

SECTION I

General Examination

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 anthropomet-

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

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

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.



2.1 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 Duchenne 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.

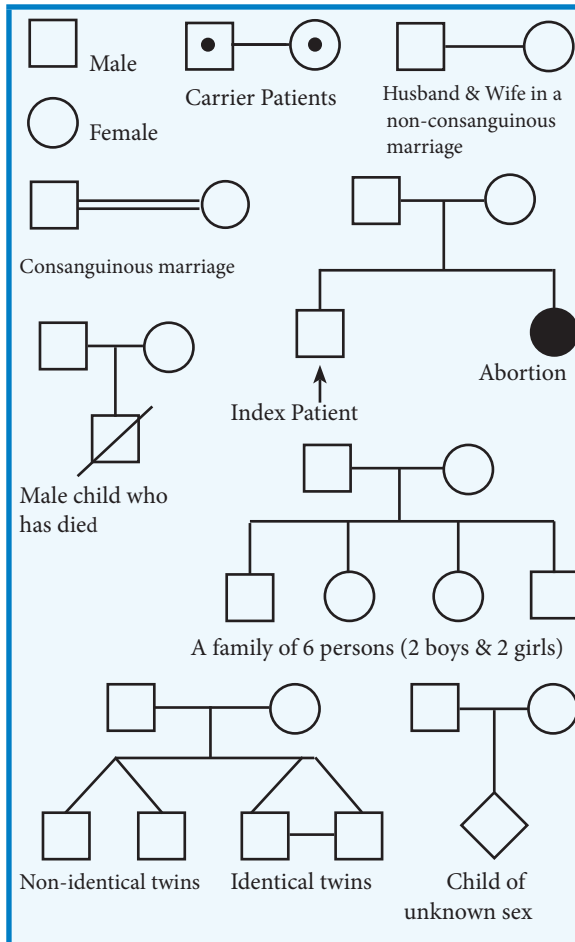


Figure 2.1 : Few general guidelines for construction of Pedigree chart

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 Pertussis 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 1 year 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 1 year 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 2 nd 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.

