complementary food
- Porridge can be wheat, barley or teff
- The consistency of the porridge should be thick enough to be fed by hand
- If the child receives any breast milk substitute, these should be given by cup, not by bottle

Feeding Recommendations

Recommendations for ages up to 6 months	
Initial breast feeding	With in 1 hours of birth
BF as often as child need	At least 8 times in 24 hours
EBF (not even water) with exception of medicine	For the first 6 month
Increase frequency of BF	During and 2 wks after illness
Expose child to sunlight	For 20-30 min daily

6 to 12 month

BF as often as child want	always
Start complementary food	At 6month
Use actively feeding	Encourage child to eat
Use his own serving	Not to compete with family
Give enriched food	
If on breast/replacement feeding	Give food 3 times per day
If not on breast/replacement feeding	Give 5times(3 meal. 2snacks) per day
Give Vit A	From 6month and every 6month
Use adequate serving	Child not want food after active serving



12 months up to 2 years

BF as often as want	**always**
give adequate serving with enriched family food	child satisfied with mixed food
give these foods	5 times per day (3 meal 2 snacks)
If stopped BF at early age	Need milk replacement beside complementary
Give vit A and Mebendazol	Every 6 months

Recommendations for ages 2 years and above

Give adequate serving of fresh enriched family food	3-4 meals per day
Give nutritious food between meal	2 times a day
Give vit A and Mebendazol	Every 6 months
Continue on demand	for 2 years and beyond.

Malnutrition

Outline

- Overview
- Kwashiorkor
- Marasmus
- Stunting
- Vitamin A deficiency
- Vitamin D deficiency
- Management of Severe Acute Malnutrition (SAM)
- Childhood obesity

Session objectives

- **At the end of this session the students will be able to:**

√ Discuss kwashiorkor

√ Discuss marasmus

√ Differentiate the clinical presentations of kwashiorkor from marasmus

√ Explain stunting

√ Describe common micronutrient deficiencies

√ Discuss the management of severe acute malnutrition

√ Explain childhood obesity

Overview of malnutrition

- **Malnutrition includes:**
  - Macronutrient deficiency
  - Micronutrient deficiency
  - Over nutrition-obesity
- **Can be classified as:**
  - Acute-wasting
  - Chronic-stunting

Kwashiorkor

- A nutritional disorder due to deficiency of protein and calories, **particularly proteins**, characterized by mental apathy, wasting, growth retardation, and **oedema**.
-

Etiology

- Lack of knowledge about diet
- Poverty
- Natural calamities like drought, earthquakes, etc
- Repeated infections like diarrhoea, measles, etc
- Taboos
- Religious customs (people of certain religions avoid non-vegetarian diet which has high-quality proteins)

Kwashiorkor ...

- **Incidence is more in:**

➢ Low birth weight

➢ Broken families

➢ In children with whose parents are unemployed

➢ Large families

Clinical features of kwashiorkor

Parameter	Features
Growth	Short statured
Mental faculties	Irritable, lack of interest in surroundings, apathetic, dull, lethargic, resents meddling
Hair	Lack of luster, easily pluckable, sparse , loss of natural curls, brownish discoloration, flag sign (Signa de Bandera)
Anterior fontanel	Delayed closure
Face	Moon face, a full well-rounded somewhat pendulous and blubbery cheeks
Eyes	Conjunctival pallor, signs of vitamin-A deficiency

Clinical features ...

Parameter	Features
Oral cavity	Angular staomatitis: iron deficiency anemia, B-complex deficiency; oral thrush
Tongue	Oedema of tongue, scarlet and raw tongue (bright red), magenta tongue (purplish red), atrophy of papillae, geographic tongue (the tongue has irregularly distributed patchy areas of denudation and atrophy of epithelium
Teeth	Caries, delayed dentition, enamel hypoplasia, enamel erosion
Gums	Spongy, bleeding gums, pyorrhoea alveolaries, recession of gums

Clinical features ...

Parameter	Features
Cheeks	Baggy cheeks of Trowel
Neck	Neck appears to be long due to wasting of muscles and sub-cutaneous fat
Chest	All the ribs and spinal processes are prominently seen due to wasting of muscles and sub-cutaneous fat
Abdomen	Abdomen is distended due to intestinal atony, hepatomegally, rarely ascites

Clinical features ...

Parameter	Features
Skin	Hypopigmented and hyperpigmented patches (crazy pavement dermatosis), flaky pavement dermatosis (peeling of skin), xerosis: generalized dryness with branny desquamation, petechiae, pellagrous dermatosis
Extremities	are thin due to wasting, pedal oedema, koilonychias
CNS	Patient is dull, lethargic, apathetic, hypotonia due to nutritional myelopathy

Clinical features ...

Parameter	Features
CVS	Intensity of heart sounds is decreased due to decrease of cardiac output
Respiratory system	Features of secondary infection
GIT	Hepatomegaly
Salivary glands	Parotid gland is enlarged. It is firm, non-tender

Differential diagnosis

- Nephrotic syndrome
- Cirrhosis of liver
- Congestive heart failure

Investigations

- **Blood**
- CBC
- Serum electrolytes, plasma protein estimation
- Blood culture & sensitivity for evaluation of septicaemia
- **Urine**
- Albumin, sugar, deposits, urine culture & sensitivity
- **Stool**
- Ova of parasite, culture & sensitivity if there is diarrhoea
- **Chest X-ray:** to r/o TB & other infections
- **Mantoux test**

Complications

- Hypothermia
- Hypoglycaemia
- Infections
- Electrolyte disturbances
- Dehydration
- Anemia

Management

- See management of SAM 2019

Prevention

- Health and nutrition education
- Early identification and treatment of the diseases
- Exclusive breast feeding up to six months
- Complementary feeding at the age of six months
- Family planning
- Safe and adequate water supply
- Immunization

Marasmus

- A nutritional disorder due to deficiency of protein and calories, **particularly calories**, characterized by:
  - Growth failure
  - Gross wasting
  - Absence of oedema

Etiology

1. **Primary causes**

- Lactation failure – the commonest cause

Lactation failure → introduction of dilute & dirty formula → infetions (diarrhoea) → starvation therapy due to diarrhoea → marasmus

Etiology ....

2. Secondary causes

a. **Birth weight:** common in premature & LBW
b. **Cardiovascular diseases** like VSD, ASD, and PDA due to:
   - Recurrent respiratory infections
   - Feeding and growth failure
   - Cough & breathlessness
   - Hypermetabolic state due to high heart rate, fever, increase in respiratory rate
   - Decreased assimilation due to congestion of liver and intestines

Secondary causes ...

c. **Respiratory causes**: TB, etc

d. **Gastrointestinal causes**

- Congenital hypertrophic pyloric stenosis- vomiting
- Congenital megacolon- diarrhoea
- Cleft lip & palate – inadequate intake of feeds, mainly breast feeds

e. **Infections**

  - Repeated diarrhoea
  - Severe infections like congenital syphilis
  - Malabsorption syndrome

Etiology ...

3. CNS causes

- Hydrocephalus and CNS infections like tuberculosis meningitis, pyogenic meningitis can cause marasmus due to decreased intake & chronic vomiting

Clinical features

Parameter	Features
Mental faculties	**If there is no infection:** •Patient is alert, playful, lively look •The cry is vigorous •Appetite is vigorous **If there is an infection**: • The child is less active, apathetic, cries in a low tone, refusal to food
Head	•Hair is normal, delayed closure of anterior fontanel may be present

Clinical features ...

Parameter	Features
Face	•Eyes: no signs of vitamin A deficiency •Mild to moderate anemia may be present •Sunken cheeks are present due to loss of buccal fad of fat •Child appears as a wizened little old man or monkey face
Oral cavity	•Oral thrush may be resent •Stomatitis and angular stomatitis may be present
Chest	All the ribs and spinal processes are prominently seen due to wasting of subcutaneous fat & muscles

Clinical features ...

Parameter	Features
Abdomen	•Abdomen is distended due intestinal atony •No hepatomegaly
Skin	•Thin •No skin changes
Extremities	Thin due to wasting of muscles & sub-cutaneous fat. There is no oedema
CVS	Size of heart decreased. Decreased intensity of heart sounds due to low cardiac output
Respiratory system	Features of secondary infection may be present

Investigations

- CBC
- Urine and stool culture
- Chest X-ray
- Mantoux test

Complications

1. Immediate complications

- Hypoglycaemia
- Hypothermia
- Septicaemia
- Electrolyte imbalance

2. Late complications

- Intellectual sub-normality
- Growth retardation

Management

- See the management of SAM 2019

Vitamin A deficiency

- More common between 6 months to 3 years of age
- 50 to 80% of severe protein malnutrition patients are associated with vitamin A deficiency

Functions of vitamin A

- Functioning of retina
- Growth and differentiation of epithelial tissue
- Growth of bone
- Reproduction and embryonic development
- Enhances immune function, reduces the incidence of infectious diseases and may protect against the development of malignancy

Etiology of vitamin A deficiency

- At birth, the liver has a low vitamin A content that can be augmented by colostrum and breast milk
- Loss of vitamin A is present by cooking, canning and freezing of food stuffs, oxidizing agents etc
- Vitamin A deficiency is seen in fat malabsorption or chronic intestinal disorders
- Low intake of vitamin A
- Increased excretion of vitamin A present in cancer, urinary tract disease and chronic diseases
- Low protein intake can cause decrease of vitamin A concentration

Clinical features

Parameter	Features
Eyes	•**Night blindness** is the earliest manifestation •**Bitot spots:** dry, silvery-gray plaques may appear on the bulbar conjunctivae •**Conjunctival xerosis:** drying of conjunctiva •**Corneal xerosis:** drying of cornea •**Xerophthalmia:** cornification of the epithelium of the conjunctiva and disappearance of the mucus cells •**Keratomalacia:** desiccation, ulceration and xerosis of the cornea & conjunctiva

Clinical features ...

Parameter	Features
Respiratory tract	Increased risk of respiratory tract infections
Skin	Keratinization & drying of the epidermis occurred and papular eruptions involving the pilosebaceous follicles may be found especially on the extremities
Genitourinary system	Epithelium is damaged. The patient can develop pyuria & hematuria
GI system	Reduction of goblet cells; diarrhoea

Clinical features ...

Parameter	Features
CNS	•Mental retardation can occur •Increased ICP with wide separation of cranial bones may occur •Hydrocephalus with or without paralysis of the cranial nerves may occur
Bone	Associated with faulty modelling of bone, with production of thick, cancellous bone instead of thinner more compact bone
Miscellaneous	•Taste and smell are impaired •Hearing may be impaired •It can interfere with erythropoiesis

Management strategies

1. Breast feeding
2. Food diversification
3. Vitamin A supplementation
4. Food fortification

Rickets (Nutritional)

- Bone consists of a protein matrix called *osteoid* and a mineral phase, principally composed of calcium and phosphate, mostly in the form of hydroxyapatite.
- **Rickets,** a disease of growing bone, occurs in children only before fusion of the epiphyses, and is **due to unmineralized matrix at the growth plates**.

Rickets ...

- Because growth plate cartilage and osteoid continue to expand, but mineralization is inadequate, the growth plate thickens.
- There is also an increase in the circumference of the growth plate and the metaphysis.
- This increases bone width at the location of the growth plates, causing some of the classic clinical manifestations, such as **widening of the wrists and ankles**

Etiology of rickets in general

- There are many causes of rickets including
- **Vitamin D disorders**,
- Calcium deficiency,
- Phosphorous deficiency, and
- Distal renal tubular acidosis

Vitamin D disorders

- **Nutritional vitamin D deficiency**
- Congenital vitamin D deficiency
- Secondary vitamin D deficiency
- Malabsorption
- Increased degradation
- Decreased liver 25-hydroxylase
- Vitamin D–dependent rickets type 1
- Vitamin D–dependent rickets type 2
- Chronic renal failure

Metabolism of vitamin D

- **Vitamin D is available in two forms:**

1. Vitamin D2 Calciferol is an irradiated ergosterol
2. Vitamin D3 is available synthetically. It is present in skin as 7-dehydrocholesterol. It will be converted to cholecalciferol on irradiation of skin by ultraviolet rays in the range of 296-310 nm.

Etiology of Nutritional vitamin D deficiency

❑Decreased intake

- Lack of vitamin D in the diet
- Lack of exposure to UV irradiation
- Black children are susceptible to rickets owing to pigmentation of their skin or inadequate penetration of sunlight

❑GIT causes

- Decreased absorption in the following conditions

a. Coeliac disease, steatorrhoea, pancreatitis, or cystic fibrosis
b. Glucocorticoids may antagonise vitamin D in calcium transport

Etiology ...

- **Liver**
  - Neonatal hepatitis, and liver cell failure may decrease absorption of vitamin D
  - Anticonvulsants like phenobarbitone and phenytoin may convert 25(OH)D3 in to more polar vitamin D3 by P450 enzyme, which is an inactive form
- **Kidney:** chronic renal failure, tubular acidosis, etc

Incidence

- The incidence is more during the period of rapid growth, particularly between 4 months to 2 years of age
- Equal in both sexes, but it is more in male children due to rapid growth

Clinical Manifestations

- Most manifestations of rickets are due to skeletal changes.
- **Craniotabes,** a softening of the cranial bones, can be detected by applying pressure at the occiput or over the parietal bones. The sensation is similar to the feel of pressing into a Ping-Pong ball and then releasing.
- Craniotabes may also be secondary to osteogenesis imperfecta, hydrocephalus, and syphilis.
- It is a normal finding in many newborns, especially near the suture lines, but it typically disappears within a few months of birth.

Clinical …

- Widening of the costochondral junctions results in a **rachitic rosary;** this feels like the beads of a rosary as the examiner's fingers move along the costochondral junctions from rib to rib.
- **Growth plate widening** is also responsible for the enlargement at the wrists and ankles.
- The horizontal depression along the lower anterior chest known as **Harrison groove** occurs due to pulling of the softened ribs by the diaphragm during inspiration.

Clinical …

- Softening of the ribs also impairs air movement and predisposes patients to **atelectasis**.
- The **risk of pneumonia** appears to be elevated in children with rickets; in Ethiopia, there may be a 13-fold higher incidence of rickets among children with pneumonia.

Summary of clinical features

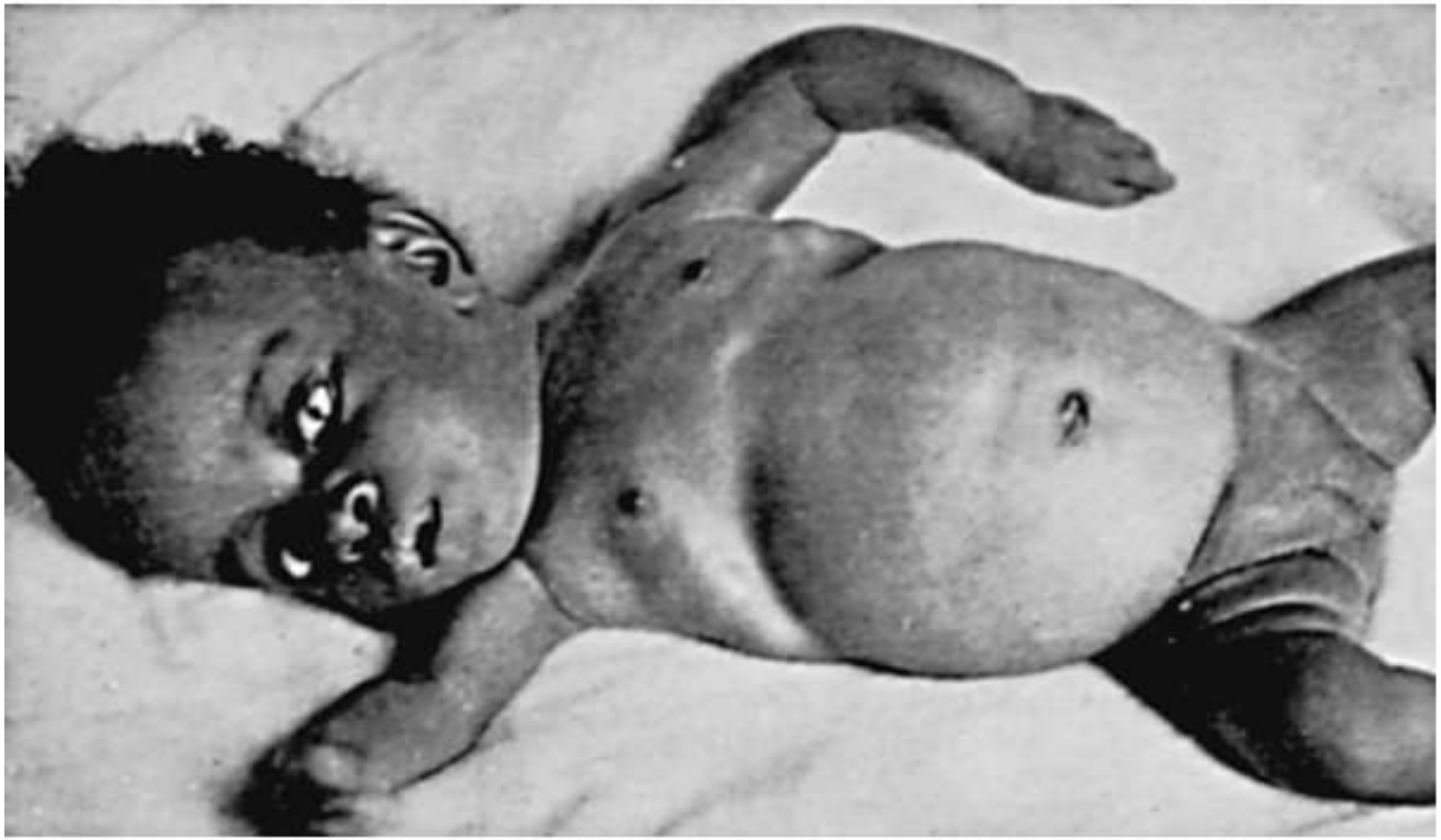
- **GENERAL**
- Failure to thrive
- Listlessness
- Protruding abdomen
- Muscle weakness (especially proximal)
- Fractures
- **HEAD**
- Craniotabes
- Frontal bossing
- Delayed fontanelle closure
- Delayed dentition; caries

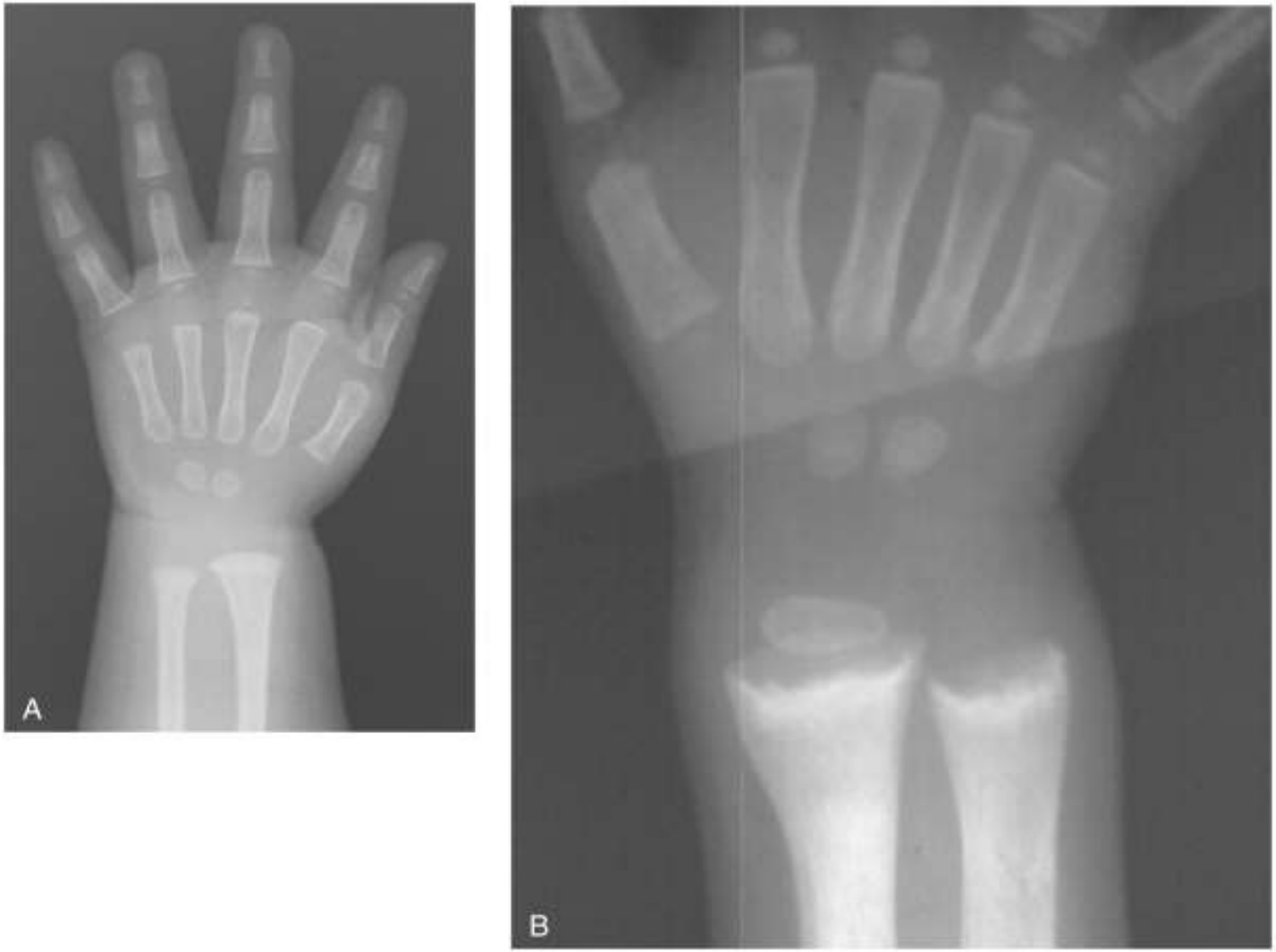
Summary of ...

- **CHEST**
- Rachitic rosary
- Harrison groove
- Respiratory infections and atelectasis
- **BACK**
- Scoliosis
- Kyphosis
- Lordosis

Summary of ...

- **EXTREMITIES**
- Enlargement of wrists and ankles
- Valgus or varus deformities
- Windswept deformity (combination of valgus deformity of 1 leg with varus deformity of the other leg)
- Anterior bowing of the tibia and femur
- Leg pain

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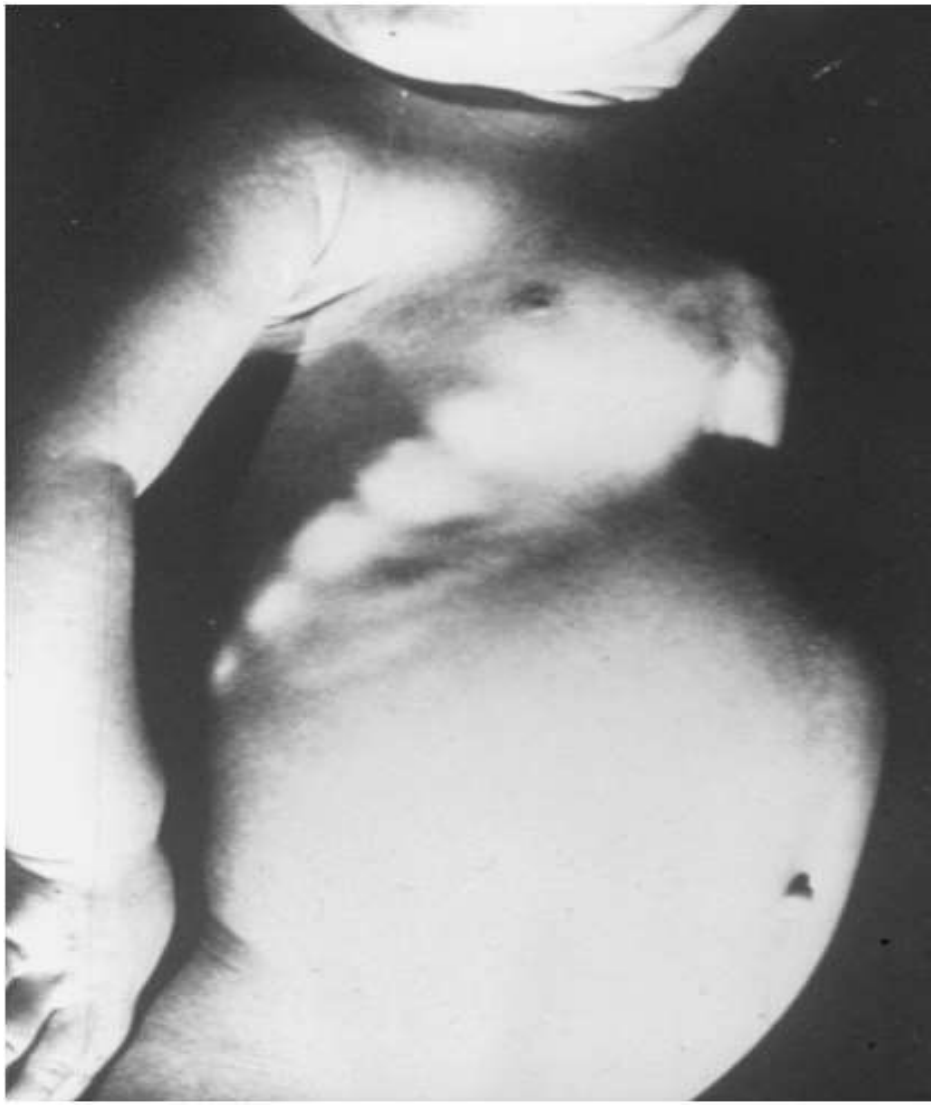


Differential diagnoses

- **Craniotabes**
- Hydrocephalus
- osteogenesis imperfecta
- **Costochondrial junction enlargement**
- Scurvy
- Chondrodystrophy
- Congenital epiphysel dysplasia
- Cytomegalic inclusion disease
- Syphilis
- Copper deficiency
- Vitamin D resistant reckets

Treatment

- Children with nutritional vitamin D deficiency should receive vitamin D and adequate nutritional intake of calcium and phosphorus.
- Vitamin D intake of 400 IU/day, typically given as a multivitamin.
- It is important to ensure that children receive adequate dietary calcium and phosphorus; this is usually provided by milk, formula, and other dairy products.

Complications

- Bronchitis
- Bronchopneumonia
- Pulmonary atelectasis
- Anemia

Prevention

- Exposure to sunlight
- Oral administration of vitamin D
- Daily requirement of vitamin D is 10 microgram or 400IU/day
- Milk fortified with vitamin D can be given
- Vitamin D should also be given to pregnant & lactating mother

Management of Acute Malnutrition

Overview

- Community-Based Management of Acute Malnutrition (CMAM), consists of four main components:

1. Community outreach/mobilization:
2. Inpatient Treatment/ care:
3. Outpatient Treatment Program (OTP):
4. Targeted supplementary feeding program (TSF):

Principle of care

- **Recognize signs of severe acute malnutrition**
- Visible severe wasting for infants under 6 months
- To look for severe wasting, remove the child's clothes. **Look at the front view of the child:**
- Is the outline of the child's ribs easily seen?
- Does the skin of the upper arms look loose?
- Does the skin of the thighs look loose?

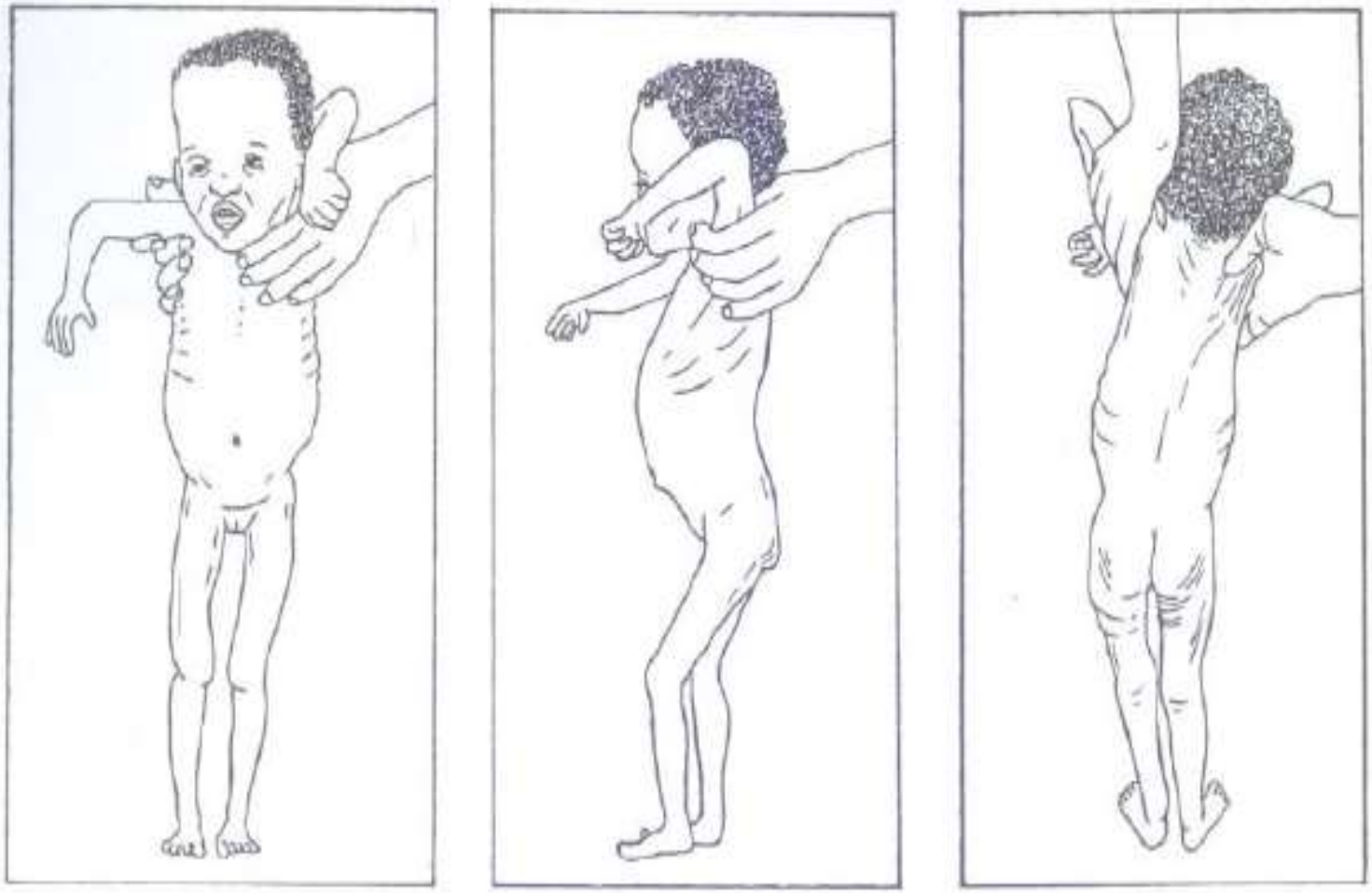
Recognize signs of …

- **Look at the back view of the child:**

o Are the ribs and shoulder bones easily seen?

o Is flesh missing from the buttocks?

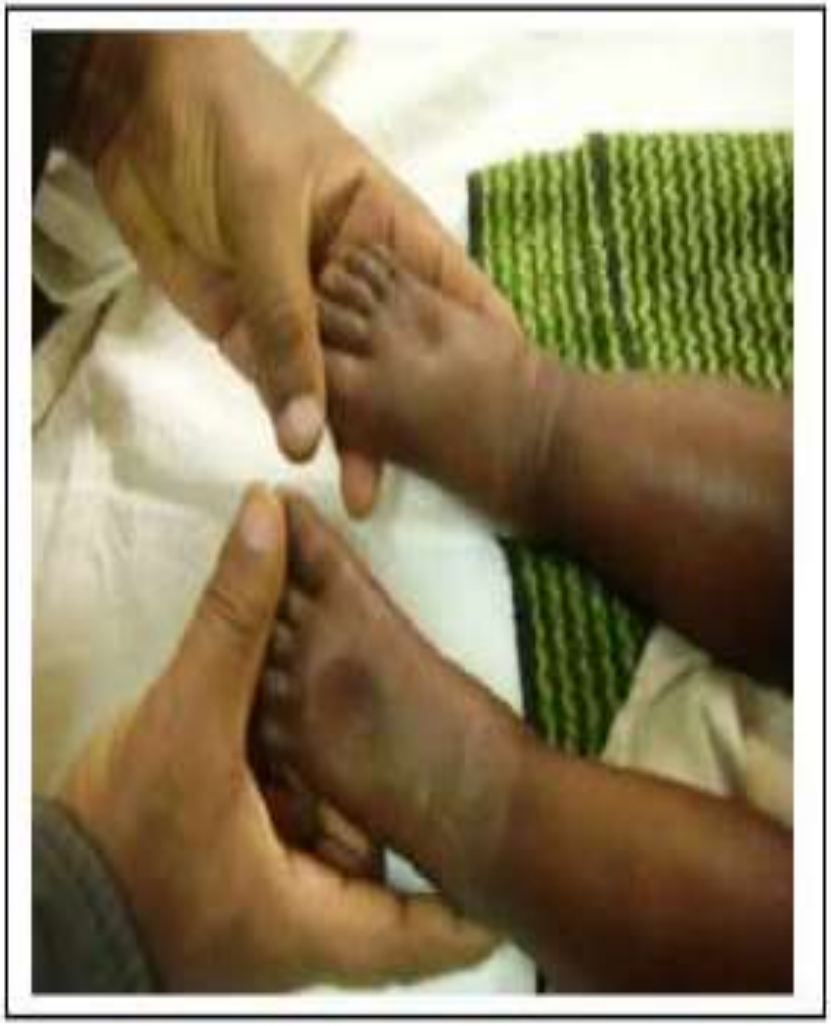
- When wasting is extreme, there are folds of skin on the buttocks and thighs. It looks as if the child is wearing "**baggy pants**".
- Because a wasted child has lost fat and muscle, this child will weigh less than other children of the same height/length and will have a **low weight-for-height/Length**



Recognize signs of …

❑Oedema

- To check for oedema, grasp both feet so that they rest in your hand with your thumbs on top of the feet. **Press your thumbs gently for three seconds** or count 101,102,103.
- The child has oedema if a pit (dent) remains in both feet when you lift your thumbs



Grading of edema

Grades of bilateral pitting edema	Definition
Absent	Absent
Grade +	Mild: both feet/ankles
Grade ++	Moderate: both feet, plus lower legs, hands or lower arms
Grade +++	Severe: generalized bilateral pitting edema, including both feet, arms and face

Dermatosis

- In severe malnutrition, it is more common in children who have oedema than in wasted children.
- A child with dermatosis may have patches of skin that is abnormally light or dark in color, shedding of skin in scales or sheets, and ulceration of the skin of the perineum, groin, limbs, behind the ears, and in the armpits.
- There may be weeping lesions. There may be severe rash in the nappy area. Any break in the skin can let dangerous bacteria get into the body. When the skin is raw and weeping, this risk is very high.

