1 Pediatric Case-Presentation

Though the basic art of history-taking & examination in Pediatrics remain almost the same as in Adults, there are a few important differences.

For e.g: the Antenatal, Birth, Perinatal history or the detailed history of the developmental milestones assumes great importance in children, whereas they are irrelevant in adults. Similarly anthropometric measurements are very important in children whereas they are of hardly any significance in adults.

The relevant details of History-taking & Examination in children are discussed in-depth in the following chapter (Chapter 2). The Schematic approach is discussed below in short in Tabular form for easy reference

Schematic Approach of a Pediatric Case Presentation

1.1 History

Left-hand side history	Chief history
Birth & Perinatal History ▸ Pedigree Chart ▸ Antenatal History ▸ Immediate Postnatal history ▸ Relevant details regarding other siblings	**Basic information** ▸ Informant being mother/father/guardian ▸ Name, age, sex of child ▸ Born of consanguinous/non-consanguinous marriage ▸ Religion ▸ Residence (Permanent residence) ▸ Hailing from native place
Immunization History Primary & Booster doses if received	**Chief Complaints** In Chronological order: e.g : ▸ Fever 20 days ▸ Convulsions 8 days ▸ Unconsciousness 5 days
Developmental History Relevant History regarding developmental milestones	**ODP of Chief Complaints** Detailed story of the presenting complaints in chronological order with a detailed symptom & system review
Dietary History ▸ Duration of breast-feeding ▸ Type & time of weaning ▸ Calorie & protein intake of the food to be calculated	**Past History** ▸ History of similar illness in the past ▸ History of other significant diseases in the past ▸ History of common infectious illness like exanthematous illness (Measles), Tuberculosis
Socioeconomic History ▸ Educational background of parents ▸ Monthly income of family ▸ Number of persons in family ▸ Number of rooms ▸ Housing conditions etc.	**Treatment History** ▸ Detailed History regarding the treatment received ▸ History of Prior Hospitalization **Family History** ▸ History of similar illness in family/siblings ▸ History of Tuberculosis in the family.

1.2 Examination

General Examination

- Attitude & Posture of the Patient
- Level of Consciousness of the patient
- Vital Parameters — Temperature, Pulse, Respiration, Blood Pressure
- Anthropometry

Parameter	Percentiles	Expected (ICMR)
▪ Weight-for-age ▪ Height-for-age ▪ Head Circumference ▪ Mid-arm Circumference (between 1–5 years of age) ▪ Chest Circumference ▪ Upper Segment / Lower Segment ratio		

- Pallor; Cyanosis; Clubbing; Lymphadenopathy; Icterus; Edema etc.
- **Examination of Head, Face & Neck :** Shape of head, Presence or absence of facial dysmorphic features, Anterior fontannel, Posterior fontannel, Craniotabes, Macewan's sign, Transillumination of skull, Auscultation of skull, Abnormalities of eyes, ears, nose, mouth & chin; Examination of Mouth & Throat; Examination of the neck (for any swellings, raised JVP etc.); Thyroid gland enlargement etc.
- Evidence of Protein or Vitamin deficiency
- Examination of Skin, hair & nails
- Examination of Bones, Joints & Spine
- Examination of Genitalia
- Developmental Assessment

Systemic Examination

Depending on the history, detailed examination of a particular system should be done while examining the other systems briefly.

Respiratory System Examination

Examination of the Upper Respiratory Tract

Throat, tonsils, pharynx, frontal & maxillary sinuses etc.

Examination of chest

Inspection

Shape of chest, Examination of shoulders & spine, Respiratory movements, Respiratory rate & rhythm, use of accessory muscles of respiration (suprasternal, subcostal, intercostal retractions), Apex impulse, Traile's sign, Pulsations, venous distension, scars over the chest etc.

Palpation

Palpation of chest is mainly done to corroborate the findings of Inspection :

- Respiratory movements
- Palpation of the trachea & the Apex beat
- Tactile vocal fremitus

Percussion

It is difficult to elicit signs in young children. Areas percussed are :

- Clavicular percussion on either side
- Delineate the liver dullness on the right side & the cardiac dullness on the left side
- Percuss anteriorly over both the lung fields, in the axilla & posteriorly over the suprascapular, interscapular & infrascapular areas & determine if the percussion note over the lung fields is hyper-resonant, dull, stony dull, impaired or tympanic.

Auscultation

The following things are noted while auscultating the chest :

- Breath sounds : Intensity (normal or decreased) & quality (vesicular, bronchial or broncho-vesicular)
- Vocal resonance
- Other miscellaneous sounds like rales, rhonchi, pleural friction rub etc.

Cardio-vascular System Examination

Inspection

Precordium (normal or bulging); Apex impulse; Pulsations over the chest; dilated veins over the chest.

Palpation

- Apex beat : Position, Character(normal, tapping, heaving)
- Parasternal heave & diastolic shock
- Thrills

Percussion

Percussion is not very useful & reliable in young children. The borders of the heart (Upper, Right, Left & lower) can be defined in older children. Pericardial Effusion may be detected by percussion

Auscultation

- ***Heart sounds :*** Intensity of the sounds (loud or soft); Splitting of the 2nd sound (normal, wide, fixed or variable, reversed split); Presence of 3rd or 4th heart sounds.
- ***Murmurs :*** Timing of the murmur (e.g. Systolic, diastolic etc.); Loudness of murmur (Grade — 1 to 6); Location of maximum intensity of the murmur; Radiation of murmur; Posture in which the murmur is best heard; Change in the murmur with change in respiration or after exercise.
- ***Miscellaneous sounds :*** Ejection clicks (aortic or pulmonary); Opening snap or Pericardial rub.

Per-Abdominal Examination

Inspection

Shape of the abdomen; movements of the abdomen; Peristaltic movements; Umbilicus; Dilated veins, pulsations, scars or sinuses over the abdomen

Palpation

- Tenderness, guarding or rigidity.
- Palpation of organs
  - Liver — Normal or enlarged; edge; Surface, borders; tenderness etc.
  - Spleen — Not palpable or enlarged.
  - Kidneys — Ballotable or not.
- Palpation of any other lump over the abdomen.

Percussion

Shifting dullness; horse-shoe shaped dullness; fluid thrill.

Auscultation

Peristaltic sounds or bruits over the abdomen or the liver.

Central Nervous System Examination

Higher Functions

- Consciousness
- Orientation (of person, place & time)
- Speech
- Memory & Intelligence

Cranial Nerves

Cranial Nerves	Examination
1st	Sense of smell in each nostril
2nd	Visual acuity, Visual field, Colour vision, Fundus (Ophthalmoscopic examination)
3rd, 4th & 6th	External ocular movements, Nystagmus, Ptosis, Diplopia, Squiant, Pupils
5th	Facial sensations; Motor function of Massetter, Temporalis & Pterygoid muscles; Conjunctival & Corneal reflexes; Jaw Jerk
7th	Taste sensation over anterior ⅔rd of tongue; Facial muscle function (ask the patient to raise his eyebrows, close his eyes tightly, show his teeth, blow his cheeks etc)
8th	Ringing of bell, Rinne's test & Weber's test
9th & 10th	Sensations over posterior ⅓rd of tongue (9th nerve); Palatal movements & movements of uvula on speaking with the mouth open; Gag reflex; Nasal regurgitation, Nasal twang in voice (10th nerve)

Table continued on next page

Cranial Nerves	Examination
11th	Sternocleidomastoid & Trapezius muscle function
12th	Movements of tongue at rest & after protusion

Motor System Examination

- **Posture** of the limbs
- **Nutrition** of the muscles — Normal, atrophy or hypertrophy
- **Tone** of the muscles — Normal, Hypotonia or hypertonia
  - Palpation of muscles
  - Posture of limbs
  - Range of passive movements
  - Specific tests in infants — Scarf sign, heel-to-ear manouvre, adductor angle and ankle dorsiflexion
- **Power** of the muscles — grade 0 to V
- **Co-ordination** in older children (> 6–7 years of age) & only if power > III / V

  Tests : Gait of patient, tandem walking, Finger-nose test, Rebound test, Dysdiadochokinesia, Knee-heel test, Rhomberg's test.
- **Involuntary movements :** Tremors, Athetosis, ballismus, myoclonus, Chorea, dystonia.
- **Reflexes**
  - ***Superficial reflexes :*** Plantars, abdominal reflexes, Cremasteric reflexes, anal reflex.
  - ***Deep tendon reflexes :*** Biceps, Triceps, Supinator, Knee Jerk, Ankle Jerk (Grade 0 to 4+)

Sensory System Examination

- **Superficial sensations :** Touch, Pain & Temperature.
- **Deep sensations :** Vibration & Position.
- **Cortical sensations :** Tactile localization, Tactile discrimination & Stereognosis.