Extent of dermatosis

- + **mild**: discoloration or a few rough patches of skin
- + + **moderate**: multiple patches on arms and/or legs
- + + + **severe**: flaking skin, raw skin, fissures (openings in the skin)

Eye signs

- **Bitot's spots –** superficial foamy white spots on the conjunctiva (white part of the eye). These are associated with vitamin A deficiency.
- **Pus and inflammation (redness)** are signs of eye infection.
- **Corneal clouding** is seen as an opaque appearance of the cornea (the transparent layer that covers the pupil and iris). It is a sign of vitamin A deficiency.
- **Corneal ulceration** is a break in the surface of the cornea. It is a severe sign of vitamin A deficiency. If not treated, the lens of the eye may push out and cause blindness. Corneal ulceration is urgent and requires immediate treatment with vitamin A and atropine (to relax the eye).

Weigh and measure the child

- Carefully measure the child's length or height once on the first day. For children less than 85 cm in length, or children too weak to stand, measure the child’s length while supine (lying down).
- For children 85 cm or more, measure standing height. Note: Length is usually greater than standing height by 0.5 cm.
- If the child is 85 cm or more but cannot be measured standing, subtract 0.5 cm from the supine length.

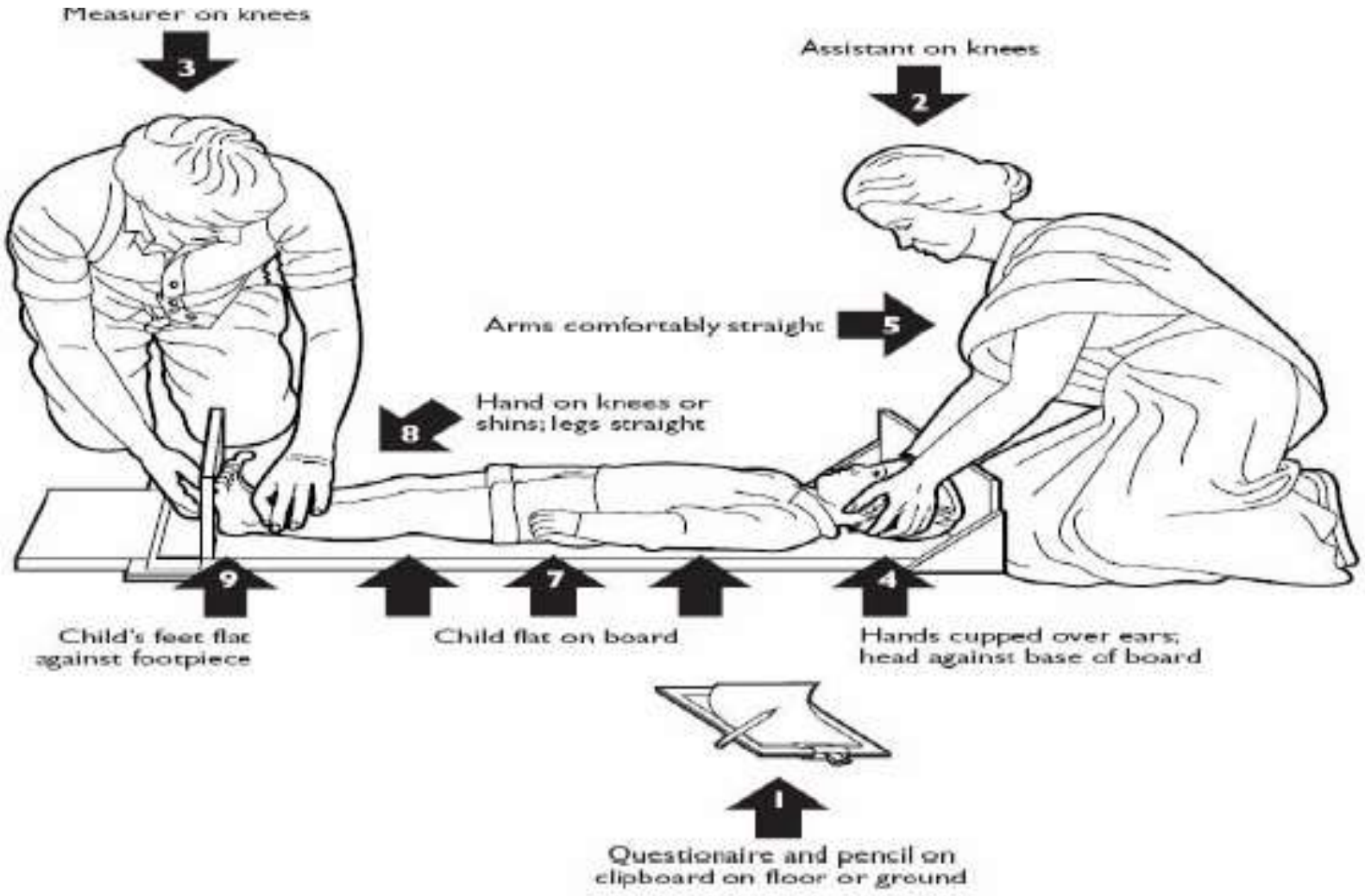
Measuring length

- Position the child lying on his back on the measuring board, supporting the head and placing it against the headboard.
- Position the crown of the head against the headboard, compressing the hair
- Hold the head with two hands and tilt upwards until the eyes look straight up, and the line of sight is perpendicular to the measuring board.

Measuring length ...

- **The other person should stand alongside the measuring board and:**

- Support the child's trunk as the child is positioned on the board.
- Place one hand on the shins or knees and press gently but firmly.
- Straighten the knees as much as possible without harming the child.
- With the other hand, place the foot piece firmly against the feet.
- The soles of the feet should be flat on the foot piece, toes pointing up. If the child bends the toes and prevents the foot piece touching the soles, scratch the soles slightly and slide in the foot piece when the child straightens the toes.
- Measure length to the last completed 0.1 cm and record immediately on the Multi-chart.



Illus.3, child being measured lying down

Measuring height

- Remove the child's socks and shoes for accurate measurement. Also remove hair ornaments and undo braids if they interfere with measurement.
- **Work with a partner. One person should kneel or crouch near the child's feet and:**
- Help the child stand with back of the head, shoulder blades, buttocks, calves and heels touching the vertical board.
- Hold the child's knees and ankles to keep the legs straight and feet flat. Prevent children from standing on their toes.
- Young children may have difficulty standing to full height. If necessary, gently push on the tummy to help the child stand to full height.

Measuring height ...

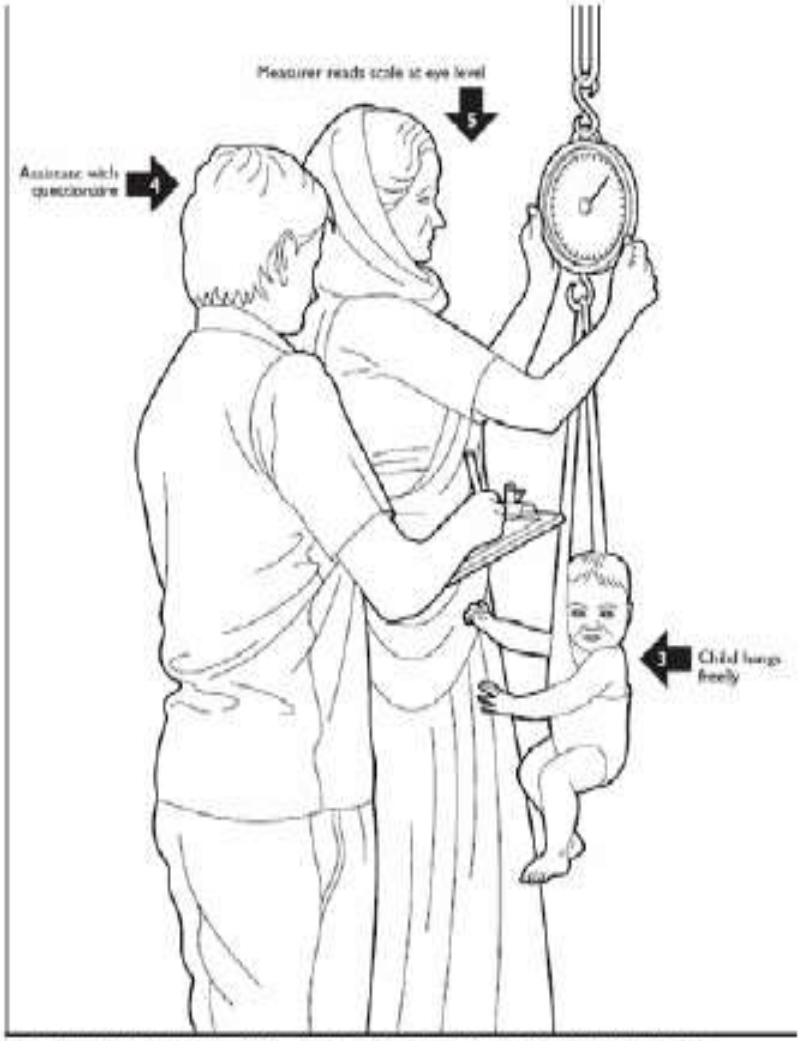
- Position the head so that the child is looking straight ahead (line of sight is parallel to the base of the board).
- Place thumb and forefinger over the child's chin to help keep the head in an upright position
- With the other hand, pull down the head board to rest firmly on top of the head and compress hair.
- Measure the height to the last completed 0.1 cm and record it immediately on the Multi chart.

Weigh the child

- Weigh the child as soon as possible after he arrives.
- If the child is admitted, weigh the child once daily, preferably at about the same time each day.
- The weighing time should be about one hour before or after a feed.

To weigh the child …

- Remove the child's clothes, but keep the child warm with a blanket or cloth while carrying to the scale.
- Put a cloth in the scale pan to prevent chilling the child.
- Adjust the scale to zero with the cloth in the pan. (If using a scale with a sling or pants or basin, adjust the scale to zero with that in place.)
- Place the naked child gently in the pan (or in the sling or pants).
- Wait for the child to settle and the weight to stabilize.
- Measure weight to the nearest 100gm or as precisely as possible. Record immediately on multi-chart.
- Wrap the child immediately to re-warm.



Source: How to Weigh and Measure Children: Assessing the Nutritional Status of Young Children, UN 1986

Standardize scales

- Standardize scales daily or whenever they are moved:
- Set the scale to zero.
- Weigh one object of known weight and record the measured weight. (A container filled with stone or IV fluids etc. if the weight is accurately known.)
- Repeat the weighing of these objects and record the weights again.
- If there is a difference of 0.01 kg or more between duplicate weighing, or if a measured weight differs by 0.01 kg or more from the known standard, check the scales and adjust or replace them if necessary.

Measure mid-upper arm circumference.

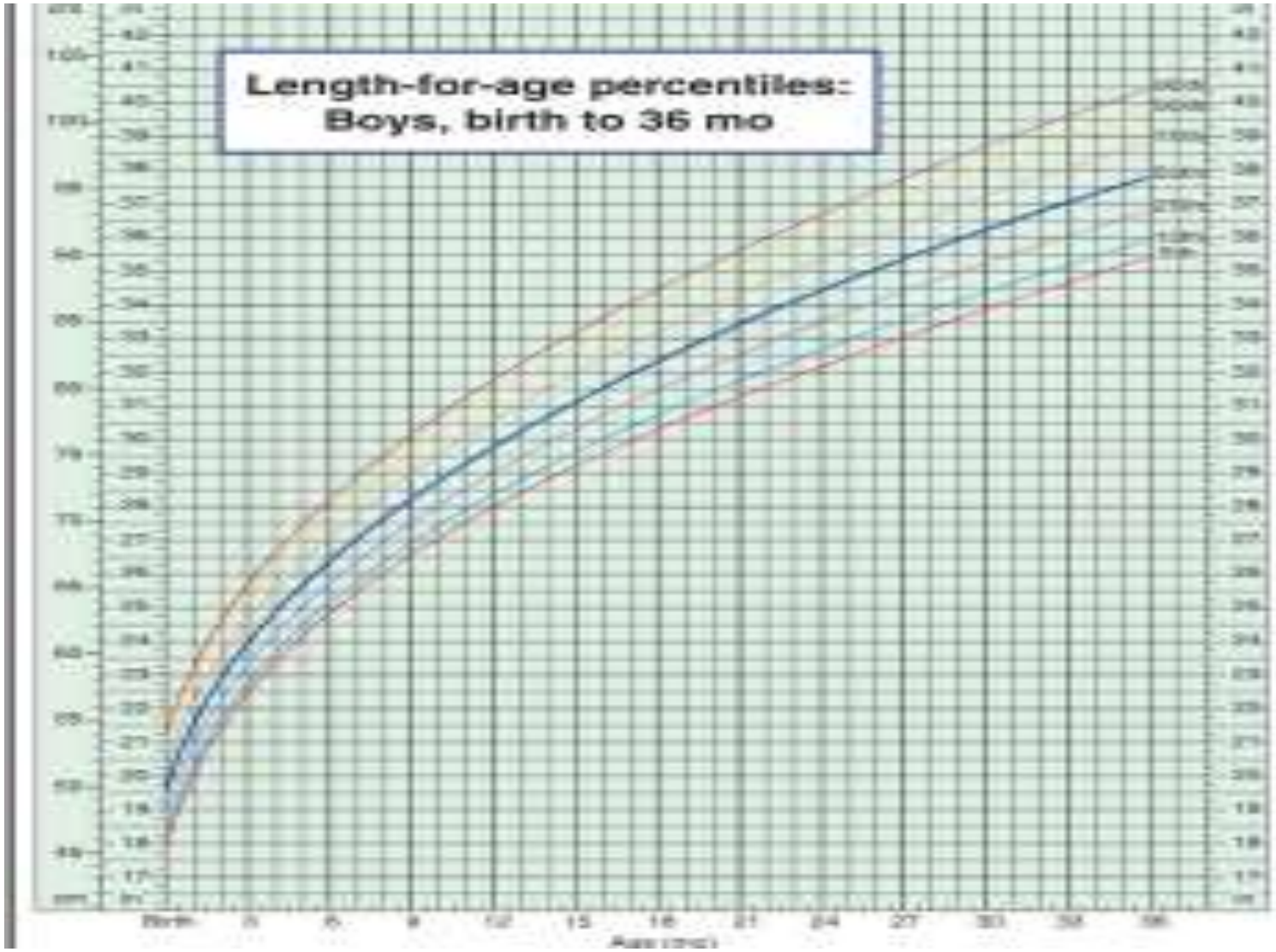
- MUAC is measured on the upper left arm.
- To locate the correct point for measurement, the child's elbow is flexed to 90°C, with the palm facing upwards.
- A measuring tape is used to find the midpoint between the end of the shoulder (**acromion**) and the tip of the elbow (**olecranon**); this point should be marked.
- The arm is then allowed to hang freely, palm towards the thigh, and the measuring tape is placed snugly around the arm at the midpoint mark.
- The tape should not be pulled too tight or too loose.

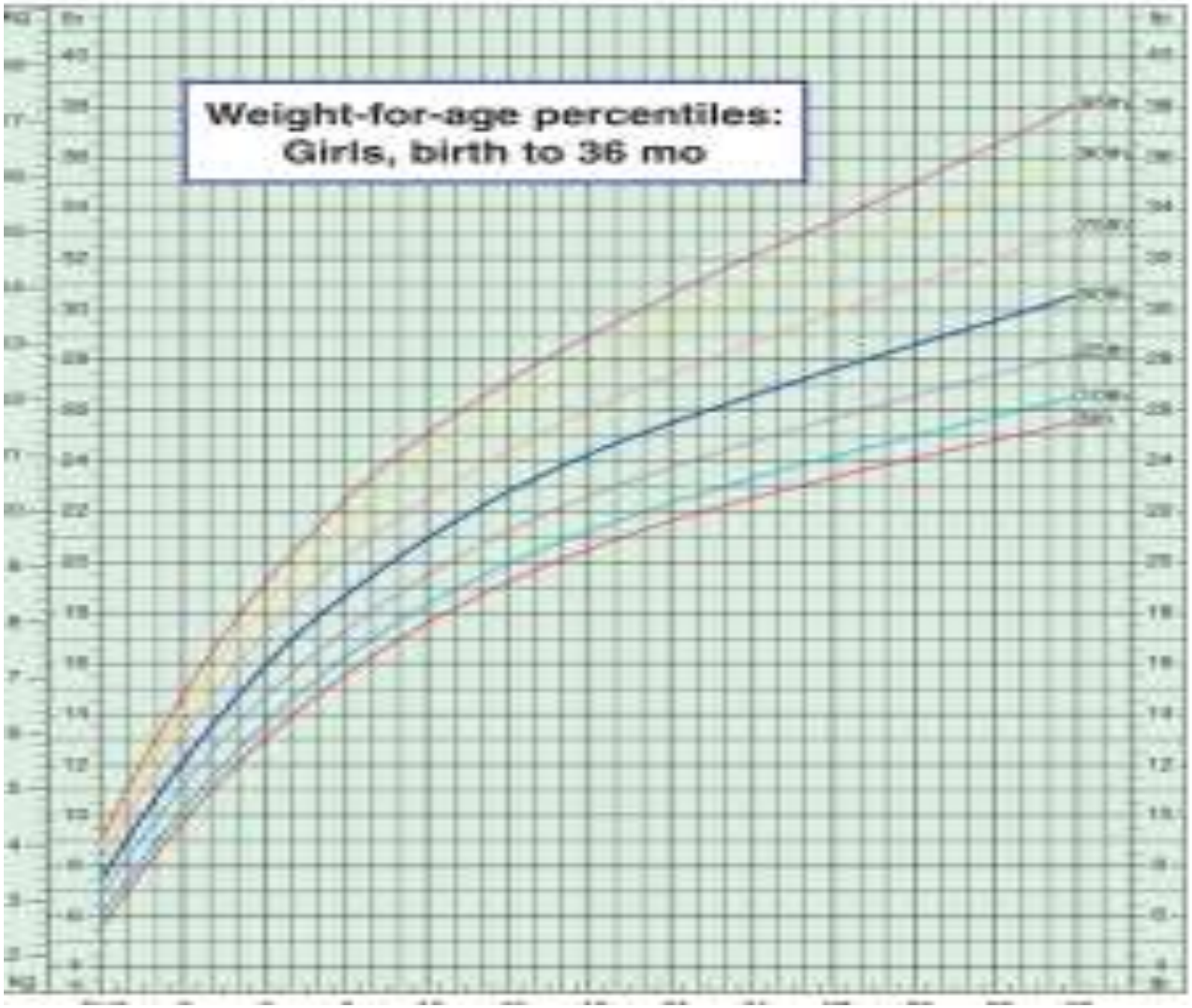
Identifying a child with severe acute malnutrition

- **Determine Percent-of-median based on child's weight and length/height**
- **What is Percent-of-median?**
- It is a way of comparing a measurement, in this case a child's weight-for-length, to an "average" (median).
- The median used in the national protocol and in this course are NCHS reference values for weight-for-height and weight-for-length.
- It is a ratio of a child's weight to the median weight of a child of the same height in the reference, expressed as percentage.
- As a concrete example if the median (or average) weight in the reference tables for a particular height was 10 kg and a child weighed 8 kg, she/he was 80% weight-for-height.

Percent of median ...

- It is important to consider a child's weight-for-height rather than simply weight-for-age. The latter is affected by stunting.
- **Stunting may cause low weight-for-age** when a child is adequate weight-for-height.
- **Feeding can correct wasting but cannot easily correct stunting.**
- There is a new WHO child growth standards/ reference that uses **z-score** classification system, which is comparable across ages and heights, and among different indicators.


Length-for-age percentiles:
Boys, birth to 36 mo


Weight-for-age percentiles:
Girls, birth to 36 mo

How to calculate the weight/height percentage?

- **Example:** For a child of 80.5 cm and weighing 8.7 kg, Weight-for-Height Reference table give a median weight for a child of this height of 10.9 kg:
- Weight-for-height = (8.7/10.9) x 100 = 80%

How to use the Weight-for-Height Reference table

- To use the reference table in the chart booklet or on your Weight-for-Height Reference Card:
- First, find the child's length or height in the first column of the table.
- Then look in the right columns in the same row to find the weight that correspond to the weight of the child.
- Look at the top of the column to see what the child’s percentage of median or degree of acute malnutrition .

… reference table

- The child's weight may be between two percentage of median. If so, indicate that the weight is between these percentage of median by writing less than (<)
- For example, if the weight is between 70 and 75%, write down as child's percentage of median is between 70 and 75%.

Recommended criteria for SAM and Admission to TFP

1. Infants less than six months or less than 3 Kg:

- Weight –for- Length (WFL) less than 70% or < -3Z score

OR

- Presence of pitting Oedema of both feet

OR

- Visible Severe Wasting if it is difficult to determine WFL

2. Children 6 months to 5 years:

- Weight –for- Length (WFL) / WFH less than 70 % or < -3Z score

OR

- Presence of pitting Oedema of both feet

OR

- MUAC <11cm for child length greater than 65 cm

Medical Complications

- If a child is 6 months to 5 years and has SAM according to the above criteria, check for the following serious medical complications that will determine the choice of treatment modalities (In-patient (TFU) or Out-patient (OTP)):

a. Unable to breast feed or drink

b. Vomiting everything

c. Very Weak, Lethargic or unconscious

d. Convulsions

e. Pneumonia/severe pneumonia:

o Chest in-drawing

o Fast breathing:

o For child 6 month to 12 months: 50 breaths per minute and above

o For a child 12 months up to 5 years: 40 breaths per minute and above

Medical complications ...

f. Hypothermia: axillary temp <35 0C or rectal < 35.5 0C

g. Fever >39 0C

h. Shock

i. Dehydration

j. Hypoglycemia

k. Severe anemia: Hgb < 4 gm/dl

l. Extensive skin lesions/infection (+++ dermatosis)

m. Dysentery

n. Jaundice

o. Bleeding Tendencies

Criteria for in-patient care

- Infants below six months of age with SAM

OR

- Children 6 months to 5 years with SAM who have any one of the medical complications or failed appetite test

OR

- Children with SAM and referred from OTP for in-patient care

OR

- When OTP is not available in your working area or where the care taker lives or if the care taker's choice is inpatient care, all SAM children need to be admitted for inpatient care even if they do not fulfill the In-patient admission criteria.
- A child who fulfills any of **the first three criteria** is classified as severe complicated acute malnutrition

Physiology of severe malnutrition

❑ Reductive adaptation

- The systems of the body begin to “shut down” with severe malnutrition.
- The systems slow down and do less in order to allow survival on limited calories. This slowing down is known as **reductive adaptation**.
- As the child is treated, the body's systems must gradually "learn" to function fully again.
- Rapid changes (such as rapid feeding or fluids) would overwhelm the systems, so **feeding must be slowly and cautiously increased**

How does reductive adaptation affect care of the child?

❑Presume and treat infection

- Nearly all children with severe malnutrition have bacterial infections.
- However, as a result of reductive adaptation, the usual signs of infection may not be apparent, because the body does not use its limited energy to respond in the usual ways, such as inflammation or fever.

Reductive adaptation ...

- **Do not give iron early in treatment**

- Due to reductive adaptation, the severely malnourished child makes less hemoglobin than usual.
- Iron that is not used for making hemoglobin is put into storage. Thus, there is “extra” iron stored in the body, even though the child may appear anemic.
- Giving iron early in treatment will not cure anemia, as the child already has a supply of stored iron.

Early iron ...

- Giving iron early in treatment can also lead to “free iron” in the body. Free iron can cause problems in three ways:

1. Free iron is highly reactive and promotes the formation of free radicals, which may engage in uncontrolled chemical reactions with damaging effects.
2. Free iron promotes bacterial growth and can make some infections worse.
3. The body tries to protect itself from free iron by converting it to ferritin. This conversion requires energy and amino acids and diverts these from other critical activities.

- Later, as the child recovers and begins to build new tissue and form more red blood cells, the iron in storage will be used and supplements will be needed.

Provide potassium and restrict sodium

- Normally the body uses a lot of energy maintaining the appropriate balance of potassium inside the cells and sodium outside the cells.
- This balance is critical to maintaining the correct distribution of water inside the cells, around the cells and in the blood.
- In reductive adaptation, the “pump” that usually controls the balance of potassium and sodium runs slower.
- As a result, the level of sodium in the cells rises and the potassium leaks out of the cells and is lost (for example, in urine or stools).
- Fluid may then accumulate outside of the cells (as in oedema) instead of being properly distributed through the body.

Provide potassium …

- All severely malnourished children should be given potassium to make up for what is lost.
- They should also be given magnesium, which is essential for potassium to enter into the cells and be retained
- The commercially prepared F-75 and F-100 have enough potassium and magnesium and there is no need to supplement.
- However, if you use the F-75 and F-100 recipe that are prepared by the health facility/ locally, Combined Mineral Vitamin mixes (CMV) should be given to supplement potassium, Magnesium, and other important minerals and vitamins.

Provide potassium ...

- Malnourished children already have excess sodium in their cells, so sodium intake should be restricted.
- If a child has diarrhea, a special rehydration solution called ReSoMal should be used instead of regular WHO ORS.
- ReSoMal has less sodium and more potassium than regular WHO ORS.

Quiz

1. When a child is severely malnourished, why is it important to begin feeding slowly and cautiously?
2. Why should all severely malnourished children be given antibiotics?
3. Why is it dangerous to give iron early in treatment?
4. Why the regular WHO ORS is not recommended for malnourished children?

Phases of in-patient care

- **Phase 1 (Stabilization phase):** children with complicated SAM are initially admitted to an inpatient facility for stabilization.
- These children are admitted to phase 1 room. During this phase:

- Life-threatening medical complications are treated
- Routine drugs are given to correct specific deficiencies
- Feeding with F-75 milk (low caloric and sodium) is begun

- The children in Phase 1 should be together in a separate room or section of the ward and not mixed with other patients

Phases of ...

- **Transition phase:** Once the child appetite recovers and the main medical complications are under control and oedema start to reduce, a transition phase is started where F-100 or RUTF (Ready-to-Use Therapeutic Food) is introduced.
- This phase is important for slow transition as the introduction of large amounts of RUTF or F100 could lead to imbalance of body fluids and severe medical complications. In this phase:

- Routine drugs are continued
- Feeding with RUTF or F100 is started

Phases of ...

- **Phase 2 (Rehabilitation Phase):** Children that progress through phase 1 and transition phase enter phase 2 (rehabilitation phase) when they have good appetite and no major medical complication.
- During phase 2:

- Routine drugs, deworming tablets and iron, are started
- Feeding with RUTF or F100 is increased in amount
- Child starts gaining weight

- Whenever possible, phase 2 is implemented as OTP with RUTF. Otherwise, it can be implemented in in-patient centers with RUTF or F100.

Process for successful management of children with SAM in In-patient care

1. Treat/prevent **hypothermia** and **hypoglycemia** (which are often related) by feeding, keeping warm, and treating infection.
2. Treat/prevent dehydration using Rehydration Solution for Malnutrition (ReSoMal).
3. Correct electrolyte imbalance (by giving feeds and ReSoMal).
4. Presume and treat infection with antibiotics.
5. Correct micronutrient deficiencies (by giving feeds and extra vitamins like vitamin A and folic acid as needed).

Process ...

6. Start cautious feeding with F-75 to stabilize the child (usually 2-7 days).
7. Rebuild wasted tissues through higher protein/calorie feeds (F-100 or RUTF).
8. Provide stimulation, play, and loving care.
9. Prepare parents to continue proper feeding and stimulation after discharge.

Important things NOT to do and why

❑Do not give diuretics to treat oedema.

- The oedema is partly due to potassium and magnesium deficiencies that may take about 2 weeks to correct.
- The oedema will go away with proper feeding including a mineral mix containing potassium and magnesium.
- Giving a diuretic will worsen the child's electrolyte imbalance and may cause death

Not to do …

- **Do not give iron during phase 1 and transition phase.**
- Add iron only when the child is in phase 2 (usually during week 2).
- As described earlier, giving iron early in treatment can have toxic effects and interfere with the body's ability to resist infection.

Not to do ...

- **Do not give high protein formula (over 1.5 g protein per kg body weight daily).**
- Too much protein in the first days of treatment may be dangerous because the severely malnourished child is unable to deal with the extra metabolic stress involved
- Too much protein could overload the liver, heart, and kidneys and may cause death.

Not to do ...

- **Do not give IV fluids routinely**
- IV fluids can easily cause fluid overload and heart failure in a severely malnourished child. Only give IV fluids to children with signs of shock.

MANAGEMENT OF MEDICAL COMPLICATIONS

❑*Manage Hypoglycemia*

- Hypoglycemia is a low level of glucose in the blood.
- In severely malnourished children, the level considered low is less than <54 mg/dl (< 3 mmol/litre).
- The hypoglycemic child is usually hypothermic (low temperature) as well.
- Other signs of hypoglycemia include lethargy, limpness, and loss of consciousness.

Treat Hypoglycemia

- If blood glucose is low or hypoglycemia is suspected, immediately give the child a 50 ml bolus of 10% glucose or 10% sucrose orally or by NG tube.
- 50 ml is a very small amount, but it can make a big difference to the child.
- Glucose is preferable because the body can use it more easily; sucrose must be broken down by the body before it can be used.
- **However, give whichever is available most quickly**.
- If only 50% glucose solution is available, dilute one part to four parts sterile or boiled water to make a 10% solution.

Treat Hypoglycemia …

- **If the child can drink, give the 50 ml bolus orally. If the child is alert but not drinking, give the** 50 ml by NG tube.
- **If the child is lethargic, unconscious, or convulsing, give 5 ml/kg body weight of sterile 10%** glucose by IV, followed by 50 ml of 10% glucose or sucrose by NG tube.
- * If the IV dose cannot be given immediately, give dose first through NG tube.

Manage Hypothermia

❑ **Hypothermia**

- Hypothermia is low body temperature.
- A severely malnourished child is hypothermic if the **rectal temperature is below 35.5 0C or if the auxiliary temperature is below 35 0C.**
- Severely malnourished children are at greater risk of hypothermia than other children and need to be kept warm.
- The hypothermic child has not had enough calories to warm the body.
- If the child is hypothermic, he is probably also hypoglycemic.
- Both hypothermia and hypoglycemia are signs that the child has a **serious systemic infection**.

Manage Hypothermia …

- **Maintain temperature (prevent hypothermia)**

- Cover the child, including his head
- Stop draughts in the room. Move the child away from windows
- Maintain room temperature of 28 and 32 0C
- Keep the child covered at night
- Warm your hands before touching the child
- Avoid leaving the child uncovered while being examined, weighed, etc.
- Promptly change wet clothes or beddin
- Dry the child thoroughly after bathing.

Manage Hypothermia …

- **Actively re-warm the hypothermic child**

- In addition to keeping the child covered and keeping the room warm, use one of the following re-warming techniques if the child is hypothermic:

1. Have the mother hold the child with his skin next to her skin when possible (kangaroo technique), and cover both of them. Keep the child's head covered. Give warm Fluid to mother.

- Tuberculosis (TB) in Children

Definition

- Tuberculosis (TB) is an infectious disease caused by Mycobacterium tuberculosis, a rod-shaped bacillus called “acid-fast” due to its staining characteristics in laboratory.
- **Etiology:**
  - M.TB
  - M.Bovis
  - M.Africanum
  - M.Microti
  - M.Canetti

Tuberculosis

- Tuberculosis (TB) is a major public health problem throughout the world
- Almost 1.3 million cases and 450,000 deaths occur in children each year
- The burden of TB in Ethiopia is one of the highest in the world
- Childhood TB reflects recent transmission within a community
- Cases of TB in children usually represents between 5-15% of all TB cases

Tuberculosis….

- The commonest age of presentation disease is between 1 and 4 years
- Young age is a risk factor for infection, for progression
- Children under one year of age are more liable to develop Miliary and TB meningitis
- Most children with TB are not infectious to others
- The commonest type of TB in children is smear-negative PTB

Risk of transmission

- Risk of transmission is dependent on :
- **Index case:**
  - Smear positive TB
  - Extensive upper lobe infiltrate & cavity
  - Copious production of sputum
  - Severe & forceful cough
  - Not treated
- **Environment:**
  - Poor ventilation
  - Overcrowding
  - Intimacy

Transmission

- Incubation period from infection to development of +ve tuberculin test is 2-6wks
- Transmission is person to person (usually by air borne mucus droplet nuclei)

Children at greater risk

- **Children at greater risk of developing TB include:**
- Children who are in close contact with a newly diagnosed smear-positive TB case
- Children less than 5 years of age
- HIV-infected children
- Severely malnourished children

PATHOGENESIS

- The complex of TB includes local infection at the portal of entry & regional lymph node
- Lung is portal of entry in more than 98% of cases
- Bacilli multiply initially within alveoli & alveolar ducts
- Most are killed, some survive within non-activated macrophages
- Macrophages carry the bacilli to regional lymph nodes by lymphatic vessels
- If lung is portal of entry, lymph node are often involved but paratracheal lymph node may be involved(upper lobe)

PATHOGENESIS

- Tissue reaction in the lung parenchyma & lymph node intensifies over the next 2-12wks
  - The parenchymal lesion of complex often heals completely by fibrosis or calcification.
  - Occasionally may continue to enlarge & result in focal pneumonitis & pleuritis
  - If caseation is intense, center of the lesion liquefies & empties into the bronchus leaving a residual cavity
  - The infection of regional LNS develop some fibrosis & encapsulation, but healing is usually incomplete
  - Viable M.TB can persist for decades within parenchymal or LN foci

PATHOGENESIS

- If hilar & Para tracheal LNs enlarge(as part of host inflammatory reaction), they may encroach on a regional LN bronchus → partial obstruction bronchus → distal hyperinflation → complete obstruction results in atelectasis
  - Inflamed caseous nodes can attach to the bronchial wall & erode through it, causing endobronchial TB or a fistula tract
  - During the development of 1o complex, bacilli are carried to most tissues of the body through the blood & lymphatic vessels; common seeding is in the organs of Reticuloendothelial System

PATHOGENESIS

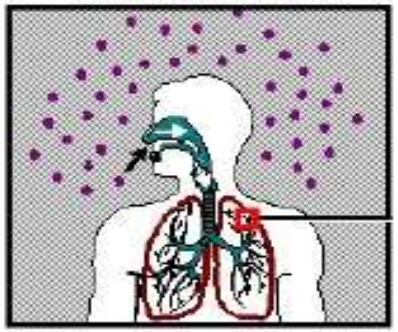
- **Bacterial replication occurs in organs with conditions that favor their growth:**
  - Lung apices
  - Brain
  - Kidneys
  - Bones
- **Disseminated TB occurs if:**
  - Circulating number of bacilli is large
  - Host immune response is inadequate

PATHOGENESIS

- The time b/n initial infection & clinically apparent disease is variable:
  - Disseminated & meningeal TB are early manifestations (2-6 month after infection)
  - TB lymphadenitis & endobronchial TB (3-9month)
  - Bones & joints take several years
  - Renal TB takes decades after infection
  - Pulmonary TB that occurs more than a year after infection is usually due to endogenous regrowth of bacilli persisting in partially encapsulated lesions
  - Common site of reactivation is the apex of upper lobes (oxygen & blood flow good)

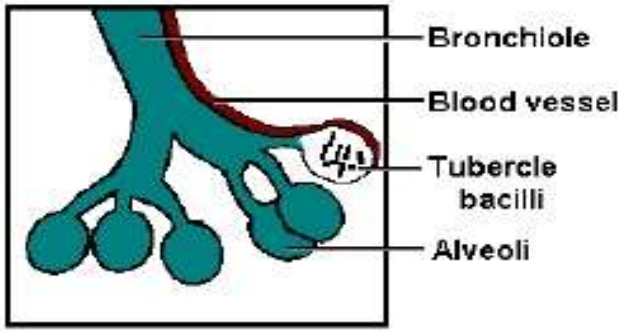
PATHOGENESIS

1



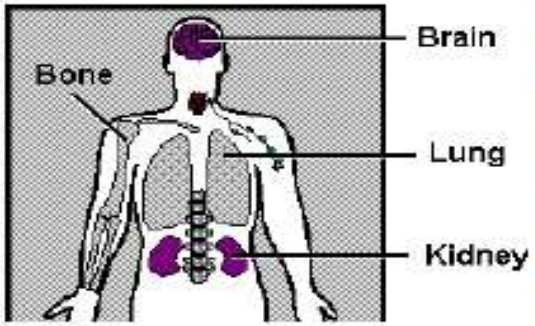
Droplet nuclei containing tubercle bacilli are inhaled, ente the lungs, and travel to the alveoli

2



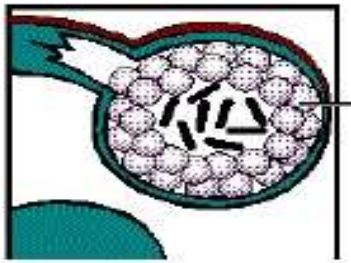
Tubercle bacilli multiply in the alveoli

3



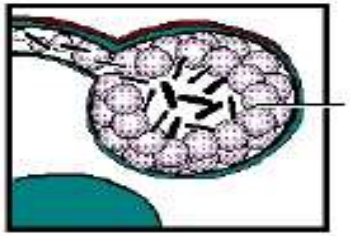
A small number of tubercle bacilli enter the bloodstream and spread throughout the body. The bacilli may reach any part of the body, including areas where TB disease is more likely to develop (such as the lungs, kidneys, brain, or bone

4



Macrophages form a hard shell & keeps bacilli under control

5



Hard shell breaks down and tubercle bacilli escape and multiply (in this example, TB disease develops in the lungs)

Signs and symptoms of childhood TB

General symptoms

- Fever
- Night sweating
- Weight loss
- Fatigue
- Loss appetite

Pulmonary symptoms

- Cough (usually productive)
- Chest pain
- Dyspnea
- Hemoptysis
- Mild wheezes

Signs and symptoms of childhood TB

- **Most common clinical presentation**
  - Persistent respiratory symptoms
  - Poor weight gain or failure to thrive
- Non-productive cough and mild dyspnea are the most common symptoms

Extra-pulmonary Tuberculosis(EPTB)

- **Extra-pulmonary Tuberculosis(EPTB):**
- The most common forms of extrapulmonary disease in children are TB of the superficial lymph nodes and central nervous system (CNS)
- Children younger than 2 years of age are at risk of disseminated disease causing miliary TB or TB meningitis
- The clinical presentation of extrapulmonary TB depends on the site of disease

Miliary Tuberculosis

- Presents with constitutional features rather than respiratory symptoms
- Early symptoms are vague and lack specificity
  - Lassitude, anorexia, failure to thrive and prolonged unexplained fever are common
- Therefore, a high index of suspicion is necessary
- TB meningitis is the commonest cause of death if miliary TB is untreated

CNS TB

- Is the result of haematogenous spread of the bacilli to the CNS.
- The patient may present with constitutional features and chronic meningitis and there is gradual onset and progression of headache and decreased consciousness
- Tuberculoma (a large solid lesion, rather like a malignant tumor)
  - Present with focal neurological deficits, seizures and obstructive hydrocephalus.
- Young children, especially those under 2 years of age, have the highest incidence and the worst prognosis.

Diagnosis of TB in Children

- The diagnosis of TB can be made with confidence in the majority of children sing careful clinical assessment
- **There are two key factors in suspecting tuberculosis in children:**
    - Identification of an infectious adult close to the child, especially in the family
    - Loss of weight or failure to thrive
- Any child with symptoms suggestive of TB, with history of exposure to an adult or adolescent pulmonary TB patient should be investigated for TB
- Children usually develop TB within 2 years after exposure and most (90%) within the first year

Diagnosis of TB in Children

- Careful history (including history of TB contact and symptoms consistent with TB)
- Clinical assessment (including serial weight)
- Diagnostic tests
    - **Bacteriologic confirmatory tests**(ZN/FM microscopy, Xpert MTB/RIF assay & Any child with symptoms suggestive of TB, with history of exposure to an adult or adolescent pulmonary TB patient should be investigated for TB culture)
    - **Chest X-ray**
    - **HIV testing**
    - **Histopathology**

Diagnosis of TB in Children

- **Key Features Suggestive of TB**
  - Chronic symptoms suggestive of TB
  - Physical signs highly suggestive of TB
  - X-ray suggestive of TB
  - A positive tuberculin skin test

Tuberculin Skin Test(Mantoux test)

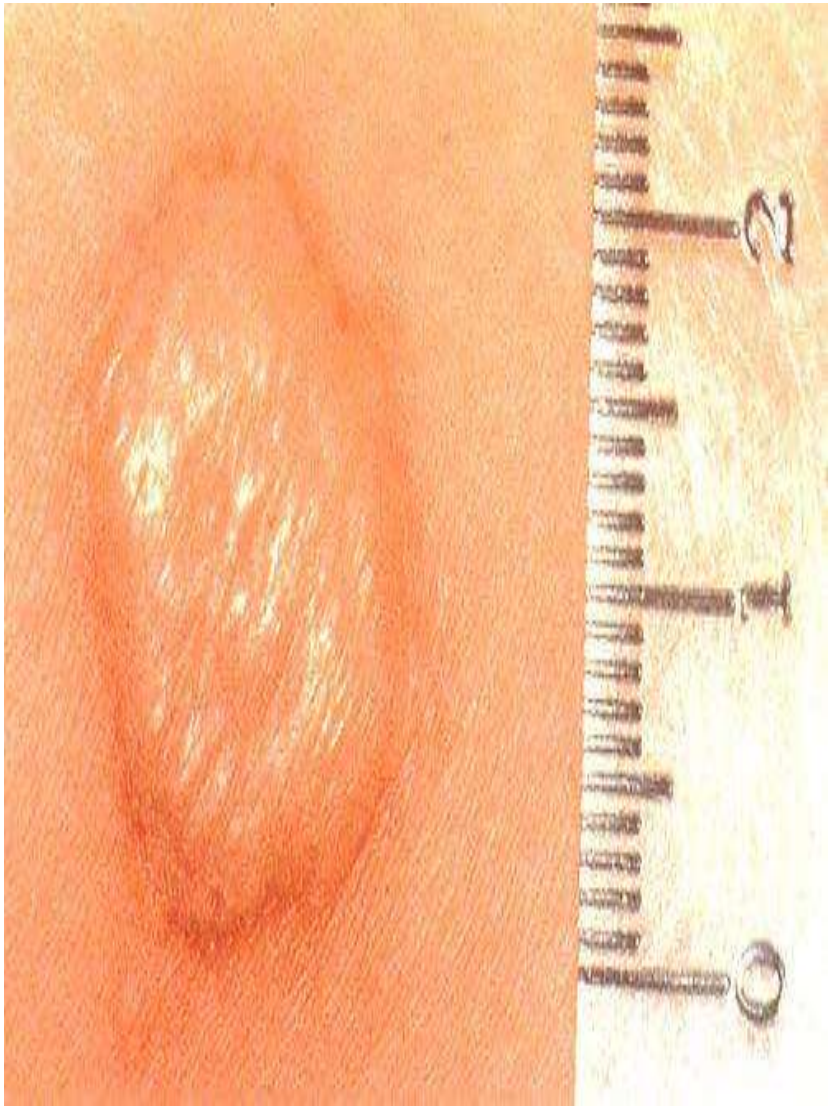
- Id, 0.1ml of PPD/purified protein derivative/, volar surface of arms
- T-cells sensitized by prior infection are recruited to the skin; release lymphokines that induce indurations through local vasodilatation, edema, fibrin deposition and recruitment of other inflammatory cells to the area
- Amount of induration is measured 48-72hrs after administration

Tuberculin Skin Test(Mantoux test)

- TST is useful to support a diagnosis of TB in children with suggestive clinical features who are sputum smear-negative or who cannot produce sputum
- **A positive TST indicates infection:**
  - Positive in any child if ≥ 10 mm, irrespective of BCG immunization
  - Positive if ≥ 5 mm in HIV-infected or severely malnourished child

Tuberculin Skin Test(Mantoux test)

- A positive TST is particularly useful to indicate TB infection when there is no known TB exposure on clinical assessment, i.e. no positive contact history.
- Caution: a positive TST does not distinguish between TB infection and active disease.
- A negative TST does not exclude TB disease.



TB TREATMENT IN CHILDREN

- The principles and management and monitoring of patient during treatment Is also similar to Adult

Recommended TB regimen for children diagnosed with TB

TB Patient type	Standard Regimen		TB types receiving the regimen
	Intensive phase	Continuation phase	
Drug susceptible TB case	2(RHZE)	4(RH)	• All pulmonary TB cases • Most Extrapulmonary TB cases
	2(RHZE)	10 (RH)	• Extrapulmonary TB patients involving: ▪ CNS (meningitis, tuberculoma) ▪ vertebra and Osteoarticular space
Drug Resistant TB(at least to rifampicin)	Second line anti-TB drugs		• Confirmed or clinically diagnosed DR-TB cases

TB TREATMENT IN CHILDREN

PATIENT TYPE	DRUGS	STRENGTH(MG)	FORMULATION	PREPARATION, ROUTE
Pediatric (body weight less than 25kg)	RHZ	60/30/ 150	dispersible tab	FDC, oral
	RHZ*	75/50/150	dispersible tab	FDC, oral
	RH	60/30	dispersible tab	FDC, oral
	RH*	75/50	dispersible tab	FDC, oral
	E	100	dispersible tab	Loose, oral
	H	100	dispersible tab	Loose, oral

TB TREATMENT IN CHILDREN

Drug	Recommended Dose	
	Daily Dose and range (mg/kg body weight)	Maximum(mg)
Isoniazid	10 (7-15)	300
Rifampicin	15 (10-20)	600
Pyrazinamide	35 (30-40)	-
Ethambutol	20 (15–25)	-
Children weighing 25kg and more can be treated using recommendation for adults		

Second line anti TB drugs for treatment of MDR-Tb in children

- Ethionamide or prothionamide
- Fluoroquinolones
  - Ofloxacin
  - Levofloxacin
  - Moxifloxacin
  - Gatifloxacin
  - Ciprofloxacin
- Aminoglycosides
  - Kanamycin
  - Amikacin
  - Capreomycin
- Cycloserine or terizidone
- paraAminosalicylic acid

Prevention of Childhood TB

- Case finding and treatment, which interrupts transmission of infection between close contacts
- Bacille Calmette-Guerin Vaccination(BCG)
- INH prophylaxis

Individual assignment

- **HIV/AIDS**
- Introduction (Definition and pathogenesis);WHO clinical staging, ART, follow-up and advice for HIV positive children
- Tuberculosis in HIV positive children

Malaria

Definition and Epidemiology

- An acute infection of the blood caused by protozoa of the genus plasmodium
- Malaria is a major health problem in Africa, Asia, Central America, Oceania, and South America
- About 40% of the world's population lives in areas where malaria is common
- Approximately 300-500 million cases of malaria occur every year, and 1-2 million deaths occur, most of them in young children

Etiology

- Malaria is caused by Plasmodium species, which are protozoal blood parasites.
- The following 5 species can infect humans:
  - P vivax
  - P falciparum
  - P malariae
  - P ovale
  - Plasmodium knowlesi

Mode of transmission

- Vector born -the bite of an infected female Anopheles mosquito
- Blood transfusion
- Organ transplantation
- Vertical transmission - Transplacental malaria(congenital malaria)

Risk factors

- Residence in, or travel through, a malarious area
- No previous exposure to malaria (hence no immunity)
- No chemoprophylaxis or improper chemoprophylaxis

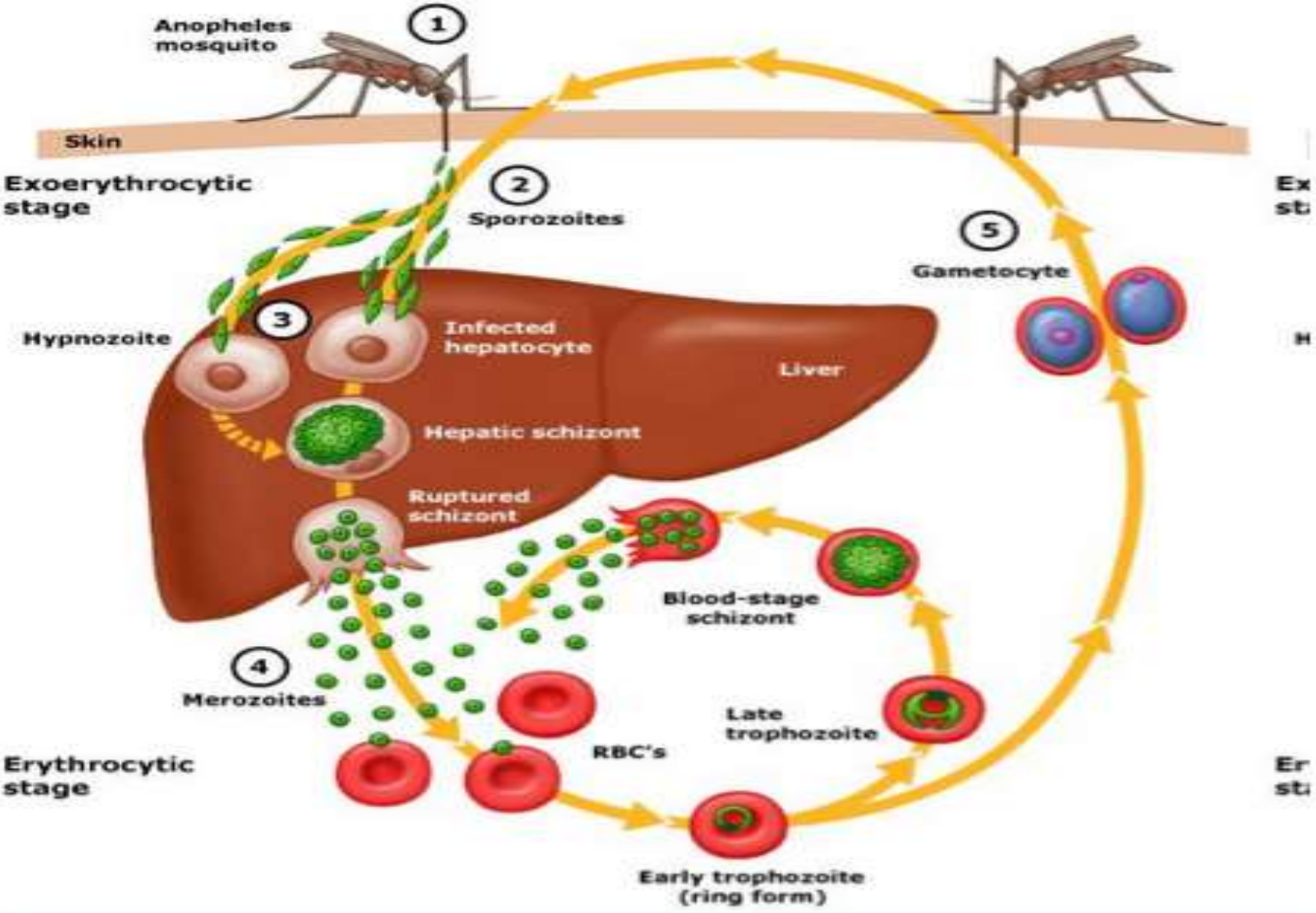
Life cycle and pathogenesis

- The plasmodium life cycle consists of an exoerythrocytic (asymptomatic) stage and erythrocytic (symptomatic) stage
- Plasmodium sporozoites are transmitted by the bite of an infected anopheline mosquito
- The sporozoites invade hepatocytes, which divide until schizonts are formed containing thousands of daughter merozoites
- These rupture and release merozoites into the bloodstream, where they invade red blood cells

Life cycle and pathogenesis

- Within red cells, merozoites mature from ring forms to trophozoites to multinucleated schizonts (erythrocytic stage).
- Some merozoites differentiate into male or female gametocytes.
- These cells are ingested by the Anopheles mosquito and mature in the midgut, where sporozoites develop and migrate to the salivary glands of the mosquito.
- The mosquito completes the cycle of transmission by biting another host

Plasmodium life cycle



Life cycle and pathogenesis

- The symptoms and pathology are caused by the asexual erythrocytic stage of the malaria parasite.
- Four pathologic process
  - Fever
  - Anemia
  - Immunopathologic events
  - Tissue anorexia resulting from cytoadherence of infected erythrocytes

Life cycle and pathogenesis

- Fever-occurs when RBC rupture and release merozoites in to circulation.
- Anemia- hemolysis, sequestration of RBC in the spleen and other organs , and suppression of the bone marrow.
- Immunopathologic events include immune complex formation, immune suppression, and release of inflammatory mediators such as TNF which may be responsible for many of the pathologic features of the disease.
- Cytoadherence to vascular endothelium which occurs in p. falciparum may lead to obstruction of blood flow and capillary damage with resultant vascular leakage of protein and fluid , edema and tissue anorexia in the brain ,heart, lungs, intestine and kidney

Clinical Manifestations

- Classic picture (shivering ,fever, and sweating) may not be observed in Younger children.
- Children become restless, drowsy, apathetic, and anorexic.
- Older children may report aching body, headache, and nausea.
- Fever is usually continuous and may be very high (40°C) from the first day.

Clinical Manifestations

- Flulike respiratory symptoms with mild cough and cold. These symptoms abate in 1-2 days, with or without treatment.
- Parasitemia in neonates within 7 days of birth implies transplacental transmission.
  - This congenital malaria is usually associated with placental parasitemia, which sometimes persists even after adequate treatment with antimalarial drugs. Babies have fever, are irritable, refuse feeds, and often develop anemia, jaundice, and hepatosplenomegaly.

Clinical Manifestations

- Vomiting
- Seizure
- Fever (temp of 40c or more)
- Slightly tender liver
- Splenomegaly
- Anemia
- Mild jaundice

Clinical Manifestations

- P vivax and P ovale both give rise to hypnozoites in the liver
- P vivax malaria may relapse for up to 3 years and P ovale for 1-1.5 years.
- P falciparum and P malariae do not form hypnozoites, so they do not have true relapses.

Severe Malaria

- Severe malaria, which is due to Plasmodium falciparum, is serious enough to be an immediate threat to life.
- The illness starts with fever and often vomiting.
- Children can deteriorate rapidly over 1–2 days, going into coma (cerebral malaria) or shock, or manifesting convulsions, severe anemia and acidosis.

Severe Malaria

Sever malaria manifests with one or more of the following:

- **Prostration:** Inability to sit unassisted in a child who is normally able to do so
- In a child who did not start to sit, it is inability to feed
- Respiratory distress (acidotic breathing, costal indrawing, use of accessory muscles, nasal alar flaring)
- **Impaired consciousness:** change in sensorium confirmed by coma scale
- If <2 in Blantyre coma Scale we define it as Cerebral Malaria

Blantyre coma scale for children

		Score (Total: 0-5)
Eyes Movement:	Directed (eg. Follows mother's face)	1
	Not directed	0
Verbal Response	Appropriately cry	2
	Moan or inappropriate cry	1
	None	0
Best Motor Response	Localizes painful stimuli	2
	Withdraws limb from pain	1
	Non specific or absent response	0

Severe Malaria

- Multiple convulsions
- Circulatory collapse
- Pulmonary edema (radiological): Supported by radiologic feature
- Abnormal bleeding;
- Jaundice
- Haemoglobinuria: Dark red or black urine, dipstick positive for hemoglobin/myoglobin, no microscopic hematuria
- Severe anemia: (haemoglobin <5 g/100ml or packed cell volume <15%)
- Hypoglycaemia:(blood glucose concentration of <2.5 mmol/l; <45 mg/100ml)
- Acidosis: Bicarbonate<15mmol/l, PH<7.35

Severe Malaria

- Renal impairment: Rare in children; urine out put <1ml/kg/hr for infants and 0.5 ml/kg/hr for children; or creatinine level above age related normal range
- Hyperlactataemia: >2mmol/l
- Hyperparasitaemia: In non immune child >4%; in immune child>20%

Diagnosis of Malaria

- Blood Smear Examination
  - Both thick and thin films are essential.
  - The thick smear is used for the detection of the parasite where as the thin is used for the detection of the species of the parasite.
- Lumbar puncture
  - Indicated to rule out meningitis in cerebral malaria and febrile seizure with malaria.

Differential diagnosis

- Viral infections such as hepatitis
- Sepsis
- Pneumonia
- Meningitis
- Encephalitis
- Gastroenteritis

Complications

- Cerebral malaria, caused by P falciparum, has a mortality rate of 25%, even with the best treatment.
- Convulsions
- Sever anemia a
- Hypoglycemia

Treatment

- **Uncomplicated malaria**
- **P.vivax, P. malariae, P. ovale:**
  - Chloroquine- Total dose of 25 mg base per kg over 3 days
  - Primaquine* may be administered daily for 14 days starting after chloroquine treatment is completed.
- **P. falciparum:**
- Artemether-Lumefantrine (Coartem)
  - Administered 2 times a day for 3 days.
- Oral quinine
  - For infants less than five kg of body weight and pregnant women,
  - Administered 3 times a day for 7 days is the first line treatment.

Treatment of sever P. falciparum malaria

- **Emergency measures : to** be taken within the first hour:
  - Check for hypoglycaemia and correct
  - Treat convulsions with rectal diazepam
  - Restore the circulating blood volume
  - If the child is unconscious, minimize the risk of aspiration pneumonia by proper positioning
  - Treat severe anemia if in heart failure
  - Start treatment with an effective antimalaria

Antimalarial treatment

- Give quinine as follows: Give it preferably IV in 5% glucose
  - Give a loading dose of quinine (20 mg/kg of quinine dihydrochloride salt) in 10 ml/kg of IV fluid over a period of 4 hours
  - Then give 10 mg/kg quinine salt in IV fluid over 4 hours TID until the child is able to take oral treatment
  - It is essential that the loading dose of quinine is given only if there is close nursing supervision
  - If this is not possible, it is safer to give IM quinine

Antimalarial treatment

- Then, give oral Artemeter-Lumefantrine PO for children above 5 kgs (those less than 5kgs must be given quinine 10 mg/kg PO every 8 hrs to complete 7 days of treatment.)
- If artemeter is not available, give quinine PO for 7 days.
- Wherever IV administration of quinine is not possible: Quinine dihydrochloride 20 mg salt per kg loading dose intramuscularly (divided in to two sites, anterior thigh) *f*

Antimalarial treatment

- Then quinine dihydrochloride 10 mg salt per kg IM every 8 hours until patient can swallow.
- Then administer artemether-lumefantrine or oral quinine as above.
- IM artemether-lumefantrine
  - Give 3.2 mg/kg IM on the first day, followed by 1.6 mg/kg IM daily for two days. Use a 1 ml tuberculin syringe to give the small injection volume.

Supportive care

- **In an unconscious child:**
- Maintain a clear airway
- Position 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

Supportive care

- Take the following precautions in the delivery of fluids:
  - Check for dehydration and treat appropriately.
  - During rehydration, examine frequently for signs of fluid overload
  - The most reliable sign is an enlarged liver.
  - If, after careful rehydration, the urine output over 6 hours is less than 0.5 ml/kg / hr, give IV furosemide.
  - In children with no dehydration, ensure that they receive their daily fluid requirements but take care not to exceed the recommended limits.

Prevention

- Chemoprophylaxis
  - Mefloquine
  - Doxycycline-2mg/kg/d for >8yr of age
  - Premaquine-0.3mg/kg
- Avoiding mosquito breeding sites
- Residual DDT spray or other chemicals
- Insecticide Treated Nets (ITN)
- Chemotherapy of cases

Expanded Programme of Immunization (EPI)

EPI Target Diseases

Target diseases of EPI in Ethiopia

- Tuberculosis
- Poliomyelitis
- Diphtheria (Cornybacterium diphtheria toxin)
- Pertussis (Bordetella pertusis)
- Tetanus (Clostridium tetani toxin)
- Influenza (Hemophilus influenza type b) Hepatitis B (Hepatitis B virus (Hepanda))
- Measles (Measles virus (Paramyxo))
- Pneumonia (Streptococal)
- Rota virus diarrhea (rota virus)

Pertussis (Whooping Cough)

- **Etiologic agent-** A gram-negative bacterium called Bordetella pertussis.
- **Pathogenesis** - The organism produces **exotoxin** and affects the pharynx, larynx, trachea, bronchi, bronchioles and sometimes the alveoli.
- **Clinical features** - Incubation period is 7 – 17 days.
  - The symptoms of classical pertussis last about **6 weeks** and are divided into **3 stages**

Catarrhal stage

- The onset is insidious
- Lasts 1- 2 weeks
- **Cough** and **rhinorrhea**

Paroxysmal stage

- Lasts 2-4 weeks following the infection.
- Characterized by rapid consecutive (5-15) **cough** before a breath is taken and followed by **deep hurried inspiration** (whoop).
- Post cough **vomiting** is common at all ages,

Cont....

- Expulsion of clear **tenacious mucus** often followed by vomiting
- **Factors stimulating cough** include fright, anger, crying, sneezing, inhalation of irritant, and overdistention of the stomach.

Convalescent stage

- It begins after 4 weeks of the illness, and is manifested by **a decrease in the frequency** and **severity** of the paroxysms of coughing.
- After improvement the disease may recur.

Diagnosis

- **Clinical**
  - The child is well appearing and playful between paroxysms of cough.
  - Presence of children with similar illness in the family or vicinity.
  - There is **no chest finding** on physical examination.
  - The diagnosis is usually made on the distinctive clinical feature of the cough. To observe the classical type of cough put tongue depressor to stimulate the coughing.

Cont'd

- **Laboratory**
  - WBC 15000 - 20000/mm3 (rarely to 50,000/mm3)
  - 60 - 80% Lymphocytes
  - Microscopy; Gram stain
  - Culture to isolate the organism
- **Differential Diagnosis**
  - Aspiration of foreign bodies
  - Viral pneumonia
  - Influenza
  - Acute bronchitis and bronchiolitis.

Management

Specific measures

- Antimicrobial
  - Erythromycin
  - Ampicillin
- Sedatives
  - Promethazine Hydrochloride
  - Phenobarbitone (when there is seizure)
- Steroid
  - Prednisolone

Cont'd

General measures

- Frequent small feeding and continue feeding if vomiting occurs soon after meal.
- Oxygen if needed
- Severe cases especially infants are best managed in hospital.
- **Prophylactic Erythromycin** for all house hold members and other contacts regardless of age, history of immunization of symptoms.

Complications

- Apnea
- Conjunctival hemorrhage
- Otitis media
- Pneumonia
- Atelectasis
- Encephalopathy

Tetanus

- An acute, spastic paralytic illness caused by **tetanus toxin** (tetanospasmin), the **neurotoxin** produced by Clostridium tetani
- **Etiologic agent**
  - A gram positive anaerobic bacterium called Clostridium tetani (Cl.tetani).
  - Can survive boiling

Pathogenesis

- Tetanus toxin, after germination of the Cl.tetani spores in a contaminated **umbilical stump** or **wound** in other parts of the body, is released to the peripheral nerves and circulation.
- This causes sustained excitatory neuronal discharge and muscle contraction.

Clinical Manifestation

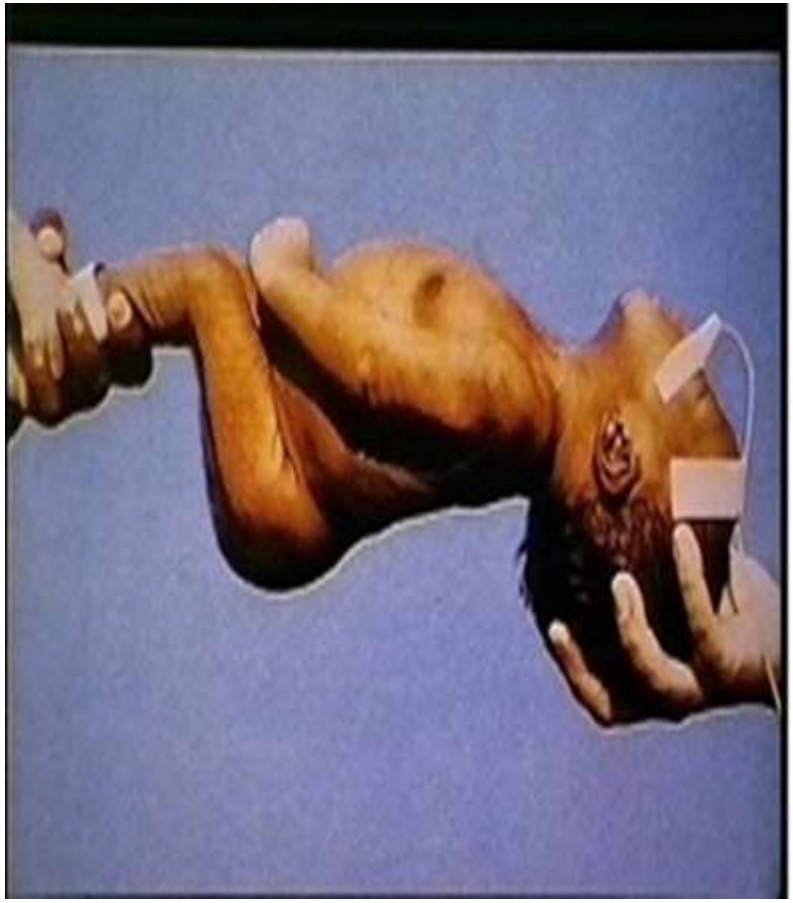
- **Incubation period** – 2 to 14 days commonly; but can be as long as months after the injury.
- Can be divided in to two:
  - **Generalized tetanus** –
    - Trismus or lock jaw (masseter muscle spasm) is presenting symptom in about 50%
    - Headache, restlessness, and irritability are early symptoms often followed by stiffness, dysphagia and neck muscle spasm

Cont'd

- **Risus Sardonicus** (sardonic smile) results from intractable spasm of facial and buccal muscles
- **Opisthotonus** – arched posture due to involvement of abdominal, lumbar, hip and thigh muscles ("board" like rigidity in which the back of the head and heals touch ground)
- Laryngeal and respiratory muscle spasm can lead to airway obstruction and asphyxiation
- **Patient remains conscious** in extreme pain and anticipation of next tetanic seizure

Cont'd

- Tetanic spasm may be triggered by the smallest disturbance (**sight, sound or touch**)
- Autonomic NS manifestations: tachycardia, arrhythmias, labile hypertension, diaphoresis and cutaneous vasoconstriction.
- Tetanic paralysis become more intense in the first week after onset, and stabilizes over the ensuing one to four weeks



Cont'd

- **Neonatal tetanus** (Tetanus Neonatrum):
  - Infantile type of **generalized tetanus**
  - Typically manifests with in 3 – 12 days of birth
  - Infection results from umbilical cord contamination during unsanitary delivery
  - Difficulty in feeding, crying, paralysis, stiffness to touch with or without **opisthotonus** are characteristics.

Cont'd

- **Localized tetanus**
  - Painful spasm of muscles **adjacent to the wound site**
  - May precede generalized tetanus
  - **Cephalic tetanus**:
    - A rare form of **localized tetanus** involving the **bulbar musculature**
    - Follow wounds or foreign bodies in the head, nostrils or face, and occasionally chronic otitis media.
    - Characterized by retracted eye lids, deviated gaze, trismus, risus sardonicus and spastic paralysis of the tongue.

Diagnosis

- No diagnostic lab test
- Based on Hx and clinical finding

Differential diagnosis:

- Poisoning
- Meningitis
- Peritonitis
- Rabies
- Dental abscess
- Hypocalcemic tetany

Treatment

- Principles
    - Eradication of C. tetani and wound environment conducive for its multiplication.
    - Neutralization of all accessible tetanus toxin-TIG
    - Control of spasms-Diazepam
    - Provision of meticulous supportive care
    - Prevention of recurrences

Complications

- Respiratory arrest
- Laryngeal spasm
- Presence of autonomic nervous system disturbances.

- **Prevention**
  - Immunization of children and women.
  - Health information on harmful practices
  - Training of Traditional Birth Attendants (TTBA).

Poliomyelitis

Etiologic agent

- It is caused by polioviruses type I, II and III.