Signs of Menigeal Irritation

Neck Stiffness, Kernig's sign and Brudzinksi's sign.

Cerebellar Signs

Staccato speech, Ataxic Gait, Hypotonia, Nystagmus & Inco-ordination (Rhomberg's test, finger-to-finger test, dysdiadochokinesia etc.)

Diagnosis

The closest diagnosis or a Differential diagnosis (D/D) should be offered after the examination findings; depending on the particular case. This will be discussed individually along with the respective cases.

§§§

2 The Art of History-taking & Examination in Pediatrics

2.1 History

Chief History

Basic Information

The basic information as discussed in Chapter 1 is usually provided by the mother, father or a close relative in children. However, an older child can definitely provide useful bits of information. In fact, in older children the child himself should be able to provide Information regarding the chief complaints & the ODP. The other information like the Birth history etc. can be provided by the mother.

Chief Complaints

The complaints with which the patient presented to the doctor should be elicited & noted in chronological order. e.g. Cough since 7 days; Fever since 2 days.

ODP of Chief Complaints

After recording the chief complaints, an attempt must now be made to ascertain the onset of symptoms, their duration & the progress of symptoms individually. Thus, for example in the above case:

Cough: Onset – Abrupt or insidious; Duration; Frequency; Nature – Productive or Dry; Character – barking cough or paroxysmal cough; Variation with the time of the day – more during night or immediately after waking up in the morning; Variations with posture – more in supine position & less in sitting position etc.

Fever: Onset – sudden or insidious; Severity – mild, moderate or high; Duration; Character – continuous throughout the day or intermittent; Diurnal variation – e.g. Evening rise of temperature in Tuberculosis; Association with rigors etc.

Past History

The mother should be asked about the detailed past history of the child-whether he suffered from similar illness in the past. This assumes great significance in chronic diseases such as Asthma where the history of repeated attacks of breathlessness in the past would help in immediately clinching the diagnosis. History of other diseases suffered in the past such as Tuberculosis, Measles, Jaundice etc. should also be asked as for e.g. Tuberculosis in the past may lead to Bronchiectasis or Measles may predispose to Malnutrition or may trigger TBM.

Treatment History

The treatment history is relevant in case of chronic diseases like Epilepsy where the patient is on daily anti-convulsant therapy or in Tuberculosis where an inquiry can be made as to how many months the medicines have been taken. History of prior hospitalization is also important to determine the chronicity of the disease.

Family History

The family history assumes significance in case of genetic diseases e.g. X-linked diseases like Ducchene Muscular dystrophy where history of similar illness in the maternal uncle should be sought for. Family history also assumes significance in case of infectious diseases like Tuberculosis. Thus in every child with a suspicion of Tuberculosis, history of contact with an adult patient of Tuberculosis should always be sought for.

The Left-Hand Side History

The left-hand side history (i.e: Birth history, Immunization history, developmental history, dietary history & the socio-economic history) should be taken in details as they are especially relevant in children.

BIRTH HISTORY

A detailed Birth History & family pedigree should be enquired & a pedigree chart should be prepared. Fig 2.1 shows a few guidelines as to the construction of the Pedigree chart.

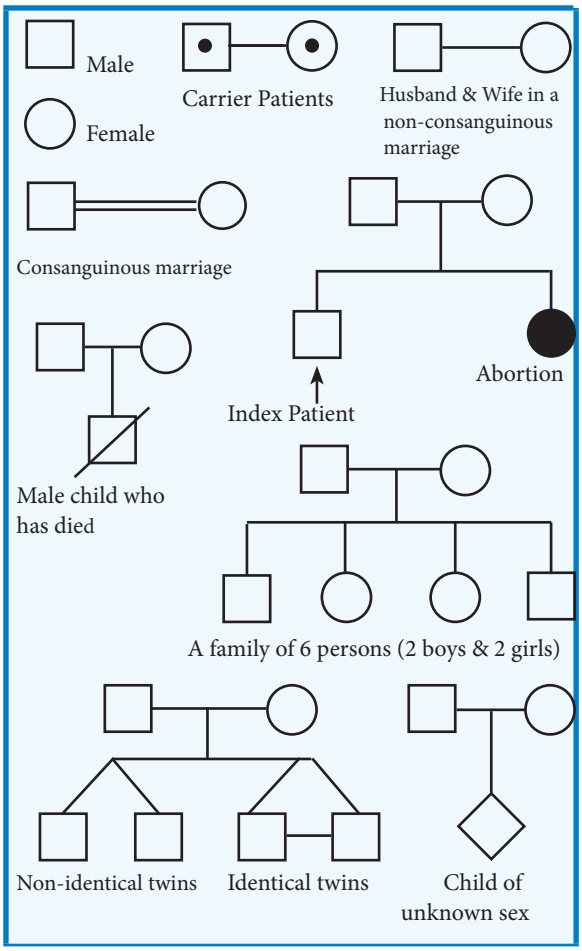

Figure 2.1 : Few general guidelines for construction of Pedigree chart

The **Antenatal History** is to be inquired in detail.

- Whether Mother was antenatally registered at some clinic / hospital/ Health centre.
- At what month was she registered.
- Whether she suffered from any infection/disease during pregnancy eg. fever with rash (Rubella)
- Whether she suffered from other conditions like Hypertension (HT) or Diabetes (DM) as they can predispose to certain ailments.
  - Hypertension — IUGR
  - Diabetes Mellitus — Congenital Heart Lesions like TGA
- Whether she was on any drugs except for Vitamins / Calcium supplements
- Whether she received 2 doses of TT injection during pregnancy.

Perinatal History

- Whether the child was Full term; Pre-term or Post-term.
- Born normally (vaginally) or by Caesarean section or with help of Forceps or Vacuum
- Born at Hospital or at home.
- If born at home, whether the Cord was cut by a sterile blade or not.
- Whether the child cried immediately or required some sort of resuscitation like Oxygen, Artificial ventilation.

Immediate Postnatal History

- Whether the child developed Icterus, Cyanosis.
- Whether the child had fever, convulsions.
- Whether the child was breast-fed or was on Top feeds.
- The number of days the child was kept in the hospital.

IMMUNIZATION HISTORY

- Ask for Immunization History, regarding administration of BCG, Polio, DPT, Measles, Boosters (depending on the age of the child).
- Look for the BCG Scar on the deltoid of the Left arm to confirm the history regarding BCG administration.

National Immunization Schedule

The national immunization schedule has recently seen addition of a number of vaccines namely Hep-B vaccine, MMR vaccine, HIB, IPV & Rotavirus vaccines to the previous ones. The schedule is discussed in Table 2.1.

Newer Vaccines

In addition to the vaccines discussed in the National Immunization schedule there are quite a few new vaccines which have become available in recent times. These vaccines include:

- Acellular Pertusis Vaccine
- Pneumococcal Vaccine
- Typhoid Vaccine

- Varicella (Chickenpox Vaccine)
- Hepatitis-A Vaccine
- Influenza Vaccine
- Human Papilloma Virus Vaccine
- Meningococcal Vaccine
- Japanese Encephalitis Vaccine
- Cholera Vaccine
- Rabies vaccine
- Yellow fever vaccine

Also, Combination vaccines involving more than one antigens are also available. These Newer & Combination vaccines are discussed in detail in chapter 14. Salient features regarding these vaccines are given in tabular form (Table 2.2). Recommendations for vaccination of HIV-infected children are discussed in Table 2.3 (page 14). It has been recommended that the newer vaccines be given to children only after a proper discussion with the parents about the pros & cons of the vaccines. These are Optional vaccines to be administered by the practising Pediatrician based on the parent's choice & his personal discretion.