Pathogenesis

- The virus affects the anterior horn cells of the spinal cord and several areas of the brain.
- Damage may be reversible with recovery, but it may go on to irreversible nuclear destruction where muscle paralysis results.

Clinical features

- Incubation period is 6 – 14 days
- Fever, malaise, headache and muscle pain
- Nausea, vomiting, soar throat and stiffness of the neck and back with or without paralysis.
- Paralysis usually affects the legs, more often one
- **Diagnosis**
- It is mainly by clinical features.
  - Positive CSF – pleocytosis 20 -300 cells/mm; protein 50 -100 mg/dl by 1st week
  - Serology – a four fold or greater rise in antibody titers
  - Culture – stool and naso-pharynx

Management

Acute phase

- Keep the limbs position with cushions
- Apply warm packs
- Provide analgesics
- Active and passive movements are assisted by physiotherapist after the acute phase ended.

Recovery phase

- Continue with full range of passive/active movement of the affected limb every day.

Residual phase

- Regular out patient supervision of physical, social and economic problems if needed.

Diphtheria

Etiologic agent

- It is caused by Gram-positive bacterium called Corynebacterium diphtheriae.

Pathogenesis

- The bacterium produces **exotoxin** which causes local tissue inflammation and necrosis.
- In cases where the pharynx is involved, there are patches of a grayish membrane with a surrounding dull red inflammatory zone, which may cause **pharyngeal obstruction**.

Clinical features

- The incubation period is usually 2 - 5 days.
- Sore throat which may be followed by **stridor**.
- Grayish white membrane seen in oropharynx.
- Upper airway obstruction by the membrane.

Diagnosis

- Clinical signs mentioned above
- Microscopy -Gram stain

Management

A. Specific

- **Diphtheria antitoxin** if the diagnosis is strongly suspected clinically.
- Antimicrobial therapy with penicillin or erythromycin

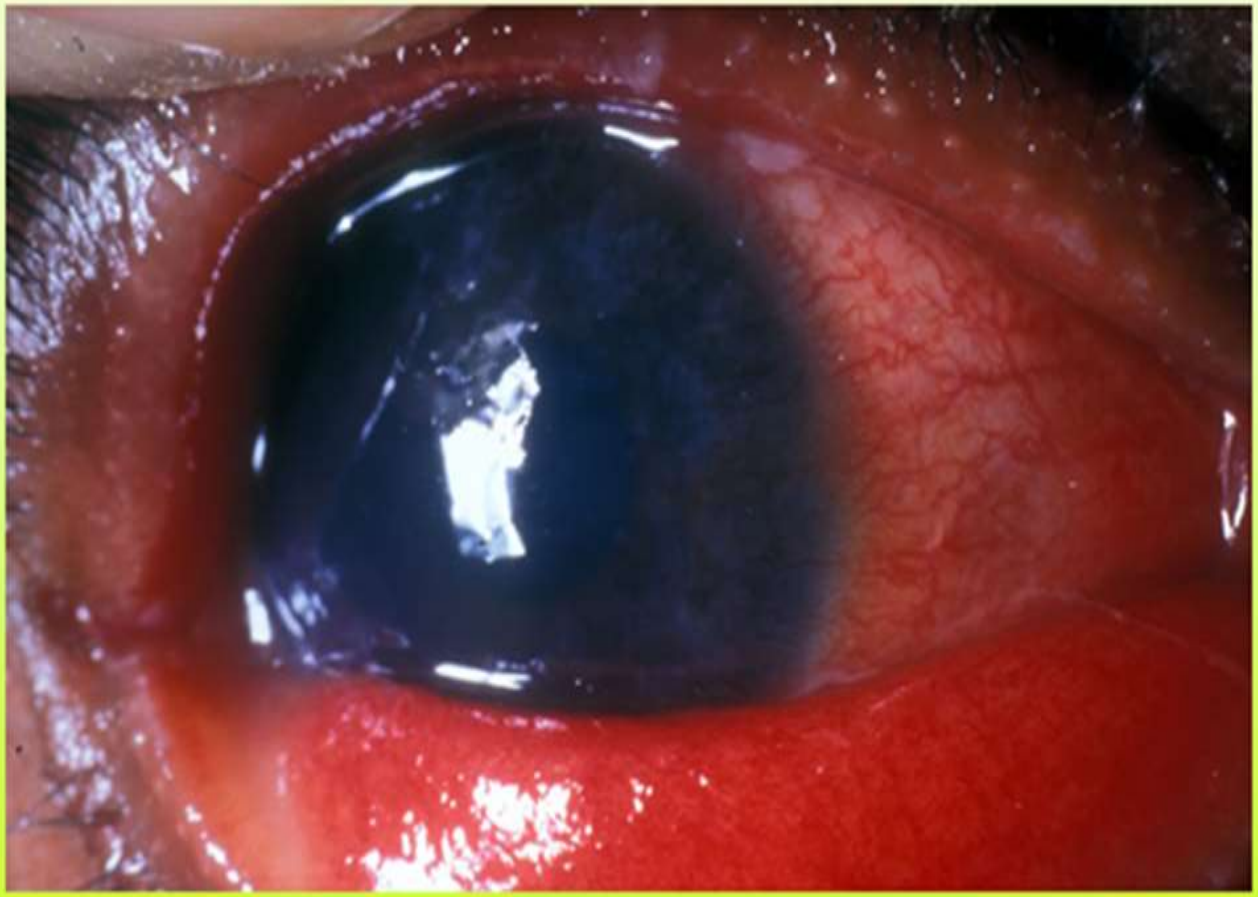
B. General

- Strict bed rest and sedation
- Intubations if needed
- **Complications**
- Airway obstruction
- Toxic cardiomyopathy (50 – 60% of diphtheria deaths)
- Vocal cord paralysis

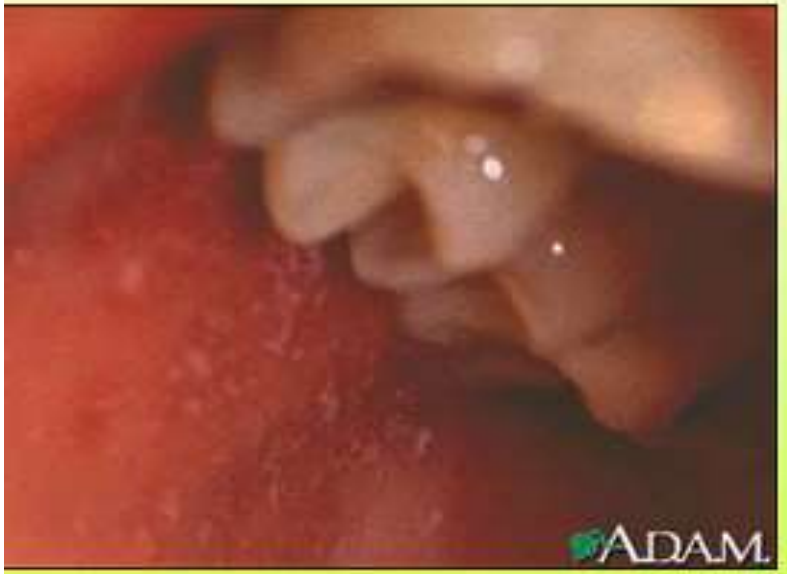
Measles

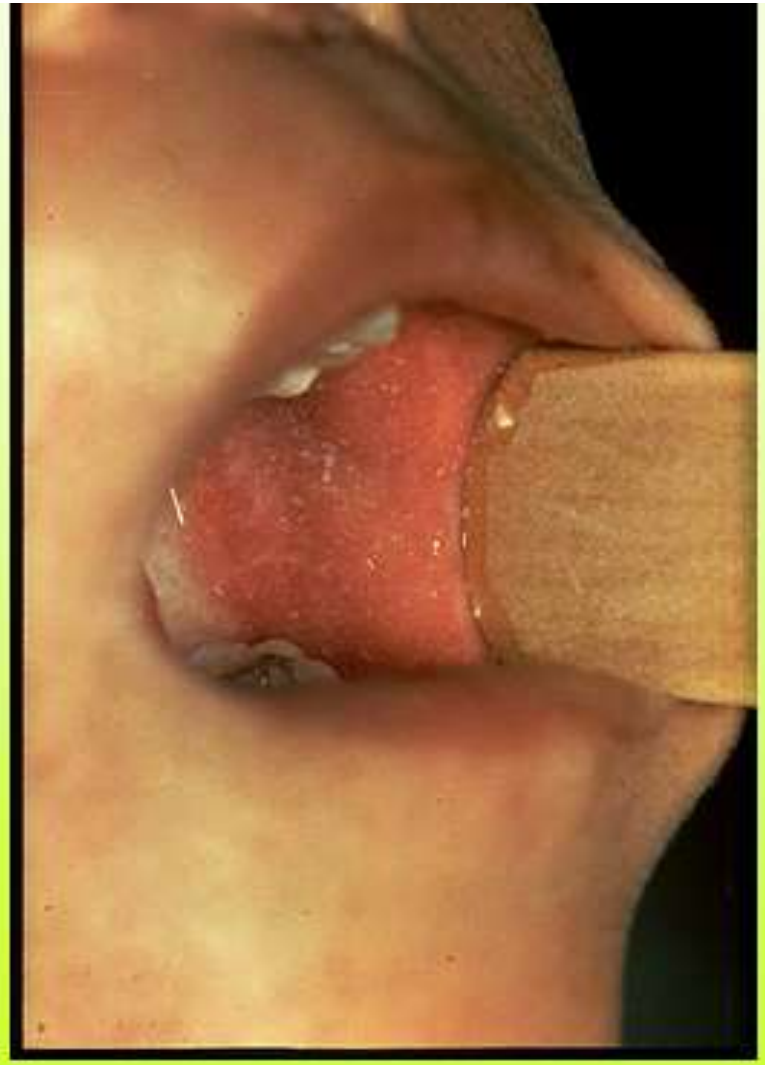
- **Etiologic agent**
  - It is caused by Measles Virus.
- **Pathogenesis**
  - The essential lesion of measles is found in the skin; the mucous membranes of the nasopharynx, bronchi, and intestinal tract; and in the conjunctivae.

- Measles conjunctivitis



- Koplik's spots





Diagnosis

- It is made mainly by clinical features epidemiological grounds.
- Serologic - identification of Ig-M antibody. (appears 1–2 days after the onset of the rash)
  - at least fourfold increase in anti-measles antibody titer
- Viral isolation from blood, urine, or respiratory secretions (by culture)
- Molecular detection by polymerase chain reaction is possible

- Case definition:
  - Generalized rash lasting > 3 days and To > 38.5 ^{o}C **plus**
  - Cough or coryza or conjunctivitis

****Management****

- Severe cases only are admitted to the hospital.
- Mothers are advised about care at home which includes – reducing fever, maintaining hydration and nutrition.
- Serious complications are treated in hospitals.

Complications

- Pneumonia
- Otitis media
- Malnutrition
- Encephalitis
- Eye problems and blindness (abscised with Vitamin A deficiency)

Definitions and General concepts

- **Immunization**
  - The process of inducing immunity artificially by either vaccination or administration of antibodies.
  - **Two types:**
    - **Active immunization** – stimulation of the immune system to produce antibodies and cellular immune response against an infectious agent
    - **Passive immunization** – providing temporary protection through administration of exogenously produced antibodies.

Cont'd

- **Vaccination**
  - Administration of any vaccine or toxoid for prevention of disease.
- Types of vaccines
  - Live attenuated (Polio, BCG, Measles, Rota)
  - Killed (IPV, Pertussis, Hib)
  - Toxoids (Tetanus, Diphtheria)

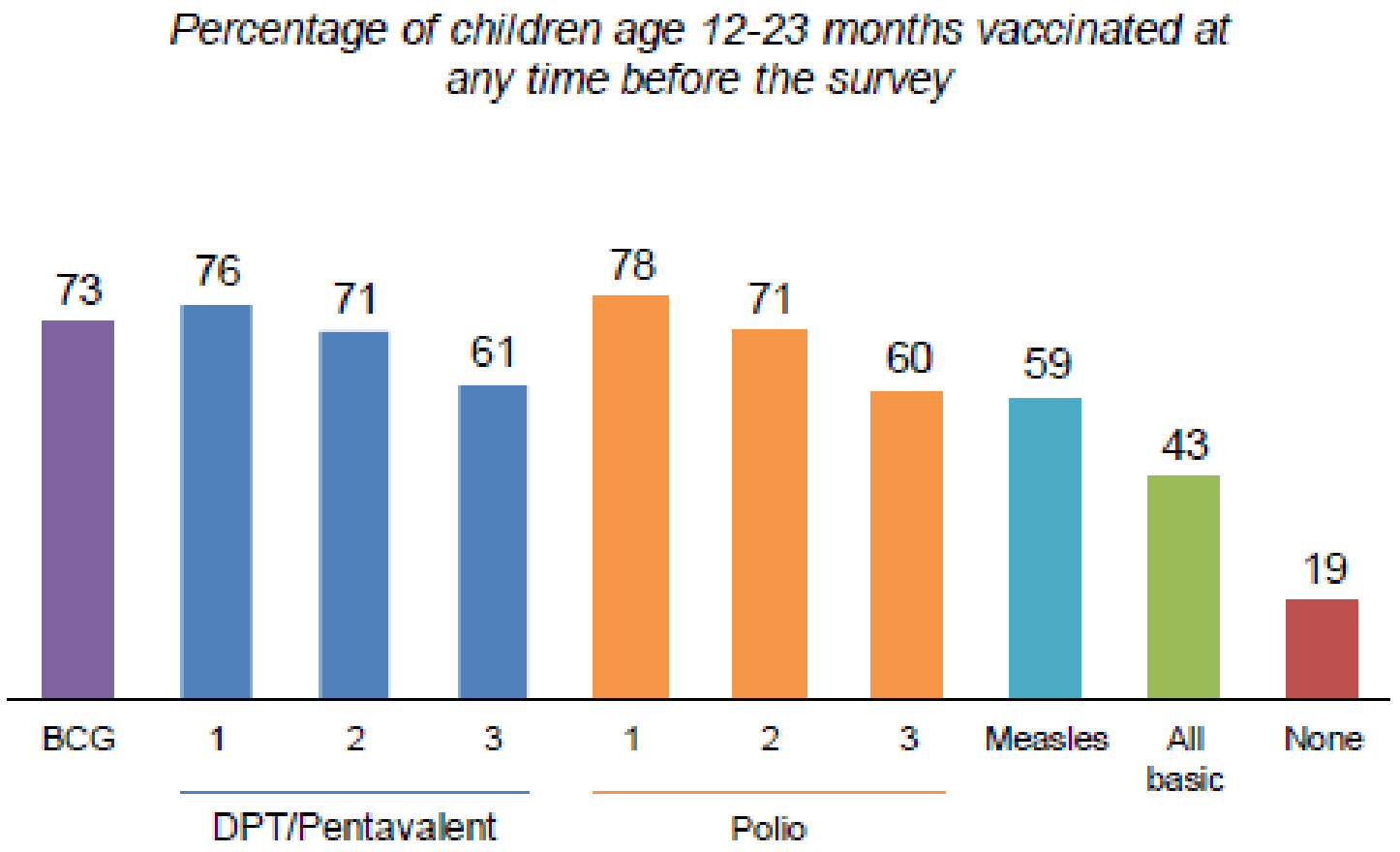
Expanded Programme on Immunization (EPI)/WHO

- Aims to provide free immunization for children against the important childhood infections
- Started in 1974
- Ethiopia launched in 1980
- **Main purpose:**
  - Prevent childhood diseases
  - Provide high quality vaccines
  - Surveillance of these diseases

Immunization schedules

When	vaccines
At birth	BCG OPV 0
At 6 week	OPV 1 DPT-Hib-HepB 1,PCV 1,Rota 1
At 10 week	OPV 2 DPT+Hib+HepB 2 ,PCV 2,Rota 2
At 14 week	OPV 3,IPV DPT-Hib-HepB 3, PCV 3
At 9 month	Measles
6-59 months	Vit A supplementation

Childhood vaccinations(EDHS,2019)



Administering vaccine for infants

Name of vaccine	BCG	DPT-HepB-Hib	PCV	Rotarix	Measles	OPV	IPV
Body site given	Outer upper right arm or shoulder	Left outer mid-thigh	Right outer mid-thigh	Oral	Left upper arm	Oral	Left outer mid-thigh; 2.5 cm apart from PCV injection
How given	Intra-dermal injection	Intramuscular injection	Intramuscular injection	Oral dropper	Subcutaneous injection	Oral dropper	Intramuscular injection
Dose	0.05 ml	0.5 ml	0.5 ml	1.5 ml	0.5 ml	2 drops	0.5 ml
Needle size	10mm, 26 gauge	25mm, 23 gauge	25mm, 23 gauge		25mm, 23 gauge		25mm, 23 gauge
Type	Powder + Diluent	Ready-to-use	Ready-to-use	liquid	Powder + Diluent	Vial with oral dropper	Ready-to-use
Appearance	White, cloudy liquid with sediment that suspends when shaken	White, cloudy liquid	White, cloudy liquid	Clear	Clear, slightly yellow liquid	Clear, pink or orange liquid	White, cloudy liquid

The strategies of EPI:

- Strategies of EPI includes:
  - Routine immunization strategies
  - National immunization days
  - Out break response immunization
- Routine immunization strategies are classified as:
    - Static immunization
    - Out reach immunization
    - Mopping up immunization (House to house)

(I) The static immunization strategy:

- Advantages: Available resources., Cold Chain maintenance , Save time, effort and money

(II) Outreach immunization:

The outreach is carried for routine immunization

Compulsory for the targets in:

Immunization not accessible.

Low vaccination coverage

The outreach is carried during any time

Limitations:

Expensive

Cold chain failure

Difficulty to arrange

Cont'd

(III) Mopping up Immunization:

- house-to-house immunization of OPV in high risk districts.
- High risk districts are those:
  - Where polio virus is still circulating
  - Low immunization coverage.
  - Transient population,
  - Overcrowding poor sanitary
  - Low access to health services.

The National Immunization Days (NIDs)

- Periodic immunization of all the eligible targets over a large geographic areas within a short period
- Used for polio eradication and tetanus elimination.

Outbreak response immunization

- Outbreak of vaccines preventable diseases requires immunization to be implemented.
- Before the immunization has been started, assessment of the outbreak is mandatory.

Cont'd

- The assessment includes:
  - The type of disease
  - The magnitude of disease
  - The requirement of vaccination
  - The number of individuals to be vaccinated
  - The number staffs required
  - Other required logistics and break down of budget

Concepts and rates

- **Immunization Coverage**
  - Immunization coverage is the proportion of the target population that has been vaccinated.
  - If coverage rates indicate that people are not using immunization services, health workers and their supervisors need to find the causes and take appropriate action.
  - Comparing coverage rates for different vaccines sometimes points toward the likely problem as well as possible solutions.

Concepts and rates…

Calculating Annual Coverage for DTP1, DTP3, and Measles Vaccines for 2003
DTP1 coverage: $\frac{\text{number immunized by 12 months with DTP1 in 2003}}{\text{number of surviving infants <12 mos. of age in 2003}} \times 100$
DTP3 coverage: $\frac{\text{number immunized by 12 months with DTP3 in 2003}}{\text{number of surviving infants <12 mos. of age in 2003}} \times 100$
Measles coverage: $\frac{\text{number immunized by 12 months with measles vaccine in 2003}}{\text{number of surviving infants <12 mos. of age in 2003}} \times 100$

Concepts and rates…

Drop-Out/Defaulter Rates

- High drop-out rates may reflect problems in demand for vaccinations, client satisfaction with services, and the ability of the immunization program to provide those services.
- i. Over all drop out rate =

$$\frac{\text{Coverage with BCG - Coverage with measles}}{\text{Coverage with BCG}} \times 100$$

ii. Drop out rate for a single antigen (e.g. DPT) =

$$\frac{\text{Coverage with } DPT_1 - \text{Coverage with } DPT_3}{\text{Coverage } DPT_1} \times 100$$

The cold chain of vaccines:

- Cold Chain is a system of equipments which ensure that correct quantity of potent vaccines reaches the people who need it.
- It is the system of storage and transportation of the vaccine at low temperature (cold condition) from the manufacture till it is consumed.
- Polio vaccine is the most sensitive vaccine to heat.
- Live attenuated vaccines are allowed to be frozen (OPV, Measles, and BCG).
- Inactivated vaccines must not be frozen (DPT, Hib and HB).

The levels of cold chain

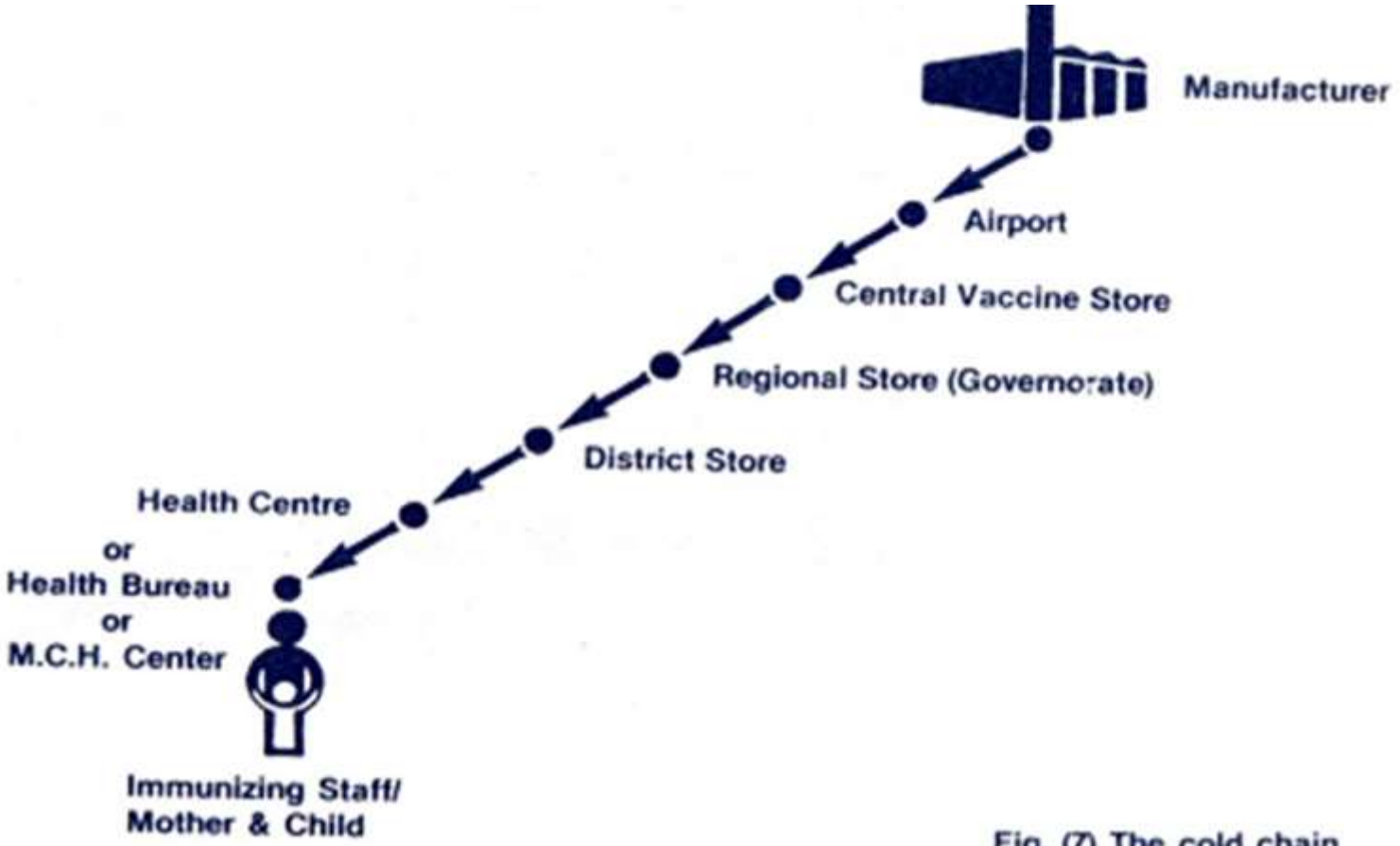


Fig. (7) The cold chain

Cont'd

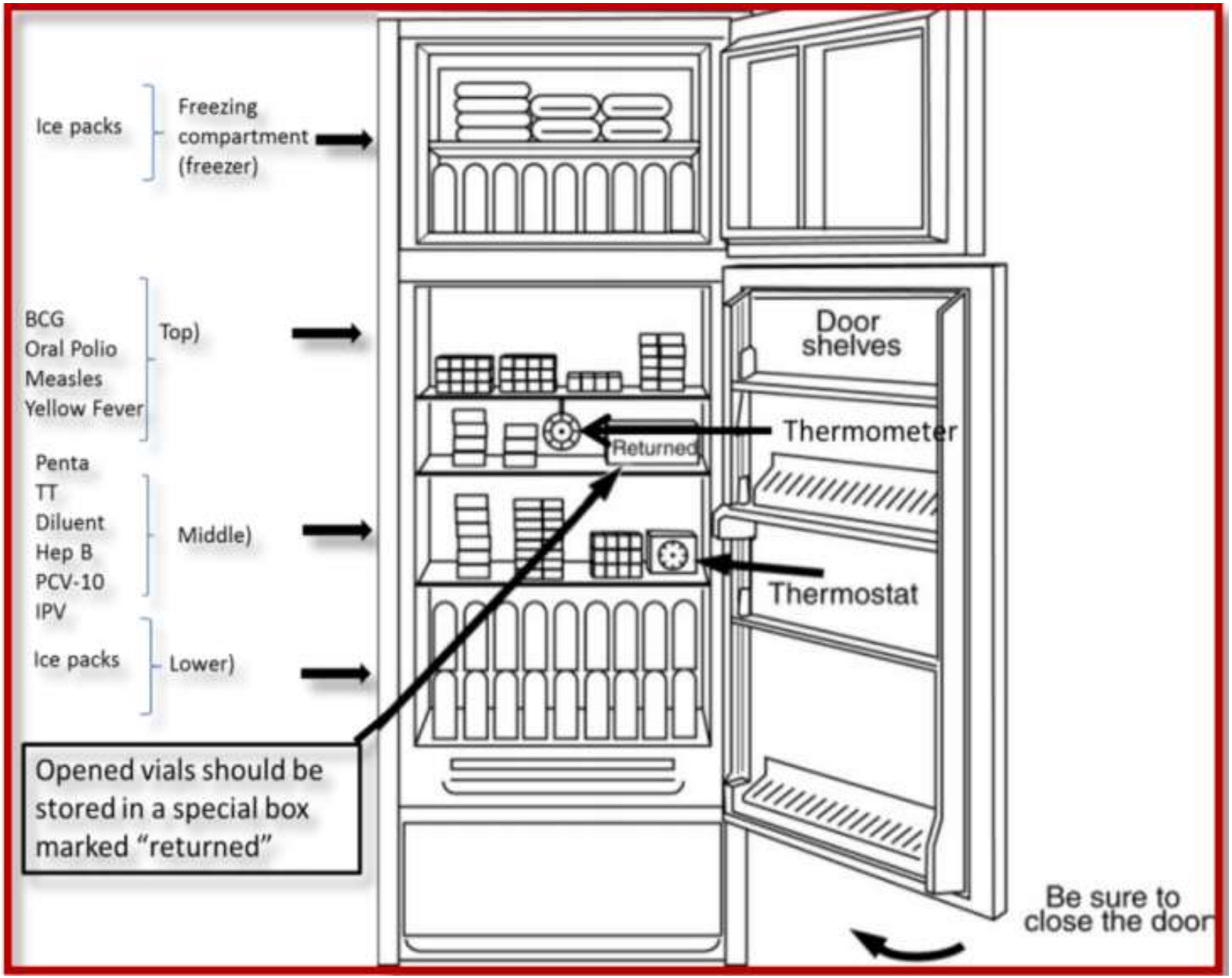
- Refrigeration equipment:
  - Refrigerator
  - Cold boxes
  - Vaccine carriers
  - The ice packs retained in the freezer
- To stabilize the temperature of the refrigerator at the optimum level fully frozen ice-packs are used for lining the vaccines carriers and the cold boxes during storing the vaccines.

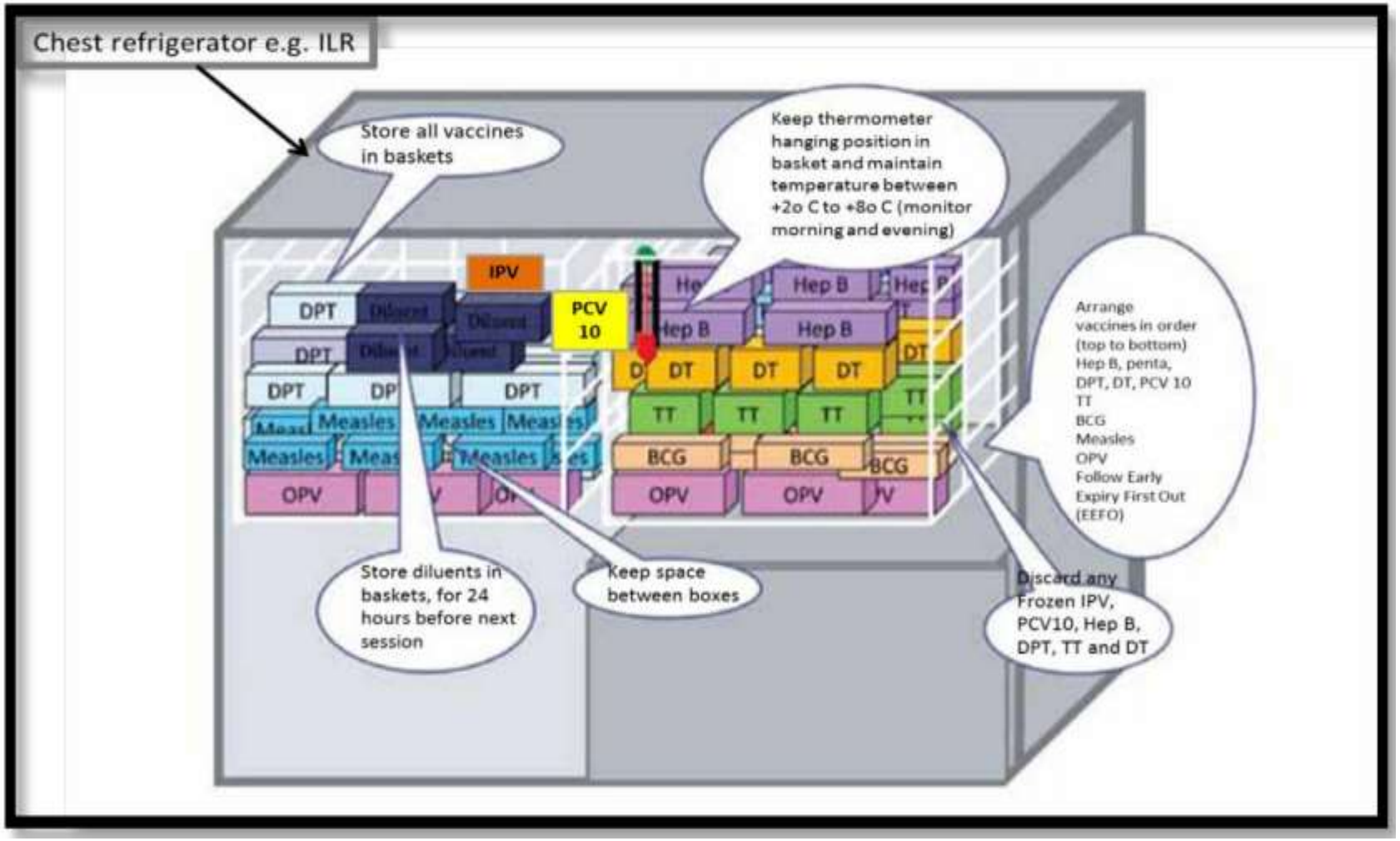
The refrigerator:

- Placed in the coolest place of the health centers away from sunlight-
- Kept locked and open only when necessary.
- Ice packs are kept in the freezer and Its temperature is recorded twice daily.
- Both the monitor and thermometer are placed in the refrigerator.
- The temperature chart is stuck on the door outside the refrigerator.
- The diluents should be kept on the lowest shelf.

Vaccine Arrangements in Refrigerator

- Polio-upper compartment
- BCG and measles-upper compartment
- Pentavalent and TT-Lower compartment
- Diluents-lower compartment


Ice packs
Freezing compartment (freezer)
BCG
Oral Polio
Measles
Yellow Fever
Top)
Penta
TT
Diluent
Hep B
PCV-10
IPV
Middle)
Ice packs
Lower)
Opened vials should be stored in a special box marked "returned"
Returned
Door shelves
Thermometer
Thermostat
Be sure to close the door


Chest refrigerator e.g. ILR
Store all vaccines in baskets
Keep thermometer hanging position in basket and maintain temperature between +2o C to +8o C (monitor morning and evening)
IPV
PCV 10
DPT
Hep B
DT
TT
BCG
OPV
Measles
Arrange vaccines in order (top to bottom)
Hep B, penta,
DPT, DT, PCV 10
TT
BCG
Measles
OPV
Follow Early Expiry First Out (EEFO)
Store diluents in baskets, for 24 hours before next session
Keep space between boxes
Discard any Frozen IPV, PCV10, Hep B, DPT, TT and DT

Tools for monitoring the cold chain:

There are **four** ways of monitoring the cold chain:

- **Cold Chain Refrigerator Graph**: regularly monitoring the storage which should always be kept between 2 and 8 degrees celicius.
- A chart should be a fixed to the front of the refrigerator and should be recorded at least twice in a day.

Cont'd

- **Using VVM** (Vaccine Vial Monitoring): when the vaccine vial has been exposed to heat over a period of time.
- Every vial is also shipped with a **temperature-sensitive label**, that health workers monitor during vaccination sessions.
- **SAFE** If the inner square is lighter than the outer ring and the expiration date is valid, the vaccine is usable
- **SPOILED** If the inner square matches or is darker than the outer ring, the vaccine must be discarded.

The Vaccine Vial Monitor says...