Table 2.1 : National Immunization Schedule

Vaccine	Age of Administration	Route	Site	Dose	General Notes
BCG	Birth	Intradermal	Left deltoid	0.1ml	Should be given before 1year if it not given at the time of birth
OPV	Birth, 6 weeks, 10 weeks, 14 weeks, B_1 – 18 months, B_2 – 4½ years to 5 years	Oral	Oral	2 Drops	Primary Schedule should be completed before 1year of age
DPT	6 weeks, 10 weeks, 14 weeks, B_1 – 18 months, B_2 – 4½ years to 5 years	Deep IM	Anterolateral aspect of thigh	0.5 ml	Primary Schedule should be completed before 1 year of age. For 2nd booster, DT should be used
MR Vaccine	9 months	SC	Deltoid	0.5 ml	Can be given before 9 months of age in high-risk cases (repeat dose after 6 months)
TT	10 years & 15–16 years	Deep IM	Deltoid	0.5 ml	2 doses at 1 month interval should be given to pregnant women
Hepatitis-B (HB)	Birth, 1 month, 6 months Or Birth, 6 weeks, 14 weeks Or 6 weeks, 10 weeks, 14 weeks	IM	Deltoid or anterolateral aspect of thigh	0.5 ml	Hepatitis-B can be given to older children following the same route of administration and the Schedule of 0, 1 & 6 months. The dose is 1 ml for children above 12 years of age
MR/ MMR Vaccine	15 – 18 months	SC	Deltoid	0.5 ml	Can be given at any age above 15 months of age (Specially to girls at Puberty, because of the risk of Rubella during pregnancy causing fetal malformations)
DT	4½ years to 5 years	Deep IM	Deltoid or anterolateral aspect of thigh	0.5 ml	In children in whom Pertussis vaccine is contra-indicated, DT should be used even for the primary immunization schedule.

Table continued on next page

Table 2.1 : National Immunization Schedule

Vaccine	Age of Administration	Route	Site	Dose	General Notes
H. Influenzae-B Vaccine (HiB)	6 weeks, 10 weeks, 14 weeks, 16–18 months **In case of Lapsed doses :** *7–14 months of age :* 2 doses at 2 months interval *12–15 months of age :* 1 dose Followed by a booster after 18 months *>18 months of age :* Single dose only	IM	Anterolateral aspect of thigh	0.5 ml	HiB is given in the form of Combined DPT & HiB vaccine at 6, 10 & 14 weeks of age at Public health centres
Inactivated Polio Vaccine (IPV)	▸ 6 weeks, 10 weeks, 14 weeks & 1½ years However, due to the severe scarcity of IPV, the GOI follows a 2-dose schedule of intradermal IPV (along with bOPV) at 6 weeks & 14 weeks	IM / Intradermal	Anterolateral aspect of thigh or Deltoid	0.5 ml (IM) or 0.1 ml (Intradermal)	Use of OPV (Scheduled doses & Pulse Polio) to be continued in those receiving IPV

Table 2.2 : Non-EPI vaccines

Vaccine	Age of Administration	Route & Dose	Remarks
Acellular Pertussis Vaccine (Available in combination with Diphtheria & Tetanus as DTaP & Tdap)			
▸ DTaP	Same as that of DPT	0.5ml IM Anterolateral aspect of thigh	As Acellular Pertussis is considerably less reactogenic than whole-cell Pertussis, it may be recommended to children from affording sections of the society instead of whole-cell pertussis vaccine following a proper discussion with parents. However, recent studies suggest better immunogenecity with whole cell vaccine
▸ Tdap	▸ *Fully immunized :* 1 dose of Tdap, preferably at 10–12 years of age followed by 1 dose of Td at 15 yrs ▸ *Incompletely immunized :* 1 dose of Tdap followed by 1 dose of Td ▸ *Non-immunized :* 1 dose of Tdap followed by 2 doses of Td	0.5 ml IM Anterolateral aspect of thigh or Deltoid	
Td vaccine	▸ *1st dose :* 10 years of age ▸ *2nd dose :* 15–16 years of age	0.5 ml IM Anterolateral aspect of thigh or Deltoid	Administration of Tdap is preferred over Td at 10 years of age as it boosts the dipping immunity levels to Pertussis.
Human Papilloma Virus Vaccine (HPV) ▸ Cervarix™ ▸ Gardasil™	**Age of Administration :** Both the vaccines are currently recommended to be given to girls before Puberty (before sexual contact) i.e : at about 10–11 years of age. ▸ Cervarix™ : 3 doses at 0, 1 month & 6 months ▸ Gardasil™ : 3 doses at 0, 2 months & 6 months	0.5 ml IM Deltoid	Presently recommended only to girls from affluent section of the society after discussing the pros & cons of the vaccine with the parents. According to the latest studies, the vaccine can also be given to non-vaccinated females upto the age of 45 years.

Table 2.2 : Non-EPI vaccines

Vaccine	Age of Administration	Route & Dose	Remarks
Typhoid Vaccine			
➤ Whole-cell vaccine (AKD Preparation)	Greater incidence of side-effects noted. Efficacy almost equal to newer vaccines, but not available nowadays. Hence not discussed any further.		
➤ Oral $Ty21_a$ Vaccine	Not available in our country. Hence not discussed any further.		
➤ Vi-Antigen ▪ ***Vi-polysacharide vaccine***	After 2 years	0.5ml SC / IM Single dose Booster every 3 years	Vi-polysaccharide vaccine is freely available all over India. Minimal incidence of side-effects noted.
▪ ***Vi-conjugate***			
¤ Pedatyph™	*As recommended by manufacturer* ***Primary dose*** (> 3 mths of age) : 1 dose ***Booster doses*** : ➤ One dose followed by booster after 2½–3 years of primary dose	0.5ml IM	Expert opinion in India favours further large-scale studies for vaccine efficacy to be conducted for Pedatyph.
¤ Typbar-TCV® / Zyvac-TCV®	> 6-9 months of age : Single dose Booster dose : After 3 years of age	0.5 ml IM	Good efficacy noticed in preliminary studies
Meningococcal Vaccine ➤ Polysaccharide vaccine ➤ Conjugate vaccine ▪ ***Quadrivalent*** ▪ ***Monovalent Group A*** ➤ Recombinant Group B vaccine (Not available in India at present)	**Polysaccharide Vaccines** ➤ *Primary doses* ▪ 3 months to 2 years : 2 doses at an interval of 3 months ▪ > 2 years : 1 dose only ➤ *Booster doses* ▪ 1st dose < 4 years of age : 1 dose 3 years after the primary dose ▪ 1st dose > 4 years of age : 1 dose 4–5 years after the primary dose **Conjugate Vaccines (Quadrivalent)** ➤ *Primary doses* ▪ > 10–55 years : 1 dose (2 doses for patients with asplenia, HIV) ➤ *Booster doses* ▪ 1st dose between 11–16 years of age : 1 dose at 16–18 yrs of age ▪ 1st dose > 16 years of age : Booster not recommended ▪ Immunocompromised patients : Booster every 5 years **Monovalent Group A vaccine** ➤ *1–29 years of age :* Single dose ➤ *Booster :* Not recommended	0.5 ml SC (Polysaccharide vaccine) **Or** IM (Conjugate vaccine). Deltoid or Anterolateral aspect of thigh	Recommended to : ➤ In Epidemics of Meningococcal Meningitis ➤ In Children with Asplenia (Anatomic or functional) ➤ Children with complement system deficiences ➤ In Close contacts of individuals afflicted with Meningococcal disease ➤ Students & tourists to US or African countries

Table 2.2 : Non-EPI vaccines

Vaccine	Age of Administration	Route & Dose	Remarks
Varicella (Chickenpox) Vaccine	**1–12 years of age** › *1st dose :* 12–15 months of age › *2nd dose :* 5–6 years of age (The minimum interval between 2 doses should be 3–4 months) **>12 years of age** › 2 doses at an interval of 1½ – 2 months	0.5ml SC Deltoid or Anterolateral area of thigh	Costly. Optional vaccine. May be recommended to following patients: › Immunocompromised children ▪ HIV-affected children ▪ Children on steroids or immunosuppresive drugs ▪ Children with Leukemia ▪ Children with Nephrotic syndrome › Adolescents & adults (As the disease increases in severity with advancing age) › In Close contacts of patients with Chickenpox (Contacts without h/o Chickenpox affliction)
Pneumococcal Vaccine › 23-Valent	*< 2 years of age :* Not recommended *> 2 years of age :* 1 dose of vaccine followed by booster dose (as below) *Booster dose :* 3–5 years after the 1st dose	0.5ml IM / SC Deltoid or Anterolateral aspect of thigh	Recommended to : › In Children with Asplenia (Congenital or Acquired – After Splenectomy) › Immunocompromised children such as in : ▪ HIV ▪ Diabetes Mellitus ▪ Chronic diseases ▪ Chronic cardiac diseases ▪ Chronic lung disease ▪ Nephrotic Syndrome ▪ CRF
› Protein Conjugate Vaccine ▪ PCV_{13} ▪ PCV_{10}	*2–6 months of age :* 3 doses at 6–8 weeks interval + 1 Booster at 12–15 months *7–11 months of age :* 2 doses at 6–8 weeks interval + 1 Booster(15 mths) *12–23 months of age :* 2 doses at 6–8 weeks interval *> 2years of age :* 1 dose only	0.5ml IM, Deltoid or Anterolateral aspect of thigh	Indications for Immunization are same as that for 23-valent vaccine. However, in addition, it can also be used as an Optional vaccine for Primary immunization of infants from affluent families after a proper discussion with parents regarding the pros & cons of the vaccine. If possible, attempt should be made to complete vaccination schedule of PCV_{13}/PCV_{10} with the respective vaccines only.

Table 2.2 : Non-EPI vaccines

Vaccine	Age of Administration	Route & Dose	Remarks
Rotavirus Vaccine › Rotarix™ › Rota Teq™ › Rotavac® › Rotasiil®	› Rotarix™ : 2 doses at age of 2 months & 4 months › Rota Teq™ : 3 doses at ages 2 months, 4 months & 6 months › Rotasiil™ : Same as RotaTeq™ › Rotavac® : 3 doses at 6 weeks, 10 weeks & 14 weeks of age	Per-Oral (PO)	› Rotavac® is being introduced in the EPI schedule in phases throughout the country › In case of Rotarix™, the 1st dose can be administered not later than 14 weeks & 6 days of age, whereas the 2nd dose can be given only upto 8 months of age (minimum interval between 2 doses should be 1 month) › The risk of Intussusception associated with the older Rotavirus vaccine has not been seen with the current vaccines in large studies done till now
Influenza Vaccine Types of Influenza vaccines : › Monovalent vaccine for Pandemic use › Trivalent influenza vaccine (TIV) for routine seasonal use ▪ ***Inactivated TIV*** ▪ ***Live attenuated Influenza vaccine (LAIV)*** › Quadrivalent inactivated influenza vaccine (TIV) for routine seasonal use	**Inactivated TIV / Quadrivalent TIV** › *Primary dose* ▪ 6 months–8 yrs of age : 2 doses at an interval of 1 month. ▪ > 8 years of age : 1 dose only › *Booster doses* ▪ At any age : 1 dose yearly **LAIV** › Single dose intra-nasally (In healthy individuals > 2 years of age)	**Inactivated TIV** › *6 months–3 years :* 0.25 ml IM › *> 3 years of age :* 0.5 ml IM **LAIV** 0.5 ml intra-nasal (½ the dose in each nostril)	In India, the influenza vaccine is not recommended to all children. It is advisable to offer Influenza vaccine (TIV) to selected children every year before the start of the flu season (which is commonly the monsoon months or the immediate post-monsoon months in India) with : › Congenital immunodeficiency syndromes › Acquired immunodeficiency due to either : ▪ AIDS ▪ Steroids ▪ Immunosuppressive drugs ▪ Cytotoxic drugs › Senior citizens (> 60–65 years of age) › Chronic diseases such as : ▪ Asthma ▪ Diabetes mellitus ▪ Chronic renal failure ▪ Chronic liver diseas ▪ Other chronic cardiac, hematologic or neurological diseases.

Table 2.2 : Non-EPI vaccines

Vaccine	Age of Administration	Route & Dose	Remarks
Hepatitis-A Vaccine	**Inactivated Aluminium-adjuvanted vaccine :** › *Havrix®* ▪ <18 years : *0.5 ml (720 EIU)* ▪ > 18 years : *1ml (1440 EIU)* › *Avaxim™* ▪ < 15 years : *0.5ml (80 U³)* ▪ > 15 years : *0.5 ml (160 U³)* **Inactivated Virosome-adjuvanted vaccine (Havpur™) :** › *For all ages > 1 year of age :* 0.5ml **Live attenuated vaccine (Biovac™-A)** › *For all ages > 1 year of age :* 0.5ml	› *For Inactivated vaccine :* IM, Deltoid or Antero-lateral aspect of thigh › *For Live attenuated vacine :* SC 2 doses should be administered at an interval of 6 months for all vaccines.	Costly. Optional Vaccine. May be recommended to following patients: › Children with chronic liver diseases (e.g : Hepatitis B/C chronic carriers) › Adolescents & adults (As the disease severity increases with increasing age) › Close contacts of patients with Hepatitis-A affliction (Contacts who have not suffered from Hepatitis-A infection) › Food handlers › Sewage workers › Medical Personnel
Cholera Vaccine Types of Cholera vaccines : › Parenteral vaccine › Oral vaccines ▪ ***Dukoral®*** ▪ ***Shanchol™***	**Parenteral vaccine** › *Primary doses* ▪ 1–2 years of age : 0.2 ml ▪ 2–10 years of age : 0.5 ml › *Booster doses* ▪ Recommended every 6 months if necessary **Dukoral®** › *> 2 years of age :* 2 doses at an interval of 1–6 weeks **Shanchol™** (Only vaccine available in India at present) › *Primary dose :* ▪ > 1 year of age : 2 doses of 1.5 ml at an interval of 2 weeks › *Booster dose* ▪ There are no specific recommendations regarding Booster doses till date	› *Route of administration* ▪ For Parenteral vaccine : IM/SC ▪ For Dukoral® & Shanchol™ : PO › *Site for Parenteral vaccine :* Deltoid or Anterolateral aspect of thigh › *Dosage :* As discussed in the types of vaccines.	It is not recommended for universal use. However, it can be administered to all age groups > 1 year of age for those who have a high probability of exposure to cholera (e.g : traveling to endemic areas or during cholera epidemics).
Yellow fever Vaccine	› *Primary dose* ▪ For all ages > 6 months of age : Single dose › *Booster doses* ▪ Single dose — 10 years after the primary dose (Indicated if continued protection is required)	0.5ml SC	Vaccination against yellow fever is compulsory for all travellers above 6 months of age traveling to endemic areas (countries) of Africa & South America. The list of areas & countries which are endemic can be ascertained from the government centres or on the internet.