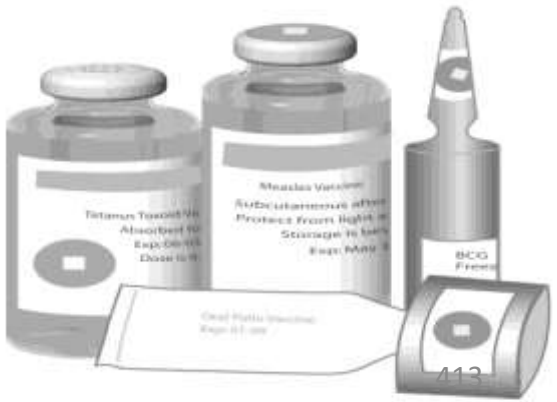
If the expiry date is not passed,

USE the vaccine

USE the vaccine **FIRST**

DO NOT USE the vaccine

DO NOT USE the vaccine



Cont'd

- **Using the cold chain monitor (freeze watch indicator):**
- Read and record the temperature recorder every day to maintain the refrigerator at 2- 8 degree centigrade.
- **The shake test** - DPT, hepatitis B (for Penta), TT and tetanus toxoid vaccines can all be damaged by freezing.
- By shaking two vials, side-by-side, one that might have been frozen and one that has never been frozen, health workers can determine if a vaccine has spoiled.
- The vaccine should be administered shortly after withdrawal from the vial.

Storage of the vaccine:

- The vaccine should not kept frozen or exposed to freezing
- Store at 2°to 8°C
- Shake vial vigorously before withdrawal and use.

What damage the Vaccines?

1. Any defect in the cold chain.
2. Out date expiry.
3. Using skin antiseptic at the site of injection (e.g. BCG).
4. Using the reconstituted vaccine (measles, BCG) after the recommended period (6 hours)
5. Exposure of the vaccine to unacceptable temperature during the immunization session.
6. Exposure of the vaccine to direct sunlight (BCG)

Cardiovascular Disorders

- Congestive heart failure
- Infective endocarditis
- Rheumatic fever

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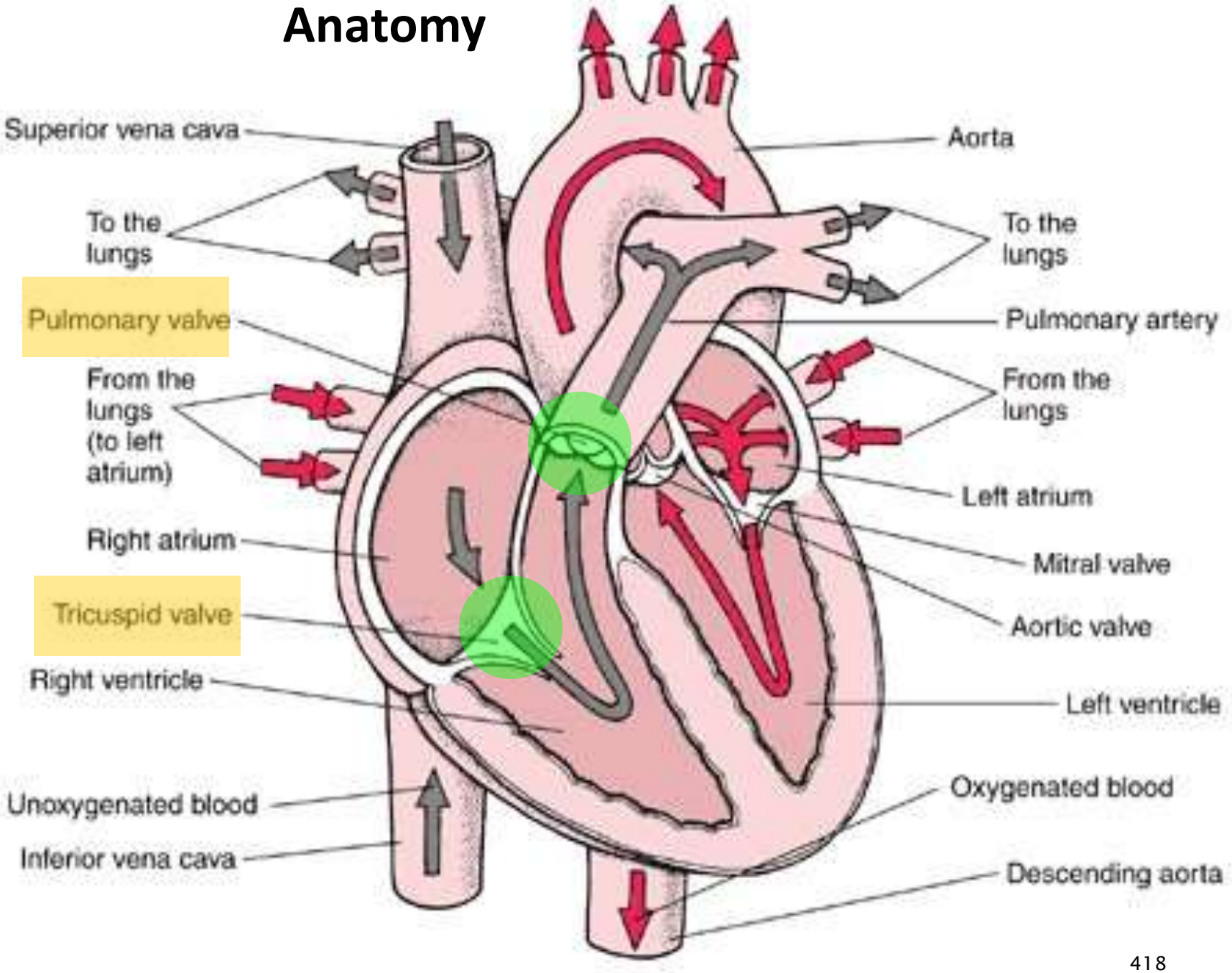
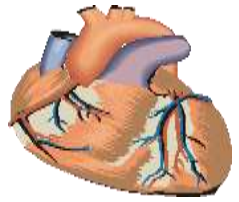
Introduction

- The Heart
- The heart is a cone-shaped, muscular organ located between the lungs behind the sternum
- The heart muscle forms the myocardium, with tightly interconnected cells of cardiac muscle tissue
- The pericardium is the outer membranous sac with lubricating fluid

Anatomy

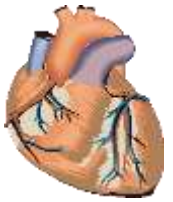

Superior vena cava
Aorta
To the lungs
To the lungs
Pulmonary valve
Pulmonary artery
From the lungs (to left atrium)
From the lungs
Left atrium
Right atrium
Mitral valve
Tricuspid valve
Aortic valve
Right ventricle
Left ventricle
Unoxygenated blood
Oxygenated blood
Inferior vena cava
Descending aorta

Chambers and valves of the heart



- The heart has four chambers:
  - two upper, thin-walled atria
  - two lower, thick-walled ventricles
- The septum is a wall dividing the right and left sides.
- Atrioventricular valves occur between the atria and ventricles
  - The tricuspid valve on the right
  - The bicuspid valve on the left

Chambers and valves of the heart



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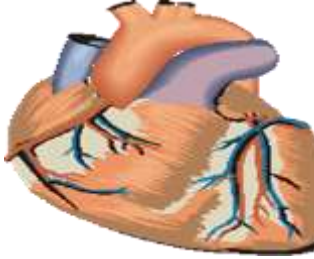
Passage of Blood Through the Heart

- Superior and inferior vena cava → right atrium → tricuspid valve → right ventricle → pulmonary valve → pulmonary trunk and arteries to the lungs → pulmonary veins leaving the lungs → left atrium → bicuspid valve → left ventricle → aortic valve → aorta → to the body.

Cardiac Cycle

- One Cardiac Cycle = One Complete Heartbeat
- **Diastole**
  - Relaxation phase of heartbeat
  - Ventricles relax and fill with blood
- **Systole**
  - Contraction phase of heartbeat
  - Ventricles contract
  - Force blood out of heart

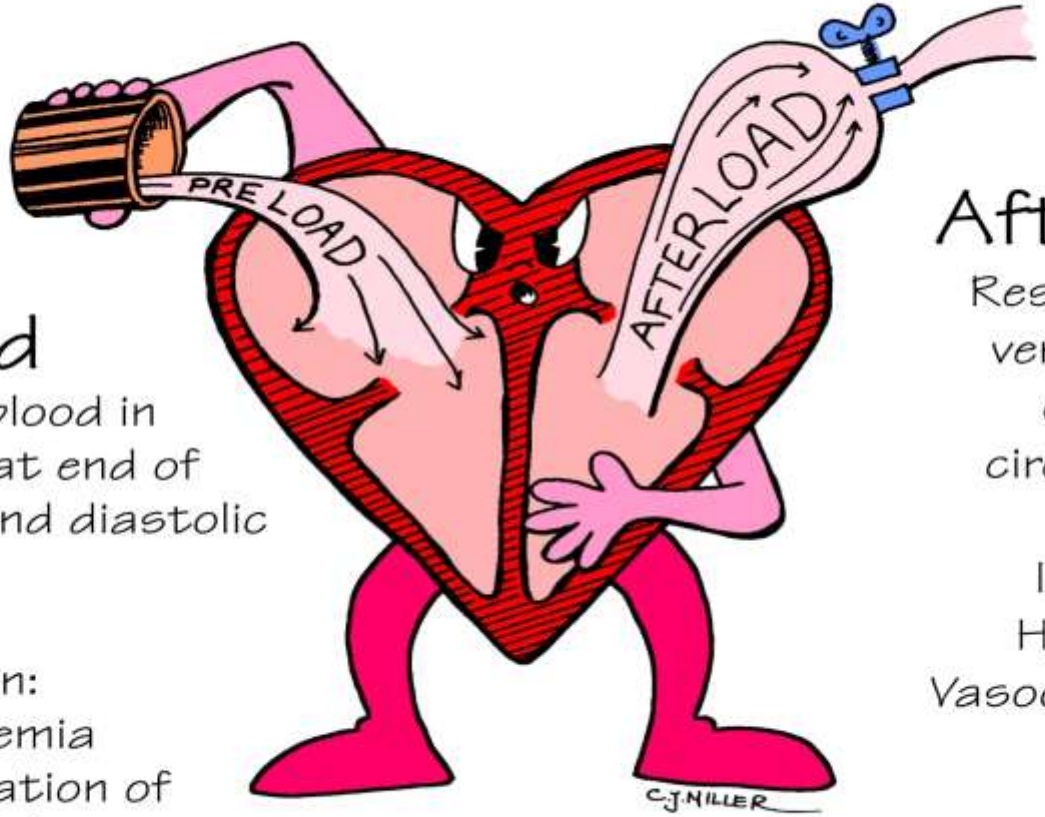


PRELOAD AND AFTERLOAD

Preload

Volume of blood in ventricles at end of diastole (end diastolic pressure)

Increased in:
- Hypervolemia
- Regurgitation of cardiac valves



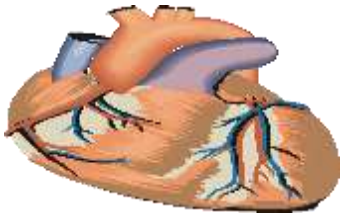
Afterload

Resistance left ventricle must overcome to circulate blood

Increased in:
- Hypertension
- Vasoconstriction

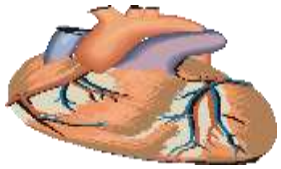
↑ Afterload
↑ Cardiac workload

Congestive Heart Failure



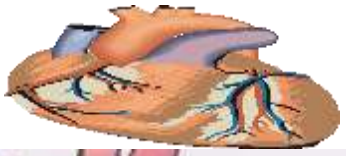
- CHF is a condition in which the heart is unable to pump adequate amount of blood to meet the metabolic demand of the body
- It must not consider as a single disease entity rather a syndrome of an over worked heart
- Heart failure is caused by ventricular pump dysfunction, or by overload of volume (preload) or pressure (afterload)

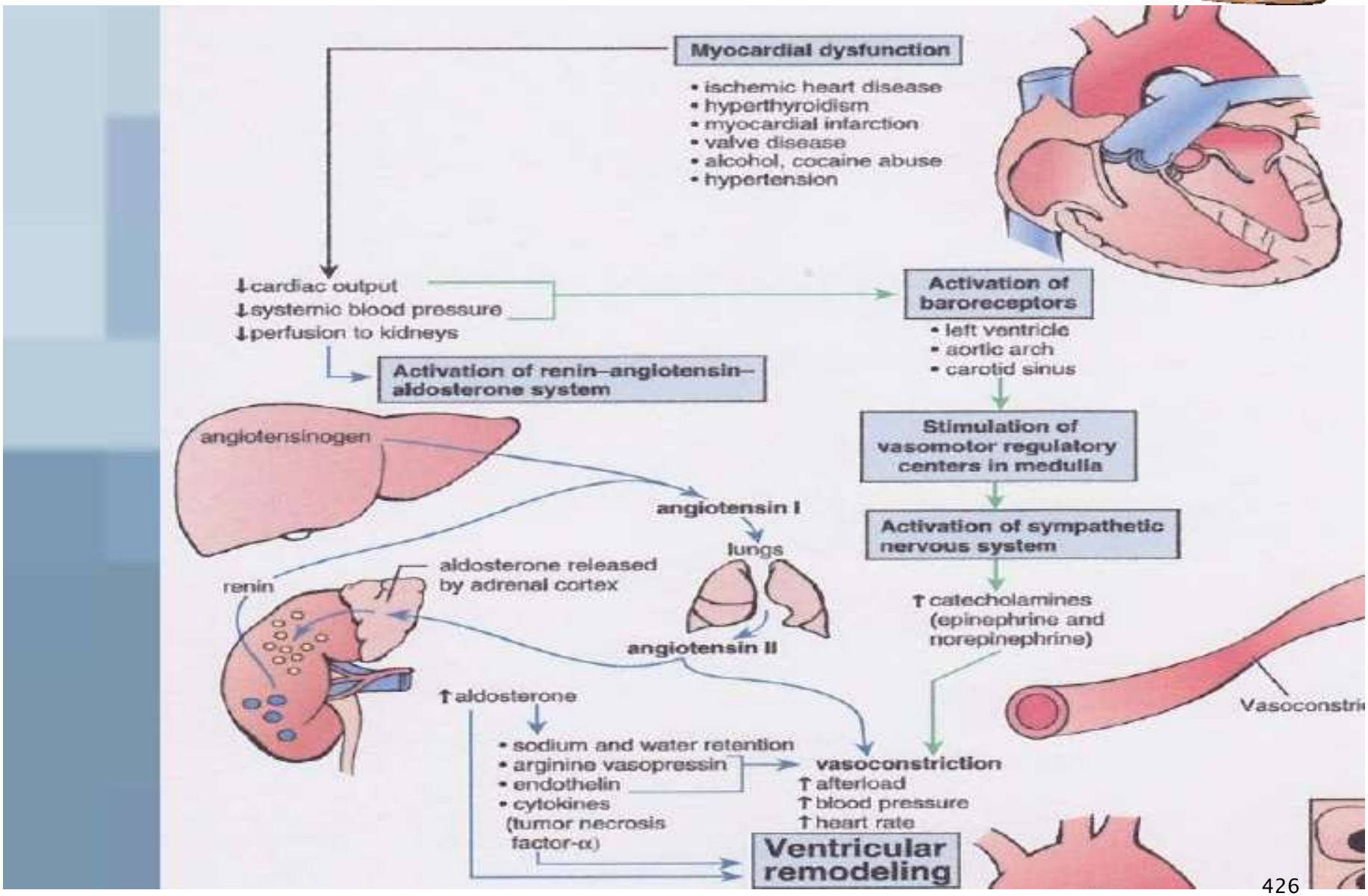
Pathophysiology and etiology



- **Ventricular pump dysfunction**
  - Cardiomyopathies
  - Myocarditis
  - MI
  - Arrhythmia
  - Congenital heart diseases
- **Volume overload with preserved ventricular contractility**
  - VSD (Ventricle septal defects)
  - PDA (Patent Ductus Arterious)
  - ASD (Atrial septal defects)
  - Renal failure
- **Pressure overload with preserved ventricular contractility**
  - Aortic stenosis
  - Coarctation of Aorta
  - Pulmonary stenosis
- **Acute precipitating factors: Infections, Anemia, Pulmonary embolism, and Myocardial infarction**

Pathophysiology

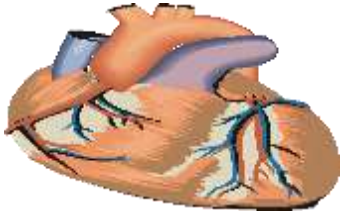




Clinical Features

- Fast breathing or interruption of feeding with diaphoresis
- Tachycardia (heart rate >160/minute in a child under 12 months old; >120/minute in a child aged 12 months to 5 years)
- Basal crackles on chest exam
- Gallop rhythm on auscultation with or without murmurs
- Enlarged, tender liver
- In older children**:** edema of the feet, hands or face, or raised JVP
- Severe palmar pallor may be present if severe anemia is the cause of the heart failure

ROSS HEART FAILURE CLASSIFICATION FOR CHILDREN for dx purpose (IJP, 2009)



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

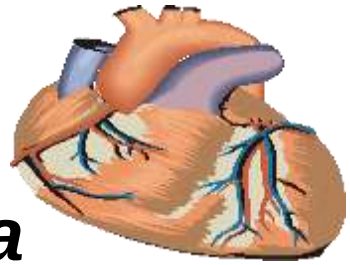
Class IV

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

Diagnosis

- Clinical Findings
- Chest X-ray
  - ✓ Cardiac enlargement
  - ✓ Increased pulmonary vascular bed
- Echocardiography
  - ✓Chamber hypertrophy
- ECG

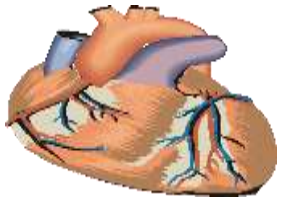
FARMINGHAM CRITERIA FOR DIAGNOSIS OF CONGESTIVE HEART FAILURE



- ***Major Criteria***
  - PND
  - Neck Vein Distention
  - Rales
  - Cardiomegaly
  - Acute Pulmonary Edema
  - S3 Gallop
  - Increased Venous Pressure (>16cm Of H20)
  - Positive Hepatojugular Reflux
  - Weight loss > 4.5kg over 5 days' treatment
- ***Minor Criteria***
  - Extremity Edema
  - Night Cough
  - Dyspnea on ordinary Exertion
  - Hepatomegaly
  - Pleural Effusion
  - Vital Capacity Reduced By 1/3 From Normal
  - Tachycardia

For establishing a definite diagnosis of CHF =2major or 1 major & 2 minor

Principles of management of CHF



- Treat underlying cause
- Treat the congestive state
- Prevent further deteriorations of cardiac lesions

Management

- **Therapeutic goals for children with heart failure are:**
  - To relieve symptoms
  - Decrease morbidity (including the risk of hospitalization)
  - Slow the progression of heart failure
  - Improve patient survival

Management…

- **Improve the cardiac efficiency/contractility force:**
  - Correct the underlying cause
  - Administer digitalis Ex. Digoxin
- ***Remove accumulated fluid and sodium from the body:***
  - Administer diuretics Ex. Furosemide
  - Restrict fluid and salt intake
  - Daily measurement & Recording of intake, output and weight
  - Supplemental potassium or encourage the child to eat potassium rich foods

Management…

- **Improve blood & tissue oxygenation:**
  - Observe for signs of respiratory distress
  - Position the child in sitting or semi sitting
  - Administer oxygen
  - Reduce the work load of the heart
  - Provide adequate rest
  - Provide small and frequent diet
  - Provide positive pressure ventilation

Management…

- **Promote normal growth and development:**
  - Provide nutritious balanced diet.
- **Support and educate parents:**
  - Adequate information about the drugs and feeding
- **Encourage parental participation in child care**

Management of CHF…

- **Digoxin** : 5–10 µg/kg/day, divided q12h.
- **Furosemide (Lasix) -** IV:1–2 mg/dose Bid.

  -PO:1–4 mg/kg/day, divided qd–qid

- **KCL** PO: one to one with the lasix(one tablet of lasix to one tablet of KCL).
- **Spironolactone** : 2-3mg/kg/24hrs in 2-3 devided doses.
- **ACEI: Enalapril** : PO 0.08–0.5 mg/kg/dose q12–24hrs

Infective Endocarditis (IE)

- An acute or subacute inflammation of the endocardium and/or heart valves that involves thrombus formation (vegetation), which may damage the endocardial tissue and/or valves.
- **Common etiologic are:**
    - Streptococcus Viridans
    - Staphylococcus Aureus
    - Group D Streptococcus

Predisposing factors

- Dental manipulation
- Dental disease (caries, abscess)
- Extra cardiac infection (lung, urinary tract, skin, bone, abscess)
- Instrumentation (urinary tract, GI tract, IV infusions)
- Cardiac surgery
- Injection drug use

Pathophysiology

Bacterial enter in the body

Patient with CHD turbulent blood flow

Nidus form

Valve damage

Platelet deposition + fibrin cause non Bacterial thrombus /vegetation/

Bacteremia

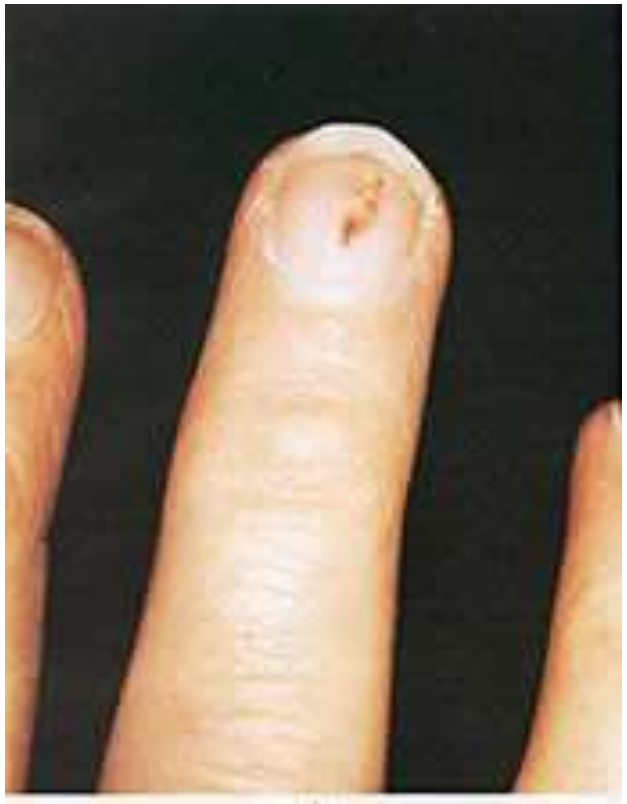
Eventual invasion of valve leaflets results in infected vegetation (sheath of fibrin & platelets, ideal conditions for further bacterial multiplications, protection from polymorphs

Clinical manifestations

- The presentation generally is indolent, with prolonged low grade fever and a variety of somatic complaints, including fatigue, weakness, arthralgias, myalgias, weight loss, rigors, and diaphoresis
- The most common presenting symptoms were fever, cardiac murmurs and dyspnea

Clinical manifestation

- **Splinter hemorrhages** (linear lesions beneath the nails)
- These lesions may represent vasculitis produced by circulating antigen-antibody complexes

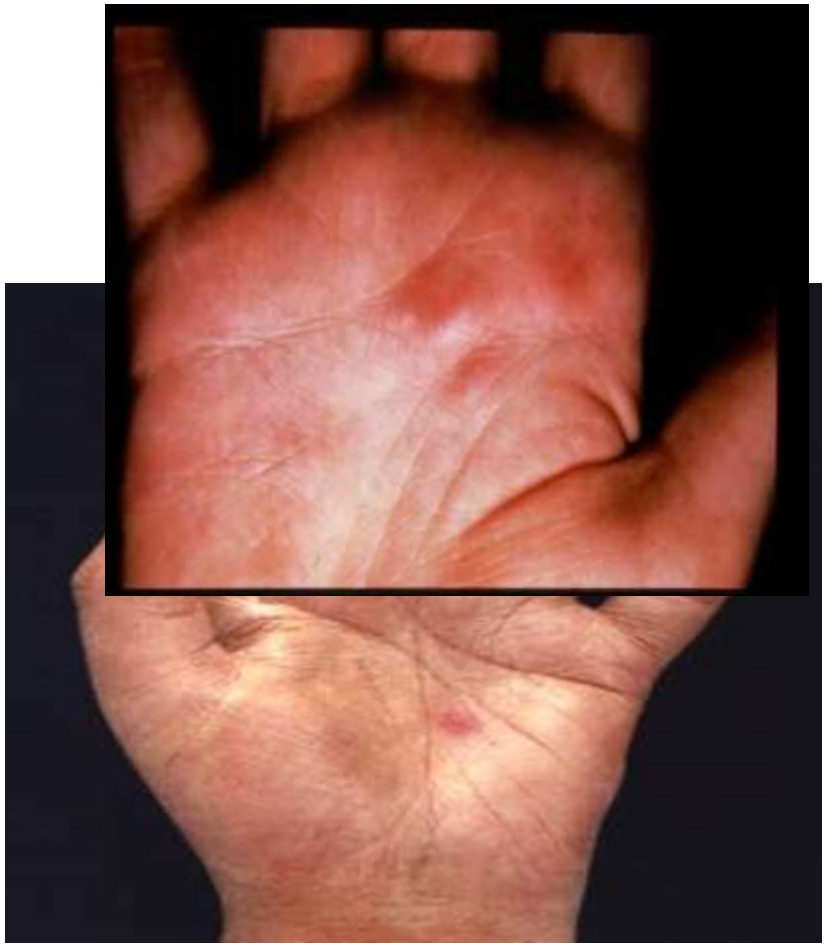


Splinter hemorrhage

Clinical manifestation

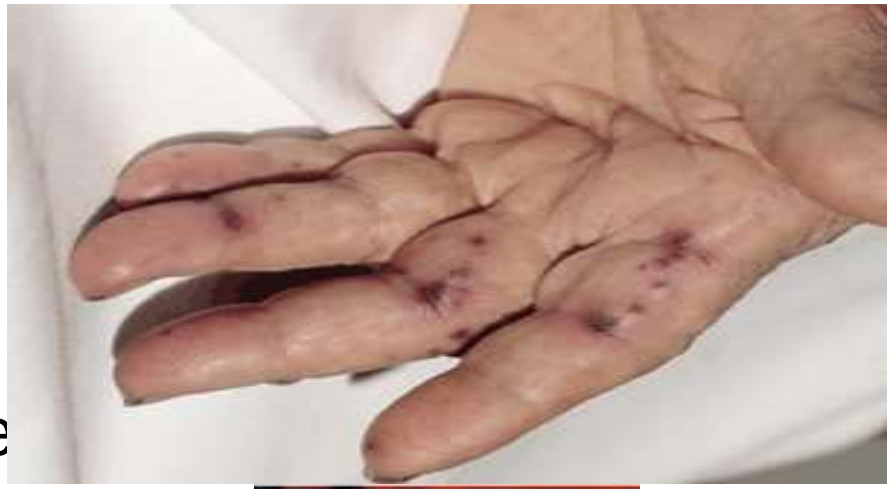
Osler Nodes

- More specific
- Painful and erythematous nodules
- Located on pulp of fingers and toes
- More common in subacute IE

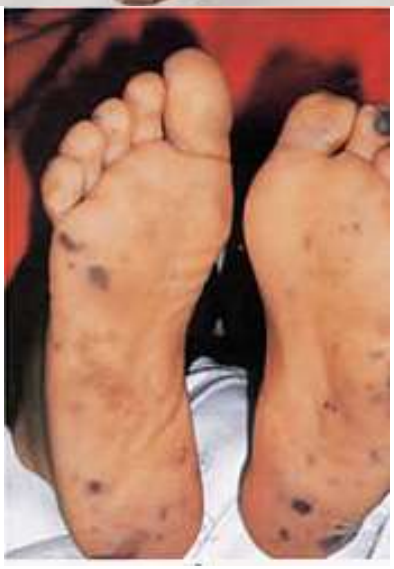


Clinical manifestation

Janeway Lesions



- Painless small erythematous or hemorrhagic lesions on the palms and soles



- More specific
- Erythematous, blanching macules
- Nonpainful

Duke's criteria of diagnosis IE

❖Major Criteria

1. Positive blood cultures :- (2 separate cultures for a usual pathogen, 2 or more for less-typical pathogens), and
2. Evidence of endocarditis on echocardiography (intracardiac mass on a valve or other site, regurgitant flow near prosthesis, abscess, partial dehiscence of prosthetic valves, or new valve regurgitant flow)

Minor Criteria

- Predisposing conditions
- Fever ≥38oc
- Embolic-vascular signs
- Immune complex phenomena (glomerulonephritis, arthritis, rheumatoid factor, Osler nodes, Roth spots)
- A single, positive blood culture or
- Serologic evidence of infection
- Echocardiographic signs not meeting the major criteria

Clinical manifestation

- **Common symptoms are:**
  - Low grade fever, chills, fatigue, arthralgia, myalgia, malaise, night sweats, weight loss, stroke or seizure
- **Physical findings:**
  - Tachycardia, arrhythmia
  - New or changing murmur
  - Splenomegaly

Clinical manifestation

- Arthritis
- Heart failure
- Neurologic deficits
- Skin manifestations such as:
  - Petechia, splinter hemorrhage (nail bed bleeding)
  - Janeway lesions (painless small hemorrhagic lesions on palms and soles)
  - Osler nodes (tender pea sized intradermal nodules in the pads of fingers)
- Clubbing

Diagnosis

- **The Diagnosis of endocarditis is based on**
  - ✓History and physical examination
  - ✓Blood cultures and other selected laboratory results
  - ✓An electrocardiogram (ECG)
  - ✓A chest radiograph
  - ✓An echocardiogram
  - ✓ MRI/CT scan

Lab Findings

- Blood culture
  - 3-5 separate samples, positive in 90% of cases without prior antibiotic intake
- Additional information can be obtained from:
  - Echocardiography (vegetations), raised ESR, leucocytosis, anemia, hematuria, renal failure….
- Diagnosis
  - Gold standard is blood culture

Diagnosis of IE

Definite IE

Pathological criteria

- Microorganisms demonstrated by culture or on histological examination of a vegetation, a vegetation that has embolized, or an intracardiac abscess specimen; or
- Pathological lesions; vegetation or intracardiac abscess confirmed by histological examination showing active endocarditis

Clinical criteria

- 2 major criteria; or
- 1 major criterion and 3 minor criteria; or
- 5 minor criteria

Possible IE

- 1 major criterion and 1 minor criterion; or
- 3 minor criteria

Rejected IE

- Firm alternate diagnosis; or
- Resolution of symptoms suggesting IE with antibiotic therapy for ≤4 days; or
- No pathological evidence of IE at surgery or autopsy, with antibiotic therapy for ≤4 days; or
- Does not meet criteria for possible IE, as above

Medical management

- Initial empiric antibiotic should be effective for both Gram-positive and Gram negative organism combine cloxacillin (100 mg /kg per 24 hours), ampicillin (300 mg/kg per 24 hr, IV) and gentamicine (3 to 4 mg / kg per 24 hours IV)
- Therapy should continue for 4 to 6 weeks (except gentamicin for 2 weeks)
- Adjustment of drugs can be done depending on blood culture results

Medical management

causative agent	Treatment option
Staphylococcus areus	Cloxacillin 200–300 mg/kg/day IV. in 4–6 equally divided doses OR Vancomycin 40 mg/kg/day IV. in 2–3 equally divided dose
Streptococci	Penicillin G 200,000 U/kg/day IV. in 4–6 divided doses Amoxicillin 300 mg/kg/day IV. in 4–6 equally divided doses Ceftriaxone 100 mg/kg/day IV. or IM. in 1 dose
Enterococcus spp.	Ampicillin 300 mg/kg/day IV. in 4–6 equally divided dose PLUS Gentamicin 3 mg/kg/day IV. or IM. in 3 equally divided doses
Candida	Amphotericin B libosomal1 mg·kg−1·d−1 IV administered over 3–4 h

Prevention

- General dental care and oral hygiene
- Treatment of infection in high risk children
- Antibiotic prophylaxis before
  - Surgical procedures of genito-urinary and gastro-intestinal systems

Rheumatic Fever (RF)

- It is an auto immune inflammatory disease that occurs following a Group A streptococcal infection
- It affects the joints, heart, skin and CNS
- RF is the leading cause of acquired heart disease
- Three percent of individuals with untreated group A streptococcal pharyngitis confronted RF
- Epidemiologically is commonly seen in children 5-15 years of age
- It is less likely to occur below 5 years and very rare during infancy

Etiology and pathogenesis

- Group A streptococcal (GAS) pharyngitis, but the bacteria could not directly damage the organs, rather the antigen antibody complex
- **Risk Factors:**
  - Overcrowding
  - Poor socioeconomic status
  - Poor environmental hygiene
- **Pathogenesis- Not completely understood**
  - Cytotoxicity theory
  - Immunologic theory

Clinical Features

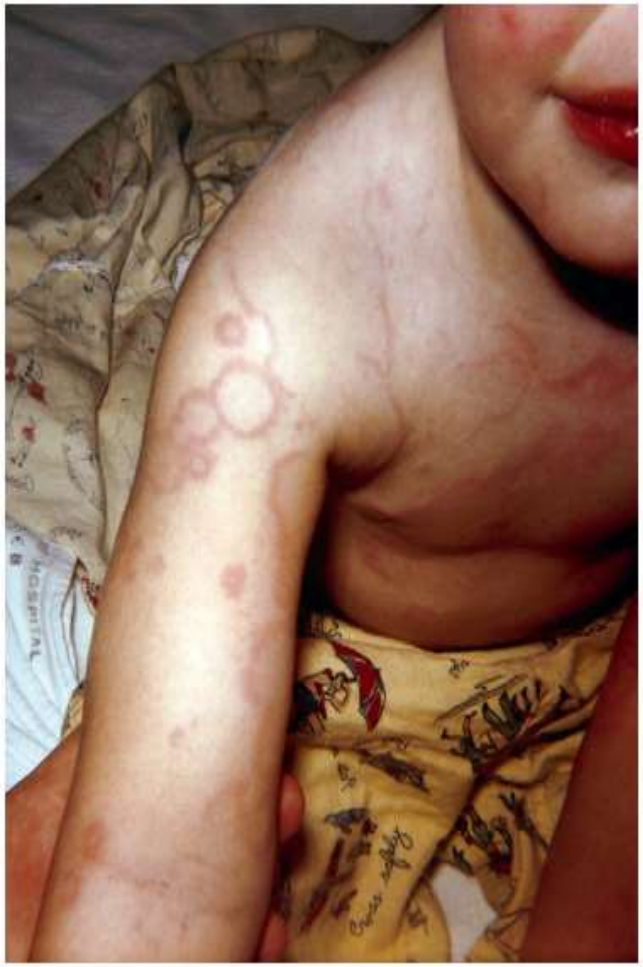
- **Major manifestations include:**
- **Migratory Polyarthritis-** affects large joint and migratory in nature, seen in 75% of patients, doesn't result deformity and resolves with or without treatment with in few days
- **Carditis-** inflammation of the heart muscle, has tachycardia, murmur, pericardial friction rub, chest pain, and gallop
  - Seen in about 30% of cases

Clinical Features……

- **Sydenham's Chorea-** is characterized by jerky, uncontrolled movement of the body, and series of rapid movements without purpose of the face and arms
- This occurs in less than 10% of cases

Clinical Features…..