Table 2.2 : Non-EPI vaccines

Vaccine	Age of Administration	Route & Dose	Remarks
Japanese Encephalitis Vaccine There are 2 main varieties : › Mouse brain-derived inactivated vaccine › Cell culture-derived vaccines ¤ Live attenuated SA14-14-2 vaccine ¤ Inactivated Vero-cell vaccines ◆ SA14-14-2 strain vacc ◆ Kolar strain vacc ¤ Live attenuated recombinant vaccine	**Mouse brain-derived vaccine** Not commonly used nowadays due to availability of cell-culture vaccines **Cell culture-derived vaccines** › *Live attenuated SA14-14-2 vaccine* ▪ Primary doses : 1 dose of 0.5ml above 9 months of age ▪ Booster doses : Not recommended › *Inactivated Vero-cell vaccines* ▪ SA14-14-2 strain vaccine ¤ 1-3 yrs of age : 2 doses of 0.25 ml at 4 weeks interval ¤ > 3 yrs of age : 2 doses of 0.5 ml at 4 weeks interval ¤ Booster : Not recommended ▪ Kolar strain vaccine ¤ > 1 year of age : 2 doses of 0.5 ml at 4 weeks interval ¤ Booster : Not recommended **Live attenuated recombinant vaccine :** Not available currently in India	› *Route of administration:* ▪ *SC* for Live attenuated SA-14-14-2 vaccine ▪ *IM* for vero-cell vaccines › *Site :* Deltoid or Antero-lateral aspect of thigh › *Dosage :* As discussed in the types of vaccines.	In India, expert opinion favours use of the safe & efficacious cell culture-derived live attenuated vaccine for immunizing all infants above 9 months to 1 year of age in endemic areas & all tourists to endemic areas in monsoon/post-monsoon months.
Rabies Vaccine There are 3 generations of anti-rabies vaccines › Nerve-tissue vaccines › Purified Duck embryo vaccine (PDEV) › Tissue-culture vaccines (HDCV, PCECV, PVRV) The nerve-tissue vaccines are rarely used nowadays. PDEV & tissue-culture vaccines are used commonly	All doses below are for PDEV & tissue-culture vaccines. **Pre-exposure Immunization** 3 doses IM on Days 0, 7 & 28 **Post-exposure Immunization** › *Intra-muscular schedule (Deltoid or antero-lateral thigh)* ▪ Essen Schedule : 5 doses on days 0, 3, 7, 14 & 28 with 6th optional dose on day 90 (for immunocompromised pts) ▪ Zagreb schedule : 2 doses on day 0, 1 dose on day 7 & 21 › *Intra-dermal Schedule* ▪ 2-site intra-dermal : ¤ Thai Red Cross Schedule (2–2–2–0–1–1) : 2 doses on days 0, 3, 7 & 1 dose on days 28 & 90 ¤ New Thai Red Cross Schedule (2–2–2–0–2–0) : 2 doses on days 0, 3, 7 & 28 ▪ 8-site intra-dermal ¤ 8–0–4–0–1–1 : 8 doses on day 0; 4 doses on day 7 & 1 dose on day 28 & 90 **Booster doses (For both pre-exposure & post-exposure immunization)** 2 doses on Days 0 & 3 (In lab workers requiring continued protection, 2 doses may be repeated every 5 years)		› Anti-rabies vaccines are indicated in Class II & III bites (WHO classification). In immunocompromised patients with Class II bites & in Class III bites, in addition to anti-rabies vaccines, Rabies immunoglobulin is also indicated. › The nerve-tissue vaccines being highly reactogenic & less potent than the newer tissue vaccines are now rarely used. › The intra-dermal route of administration is not recommended for Pre-exposure immunization, but is especially useful for post-exposure immunization in community settings due to its cost-effectiveness

Table 2.3 : Recommended Vaccines in HIV-Infected Children

Vaccine	Asymptomatic	Symptomatic
BCG	Yes	No
OPV	Yes	Yes*
DPT	Yes	Yes
Measles	Yes	Yes
MMR	Yes	Yes*
Hepatitis-B	Yes	Yes
HiB Conjugate	Yes	Yes
Typhoid (Vi antigen)	Yes	Yes
IPV	Yes	Yes
Varicella	Yes	No
Hepatitis-A	Yes	Yes
Pneumococcal	Yes	Yes
Influenza	Yes	Yes
Rotavirus	Defer use till further studies	
HPV	Yes	Yes*

**Not indicated in severely immunocompromised children*

DEVELOPMENTAL HISTORY

A detailed developmental history may not be essential in all cases; but nevertheless the achievement of a few basic milestones like social smile, head-holding, rolling over, sitting (with & without support) pull-to-stand, walking & development of language should always be inquired in all the cases. In children suspected to have delayed development or a CNS disorder, a detailed developmental screening should be undertaken.

The developmental history of other siblings should also be inquired as it can be compared to that of the patient. In older children, scholastic backwardness is an important indication of developmental retardation after ruling out organic causes (like deafness or myopia) & social causes (Poverty, Child labour). Similarly, social behavior & ability to play games or solve puzzles play an important role in determining the development of the older child.

Further details about the developmental milestones & the assessment of development are discussed later in the text.

DIETARY HISTORY

Ask the following details:

- Whether the child has been breast-fed or not.
- Exclusively breast-fed for what duration (how many months)
- If top-fed — whether it was Cow's milk or Formula-Milk
- If top-fed — what was the dilution used
- Whether he was bottle-fed or fed with a wati spoon
- If he was bottle-fed whether the bottle, nipple were washed regularly before each feed.
- For breast-feeding infants, the frequency, the type of schedule (time or demand), etc should be inquired into.
- Age of weaning, nature & amount of food given to the child should also be asked.
- In older children, food intake during 24 hours prior to the onset of illness should be inquired in detail so as to calculate the approximate calorie & protein intake per day.

Liquid Diet used in Hospital

RMP — Rice Moongdal Powder

Cereals	Rice	Moongdal
Proportions	3 Parts	2 Parts

RMP Powder can be given by Oral route or Ryle's tube (RT route) depending on the general condition of the patient. Table 2.4 describes the recipe of RMP Powder, whereas Table 2.5 describes the nutritive value of RMP Powder (per 100 ml)

Table 2.4 : Rice Moongdal Powder

	Oral Route	RT Route
RMP Powder	10 tsp	10 tsp
Liquid	300 ml	500 ml
Sugar	2 tsp	2 tsp
Oil	1 tsp	1 tsp
Salt	1 pinch	1 pinch
Quantity after cooking	275 ml	450 ml

Table 2.5 : Nutritive Value of RMP (Per 100 ml)

	Oral Route		RT Route	
	In Milk	In Water	In Milk	In Water
Calories	160	90	120	50
Proteins (gm)	6.0	2.3	5.1	1.4

Other types of liquid food available in the hospital are: (described in Table 2.6)

Table 2.6 : Liquid Food Other than RMP

Food	Contents	Calories	Proteins
Rice Kanji	Quantity 100 ml	25–50	0.5–1 gms
Egg Flip	1 Egg, Milk (150 ml), Sugar(10 gms)	225	4.5 gms
Banana Flip	1 Banana, Milk (150 ml), Sugar (10 gms)	240	1.5 gms

Food Exchanges

In the Dietary history of the patient, it is important to calculate the approximate number of calories consumed by the child per day prior to the onset of illness (Specially in a patient with PEM). For this purpose, it is important to know the calorie & protein content of various food-stuffs. This is described in Table 2.7. Table 2.8 is a Ready reckoner of food-stuffs which provide 100 calories (this comes in handy while preparing the diet for a patient with PEM)

Table 2.7 : Food Exchanges (Approximate values)

Food	Proteins	Calories
Cereals		
1 Cup Rice	2 gms	100 cals
1 Chappati	2 gms	50 cals
1 Cup Upama	6 gms	250 cals
Ragi (6 tsp)	2 gms	50 cals
1 Chappati/ 1 Idli/ 1 Dosa/ 2 Puris/ 1 Slice of bread	2 gms	50 cals
Pulses		
1 Cup Cooked Dal	10 gms	300 cals
1 Cup Cooked Soyabean	43 gms	430 cals

Table 2.7 : Food Exchanges (Approximate values)

Food	Proteins	Calories
Milk (Per 100 ml)		
Human milk	1.1 gms	65 cals
Cow's milk	3.3 gms	67 cals
Buffalo milk	4.4 gms	104 cals
Curd (100 gms)	3.3 gms	67 cals
Fats		
Ghee (1tsp)	—	45 cals
Butter (100 gms)	—	730 cals
Coconut (100 gms)	—	450 cals
Groundnut (100 gms)	26 gms	570 cals
Fruits		
1 Ripe Banana	0.6 gms	104 cals
Guava(100 gms)	0.9 gms	50 cals
Papaya (100 gms)	0.6 gms	32 cals
Vegetables & Roots		
Spinach (100 gms)	2 gms	26 cals
Potato (100 gms)	1.6 gms	97 cals
Tomato (100 gms)	1.4 gms	21 cals
Non-Veg Food		
1 Egg (Medium-sized)	6 gms	60 cals
Fish (100 gms)	20 gms	100 cals
Mutton (100 gms)	22 gms	118 cals
Miscellaneous		
1 Biscuit	0.5 gms	25 cals
1 Cup Tea/ Coffee	1.4 gms	60 cals

6 gms Proteins

= 1 Egg = 2 cups milk = 3 Idlis = 3 Chappatis
= 3 dosas = 6 puris = 12 tsp cooked dal
= 18 tsp Ragi = l ounce (30 gms) Meat/Fish.
= 50 groundnut seeds = 15 cashewnuts
= 3 cup Cooked rice = 6 tsp Bengal gram.

Table 2.8 : Common Food stuffs supplying 100 Calories

Food	Amount	Cooked measure
Cereals	30 gms	approx. 1 Medium Katori or 2 medium size chappati
Pulses	30 gms	approx. 1 medium Katori
Fruits (Pulpy fruits)	125 gms	1 medium size (raw)

Table 2.8 : Common Food stuffs supplying 100 Calories

Food	Amount	Cooked measure
Vegetables		
▸ Leafy	200 gms	approx 1½ katori
▸ Roots	100 gms	approx ¾ katori
▸ Other	300 gms	approx 2 katori
Nuts	15 gms	—
Milk (Cow's)	150 ml	¾–1 Cup
Egg	1¼	1¼
Meat	80 gms	approx. 2 big pieces.
Sugar	25 gms	5 tsp
Butter	15 gms	3 tsp
Oil	10 gms	2 tsp
Sago Seeds (Sabudana)	30 gms	1 medium katori (Cooked)

SOCIO - ECONOMIC HISTORY

- Enquire about the number of persons living together
- Enquire about the occupation, education & income of parents.
- Enquire about the number of working persons in the family & their income so as to calculate the Per capita income.

$$\text{Per-Capita Income} = \frac{\text{Total income of family}}{\text{Number of family members}}$$

- Enquire about the housing conditions — whether living in a flat, chawl or a slum.
- Enquire about the water supply; water disposal; sewage disposal etc.

2.2 Examination

The physical examination can be broadly divided into General Examination & the Systemic Examination.

The General examination should be done prior to the systemic examination; however this is not a hard-and-fast rule. The pediatrician should learn to be flexible & certain examinations like that of the throat or the genitalia should be postponed to after the systemic examination, lest the child becomes frightened & does not co-operate further in the examination. The doctor should adopt a playful attitude towards the child in order to make him happy which will allow the examination to be conducted with ease.

Neonates & Paraneonates should be examined on the table itself. Infants from 4 months to 18 months should be examined on the mother's lap. Older children can either be examined in the standing position or on the table.

General Examination

The General examination should be conducted in the following sequence

Attitude & Posture of the Patient

Whether the patient is Restless, anxious, comfortable, lying down on the bed turned away from light (Photophobia seen in Pyogenic Meningitis) or in tonic Posture (e.g. Ophisthotonus in Cerebral Palsy or in TBM)

Level of Consciousness of the patient

Whether the Patient is conscious, drowsy, stuporous, comatose etc.

Grading of Consciousness

- **Clinical grading**
  - *Fully conscious.*
  - *Drowsiness (physiological):* Easily arousable on light stimulus.
  - *Pathological Drowsiness:* Arousable on light stimulus, responds coherently during awake state, but goes back to sleep after withdrawal of stimulus.
  - *Stupor:* Is Sleepy. Requires stronger stimulus for arousal, localizes pain & tries to remove the painful stimulus.
  - *Delirium:* Same state as that of stupor, except that patient is disoriented, confused & responds incoherently to strong & painful stimuli.

- *Light Coma:* Requires sustained, painful stimuli for arousal, Moans on such stimulus & does not localize pain. Reflexes are present.
- *Deep Coma:* Patient does not arouse even on sustained painful stimulus. He may go into Decerebrate/ Decorticate rigidity.
- *Flaccid Coma/Death:* Patient does not respond to any form of stimulus. Tone, power & Reflexes are absent. Pupils are fixed & dilated.
- *Vegetative state:* State of wakefulness without awareness lasting more than 1 month.

Glasgow Coma Scale: EMU Scale

The Glasgow Coma Scale (Table 2.9) is a clinical method of grading coma

The Glasgow Coma Scale has prognostic value & is useful in following up & monitoring patients because it is an objective method to determine the grade of Consciousness. Value <5 indicates poor prognosis

Vital Parameters

Temperature

Temperature can be measured with the help of a thermometer in the axilla in infants & small children, whereas in older children, Oral temperature should be measured. Rectal temperature should be measured only in a malnourished or a very ill child (Children with PEM very frequently have hypothermia).

Rectal temperature > Oral temperature > Axillary temperature by 1°F. Normal range of temperature is 97.7°F – 99.5°F with quite a few children having temperature greater than 99°F in the evening (Diurnal Variation).

Method of measurement of rectal temperature

The infant is placed prone on the mother's lap with his legs dangling over her leg. With one hand the mother should hold the infants buttocks firmly and with the other hand the arms. The thermometer is lubricated and inserted within the anus upto 2 cms. The supine position is not preferred for measurement of the rectal temperature as insertion of thermometer in this position may perforate the rectum because of change in the angle of insertion.

Figure 2.2 : Measurement of rectal temperature

Pulse

The radial pulse should be palpated & its characteristics such as Rate, Rhythm, Volume, Force etc should be determined. The radial pulse should be palpated on both the sides to detect Inequality (As in Co-arctation of Aorta, Aortitis etc). Peripheral pulses such as Femoral, Posterior

Table 2.9 : Glasgow Coma Scale

Grading the response of the child helps determine the grade of consciousness (Value <5 indicates poor prognosis)	E-Eye Opening	M-Motor Activity	V-Verbal
	Spontaneous (4)	Follows Commands (6)	Oriented in time, place & person (5)
	On Verbal Stimuli (3)	Localizes Pain (5)	Disoriented (4)
	On Pain (2)	Withdrawal to Pain (4)	Inappropriate words (3)
	Nil (1)	Flexion to Pain (3)	Non-specific sounds (2)
		Extension to Pain (2)	Nil (1)
		Nil (1)	

Tibial & Dorsalis Pedis should also be palpated in both the lower limbs. Peripheral pulses are weak in case of Shock, Dehydration etc. Inequality in Pulses between the Upper Limb & the Lower Limb may occur in case of Co-arctation of Aorta. (Femoral pulse may be absent in co-arctation of aorta).

The Pulse rate varies with age (Table 2.10) as also with temperature & disease. Thus with every 1°C rise in temperature the pulse rate rises by 10 beats/minute.

Table 2.10 : Pulse Rate At Different Ages

Age	Pulse Rate (Per Minute)
Newborn	130–150
1 month to 1 Year	110–130
1–2 Years	100–120
2–4 Years	110
4–6 Years	100
6–8 Years	90–100
8–10 years	90
10–12 Years	80–90
> 12 Years	80

Respiration

The breathing pattern & the respiratory rate should be looked at. Preterm & LBW infants have irregular respiration with occasional episodes of apnea. The Breathing is Abdominal in infants, Abdomino-thoracic in young children & thoracic in older children & adolescents.

Table 2.11 : Respiratory Rate at Different Ages

Age	Respiratory Rate (Per Minute)
Newborn	40–45
From 1 month to 1 Year	30–40
1–2 Years	26–30
2–4 Years	24–28
4–6 Years	22–26
6–8 Years	20–24
8–10 years	19–22
10–12 Years	18–21
> 12 Years	17–20

The respiratory rate varies with age (Table 2.11) as also with temperature & disease. Thus respiratory rate is more in newborns than in older children & more in fever & during acute attacks of asthma.

Blood pressure

The Blood pressure should be measured in all children with an appropriate cuff (The bladder should cover atleast ⅔rd of the circumference of the upper arm & should be placed over the inner aspect of the arm so as to cover the brachial artery).

Table 2.12 : Blood Pressure At Different Ages

Age	Average BP (mms of Hg)	
	Systolic BP	Diastolic BP
Newborn	70	45
1 month to 1 Year	70–75	45–50
1–2 Years	75–80	45–50
2–4 Years	75–85	50–55
4–6 Years	80–90	50–60
6–8 Years	85–95	55–65
8–10 years	90–100	60–70
10–12 Years	95–105	65–75
12–14 Years	100–110	70–80
> 12 Years	110–120	80

The size (width) of the bladder generally used for measuring BP in infants is 4–6 cms & in children 7–9 cms. In children suspected to have a cardiac problem, B.P should be measured in both the upper arms & also in the lower limbs (for e.g. In preductal co-arctation of aorta, B.P is higher when measured on the right side than on the left side).

B.P increases as age increases (Table 2.12) unto adolescence. As a general guide to the estimation of average BP from Birth to Adolescence: At Birth — BP is 70/45. Every year following birth, add 3/year for the systolic BP & 2/year for the diastolic BP.

Anthropometry

The following measurements are very important

& should always be done.

- Weight (in kgs)
- Height or length (in cms)
- Head Circumference (in cms)
- Chest circumference (cms) — upto 3 years of age.
- Mid-arm circumference (cms) — between 1–5 years of age.
- Upper segment / Lower segment ratio

The above measurements should be expressed in the form of percentiles (derived from percentile charts) & compared to the expected percentiles (ICMR) as shown in Table 2.13.