- **Erythematic marginatum**
- Non pruritic macular lesions which initially appear on the trunk and inner aspects of extremities with erythematous margins



Clinical Features……

- **Subcutaneous Nodules-** small (0.5-1cm diameter) firm, non tender and with no skin attachment nodules over the extensor surface of joint

Minor manifestations:

- Low grade fever
- Weakness
- Fatigue
- Weight loss
- Epistaxis of unknown cause
- Abdominal pain
- Arthralgia

Diagnosis

- No single confirmative lab test available
- Thus, combination of clinical and lab evidences used for diagnosis.
- **The Modified John's criteria:**
  - **Major criteria:** Polyarthritis, Carditis, Sydenham's chorea, Erythema marginatum, and Sub cutaneous Nodules.
  - **Minor criteria:** Fever, Arthralgia-(Joint pain without swelling), acute phase reactants (Raised ESR, C-Reactive Protein).

DX

- Diagnosis made with:
- 2 major criteria or 1 major and 2 minor

+

- Supporting evidence for antecedent
- Streptococcal pharyngitis (mandatory)

Management:

- Suppression of the acute inflammatory process:
  - Aspirin: 90-120 mg/kg/day until clinical manifestations subside.
  - Corticosteroids: 2-5mg/kg/day in two divided doses. (reduce acute inflammation and given till the acute disease subsides).

Management

- **Eradication of the streptococcal infection:**
  - Procaine penicillin G 600,000 IU Iv/ IM daily for 10 day
  - Byzantine penicillin G. 1.2 mg Iv/ IM stat
  - Erythromycin 1 gm Po daily for 10 days
- **Prevention of disease recurrence:**
  - Monthly Byzantine or sulfadiazine injections or erythromycin 250mg Po QID (40mg/kg/day)

General care

- Assist with the history and physical examination
- Provide adequate bed rest and avoid exertion
- Encourage fluid intake to prevent dehydration on febrile periods
- Provide small and frequent diet
- Decrease pain by administering anti inflammatory agents or by cold application

Management

- Position the child in a best comfortable way and avoid pressure on joint areas.
- Protect the child from injury during involuntary jerking
- Provide emotional support for the child and the family.
- Instruct parents about the importance of follow up care.

Prevention

- Prompt antimicrobial treatment of streptococcal pharyngitis
- Provision of prophylaxis for the prevention of recurrent infections

Urinary Disorders

- Nephrotic Syndrome
- Wilms tumor
- UTI

Nephrotic Syndrome

- It is the clinical manifestation of a large number of glomerular disorders.
- **The nephritic syndrome is characterized by :**
  - **Proteinuria** *40 mg/m 2/hr in children (>3.5mg/24hr in adult)*
  - **Hypoalbuminemia** (<2.5g/dl)
  - **Hyperlipidemia**
  - **Edema**

Classification

- Nephritic syndrome classified as Primary and Secondary
- **Primary nephritic syndrome:** associated with primary Glomerular disease
- **Secondary nephritic syndrome:** when the nephritic syndrome occurs as parts of systemic disease
- For 90% of cases the cause is unknown

Pathophysiology

↑Glomerular capillary wall permeability

↓

Proteinuria

↓

Hypoalbumemia

↓

Plasma oncotic pressure

↓

Transudation of fluid from intravascular volume

↓

↓intravascular volume

Pathophysiology …

1)↓ Activate renine –angiotinnnnsin aldostrone

Stimulate distal tubule reabsorption of Na

2) Stimulate release of ADH

- *Enhance H2O reabsorption in collecting duct*
- Both contribute to edma
- **Serum lipid levels are elevated**

1)Hypoalbuminemia stimulates hepatic protein synthesis, including synthesis of lipoproteins.

2) Reduced lipoprotein lipase due to increased urinary losses of this enzyme

Clinical manifestation

- M:F 2:1
- Age 2-6 years
- Puffiness of face →anasarca, ascits, pleural effusion pretibial , and pedal pitting edema
- Oliguria (↓urine out put)
- Anorexia, abdominal pain ,diarrhea of unexplained mechanism
- Hypertension and hematuria uncommon

Diagnosis

- U/A ↑ albumin (+++)
- CBC
- Renal biopsy

Management

- The goal is reduction of protein excretion.
- Prednisone is the drug of choice
- For relapsing cases: Cyclophosphamide or Chloramphenicol have been effective
- Encourage age appropriate diet rich in protein
- Diuretics
- Albumin transfusion

Management...

- Providing care during hospitalization
- Administering medications
- Maintaining proper fluid balance and assessing edema
- Providing emotional support and education for all family members

Wilms tumor (Nephroblastoma)

- Wilms tumor, also known as nephroblastoma**,** is a complex mixed embryonic neoplasm of the kidney
- Wilms tumor accounts for nearly 6% of all pediatric cancers and more than 95% of all kidney tumors in children
- Survival for patients with Wilms tumor is generally excellent around 90%
- Wilms tumor is the second most common intra-abdominal cancer of childhood and the fifth most common pediatric malignancy overall

Epidemiology

- Age 2-5 yrs (75%)
- Incidence ≈8/million children < 15 yrs
- Comprises≈ 6% of pediatric cancers
- Bilateral ≈ 7%
- Usually sporadic, but 1-2% of cases are familial

Etiology and Pathogenesis

- **Etiology**
  - Sporadic –mostly
  - Family history- 1-2%(bilateral &low grade at diagnosis)
- Genetic alteration WT1gene- at 11p13 chromosome(in 20%)
- Embryonal tumor of the kidney with histologic categories

Clinical manifestations

- Initially asymptomatic abdominal mass
- Malaise, Anorexia
- Abdominal pain
- Gross or microscopic hematuria
- Hypertension
- Bleeding diathesis can occur due to the presence of acquired von Willebrand disease

P/E

- Presence of congenital anomalies
- Location and size of mass

Initial presentation frequency

Signs and symptoms	Frequency
Palpable mass in the abdomen	60
Hypertension	25
Hematuria	15
Obstipation	4
Weight loss	4
Urinary tract infection	3
Diarrhea	3
Previous trauma	3
Nausea, vomiting , abdominal pain, cardiac insufficiency, pleural effusion, polycythemia , hydrocephalus	8

Staging

Stage	Description
I	Confined to kidney, intact capsular surface, completely excisable
II	Confined to kidney, but capsule is penetrated and regional extension, vessel infiltration ; completely excisable
III	Post surgical residual, but no hematogenous spread, confined to abdomen, may involve perirenal bed, draining lymphnodes and surrounding tissue and organ by contiguity. Not completely removable due to infiltration of vital structure
IV	Hematogenous metastasis (lung, liver, bone, brain)
V	Bilateral renal involvement at diagnosis

Diagnosis

- CBC- polycythemia, anemia, thrombocytopenia
- U/A - Hematuria
- Coagulation factors- PT,PTT, von Willebrand factor or factor VII level
- Ultrasound evaluation – origin, regional involvement
- CT and or MRI
- CXR- Pulmonary metastasis
- Dx is tissue biopsy - Histologic variants
- Staging – Post surgical intervention

Treatment

- Pre-Operative chemotherapy
- Nephrectomy
- Chemotherapy

1. Stage I, II- Favorable histology
   - Vincristine + Dactinomycin
2. Stage III, IV
   - Vincristine
   - Dactinomycin
   - Doxorubicin
   - Radiation therapy

Prognosis

❖**Poor prognosis**

- Tumor size > 500gm
- Advanced stage (III,IV)
- Anaplastic histology

Urinary tract infection (UTI)

- UTI- Infection of any component of the urinary tract like urethritis, cystitis and pyelonephritis
- Bacteria first infect the urethra, then move to the bladder and finally to the kidneys
- UTI tend to occur more in female than male

Etiology

- UTIs are caused mainly by colonic bacteria
- In girls 75-90% of all infections are caused by: E. coli, Klebsiella spp and Proteus spp
- Others gram-positive organisms are S. saprophyticus and enterococcus
- Adenovirus and other viral infections also can occur, especially as a cause of cystitis

Risk factors

- Structural anomalies
- Voiding dysfunction
- Uncircumcised male
- Poor Hygiene
- Neuropathic bladder
- Female Gender

Pathogenesis

- The bacteria arise from the fecal flora, colonize the perineum, and enter the bladder via the urethra
- In uncircumcised boys, the bacterial pathogens arise from the flora beneath the prepuce
- In some cases, the bacteria causing cystitis ascend to the kidney to cause pyelonephritis
- Rarely, renal infection occurs by hematogenous in neonates
- If bacteria ascend from the bladder to the kidney, acute pyelonephritis can occur

Clinical Manifestations

- **Pyelonephritis** is characterized by the following:
  - Abdominal, back, or flank pain;
  - Fever
  - Malaise
  - Nausea, Vomiting and, occasionally, diarrhea
  - Newborns can show non-specific symptoms such as poor feeding, irritability, jaundice, and weight loss

Clinical manifestation ….

❖ **Cystitis indicates**

✖ Dysuria, urgency, frequency, supra-pubic pain, incontinence, and malodorous urine.

✖ Cystitis does not cause fever and does not result in renal injury.

✖ Acute hemorrhagic cystitis is often caused by E. coli; it also has been attributed to adenovirus Adenovirus cystitis is more common in boys; it is self limiting.

Clinical manifestation ….

- **Urethritis** refers to a condition in which there is a positive urine culture without any manifestations of infection; most common in girls.
- The incidence declines with increasing age.
- Some girls are mistakenly identified as having asymptomatic bacteriuria, whereas they actually are experiencing day or night incontinence or perineal discomfort secondary to UTI

Diagnosis

- ✓ Sign and Symptom
- ✓ Chemical methods & microscopic (urinalysis)
- ✓ Culture& sensitivity

Treatment

- Choose narrowest spectrum considering host factors
- Adjust therapy when sensitivities available
- Empiric therapy is directed to organism and adjusted for age
- **Ampicillin** plus a second antibiotic (usually **Gentamycin or Cefotaxime**) to cover for GBS, Listeria, as well as gram negative organisms
- **Vancomycin** may be indicated for toxic patients

Prevention

- If untreated can leads to end stage renal failure.

Prevention

- Good hygiene practice
- Early treatment
- Health education

Neurologic Disorders

- **Meningitis** – inflammation of the meninges
  - **Encephalitis** – infection of the brain parenchyma
  - **Meningoencephalitis** – inflammation of brain + meninges
  - **Aseptic meningitis** – inflammation of meninges with sterile CSF

Etiology

1.Neonates -infants

- Escherichia coli
- Listeria monocytogenes
- B-haemolytic streptococci
- Staphylococcus aureus
- Staphylococcus epidermidis

2. I2mth-2yrs

- Hib,
- Strep pneumoniae &
- Neisseria meningitis

3. 2-21yrs

- Neisseria meningitis

A, B, C, Y, and W 135,

- Hib
- Strep pneumoniae

The 3 main bacterial species that contribute to this disease

Pathophysiology

- The causative organism enters the bloodstream, crosses the blood–brain barrier, and triggers an inflammatory reaction in the meninges
- Independent of the causative agent, inflammation of the subarachnoid and pia mater occurs
- Increased intracranial pressure (ICP) results
- Meningeal infections generally originate in one of two ways: either through the bloodstream from other infections (cellulitis) or by direct extension (after a traumatic injury to the facial bones)

Risk factors of meningitis

- Extremes of age (< 5 or >60 years)
- Immunosuppression
- HIV infection
- Crowding
- Recent exposure to others with meningitis.
- Contiguous infection (eg, sinusitis)
- Dural defect (eg, traumatic, surgical, or congenital)
- Bacterial endocarditis

Modes of transmission

- Close contact with a person who is sick with the disease
- Contact with carriers
- Living in close quarters, such as college dormitories
- Being in crowded situations for prolonged periods of time
- Sharing drinking glasses, water bottles, or eating utensils
- Kissing, sharing a cigarette

Clinical feature

- High grade fever, feeding problems & Irritability
- High-pitched crying
- Bulging fontanels & Severe persistent headache.
- Neck stiffness : infants may not develop a stiff neck
- Seizures
- Nausea and vomiting, sometimes along with diarrheal
- Confusion and disorientation can progress to stupor, coma, and death

Clinical features…

- Drowsiness or sluggishness
- Eye pain or sensitivity to bright light
- Numbness and tingling
- Nuchal rigidity or neck stiffness

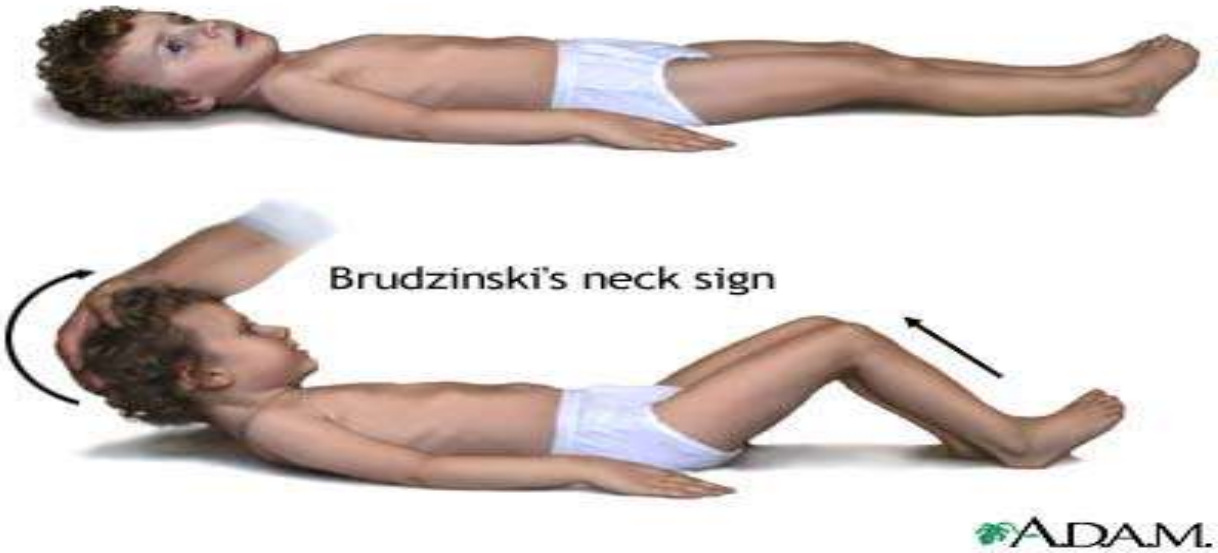
Clinical features…

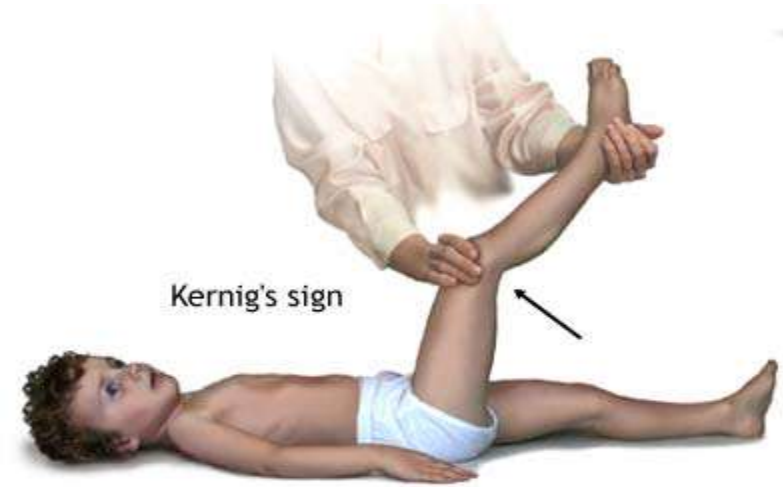
Increased intracranial pressure

- Headache
- Projectile vomiting
- Hypertension
- Bulging fontanel
- Cranial sutures diastasis/separation
- Coma
- Cerebral hernia

Clinical features…

BRUDZINSKI SIGN is +ve





The Kernig sign is +ve

Diagnosis

CM

- CSF analysis Blood test
- Chest X-ray
- CT scan or MRI
- Cultures of samples of CSF, blood, urine, mucus from the nose and throat, and pus from skin infections.

Management

- **Empiric treatment** should be begun as soon as the diagnosis is suspected using bactericidal agent(s) that achieve significant levels in the CSF

- Ceftriaxone 50-100 mg/kg/day IV/IM q12 hr
- Vancomycin 60 mg/kg/day IV q6h.

Convulsive management

- Diazepam
- Phenobarbital

Drug of choice according to the culture isolates

Organism	Drug of choice
Gr. B strep coccus	Cefotaxim Ceftriaxone and Gentamicin
L. Monocytogenes	Ampicillin
H.Influenzae	Cefotaxim Ceftriaxone and CAF
N.Meningitides	Benzile pens, Ceftriaxone
S.pneumoniae	Vancomicin, Benzile pens, Ceftriaxone
S.Aureus	Ceftazidime, Vancomicin
Pseudomonas	Ceftazidime

Complication

- Increased ICP
- Hydrocephalus
- Hypoglycemia
- Myocarditis
- Brain damage
- severe vomiting
- Internal bleeding
- Low blood pressure
- Shock
- Death

Acute Complications

- Development delay
- Cerebral palsy
- Microcephaly
- Seizure disorder
- Hemiparesis
- Hearing loss
- Blindness

Late complications

Epilepsy in children

Seizure

- An episode of altered behavior or awareness
- Associated with too much excitation of a population of nerve cells (neurons)

Epilepsy

- The tendency to have recurrent, unprovoked seizures (brain makes seizures happen)

Seizure Disorders

- **Seizure** or **convulsion**

- Paroxysmal involuntary disturbance of brain function that may manifest as impairment of consciousness, abnormal motor activity, sensory abnormality or autonomic dysfunction

Epilepsy

- Two or more unprovoked seizures which occur >24 hour apart

Cont'd

- **Tonic seizures :** increased tone or rigidity
- **Atonic seizures :** flaccidity or lack of movement during a convulsion
- **Clonic seizures:** rhythmic muscle contraction and relaxation
- **Myoclonus :** Shock like contraction of a muscle
- Seizures are common in the pediatric age group and occur in 10% of children
- Less than one third of seizures in children are caused by epilepsy

Causes

Most Idiopathic

- Prenatal asphyxia or intra cerebral injuries
- Post natal vascular accident
- Congenital or metabolic disorders
- Head injuries, Infection, Heredity

Classification:

- **1. Partial seizures-** result from abnormal electrical discharges in the circumscribed portion of the brain and begin focally.
- **Simple partial seizure-** doesn't involve any change of consciousness.
  - Usually have motor manifestations and tend to involve the face, neck and extremities.
  - Some may have auras and usually lasts 10-20 sec.

Classification…

- **Complex partial seizure-** consciousness will be impaired.
  - Usually proceeded by aura (anxiety, thirst, dizziness, flushing lights).
  - Lasts 1-2 minutes
- **Neonatal seizures**
  - Caused by prenatal problem occurs as focal seizure.
  - There will be myocolonic spasm, nystagmus, and chewing, sudden loss of muscle tone, intermittent apnea followed by bradycardia, opisthotonus.

2. Generalized seizures

- Involve both cerebral hemispheres symmetrically. Consciousness may be impaired immediately motor abnormalities (if any) are bilateral and symmetric.
- **Absence seizures-** consist primarily impairment of consciousness but may include: Automatism or mild colonic, tonic expression, unresponsiveness, arrest of speech or activity and some times repetitive eye blinking.
  - Average duration 10-30 seconds, No aura or postictal phase, Several attacks may occur in a single day.

Classification…

- **Generalized tonic-clonic seizures-** are the classic convulsive seizures.
  - The child looses consciousness immediately and falls
  - Occasional 'epileptic cry' (results from forceful exhalation)
  - The convulsion consists of two phases of the predictable and orderly sequence of steady muscle contractions (tonic-phase) followed by repeated course of muscle jerks (clonic phase).

Generalized tonic-clonic seizures

- There may be: Tachycardia, diaphoresis, pallor and flushing after the tonic-colonic phase.
- Cyanosis during tonic phase, Pupils become dilated and reaction to light will be reduced.
- It takes 1 to 3 minutes followed by lethargy
- After regaining consciousness the patient may sleep for several hours.

Cont'd…..

- **Status epileptics-**It refers to a single prolonged seizure or series of closely spaced seizures that repeat so often as to produce a fixed and enduring epileptic condition.
  - It is permanent and death that makes the condition a medical emergency.

Treatment of Epilepsy

- Treatment is started
  - Risk of seizure recurrence increases after each seizure
  - Consider treatment after 2 seizures
- Treatment for seizures
  - Antiepileptic medications (AED)
  - Work up to determine cause of seizure activity

Antiepileptic Drugs

- **Partial Seizures**

- carbamazepine
- clobazam
- clonazepam
- gabapentin
- lamotrigine
- nitrazepam
- phenytoin
- phenobarbital
- topiramate
- levetiracetam
- oxcarbazepine
- zonisamide

Generalized Seizures

- valproic Acid
- ethosuximide

Infantile Spasms

- Vigabatrin and Prednisone

New AEDS

- tiagabine
- lacosamide
- rufinamide
- stiripentol

Intractable Childhood Epilepsy

- Intractable seizures refers to seizures that are not well controlled by anti-epliptic medications
- 25 to 30% of children will continue to have seizures despite medication
- ***Factors which may contribute:***
  - Younger age at onset
  - Status epilepticus
  - Structural brain abnormality

Febrile seizures

- Most common cause of seizures in childhood
- Excellent prognosis
- Diagnosed by exclusion
- Incidence : ≈ 3-4% of young children
- Recurrence : in 30-50 % of cases
- Genetic predisposition

Simple Febrile Seizures

- Age 9 months – 5 years
- Core T0 ≥ 39 0C
- Duration : few seconds -15 minutes
- R/o
  - CNS infections (bacterial ,viral) (LP if any doubt !!!)
  - Sepsis
  - * Risk of epilepsy = 1%

Complex or Complicated febrile seizures

- Duration >15 min
- Repeated convulsions in 24 hrs
- Focal seizure activity
- Focal findings during postictal period
- ** LP must be done if no C/I !
- Seizure with fever
- Children with a chronic seizure disorder with more seizures during fever

Treatment

- Search for cause of fever
- Reassurance & education of parents
- Control fever
  - Antipyretics : not shown to prevent seizure recurrence
- Long term anticonvulsants not indicated !!
- Diazepam oral 0.3mg/kg (1mg/kg/24hr) Q 8 hourly for duration of illness(2-3 days)

Seizures: Nursing Considerations

- ABC’s
  - Is the patient actively seizing
    - Secure an airway
    - Apply oxygen or prepare to intubate if prolonged seizure
    - Assess circulation and establish IV access
- Is the patient postictal
  - Support ABC’s and monitor immediately
- Reassure parents

Use of Oxygen During a Seizure

- For short term seizures
- No evidence oxygen by mask is effective during short seizure
- Contraction of airway inhibits oxygen intake by mask
- Short periods of apnea (up to 45 seconds) during the tonic phase is common.
- Blood flow reduced at the peripheries and increased to the vital organs (↑200% to brain)
- Oxygen is rarely used at home for seizures

Nursing Management

- **Emergency Care**: Assist the child to a lying position; if possible place something soft under the child head.
- Remove dangerous objects from the area and loosen tight clothing, do not force anything into the Childs mouth .
- Allow the seizures to run its course.
- When the child relived from the seizures attack, turn him to one side to help saliva drain from the mouth
- Treat any injuries that may have occurred during the convulsion.

Cont’d

- Hospital Care Keep bed at lowest position with rails up, Pad the side rails, pharyngeal suction, oxygen.
- Assist with diagnostic procedures, Administrator medications appropriately and Provide emotional support.

Anemia

- Anemia is defined as a reduction of the hemoglobin concentration or red blood cell (RBC) volume below the range of values occurring in healthy persons.
- Anemia can not be considered a specific disease entity; it is an indication of an underlying pathologic process or disease.

Classification

- Anemia can be classified based on their cause or morphologic appearance of RBCs.
- **A. Physiologic classification (based on cause)**
  - Sickle cell anemia: Excessive RBC destruction
  - Nutritional anemia: Reduced capacity to produce RBCs

B. Morphologic classification

- Microcytic e.g. Iron deficiency anemia
- Normocytic e.g. Blood loss anemia
- Macrocytic e.g. Megaloblastic anemia (Vit.B12 deficiency)

Pathophysiology

- When circulating hemoglobin is reduced, the oxygen carrying capacity of the blood becomes reduced
- During the falling of hemoglobin to below 7 to 8 g/dl , the heart tries to compensate by increasing the rate and cardiac out put.

Clinical Manifestations

- Fatigue, weakness and restlessness are early s/s.
- Pallor, Dyspnea on exertion, Tachycardia

Diagnosis:

- Clinical examination plus
- Hemoglobin & Hct level
- RBC count
- Serum Iron
- Stool examination

Management

- Depends on their cause
- Medical Management:
  - Blood transfusion,
  - O2 therapy,
  - Specific therapy

General care

- Obtain a thorough history and physical examination
- Prepare the child for laboratory examination.
- Reduce oxygen demand by provision of adequate rest
- Monitor vital signs
- Administer transfusion therapy
- During blood transfusion observe for signs of reaction and as much as possible try to prevent them
- Observe for signs of infections and complication

Care during transfusion of blood

- Monitor V/S before, during and after procedure.
- Do blood grouping and cross match carefully.
- Administer blood as soon as possible after it arrives from blood bank.
- Inspect the blood for unusual color.
- Mix the blood gently but thoroughly before and during transfusion to prevent settling of RBC.

Cont’d

- Remain with the child during transfusion in order to detect reactions as early as possible.
- Complete transfusion within four hour to prevent bacterial proliferation.
- Stop transfusion immediately if the onset of reaction is suspected and run normal saline to keep patency of the intravenous line.

Iron Deficiency Anemia

- Anemia resulting from lack of sufficient iron for synthesis of hemoglobin is the most common hematologic disease of infancy and childhood.
- It is more common between ages of 6 month-2 years.
- To maintain positive iron balance in childhood, about 1 mg of iron must be absorbed each day.
- The body of a newborn infant contains about 0.5 g of iron, whereas the adult contains 5 g.

Cont’d

- An average of 0.8 mg of iron must be absorbed each day during the first 15 year of life to have adult amount.
- Absorption of dietary iron is assumed to be about 10%; a diet containing 8–10 mg of iron daily is necessary for optimal nutrition.
- Iron is absorbed 2 to 3 times more efficiently from human milk than from cow's milk
- Breast-fed infants may, therefore, require less iron from other foods.

Etiology

- Insufficient iron supply at birth
- Insufficient intake of iron during periods of rapid growth
- Impaired iron absorption
- Blood loss

Pathophysiology

- Iron deficiency anemia occurs over a period of time.
- Low Fe supply -> Depletion of stores -> low serum transferring level ->low hemoglobin Synthesis
- Low Hgb Synthesis-Microcytic RBCs, Less filled with Hgb and Reduced o2 carrying capacity of blood

Clinical Feature

- Pallor- palmar, nail bed and conjunctiva
- Tachycardia, systolic murmurs are often present
- Pica or Pagophagia, the desire to ingest unusual substances such as ice or dirt, may be present.
- Affected growth, motor development, intellectual and neuralgic functioning especially attention span, alertness and level of learning.

Clinical Feature…

- When the hemoglobin level falls to <5 g/dL, irritability and anorexia are prominent.
- In mild to moderate iron deficiency (i.e., hemoglobin levels of 6–10 g/dL), compensatory mechanisms, may be so effective that few symptoms of anemia are noted, although affected children may be irritable.

Diagnosis

- History (dietary history) and physical examination
- Laboratory
  - Hct and Hgb level reduced (<33% and <11gm/dl respectively).
  - Low serum iron
  - Stool-for the presence of parasite (hook worm)

Management

- Oral iron supplement 6mg/kg/day in 3 divided dose for 3 to 4 month.
- Parenteral iron therapy 50mg/day of iron dextran IM
- Blood transfusion If the Hgb level is < 4g/dl, or, if superimposed infection is interfering with response to treatment.

Leukemia

- These are diseases that are characterized by abnormal proliferation and maturation of the bone marrow interfering with the production of normal blood cells.
- They are the most common malignancies of <15 years children with the peak age of 4 years.

Causes

- The exact cause of leukemia is unknown
- Several etiologic factors including
  - Viruses
  - Radiation
  - Exposure to drugs & chemicals
  - Familial predisposition

Classification

- **Acute lymphocytic leukemia (ALL)** It affects the lymphoid cell line and believed to be curable with chemotherapy and radiation. accounts about 80% of child hood leukemia.
- **Acute myeloid leukemia (AML)-**There is generalized progressive proliferation of immature monocyte myelocytes from the bone marrow that invades the blood and other tissues.

Clinical Features

- Onset can be abrupt or gradual and Usually non-specific
- The most classic manifestations are:
  - **Anemia**-due to inadequate & incompetent RBC production.
  - **Bleeding tendency** -inadequate & incompetent Platelet production.
  - I**nfection**- inadequate & incompetent white cells.
- **The above triads can be manifested with:**
  - Pallor, Fatigue, Weakness, Dyspnea →Due to anemia,
  - Purpura →due to reduced platelet, results bleedings from nose, gum,
  - Fever-due to infection

Diagnosis

- **CBC and Bone marrow analysis**

Management

- Treatment of anemia & infections
- Prevention of hemorrhage
- Alleviation of pain
- Early treatment, aggressive supportive care and continuation of therapy
- These can be achieved by: Chemotherapy, radiation & Bone narrow transplantation.

General care

- **Psychosocial care**
  - Confirmed diagnosis of leukemia can be a very devastating and stressful event.
  - So, proper explanation and provision of emotional support is important.
- **Physical care**
  - Assess, manage and prevent infections, and nutritional problems.
  - Prevent and manage bleeding.
  - Transfuse the child if necessary.
  - Provide meticulous oral, skin & hair care.

Diabetes Mellitus

- **Diabetes mellitus (DM)** is a group of metabolic diseases characterized by chronic hyperglycemia resulting from defects in insulin secretion, insulin action, or both.

Cont'd

- **The major forms of diabetes are classified:**
- **Type 1 DM, or T1DM :** Those caused by deficiency of insulin secretion due to pancreatic β-cell damage
- **Type 2 DM, or T2DM** : Those that are a consequence of insulin resistance occurring at the level of skeletal muscle, liver, and adipose tissue, with various degrees of β-cell impairment

Cont'd

- T1DM is the most common endocrine-metabolic disorder of childhood and adolescence, with important consequences for physical and emotional development.
- Morbidity and mortality stem from acute metabolic derangements and from long-term complications that affect small and large vessels resulting in retinopathy, nephropathy, neuropathy, ischemic heart disease, and arterial obstruction with gangrene of the extremities.

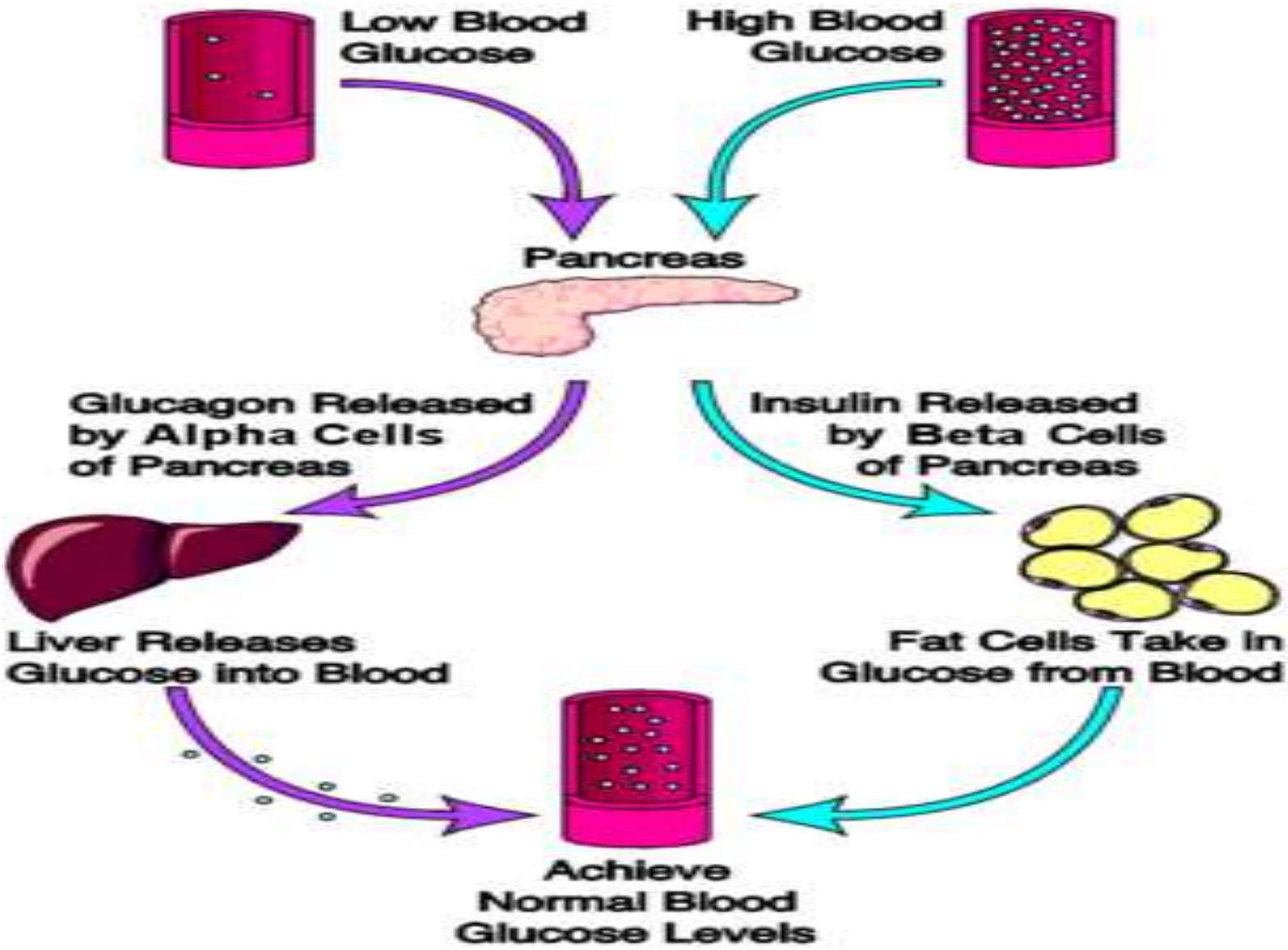
Cont'd

- The acute clinical manifestations are due to hypoinsulinemic hyperglycemic ketoacidosis.
- Autoimmune mechanisms are factors in the genesis of T1DM; the long-term complications are related to metabolic disturbances (hyperglycemia).
- DM is not a single entity but rather a heterogeneous group of disorders in which there are distinct genetic patterns as well as other etiologic and pathophysiologic mechanisms that lead to impairment of glucose tolerance.