Table 2.13 : Anthropometric Measurements

Parameter	Percentiles	Expected (ICMR)
▸ Weight-for-age ▸ Height-for-age ▸ Head circumference ▸ Chest circumference ▸ Mid-arm circumference ▸ Upper segment/lower segment ratio		

The anthropometric measurements can be broadly divided into Age-dependent Measurements & Age-independent measurements.

Age-Dependent Measurements

▸ Weight-for-age

The weight-for-age is a very good index for detecting the nutritional status of the child. The Wellcome Trust classification, IAP classification, Gomez' classification, Bengoa's classification & Jellife's classification of PEM are all based on Weight-for-age as the criterion. (These classifications are discussed in detail later on in the chapter on PEM).

Methods of measurement

- ***In neonates & infants below 1 year of age :*** Pan/Tray type (Figure 2.3) weighing machine — spring scales [accuracy of about 50 grams (+/-)] or electronic scales can be used.

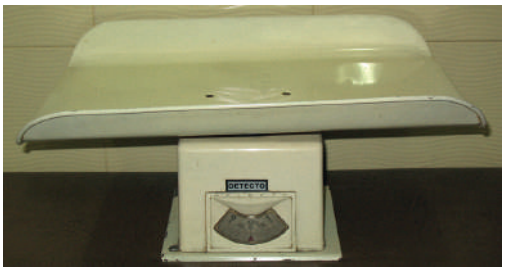

Figure 2.3 : Pan-type infant-weighing scale

- ***In older children :*** Beam-balance type (Figure 2.4) or bathroom scales can be used. Electronic scales are preferred due to their accuracy.

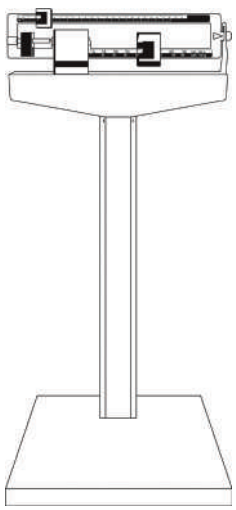

Figure 2.4 : Beam-balance

Formulas for weight (Table 2.14)

(Percentile charts are ideal methods of calculating weight-for-age. Classification is based on Harvard's 50th centile as standard).

Table 2.14 : Formula To Calculate Weight At Different Ages

Age	Formula To Calculate Weight In Kgs
3 months to 1 years of age	$\frac{9 + \text{age (months)}}{2}$
1 year to 6 years of age	2 (age in years) + 8
6 years to 12 years of age	$\frac{7 \text{ (age in years)} - 5}{2}$

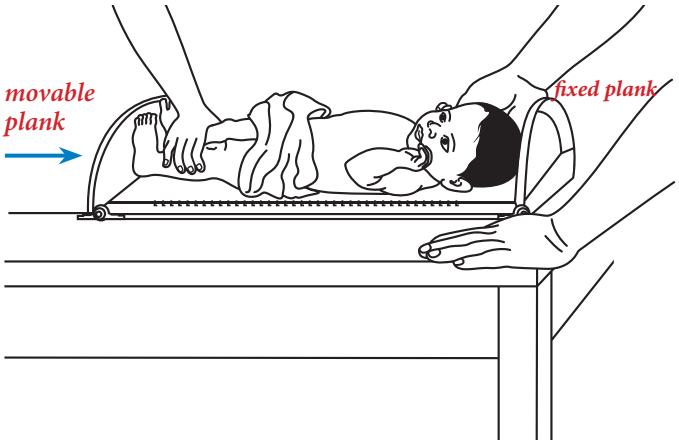

Figure 2.5 : Measuring the length of the infant with the help of the Infantometer

The newborn loses weight in the first few days after birth due to loss of edema fluid & regains birth weight by about the 10th day of life. Weight increases by 25–30 grams/day from Day 10 of life to 3 months age. Later on, formulas can be used to determine ideal weights.

Height-for-age

It is not as sensitive as weight because height cannot decrease, however stunting of height indicates long-term (chronic) malnutrition.

Methods of measurement

- ***Below 2 years of age:*** Length is measured with the help of Infantometer. The Infantometer is a machine having a measuring scale placed horizontally with two vertical planks on it. One of the planks is fixed whereas the other can be moved over the measuring scale. To measure the length of the infant (see Figure.2.5), he is placed supine on the infantometer with the head touching the fixed vertical plank. Then the legs are extended & the movable vertical plank is brought closer to the child & made to touch the soles of the feet. The length is read on the measuring scale that is provided.

- ***For children above 2 years of age:*** The height should preferably be measured using a Stadiometer (see figure 2.6). It can also be measured by asking the child to stand against a wall with his bare feet touching each other & the heels, hips, upper back & head touching the wall. The length is then measured using a measuring tape.

Figure 2.6 : Measuring height with the Stadiometer

Table 2.15 : Height at different ages & Rate of increase of height		
Approximate values for height		**Growth velocity (Rate of increase of height per year)**
At birth	50 cms	
1 year	75 cms	25 cms/year in 1st year
2 years	87 cms	12 cms/year in 2nd year
3 years	94 cms	6 cms/year in 3rd year
4 years	100 cms	Then, 4-5 cms/year till Puberty
After 2 years age: Height (cms) = age (6) + 77		

Based on both Weight-for-age & Height-for-age, the anthropometric categories of children (as described by Waterlow in 1972) are:

Table 2.16 : Anthropometric Categories Of Children			
Anthropometric Categories	**Weight-For-Age**	**Height-For-Age**	**Weight-For-Height**
Normal	N	N	N
Acute malnutrition	↓	N	↓
Acute-on-Chronic Malnutrition	↓	↓	↓
Chronic Malnutrition	↓	↓	N

N – Normal ↓ *– Decreased*

Skinfold thickness

This is not a very sensitive or a useful indicator of malnutrition & is generally not used in all cases. It is used primarily for academic & research purposes. Triceps & Subscapular measurement are used.

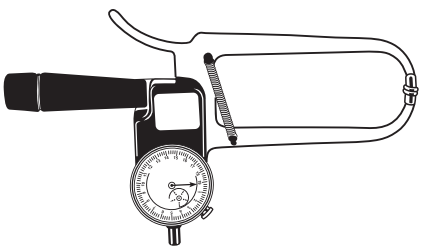

Figure 2.7 : Harpenden's Callipers

Triceps measurement

Harpenden's callipers are used to pinch the skin midway between the tip of acromion process of scapula & olecranon process of ulna.

Between 1 – 6 years age: >10 mm is normal (<6 mm is abnormal).

Disadvantages:

- Choice of exact site is difficult
- It is not a very objective method as the amount of skin grasped by the callipers may be different when done by different people.
- Edema in case of kwashiorkar can give rise to false rise in the skin-fold thickness.

Head Circumference

Measurement of head circumference is very important in infants & children. However, since brain-sparing occurs in acute & milder forms of PEM, brain growth & head circumference remain unaffected except in chronic or severe PEM.

Method of measurement

The head circumference is measured with the help of a non-stretchable plastic measuring tape encircling the prominent areas of the forehead & the occiput.

Figure 2.8 : Method of measurement of head circumference

Normal Head circumference is 33–35 cms at birth. It increases at the rate of 2–2.5 cms/month for 1st 3 months

Then at 1–1.25 cms/month for next 3 months

Then at 0.5–0.75 cms/month for next 6 months

Then 2–3 cms/yr between 1 to 4 years

Then; 1–2 cms/year between 4 to 6 years of age after which it remains stable.

In 1st year of life:

$$\text{Head Circumference} = \frac{\text{Length}}{2} + 9.5\ (\pm\ 2.5\ \text{cms})$$

Chest Circumference

The chest circumference is lower than the head circumference at birth. It equals the head circumference by 9 months to 1 year in western children & by 1–2 years in Indian children & then crosses it. In PEM, because of brain-sparing, the head circumference is not as much affected as the chest circumference & hence the cross-over may occur after 3 years of age.

Method of measurement

The chest circumference is measured with the help of a non-stretchable plastic measuring tape encircling the chest at the level of the nipples.