Pathophysiology

- Insulin performs a role in the storage and retrieval of cellular fuel
- Its secretion in response to feeding is modulated by the interplay of neural, hormonal, and substrate-related mechanisms.
- Insulin levels must be lowered to then mobilize stored energy during the fasted state.
- Thus, in normal metabolism, there are regular swings between the postprandial, high-insulin anabolic state and the fasted, low-insulin catabolic state that affect liver, muscle, and adipose tissue.

Cont'd


Low Blood Glucose
High Blood Glucose
Pancreas
Glucagon Released by Alpha Cells of Pancreas
Insulin Released by Beta Cells of Pancreas
Liver Releases Glucose into Blood
Fat Cells Take in Glucose from Blood
Achieve Normal Blood Glucose Levels

Cont'd

- T1DM is a progressive low-insulin catabolic state in which feeding does not reverse
- With moderate insulinopenia:
  - Glucose utilization by muscle and fat decreases - postprandial hyperglycemia appears.
  - Liver produces excessive glucose via glycogenolysis and gluconeogenesis- fasting hyperglycemia begins.
- Hyperglycemia produces an osmotic diuresis (glycosuria)
  - Renal threshold is exceeded (180 mg/dL; 10 mmol/L).

Cont'd

- Loss of calories and electrolytes, and persistent dehydration, produce hypersecretion of stress hormones (epinephrine, cortisol, growth hormone, and glucagon).
- Stress hormones, in turn, contribute metabolic decompensation by:
  - Impairing insulin secretion (epinephrine),
  - Antagonizing its action (epinephrine, cortisol, growth hormone),
  - Promoting glycogenolysis, gluconeogenesis, lipolysis, and ketogenesis (glucagon, epinephrine, growth hormone, and cortisol)
  - While decreasing glucose utilization and glucose clearance (epinephrine, growth hormone, cortisol).

Clinical Manifestations:

- Initially hyperglycemia occurs.
- Intermittent polyuria or nocturia begins.
- Polydipsia becomes more apparent.
- Glycosuria triggering a compensatory polyphagia.
  - 50%, of the average daily caloric intake lost in the urine.
- Loss of body fat ensues, with clinical weight loss
- Ketoacidosis: deteriorates, abdominal discomfort, nausea, and emesis.
- Is persists- Kussmaul respirations (deep, heavy, rapid breathing), fruity breath odor (acetone), diminished neurocognitive function, and possible coma.

Signs and Symptoms
The Three "P's"

Polyuria

Polydipsia

Polyphagia

Diagnosis

- Based on blood glucose measurements and symptoms
  - Symptoms plus a random plasma glucose > 200 mg/dL
  - Fasting plasma glucose >126 mg/dL
  - Two-hour plasma glucose > 200 mg/dL during an oral glucose tolerance test using a 75g glucose load

Management

- Three phases depending on presentation
  - Management of DKA
  - Transition period
  - Continuation period
- Nutrition

Manage….

- Exercise
  - No form of exercise should be forbbiden
- Honey moon period
  - Around 75% of newly diagnosed require progressive reduction in insulin dosage
- Psycho logic aspects

Infant of Diabetic Mother (IDM)

- Before 1921 (discovery of Insulin) women rarely reached reproductive age or survived pregnancy
- IDM are at risk of:
  - Respiratory distress
  - Polycythemia

IDM….

- Hypoglycemia
- Electrolyte disturbance
- Growth abnormalities (LGA & SGA)

- Prevention centers on
  - CLOSE MONITORING DURING REGNANCY

Treatment

- Therapy encompasses initiation and adjustment of insulin, extensive teaching of the child and caretakers, and reestablishment of the life routines
- Insulin Therapy:
- Insulin - 0.7 U/kg/d if pre pubertal,
- Insulin 1.0 U/kg/d at mid puberty, and
- Insulin 1.2 U/kg/d by the end of puberty.
- The optimal insulin dose can only be determined with frequent self-monitored blood glucose levels and insulin adjustment by the diabetes team.

Table 583-3 SUBCUTANEOUS INSULIN DOSING

AGE (yr)	TARGET GLUCOSE (mg/dL)	TOTAL DAILY INSULIN (U/kg/day)*	BASAL INSULIN, % OF TOTAL DAILY DOSE	BOLUS† INSULIN	
				Units Added per 100 mg/dL Above Target	Units Added per 15 g at Meal
0-5	100-200	0.6-0.7	25-30	0.50	0.50
5-12	80-150	0.7-1.0	40-50	0.75	0.75
12-18	80-130	1.0-1.2	40-50	1.0-2.0‡	1.0-2.0

Ketoacidosis management

Table 583-4 DIABETIC KETOACIDOSIS (DKA) TREATMENT PROTOCOL

TIME	THERAPY	COMMENTS
1st hr	10-20 mL/kg IV bolus 0.9% NaCl or LR Insulin drip at 0.05 to 0.10 μ/kg/hr	Quick volume expansion; may be repeated. NPO. Monitor I/O, neurologic status. Use flow sheet. Have mannitol at bedside; 1g/kg IV push for cerebral edema.
2nd hr until DKA resolution	0.45% NaCl: plus continue insulin drip 20 mEq/L KPhos and 20 mEq/L KAc 5% glucose if blood sugar >250 mg/dL (14 mmol/L)	$\text{IV rate} = \frac{85\,\text{mL/kg} + \text{maintenance} - \text{bolus}}{23\,\text{hr}}$
		If K <3 mEq/L, give 0.5 to 1.0 mEq/kg as oral K solution OR increase IV K to 80 mEq/L
Variable	Oral intake with subcutaneous insulin	No emesis; CO_2 ≥16 mEq/L; normal electrolytes
Note that the initial IV bolus is considered part of the total fluid allowed in the 1st 24 hr and is subtracted before calculating the IV rate.		
Maintenance (24 hr) = 100 mL/kg (for the 1st 10 kg) + 50 mL/kg (for the 2nd 10 kg) + 25 mL/kg (for all remaining kg)		
Sample calculation for a 30-kg child:		
1st hr = 300 mL IV bolus 0.9% NaCl or LR		
$\text{2nd and subsequent hours} = \frac{(85\,\text{mL} \times 30) + 1750\,\text{mL} - 300\,\text{mL}}{23\,\text{hr}} = \frac{175\,\text{mL}}{\text{hr}}$ (0.45% NaCl with 20 mEq/L Kphos and 20 mEq/LKAC)		

I/O, input and output (urine, emesis); KAc, potassium acetate; KPhos, potassium phosphate; LR, lactated Ringer solution; NaCl, sodium chloride.

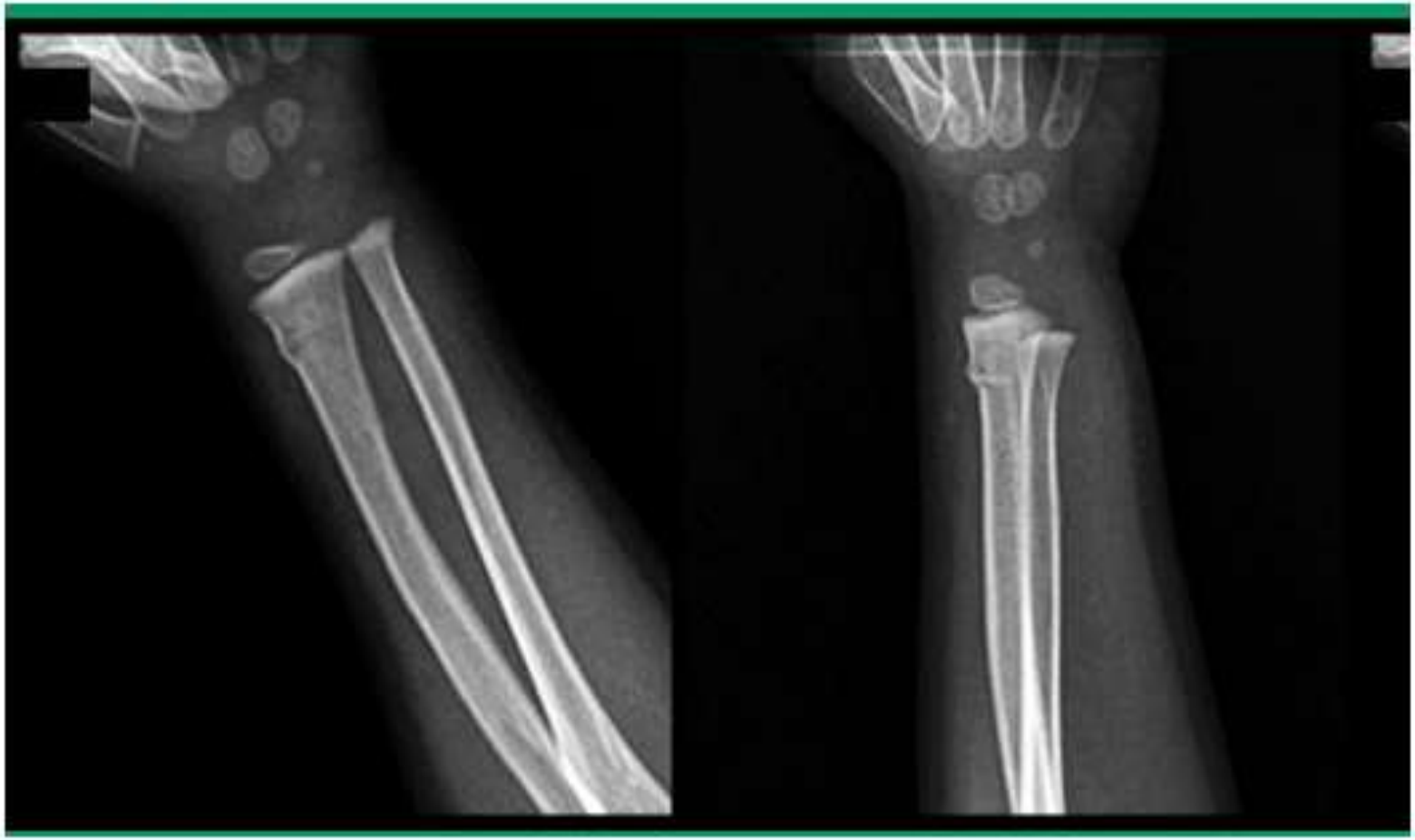
Fracture:

- The anatomy, biomechanics, and physiology of the pediatric skeletal system are different from that of adults. This results in different fracture patterns.

Pediatric fracture pattern

- Buckle (torus) — Buckle fractures follow compression failure, often at the junction between the porous metaphysis and the denser diaphysis.
- These injuries typically occur in the distal radius after longitudinal trauma (eg, fall on an outstretched hand), but are also seen in the distal tibia, fibula, and femur.
- Buckle fractures are by definition stable and can often be managed with splinting and a single orthopedic follow-up visit

Buckle fracture

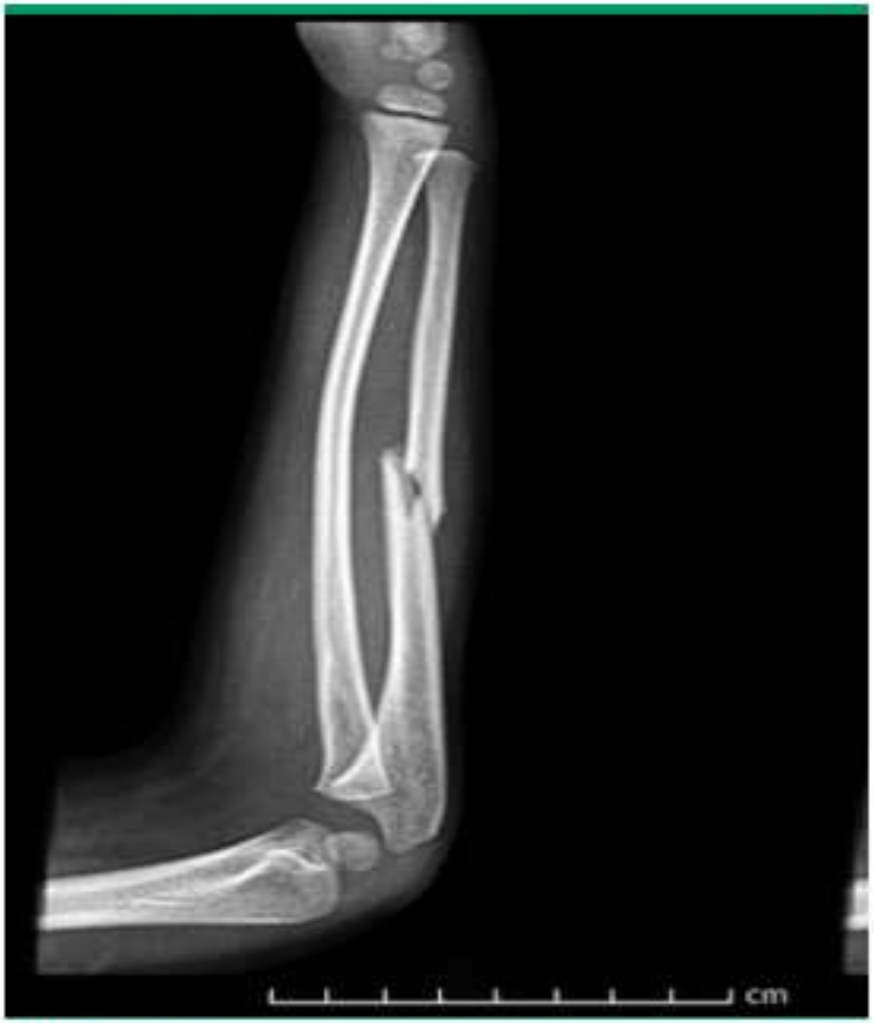


AP and oblique views of the left forearm. Buckle (torus) fracture of the dorsolateral cortex of the distal radial metaphysis. No displacement or angulation.

Pediatric fracture pattern …

- Plastic Deformation: Plastic deformation is unique to children.
- It is most commonly seen in the ulna and occasionally the fibula.
- The fracture occurs due to a force that produces microscopic failure on the tensile side of bone and does not propagate to the concave side.
- The bone is angulated beyond its elastic limit, but the energy is insufficient to produce a fracture.

Plastic deformation

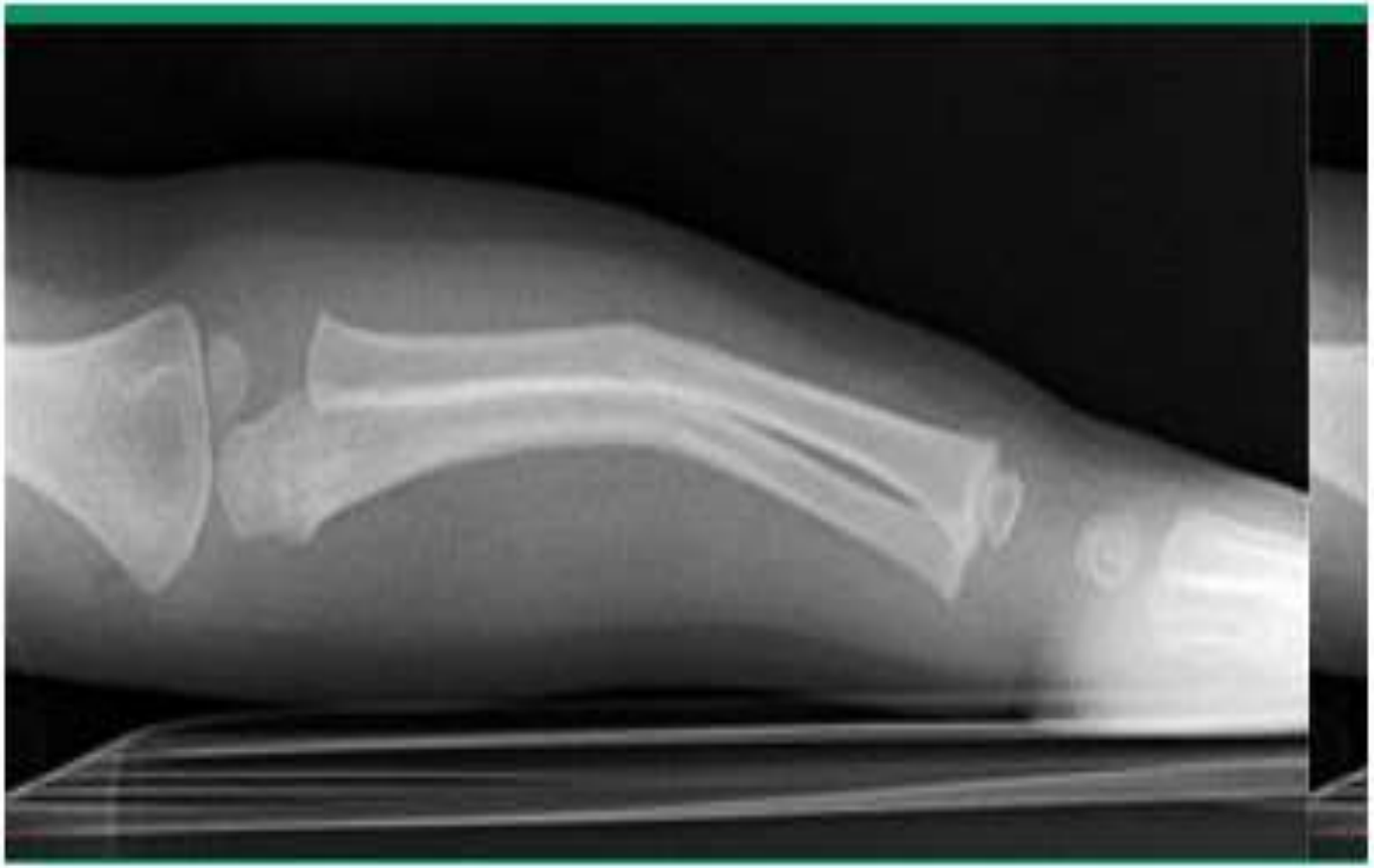


Plastic deformation (bowing deformity) of the right radius and an oblique mid-diaphyseal ulnar fracture with posterior displacement of the distal fragment (one shaft-width).

Pediatric fracture pattern …

- **Greenstick :** These fractures occur when the bone is bent, and there is failure on the tensile (convex) side of the bone.
- The fracture line does not propagate to the concave side of the bone
- The concave side shows evidence of microscopic failure with plastic deformation.
- It is necessary to break the bone on the concave side as the plastic deformation recoils it back to the deformed position.

Midshaft greenstick fracture



Both the radius and ulna are bent and the fracture line does not extend completely through the width of the bone.

Specific fractures

- **Clavicular-** Approximately 87 percent of clavicle fractures are caused by a fall onto the shoulder.
- Clinical presentation and examination- Because the clavicle lies close to the skin, examination often reveals a visible bulge due to hematoma (often with associated ecchymosis), bone angulation, or displaced bone edges.
- Treatment - Immobilization with either a sling or figure of eight bandage is continued until clinical union occurs (ie, the fracture site is nontender and the patient can move the arm fully with little or no discomfort).
- Pain control and reduction of motion at the fracture site until clinical union occurs.

Proximal humerus

- Humeral fractures are the second most common birth injury after clavicle fractures.
- Fractures of the proximal humerus commonly occur due to a fall on an outstretched hand or from a direct blow to the lateral aspect of the shoulder.
- The child with a proximal humeral fracture typically presents with a history of trauma, severe shoulder pain, and marked pain on arm movement.
- Initial treatment consists of pain management, immobilization, and radiographic evaluation.

Distal radius and ulna

- Forearm fractures are among the most common fractures in children, representing 40 to 50 percent of all childhood fractures.
- The distal third of the forearm, involving the radius and/or ulna, is the most common location.
- The child with a distal forearm fracture typically has a history of a fall on an outstretched hand with swelling, bony pain, and/or deformity of the distal forearm.
- Physical examination of children with distal forearm fractures should focus on the presence of open wounds near the fracture site, careful neurovascular assessment, and identification of any injury to the wrist or elbow joints.

Cont'd

- INITIAL TREATMENT — The goals for initial care of children with a suspected distal forearm fractures are the following:
  - Identify and treat vascular compromise
  - Identify open fractures
  - Provide analgesia and immobilization
- Children with open fractures of the distal forearm should receive the following initial care
  - Application of a sterile dressing
  - Tetanus prophylaxis, as needed
  - Intravenous antibiotics directed at the most common organisms

Assignment individual

1. Hemophilia

- Definition, Etiology and incidence, Pathogenesis , Clinical manifestation, Diagnosis and Management
- 2. **Failure to thrive**
- Definition, Etiology and incidence, Clinical manifestation, Diagnosis, Management and Prognosis

3. Mental retardation

- Definition**,** Etiology and incidence, Clinical manifestation Diagnosis**,** Management and Prevention

IMNCI (2016)
Integrated Management of New born and Childhood Illnesses

Introduction to

IMNCI

Child health

INTRODUCTION

- Under 15 years constitute **44.7%** of the population
- Of which **40% are under five** and **8% are under one year.**
- Neonatal mortality rate 29/1000 live birth
- Infant mortality rate is 48/1000 live births
- Under five mortality rate 67/1000 live births

EDHS 2016

Child health…

More than 70% of these deaths are due to the five diseases.

- ✓ Pneumonia 28.9%
- ✓ Malaria 21.6%
- ✓ Diarrhea 12%
- ✓ Measles 5%
- ✓ 60% of these deaths are associated with malnutrition

  HIV/AIDS 11%

IMNCI

WHAT IS IMNCI?

- IMNCI is a strategy to reduce morbidity & mortality associated with the major illness.
- Is the integrated strategy that combines and links together existing child health programs.

IMNCI…

- Action-oriented CLASSIFICATIONS, rather than EXACT DIAGNOSES are used.
- Using FEW CLINICAL SIGNS as possible which health workers of diverse background can be trained to recognize.
- The IMNCI guidelines rely on detection of cases based on SIMPLE CLINICAL SIGNS without laboratory tests and offer EMPIRIC TREATMENT.

What are under-fives dying of?
(excluding neonatal causes of death)

- Pneumonia
- Malaria
- Diarrhoea
- Measles
- HIV/AIDS

} ~ 50%

➢**Malnutrition contributes to more than half of all under-five deaths**

What are neonates dying of?

- Preterm births
- Severe infection
- Asphyxia
- Congenital anomalies
- Tetanus

} ~ 75%

The Case Mgt Process

The case mgt process is presented on series of charts which shows the sequence of steps.

The charts described the following steps.

Assess the child/ young infant: - assess a child by checking first for general danger signs (possible series bacterial infection in a young infant).

Assess means taking Hx & P/E.

The case mgt…

- **2. Classify the illness**: means select category or classification based on the major symptoms, or classify a child's illnesses using a colour-coded triage system.

- 3**. Identify Rx-** After classifying all conditions, identify specific treatments for the child. Selecting & classification on the chart is sufficient to identify Rx.

The Case Mgt …

4**. Treat the child-** Provide practical treatment instructions, including teaching the caretaker how to give oral drugs, how to feed and give fluids during illness, and how to treat local infections at home.

The Case Mgt …

5. Counsel the mother.

Assess feeding, including ASSESM'T of breastfeeding practices, and counsel to solve any feeding problems found. Telling her about foods & fluids to give the child & to bring the child back to the clinic.

6. Give follow up care: - When a child is brought back to the clinic as requested, give follow-up care and, if necessary, reassess the child for new problems.

Case Mgt Process…

❖The case management process is presented on two different sets of charts:

1. For infant Age birth up to 2 months and
2. For children Age 2 months up to five years.

Selecting the appropriate case management charts

FOR **ALL SICK CHILDREN** age birth up to 5 years who are brought to the clinic:

ASK THE CHILD'S AGE

IF the child is **from birth up to 2 months**

USE THE CHART:

ASSESS, CLASSIFY AND

TREAT THE SICK YOUNG

INFANT

IF the child is from **2 months up to 5 years**

USE THE CHARTS:

- ASSESS AND CLASSIFY THE SICK CHILD
- TREAT THE CHILD
- COUNSEL THE MOTHER

Assess and Classify

The Sick child

Age 2 Months Up to 5 yrs

2 Months – 5years sick children

This age group of children are usually assessed by :

1. Checking the presence or absence of General Danger Sign.

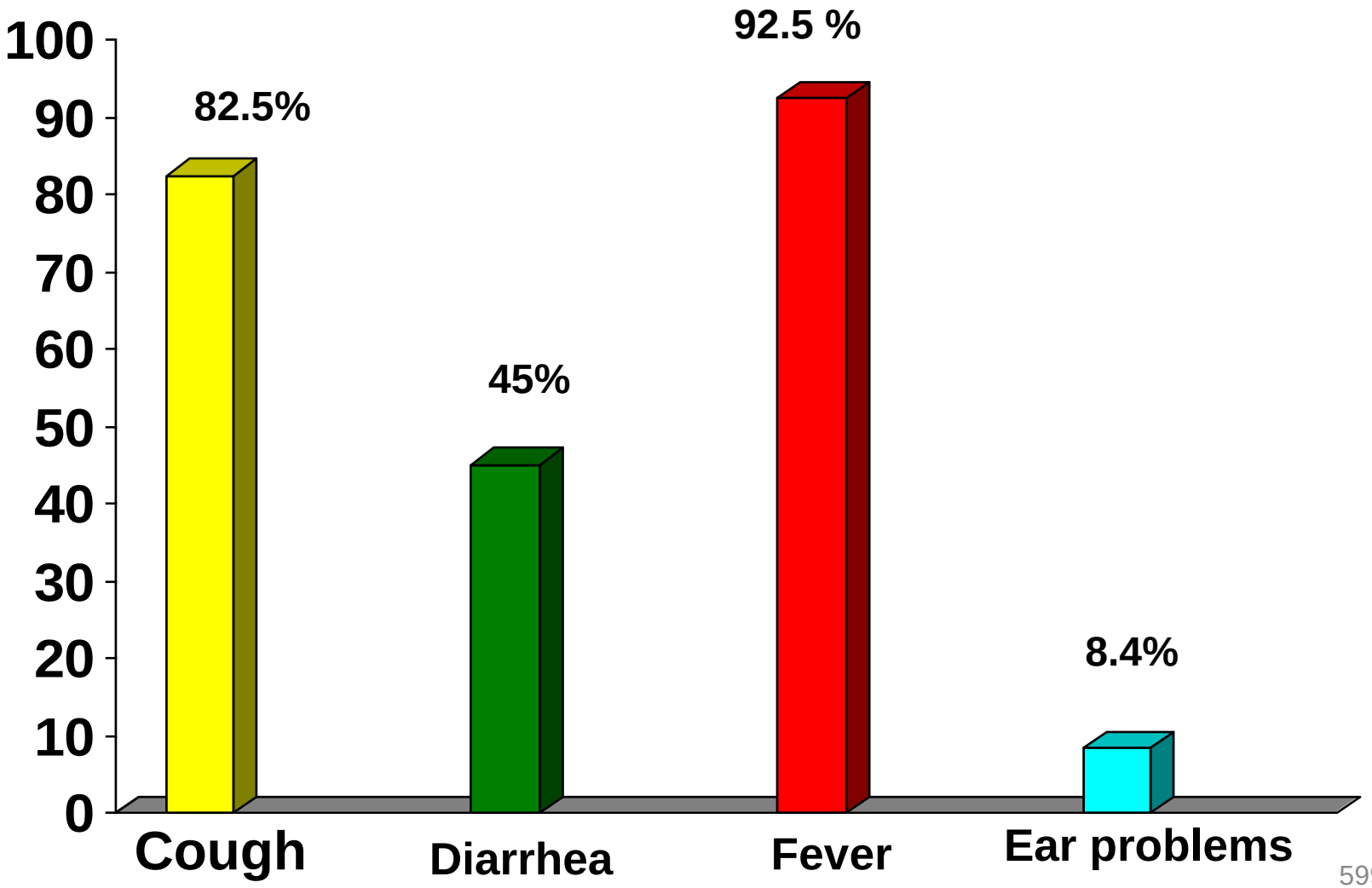
Ask	LOOK
✓ Is the child able to drink or breastfeed? ✓Does the child vomit everything? ✓ Has the child had convulsions?	✓See if the child is lethargic or unconscious. ✓ Is the child convulsing now?

2 months – 5 years sick Children...

2. Ask the four main symptoms:

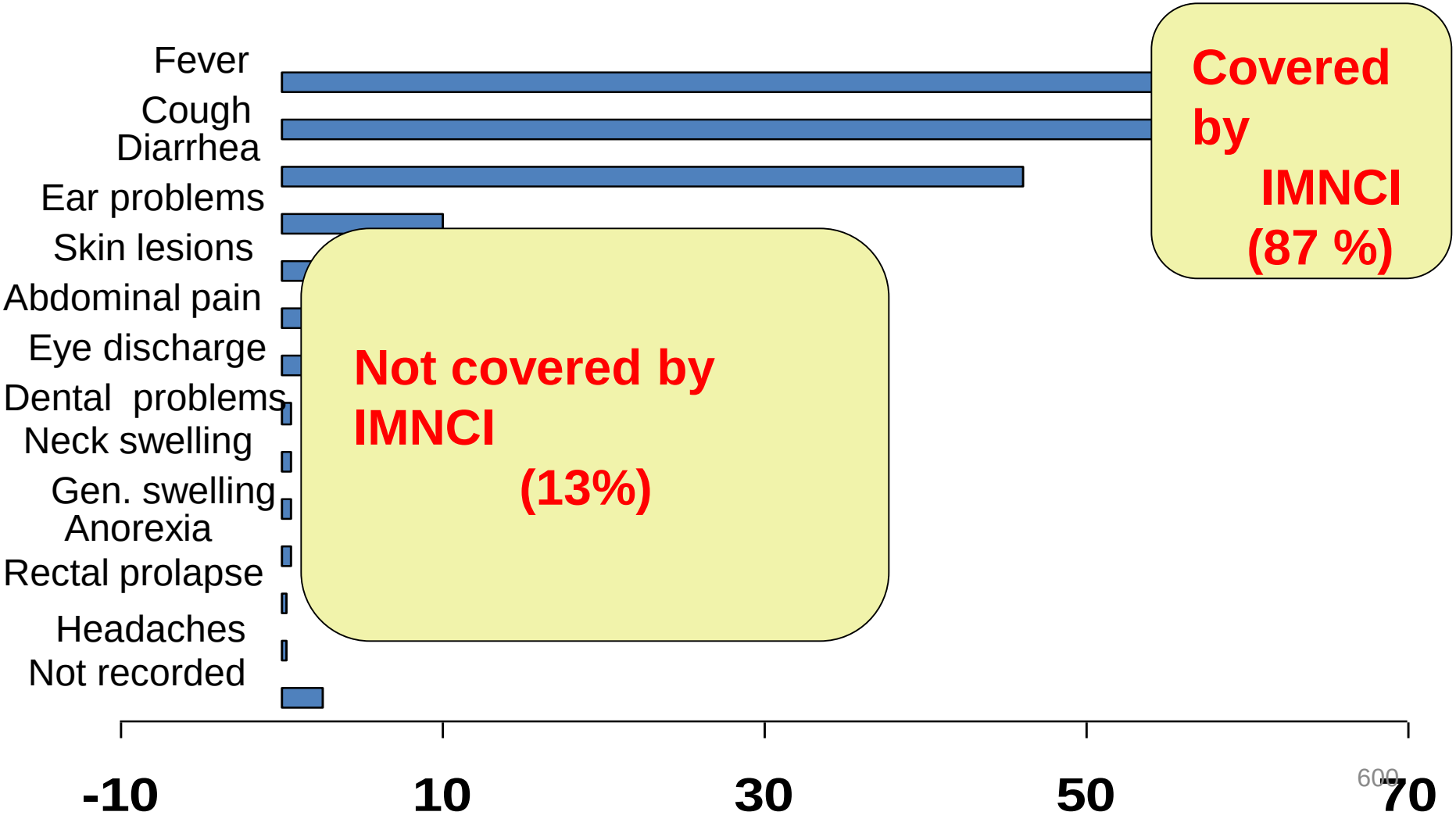
- ✓Cough or difficult breathing,
- ✓Diarrhoea,
- ✓Fever, and
- ✓Ear problem.

Main symptoms of 450 sick children



IMNCI

Frequency of presenting complaints of 450 children (as volunteered by mothers)



Top part of the case recording form for 2Mth-5 Yrs

MANAGEMENT OF THE SICK CHILD AGE 2 MONTHS UP TO 5 YEARS

Child's Name: xxxx Age: x months Weight: x Temperature: x

ASK: What are the child's problems? cough, trouble breathing Initial Visit? ✓ Follow-up Visit?

ASSESS (Circle all signs present) **CLASSIFY**

CHECK FOR GENERAL DANGER SIGNS

NOT ABLE TO DRINK OR BREASTFEED LETHARGIC OR UNCONSCIOUS

VOMITS EVERYTHING

CONVULSIONS

General danger sign present?