Fig 2.9 : Method of measurement of chest circumference

Mid-arm Circumference

The mid-arm Circumference remains consistenly between 16–17 cms in healthy children aged 1–4 years (though, it maybe falsely elevated in Kwashiorkar because of edema). The reason for it to remain constant is the replacement of baby fat of infancy with muscles.

Method of measurement

The mid-arm Circumference can be measured (Fig 2.10) with the help of a non-stretchable plastic measuring tape midway between the olecranon process & the acromian.

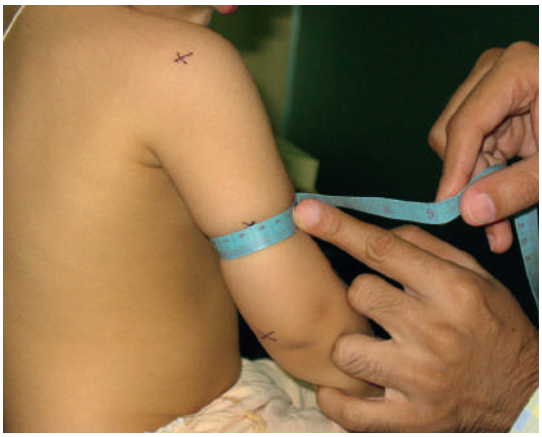

Fig 2.10 : Method of measurement of MAC

Grading PEM with help of Mid-arm circumference

PEM can also be graded on the basis of the mid-arm circumference (Table 2.17) & Shakir's tape (Fig 2.11).

Table 2.17 : Mid-arm Circumference

Grades	Circumference (cms)	Shakirs Tape (Colour)
Normal	16 cms	—
Mild PEM	between 13.5–16 cms	Green
Moderate PEM	between 12.5–13.5 cms	Yellow
Severe PEM	< 12.5 cms	Red

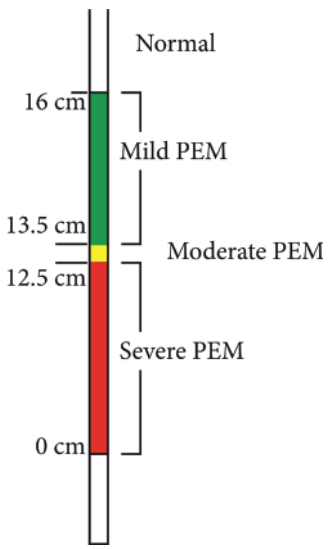

Fig 2.11 : Shakir's tape

Upper segment/Lower segment ratio

The upper segment of the body extends from the vertex of the head to the symphysis pubis. The lower segment extends from the Symphysis pubis to the heels (Fig 2.12).

The lower part of the body grows rapidly after birth as compared to the upper part giving rise to the gradual reduction in the Upper segment / Lower segment ratio with the progression of age.

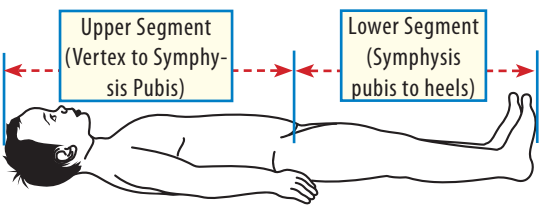

Fig 2.12 : Upper segment/Lower segment ratio

Table 2.18 : Upper Segment / Lower Segment Ratio

Age	Upper Segment : Lower Segment Ratio
At Birth	1.7 : 1.0
At 3–3.5 Years	1.3 : 1.0
At 7–8 Years	1.0 : 1.0
Thereafter	1.0 : 1.1

Age-Independent Measurements

Weight for height

It is sensitive in acute malnutrition, but not in chronic malnutrition (because both height & weight decrease but weight remains proportional to height)

$$\% \text{ Weight-for-height} = \frac{\text{Weight of child}}{\text{Weight of normal child of same height}} \times 100$$

Rao & Singh's Index

$$\frac{\text{Weight (Kg)}}{\text{Ht}^2\text{(cms)}} \times 100$$

Normal = 0.15–0.16 (This is constant between 1–5 years of age irrespective of sex)

In PEM ≤ 0.14

Mid-aim circumference / Height Ratio

(Used in Quac Stick i.e. Quacker's arm circumference measuring stick)

Quac stick (Fig 2.13) is a stick which measures height but it is marked in arm circumference measurements. For the various height levels, the 3rd percentile value (80%) of the expected mid-arm circumference is listed. The Child is diagnosed to have Malnutrition if his height is greater than his mid-arm circumference value on the Quac stick.

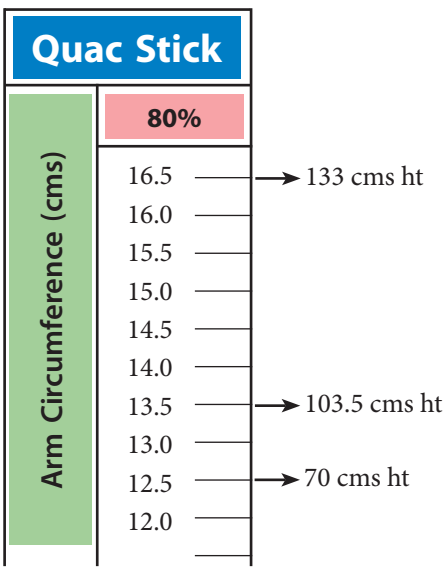

Fig 2.13 : Quac stick

Kanawati & Mclaren's Index

$$\frac{\text{Mid arm circumference}}{\text{Head circumference}}$$

Normal Value = 0.32 – 0.33 (Constant between 3 months to 4 years of age irrespective of gender)

Mild PEM = 0.32 – 0.28

Moderate PEM = 0.28 – 0.26

Severe PEM ≤ 0.25

Other Features

The child should then be examined for Pallor (nails, conjunctiva, tongue); cyanosis, clubbing

(fig 2.14); icterus (fig 2.15), lymphadenopathy (fig 2.16) [the cervical & axillary group of lymph nodes are frequently enlarged in children & should be palpated carefully); edema (important in kwashiorkar] & Jugular Venous Pressure (JVP) – important in CCF.

Fig 2.14 : Clubbing

Fig 2.15 : Icterus

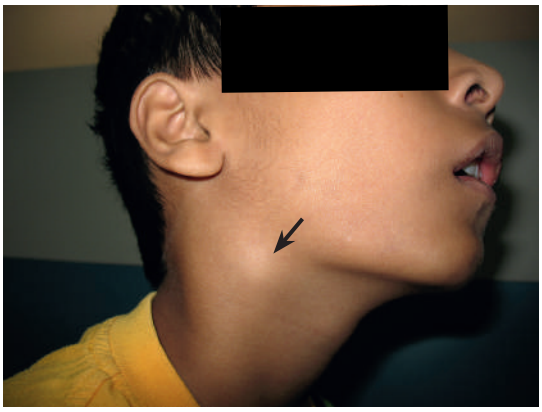

Fig 2.16 : Right Cervical lymphadenopathy

› Examination of Head, Face & Neck

- **Shape of head**

It is important in cases of craniosynostosis (premature fusion of sutures of skull). e.g: *Brachycephaly* — Decreased anteroposterior diameter of skull due to bilateral fusion of coronal sutures. *Dolichocephaly* — Increased A-P diameter of skull due to fusion of sagittal suture. *Plagiocephaly* — Asymmetrical skull due to fusion of unilateral coronal suture.

Fig 2.17 : Craniosynostosis (Arrow points to fused suture)

The head may be flattened on one side in infants who sleep in only one position or in children with Torticollis.

- **Facial dysmorphic features**

Presence or absence of facial dysmorphic features suggestive of certain syndromes: e.g. Down's syndrome. Look for facial paralysis (It may be seen unilaterally in children with Acute Infantile Hemiplegia, Bell's palsy, Cerebral Palsy etc. Bilateral Facial palsy may be seen in Guillain-Barré Syndrome.)

- **Anterior Fontannel**

Open or closed; normal, bulging (raised ICT)

- **Posterior Fontannel**

It usually closes by 2–3 months of age. Delayed closure of Posterior fontannel may be seen in children with Down's Syndrome.

- **Craniotabes**

It indicates softening of the outer table of the skull. It is elicited by applying pressure on the scalp behind and above the ears (Parietal area). Presence of a snapping sound on application of pressure is indicative of Craniotabes.