Yes ✓ No

Remember to use danger sign when selecting classifications

Classify cough or difficult breathing

IF YES, ASK:	*LOOK, LISTEN, FEEL:*		
• For how long?	• Count the breaths in one minute. • Look for chest indrawing • Look and listen for stridor	} CHILD MUST BE CALM	**Classify COUGH or DIFFICULT BREATHING**

CLASSIFICATION TABLE FOR COUGH OR DIFFICULT BREATHING.

Assess	Classify	Identify Rx
Any general danger sign OR Stridor in calm child.	SEVERE PNEUMONIA OR VERY SEVERE DISEASE	➢ Give first dose of an appropriate antibiotic. ➢ Refer URGENTLY to hospital.
Fast breathing OR Chest indrawing	PNEUMONIA	• Give an appropriate oral antibiotic for 5 days. • Soothe the throat and relieve the cough with a safe remedy. • Advise mother when to return immediately. • Follow-up in 2 days.
No signs of pneumonia or very severe disease.	NO PNEUMONIA: COUGH OR COLD	-If coughing more than 21 days, refer for assessment. -Soothe the throat and relieve the cough with a safe remedy. -Advise mother when to return immediately. -Follow-up in 5 days if not improving.

After checking the general danger sign and asking the presence or absence of cough then we need to ask does the child have diarrhea?

Does the child have diarrhea?

IF YES, ASK

✓ For how long?

✓ Is there blood in the stool ?

LOOK AND FEEL

-Look at the child general condition. is the child:

-Lethargic or Unconscious?

-Restlessness or irritable

-Look for sunken eye

- Offer the child fluid. is the child:

-Not able to drinking or drinking poorly ?

-Drinking – eagerly, thirsty?

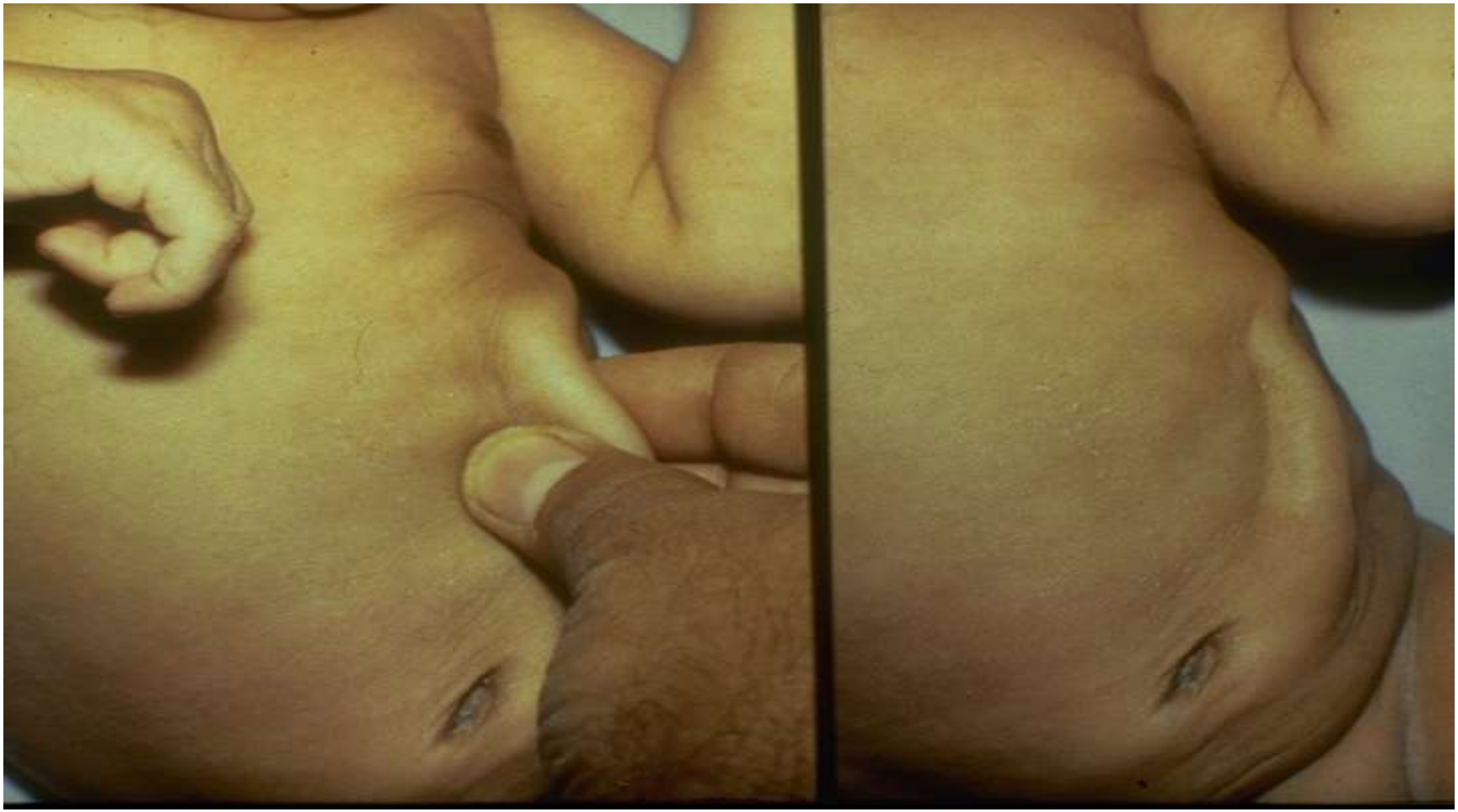
- Pinch the skin of abdomen, does it go back very slowly, (longer than 2 second, or slowly).

- If the mother says the child does **not have diarrhea**

Then ASK about the next main symptoms fever, and ear problem.

- Diarrhoea occurs when stools contain more water than normal. Diarrhoea is also called loose or watery stools. It is common in children, especially those between 6 months and 2 years of age. It is more common in babies under 6 months who are drinking cow's milk or infant formulas. Frequent passing of normal stools is not diarrhoea.

Skin pinch technique



How To Classify Diarrhoea

I. DHN-all children with diarrhoea are classified for dehydration

II. Persistent-if the child has had diarrhoea for 14 days or more, classify the child for persistent diarrhoea

III.Dysentery-if the child has blood in the stool, classify the child for dysentery.

I. Classify Dehydration (DHN)

They are “3” possible classification DHN

1. Severe DHN

2.Some DHN

3. No DHN

Classification of DHN

Assess	classify	Identify Rx
Two of the following signs ➢Lethargic or unconscious ➢Sunken eye ➢Not able to drink or drinking poorly ➢Skin pinch goes back very slowly	Sever DHN	➢If child has no other severe classification: ➢Give fluid for severe dehydration (Plan C). OR ➢If child also has another severe classification: ➢Refer URGENTLY to hospital with mother giving frequent sips of ORS on the way. ➢ Advise the mother to continue breastfeeding. ➢If child is 2 years or older, and there is cholera in your area, give antibiotic for cholera.

Classification of DHN…

Two of the following signs - Restless, irritable - Sunken eye - Drinks eagerly, thirsty - Skin pinch goes back slowly	Some DHN	-Give fluid, Zinc supplement & food for some DHN (plan- B) - If the child has sever classification: . Refer urgently to hospital with mother giving frequent sips of ORS on the way - Advise the mother to continue B/F - Advise the mother when to return immediately. - Follow up for “5” day if not improving

Classification of DHN …

- No enough sign to classify some or severe DHN	NO DHN	-Give Fluid ,Zinc supplement & food to treat diarrhea (plan – A) -Advise the mother when to return immediately -Follow up in 5 days if not improving - If confirmed/ suspected symptomatic HIV, follow up in 2 days if not improving

II. Classify Persistent Diarrhea

If the diarrhea lasts 14 days or more classify for persistent diarrhea.

Two classifications

1. Severe persistent diarrhea if some or severe DHN present

2. Persistent diarrhea if no some or severe DHN present.

DHN present	Severe - persistent diarrhea	✓Treat DHN before referral if the child has no severe disease classification ✓Refer to hospital ✓Vit – A supplementation
No DHN	Persistent diarrhea	✓Advise the mother on feeding a child ✓Follow up for in 05 day ✓Give vit – A

III. Classify dysentery

Dysentery: Diarrhea with blood in the stool, with or with out mucous.

- If the child has blood in the stool classify for

Blood in the stool	Dysentery	-Treat for 03 days with oral antibiotic (ciprofloxacilin) - Follow up for 2 days

Assess and classify FEVER

- **DOES THE CHILD HAVE FEVER?** (by history or feels hot or temperature 37.5 **^{0}C** or above)

IF YES

- **Decide Malaria** Risk: high or low or no
- if “Low or no” malaria risk, then ask: Has the child travelled outside this area during the previous 2 weeks?
- If yes, has he been to a malarious area?

Classification of FEVER for high malaria

SIGN	CLASSIFY	IDENTIFY TREATMENT
•Any general danger sign or • Stiff neck or •Bulging fontanel	VERY SEVERE FEBRILE DISEASE	➢Give first dose Artesunate or Quinine for severe malaria ➢ Give first dose of IV/IM Ampicillin and Gentamycin ➢ Treat the child to prevent low blood sugar, Give Paracetamol in health facility for high fever (≥38.5°C) ➢ Refer URGENTLY to hospital.
• Positive blood film/positive RDT (if blood film/RDT available), or • Fever(by history or feels hot or temperature 37.5° C** or above)	MALARIA	➢Treat with Artemeter-Lumefantrine for P. falcip. or mixed or no confirmatory test done ➢Treat with Chloroquine for confirmed P. vivax ➢ Give Paracetamol in health facility for high fever (38.5°C or above) ➢Give an appropriate antibiotic for identified bacterial cause of fever ➢Advise mother when to return immediately ➢ Follow-up in 2 days if fever persists ➢ If fever is present every day for more than 7 days, refer for assessment

Then ask	Look and feel
• For how long? • If more than 7 days, has fever been present every day? • Has the child had measles within the last 3 months?	• Look or feel for stiff neck • Look or feel for bulging fontanels (< 1year old) • Look for runny nose • Look for signs of MEASLES Generalized rash and one of these: cough, runny

If the child has measles now or within the last 3 months:

Look for mouth ulcers- Are they deep and extensive?
Look for pus draining from the eye.
Look for clouding of the cornea.

Classification of FEVER in Low Malaria Risk

SIGN	CLASSIFY AS	IDENTIFY TREATEMENT
• Any general danger sign • Stiff neck	VERY SEVERE FEBRILE DISEASE	➢ Give quinine for severe malaria (first dose). ➢ Give first dose of an appropriate antibiotic. ➢ Rx to prevent low blood sugar. ➢ Give one dose of paracetamol in clinic for high fever (38.5° C or above). ➢ Refer URGENTLY to hospital.
• Positive blood film/positive RDT (if blood film/RDT available), or -NO runny nose and -NO measles and -NO other cause of fever	MALARIA	➢ Treat with oral antimalarial. ➢ Give one dose of paracetamol in clinic for high fever (38.5° C or above). ➢ Advise mother when to return immediately. ➢ Follow-up in 2 days if fever persists. ➢ If fever is present every day for more than 7 days, REFER for assessment.

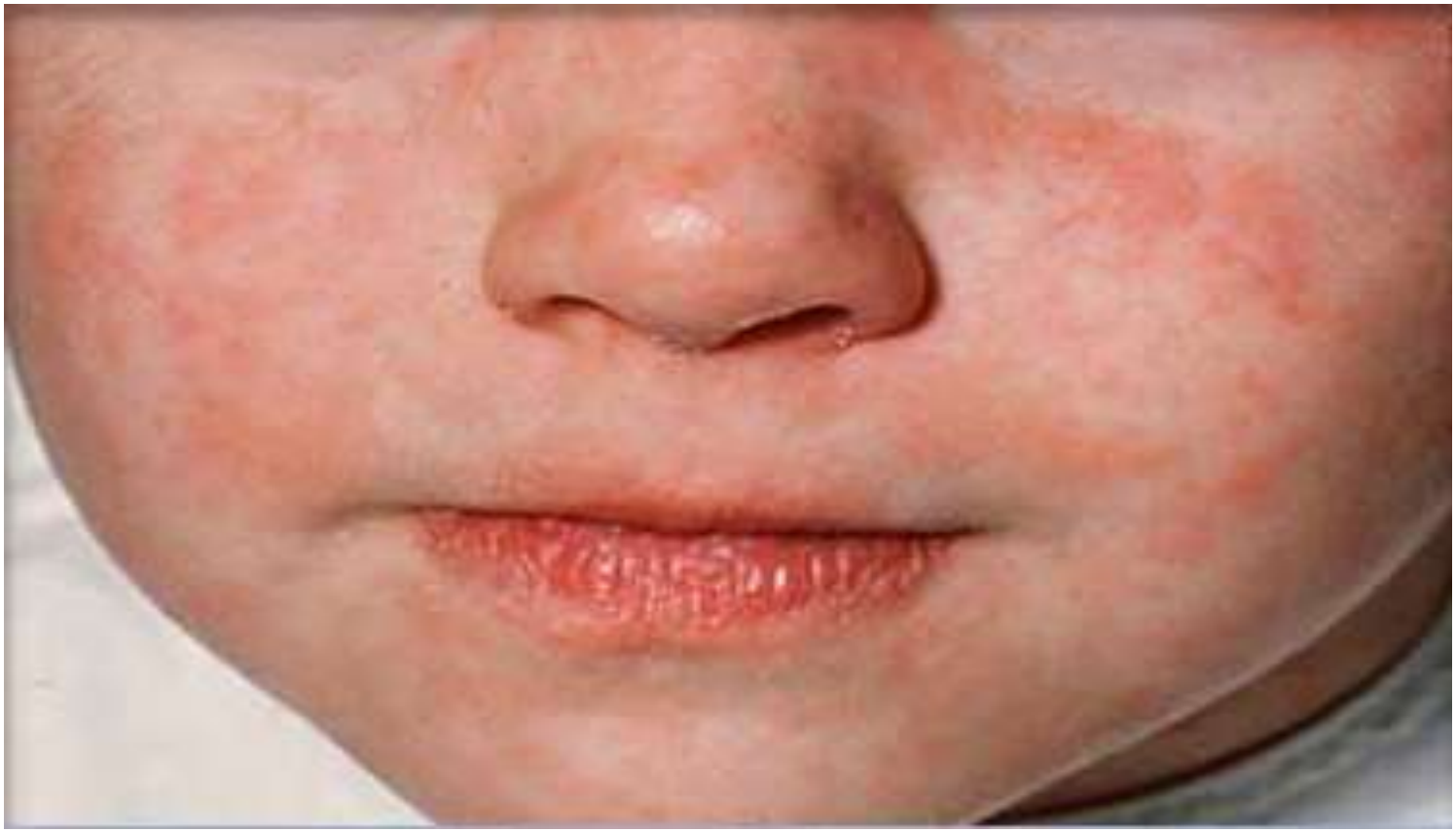
Classification of FEVER in Low Malaria Risk…

SIGN	CLASSIFY AS	IDENTIFY TREATEMENT
•Runny nose PRESENT OR • Measles PRESENT OR • Other cause of fever PRESENT.	FEVER - MALARIA UNLIKELY	➢ Give one dose of paracetamol in clinic for high fever (38.5° C or above). ➢ Treat other obvious cause of fever ➢ Advise mother when to return immediately. ➢ Follow-up in 2 days if fever persists. ➢ If fever is present every day for more than 7 days, REFER for assessment.

Classification for NO malaria risk and NO travel to a malaria risk area.

Any general danger sign or -Stiff neck	VERY SEVERE FEBRILE DISEASE	➢ Give first dose of an appropriate antibiotic. ➢ Treat the child to prevent low blood sugar. ➢ Give one dose of paracetamol in clinic for high fever (38.5° C or above). ➢ Refer URGENTLY to hospital.
NO general danger sign AND NO stiff neck.	FEVER -(NO MALARIA)	➢ Give one dose of paracetamol in clinic for high fever (38.5° C or above). ➢ Treat other obvious causes of fever ➢ Advise mother when to return immediately. ➢ Follow-up in 2 days if fever persists. ➢ If fever is present every day for more than 7 days, ➢ REFER for assessment.

What is measles ?



Classification table for measles (if measles now or within the last 3 months).

• Any general danger sign or • Clouding of cornea or • Deep or extensive mouth ulcers.	SEVERE COMPLICATED MEASLES	➢ Give vitamin A therapeutic dose. ➢ Give first dose of an appropriate antibiotic. ➢ If clouding of the cornea or pus draining from the eye, apply tetracycline eye ointment. ➢ Refer URGENTLY to hospital.
• Pus draining from the eye or •Mouth ulcers	MEASLES WITH EYE OR MOUTH COMPLICATIONS	➢ Give vitamin A, therapeutic dose.. ➢ If pus draining from the eye, treat eye infection with tetracycline eye ointment. ➢ If mouth ulcers, treat with gentian violet. ➢ Follow-up in 2 days.
• Measles now or within the last 3 months	MEASLES	➢ Give vitamin A, therapeutic dose. ➢ Advise when to return immediately

Assess and classify EAR Problem

Ask if the child has ear problem

IF YES, ASK:	LOOK AND FEEL
▪Is there ear pain?	-Look for pus draining from the ear
▪ Is there ear discharge?	-Feel for tender swelling behind the ear
▪If yes, for how long?	

Classification table for ear problem.

• Tender swelling behind the ear.	MASTOIDITIS	➢ Give first dose of an appropriate antibiotic. ➢ Give first dose of paracetamol for pain. ➢ Refer URGENTLY to hospital.
• Pus is seen draining from the ear and discharge is reported for less than 14 days, OR • Ear pain.	ACUTE EAR INFECTION	➢ Give an oral antibiotic for 5 days. ➢ Give paracetamol for pain. ➢ Dry the ear by wicking. ➢ Follow-up in 5 days.
• Pus is seen draining from the ear and discharge is reported for 14 days or more.	CHRONIC EAR INFECTION	➢ Dry the ear by wicking. ➢ Treat with topical quinolones eardrops for 2 weeks ➢ Follow-up in 5 days.
• No ear pain and No pus seen draining from the ear.	NO EAR INFECTION	No additional treatment.

Then

CHECK for :

- ✓Malnutrition and
- ✓ Anaemia,
- ✓HIV infection,
- ✓Immunization status and
- ✓Other problems.

Classify nutritional status and

SIGNS	CLASSIFY AS	IDENTIFY TREATEMENT
If age up to 6 months and visible severe wasting or edema of both feet If age 6 months and above & - MUAC < 11cm (Lt ≥ 65 - 110cm), or edema of both feet and poor appetite or pneumonia or persistent diarrhoea or dysentery.	SEVERE COMPLICATED MALNUTRITION	➢ Treat the child to prevent low blood sugar ➢ Give first dose of Vitamin A for all except for those with edema or those who received a dose in the past 6 months ➢ Refer URGENTLY to hospital
If age 6 months or above & - MUAC < 110 mm (Lt ≥ 65 - 110cm), or edema of both feet and some appetite	SEVERE UNCOMPLICATED MALNUTRITION	▸ Refer to the Outpatient Treatment Program ▸ When OTP is not available, manage as follows:- ▸ Counsel the mother on how to feed a child with RUTF, if available, or refer to hospital ▸ Give first dose of Vitamin A (as above) ▸ Give amoxicillin for 7 days ▸ Give 5mg folic acid for those with anemia ▸ Give Mebendazole (if child age is>1year) ▸ Advise the mother when to return immediately ▸ Follow-up in 7 days

Classification table for anaemia

•Severe Palmar Pallor	Severe Anaemia	➢ Give vitamin A ➢ Refer URGENTLY to hospital
•Some Palmar Pallor	Anaemia	➢ Give iron ➢ Give oral antimalarial if high malaria risk. ➢ Give mebendazole if child is 12 months or older and has not had a dose in the previous 6 months. ➢ Advise mother when to return immediately. ➢ Follow-up in 14 days.
• No pallor	No Anemia	➢ No additional treatment

CLASSIFY FOR HIV INFECTION

There are five classifications in the ASSESS AND CLASSIFY chart

• Positive HIV antibody in a child 18 months and above, OR, Positive PCR test at any age AND • Two or more of the following HIV - related conditions ▪ Pneumonia/Severe Pneumonia ▪ Persistent diarrhea/severe persistent diarrhea ▪ Ear discharge ▪ Very low weight/Severe Malnutrition ▪ Oral thrush ▪ Enlarged palpable lymph nodes in two or more sites ▪ Bilateral Parotid enlargement for 14 days or more	Confirmed Symptomatic Hiv Infection	➢ Give Cotrimoxazole prophylaxis ➢ Treat HIV-related conditions if present (e.g., thrush) ➢ Give multivitamin supplements ➢ Assess the child's' feeding and counsel as necessary ➢ Counsel the mother about her own HIV status and arrange counselling & testing if necessary ➢ Advise the mother on home care ➢ Refer for ARV

•Positive HIV antibody in a child 18 months and above, OR •Positive PCR at any age And •Less than two HIV-related conditions	CONFIRMED HIV INFECTION	➢ Give Cotrimoxazole Prophylaxis ➢ Treat HIV-related conditions if present (e.g., thrush) ➢ Give multivitamins Assess child's feeding and counsel as necessary ➢ Advise home care ➢ Counsel the mother about her own HIV status and arrange

• Positive HIV antibody in a child under 18 months, OR No HIV test result in a child AND • Two or more HIV-related conditions	SUSPECTED SYMPTOMATIC HIV INFECTION	➢ Give Cotrimoxazole Prophylaxis ➢ Treat HIV-related conditions present (e.g., thrush) ➢ Give multivitamin ➢ Assess the child's' feeding counsel as necessary ➢ Advise on benefits of HIV refer for VCT (for both and child) ➢ Advise the mother on home care ➢ Follow-up in 14 days

• Positive HIV antibody in a child under 18 months, OR • Mother HIV Positive	POSSIBLE HIV INFECTION or (HIV EXPOSED)	➢ Give appropriate feeding advice ➢ Treat HIV-related conditions if present ➢ Give Cotrimoxazole prophylaxis and for HIV at 18 months (If child still breastfed repeat HIV testing 3 months after stopping breastfeeding) ➢ Assess child's feeding and counsel as necessary ➢ Follow-up in 14 days

• Not enough signs to classify as symptomatic OR •possible HIV infection	HIV INFECTION UNLIKELY	➢ Treat, counsel and f/up existing infections; advise on home care ➢ Encourage HIV testing

Assess and classify the child for tuberculosis

SIGNS	CLASSIFY AS	IDENTIFY TREATEMENT
Contact with a known MDR TB patient	Suspected MDR TB	►Advise mother on the need of referral ►Refer Urgently to Hospital for MDR TB investigation and Treatment
➢Contact with TB patient And two or more of the signs / One or more of the signs if known HIV+ And/ Or ➢A sign AND AFB/GeneXpert +ve Or ➢A sign AND Chest X ray suggestive of TB (eg. meliary pattern	TB	► Council the mother on DOTS principle ► Advise mother to bring any other contacts ► Do provider initiated HIV testing and Counseling ► Link to TB clinic for initiation of treatment and follow up

Assess and classify the child for tuberculosis…

SIGNS	CLASSIFY AS	IDENTIFY TREATEMENT
➢Contact to TB patient (non—MDR) and no other finding	**TB Exposed Child**	► Council the mother on the diagnosis of TB exposure and the need for INH prophylaxis ► Link to TB clinic for INH prophylactic-treatment initiation and follow
➢No conclusive sign & ➢ No Contact with TB patient ➢AFB/GeneXpert – ve And ➢ Chest X– ray not suggestive	**No TB Infection**	►Look and treat for other causes for the main compliant ► Council the mother on the need for INH prophylaxis in the presence of HIV infection for HIV +ve children ► Link to TB clinic for INH prophylactic-treatment initiation and follow up for HIV +ve children ► Follow up in 30 days

Immunization status

	AGE	VACCINE	
IMMUNIZATION SCHEDULE	Birth	BCG	OPV-0
	6 weeks	DPT1-HepB1-Hib1, Rota1, PCV1	OPV-1
	10 weeks	DPT2-HepB2-Hib2, Rota2, PCV2	OPV-2
	14 weeks	DPT3-HepB3-Hib3, PCV3	OPV-3
	9 months	Measles	Vitamin A (if not given with in last 6 months)

Observe contraindications of immunization

- There are only three situations at present that are contraindications to immunization:

1. **Do not give BCG** to a child known to have SYMPTOMATIC HIV INFECTION.
2. **Do not give DPT2-HepB2-Hib2 or DPT3-HepB3-Hib3** to a child who has had convulsions or shock within 3 days of the most recent dose.
3. **Do not give DPT-HepB-Hib** to a child with recurrent convulsions or another active neurological disease of the central nervous system

Immunization …

- Children with diarrhoea who are due for OPV should receive a dose of OPV (oral polio vaccine) during this visit. However, **do not count the dose**. The child should return when the next dose of OPV is due for an extra dose of OPV.
- In all other situations, here is a good rule to follow: **There are no contraindications to immunization of a sick child if the child is well enough to go home.**

Finally we have to:

- ✓ Assess other problems
- ✓ Counsel the mother about her own health

Example of referral note

Date/hr

Urgent referral to Gondar University Referral Hospital

Child name: - Birhanu Asfaw, age 12 months

Referred for:

SEVERE DEHYDRATION
SEVERE MALNUTRITION
Also has cough – no fast breathing, no chest indrawing

Treatment given at poly Health Center:

Vitamin A 200 000 IU
ORS – Mother to give sips on the way to hospital

Needs measles immunization – not given

Teach the mother to give oral drugs at home

- Follow the instructions below for every oral drug to be given at home.
- Also follow the instructions listed with each drug‘s dosage table.
- Determine the appropriate drugs and dosage for the child‘s age or weight.
- Tell the mother the reason for giving the drug to the child.
- Demonstrate how to measure a dose.
- Watch the mother practice measuring a dose by herself.
- Ask the mother to give the first dose to her child.
- Explain carefully how to give the drug, then label and package the drug.
- If more than one drug will be given, collect, count and package each drug separately.

Give an Appropriate Oral Antibiotic

FOR DYSENTRY: Give Ciprofloxacin First-Line antibiotic: oral Ciprofloxacin		
AGE	CIPROFLOXACIN Give 15mg/kg two times daily for 03 days	
250 mg Tablet	500mg Tablet	
Less than 6 months	1/2	1/4
6 months up to 5 years	1	1/2

Give an Appropriate Oral Antibiotic

- FOR PNEUMONIA, ACUTE EAR INFECTION OR VERY SEVERE DISEASE*
  FIRST LINE ANTIBIOTIC: Oral Amoxicillin

AGE OR WEIGHT	AMOXICILLIN** Give two times daily for 05 days		
	250 mg Dispersible Tablet (DT)	125 mg Dispersible Tablet (DT)	250mg Syrup
2 months up to 12 months (4 <10 kg)	1	2	5ml
12 months up to 3 years (10 <14 kg)	2	4	10ml
3 years up to 5 years (14 19 kg)	3	6	15ml

For severe pneumonia or very severe disease use oral Amoxicillin as pre-referral treatment if IV or mpicillin and Gentamycin not available.

Amoxicillin is the recommended first-line drug of choice in the treatment of pneumonia due to its fficacy and increasing high resistance to Cotrimoxazole.

FOR CHOLERA:

First-Line Antibiotic for Cholera: **AMOXICILLIN**

Second-Line Antibiotic for Cholera: **TETRACYCLIN**

AGE or WEIGHT	AMOXICILLIN	TETRACYCLIN ➢ Give four times daily for 3 days
	See doses above	CAPSULE 250mg
2 months up to 4 months (4-6 kg)		
4 months up to 12 months (6-10 kg)		½
12 months up to 5 years (10-19 kg)		1

***Follow the latest national recommendation accordingly

FOR SEVERE ACUTE MALNUTRITION :

Give Amoxicilin for 7 days

First-Line Antibiotic: **AMOXICILLIN**

WEIGHT	AMOXICILLIN Give 2 times daily for 7 days		
	SYRUP 125mg per 5 ml	DISPERSIBLE TABLET (DT) 250mg	DISPERSIBLE TABLET (DT) or CAPSULE 500mg
< 5 kg	5 ml	½	
5-10 Kg	10 ml	1	
10-20 kg	20 ml	2	1
20-35 kg		2½	1½
>35 kg			2

Give extra fluids for diarrhea and continue feeding

PLAN A: treat diarrhea at home

- Counsel the mother on the **4 RULES** of home treatment:

  Give extra fluids, give zinc supplements, continue feeding, when to return

1. GIVE EXTRA FLUIDS TELL THE MOTHER:

- Breastfeed frequently and for longer at each feed.
- If the child is exclusively breastfed, give ORS in addition to breast milk. If the child is not exclusively breastfed, give one or more of the following: ORS Solution, food-based fluids (such as soup, rice water and yoghurt drinks), or clean water.

- Teach the mother how to mix and give **ORS.** Give 2 packets of ORS to use at home. Show the mother how much fluid to give in addition to the usual fluid in-take… **10 ml/kg.**
  - ✓Up to 2 years 50 to 100 ml after each loose stool.
  - ✓2 years or more 100 to 200 ml after each loose stool

2.GIVE ZINC SUPPLEMENTS : TELL THE MOTHER HOW MUCH ZINC TO GIVE:

- ✓0-6 months- 1/2 tablet for 10 days
- ✓6 months or more - 1 tablet for 10 days

SHOW THE MOTHER HOW TO GIVE ZINC SUPPLEMENTS

- ✓ Infants- dissolve tablet in a small amount of expressed breast milk, ORS or clean water in a cup
- ✓ Older children- tablets can be chewed or dissolved in a small amount of clean water in a cup

3. CONTINUE FEEDING

4. WHEN TO RETURN COUNSEL THE MOTHER

Plan B: Treat Some Dehydration with ORS

•Give in clinic recommended amount of ORS over 4-hour period .

•DETERMINE AMOUNT OF ORS TO GIVE DURING FIRST 4 HOURS

AGE	**Up to 4 months**	**4 - 12 months**	**12 mo - 2 years**	**2 - 5 years**
Weight in kg	<6 kg	6-10kg	10-12 kg	12-19 kg
ORS in ml	200-400	400-700	700-900	900-1400
ORS in coffee cups	3-6	6-10	10-13	13-20

Plan B…

- Use the child's age only when you do not know the weight.
- The approximate amount of ORS required - **75ml/kg.**
- If the child wants more ORS than shown, give more.
- For infants under 6 months who are not breastfed, also give 100-200 ml

SHOW THE MOTHER HOW TO GIVE ORS SOLUTION:

- Give frequent small sips from a cup.
- If the child vomits, wait 10 minutes. Then continue, but more slowly. Continue breastfeeding whenever the child wants.

AFTER 4 HOURS:

Reassess the child and classify the child for dehydration.

Select the appropriate plan to continue treatment.

Begin feeding the child in clinic.

IF THE MOTHER MUST LEAVE BEFORE COMPLETING TREATMENT:

Show her how to prepare ORS solution at home.

Show her how much ORS to give to finish 4-hour treatment at home.

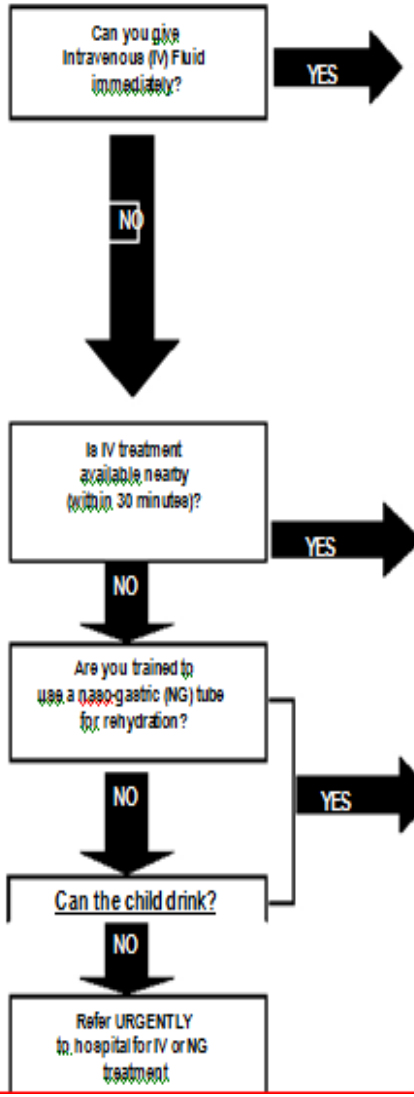
Give her enough ORS packets to complete rehydration. Also give her 2 packets as recommended in plan A.

Explain the 4 Rules of Home Treatment:

1.GIVE EXTRA FLUID
2. GIVE ZINC
3. CONTINUE FEEDING
4. WHEN TO RETURN

See Plan A for recommended fluid and See COUNSEL THE MOTHER chart

Plan C: Treat Severe Dehydration



☐ Start IV fluid immediately. If the child can drink, give ORS by mouth while the drip is set up. Give 100ml/kg Ringer's Lactate Solution (or, if not available, normal saline), divided as follows:

AGE	First give 30 ml/kg in:	Then give 70 ml/kg in:
Infants (under 12 months)	1 hour*	5 hours
Children (12 months up to 5 years)	30 minutes*	2 ½ hours

* Repeat once if radial pulse is still very weak or not detectable

☐ Reassess the child every 1-2 hours. If hydration status is not improving, give the IV drip more rapidly.

☐ Also give ORS (about 5 ml/kg/hour) as soon as the child can drink: usually after 3-4 hours (infants) or 1-2 hours (children).

☐ Reassess an infant after 6 hours and a child after 3 hours. Classify dehydration. Then choose the appropriate plan (A, B, or C) to continue treatment.

☐ Refer URGENTLY to hospital for IV treatment.

☐ If the child can drink, provide the mother with ORS solution and show her how to give frequent sips during the trip

☐ Start rehydration by tube (or mouth) with ORS solution give 20 ml/kg/hour for 6 hours (total of 120 ml/kg)

☐ Reassess the child every 1-2 hours:

- If there is repeated vomiting or increasing abdominal distension, give the fluid more slowly. - If hydration status is not improving after 3 hours, send the child for IV therapy.

☐ After 6 hours, reassess the child. Classify dehydration. Then choose the appropriate plan (A, B, or C) to continue treatment.

NOTE:

If the child is not referred to hospital, observe the child at least 6 hours after rehydration to be sure the mother can maintain hydration giving the child ORS solution by mouth.

Thank you for any question, you can ask using the following address

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Stay at home! Be safe from COVID-19