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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 : <i>7–14 months of age</i> : 2 doses at 2 months interval <i>12–15 months of age</i> : 1 dose Followed by a booster after 18 months <i>>18 months of age</i> : 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 affluent sections of the society instead of whole-cell pertussis vaccine following a proper discussion with parents. However, recent studies suggest better immunogenicity with whole cell vaccine
► Tdap	► <i>Fully immunized</i> : 1 dose of Tdap, preferably at 10–12 years of age followed by 1 dose of Td at 15 yrs ► <i>Incompletely immunized</i> : 1 dose of Tdap followed by 1 dose of Td ► <i>Non-immunized</i> : 1 dose of Tdap followed by 2 doses of Td	0.5 ml IM Anterolateral aspect of thigh or Deltoid	
Td vaccine	► <i>1st dose</i> : 10 years of age ► <i>2nd dose</i> : 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 Ty21a Vaccine	Not available in our country. Hence not discussed any further.		
➤ Vi-Antigen ▪ <i>Vi-polysaccharide vaccine</i> ▪ <i>Vi-conjugate</i> ▫ Pedatyph™ ▫ Typbar-TCV® / Zyvac-TCV®	After 2 years <i>As recommended by manufacturer</i> Primary dose (> 3 mths of age) : 1 dose Booster doses : ➤ One dose followed by booster after 2½–3 years of primary dose > 6-9 months of age : Single dose Booster dose : After 3 years of age	0.5ml SC / IM Single dose Booster every 3 years 0.5ml IM 0.5 ml IM	Vi-polysaccharide vaccine is freely available all over India. Minimal incidence of side-effects noted. Expert opinion in India favours further large-scale studies for vaccine efficacy to be conducted for Pedatyph. Good efficacy noticed in preliminary studies
Meningococcal Vaccine	Polysaccharide Vaccines ➤ <i>Primary doses</i> ▪ 3 months to 2 years : 2 doses at an interval of 3 months ▪ > 2 years : 1 dose only ➤ <i>Booster doses</i> ▪ 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) ➤ <i>Primary doses</i> ▪ > 10–55 years : 1 dose (2 doses for patients with asplenia, HIV) ➤ <i>Booster doses</i> ▪ 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 ➤ <i>Booster</i> : 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 deficiencies ➤ 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 immunosuppressive 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	<i>< 2 years of age</i> : Not recommended <i>> 2 years of age</i> : 1 dose of vaccine followed by booster dose (as below) <i>Booster dose</i> : 3–5 years after the 1 st 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 ▪ PCV₁₃ ▪ PCV₁₀	<i>2–6 months of age</i> : 3 doses at 6–8 weeks interval + 1 Booster at 12–15 months <i>7–11 months of age</i> : 2 doses at 6–8 weeks interval + 1 Booster(15 mths) <i>12–23 months of age</i> : 2 doses at 6–8 weeks interval <i>> 2years of age</i> : 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 1 st dose can be administered not later than 14 weeks & 6 days of age, whereas the 2 nd 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 ▪ <i>Inactivated TIV</i> ▪ <i>Live attenuated Influenza vaccine (LAIV)</i> ▶ Quadrivalent inactivated influenza vaccine (TIV) for routine seasonal use	Inactivated TIV / Quadrivalent TIV ▶ <i>Primary dose</i> ▪ 6 months–8 yrs of age : 2 doses at an interval of 1 month. ▪ > 8 years of age : 1 dose only ▶ <i>Booster doses</i> ▪ 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 diseases ▪ 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 : ▶ <i>Havrix</i> [®] ▪ <18 years : 0.5 ml (720 EIU) ▪ > 18 years : 1ml (1440 EIU) ▶ <i>Avaxim</i> [™] ▪ < 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 In-activated vaccine : IM, Deltoid or Antero-lateral aspect of thigh ▶ For Live attenuated vaccine : 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 ▪ <i>Dukoral</i>[®] ▪ <i>Shanchol</i>[™]	Parenteral vaccine ▶ <i>Primary doses</i> ▪ 1–2 years of age : 0.2 ml ▪ 2–10 years of age : 0.5 ml ▶ <i>Booster doses</i> ▪ 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) ▶ <i>Primary dose</i> : ▪ > 1 year of age : 2 doses of 1.5 ml at an interval of 2 weeks ▶ <i>Booster dose</i> ▪ There are no specific recommendations regarding Booster doses till date	▶ <i>Route of administration</i> ▪ For Parenteral vaccine : IM/SC ▪ For <i>Dukoral</i>[®] & <i>Shanchol</i>[™] : PO ▶ <i>Site for Parenteral vaccine</i> : Deltoid or Anterolateral aspect of thigh ▶ <i>Dosage</i> : 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	▶ <i>Primary dose</i> ▪ For all ages > 6 months of age : Single dose ▶ <i>Booster doses</i> ▪ 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 ➤ <i>Live attenuated SA14-14-2 vaccine</i> ■ Primary doses : 1 dose of 0.5ml above 9 months of age ■ Booster doses : Not recommended ➤ <i>Inactivated Vero-cell vaccines</i> ■ 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	➤ <i>Route of administration:</i> ■ SC for Live attenuated SA-14-14-2 vaccine ■ IM for vero-cell vaccines ➤ <i>Site :</i> Deltoid or Antero-lateral aspect of thigh ➤ <i>Dosage :</i> 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 ➤ <i>Intra-muscular schedule (Deltoid or antero-lateral thigh)</i> ■ 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 ➤ <i>Intra-dermal Schedule</i> ■ 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 = 1 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

	E-Eye Opening	M-Motor Activity	V-Verbal
Grading the response of the child helps determine the grade of consciousness (Value <5 indicates poor prognosis)	► 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-arcuation of Aorta. (Femoral pulse may be absent in co-arcuation 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 at least $\frac{2}{3}$ rd 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-arcuation 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 & Jelliffe'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.

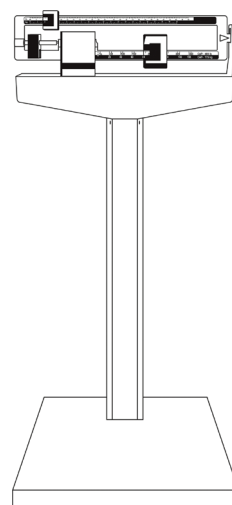


Figure 2.4 : Beam-balance

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	$2 (\text{age in years}) + 8$
6 years to 12 years of age	$\frac{7 (\text{age in years}) - 5}{2}$

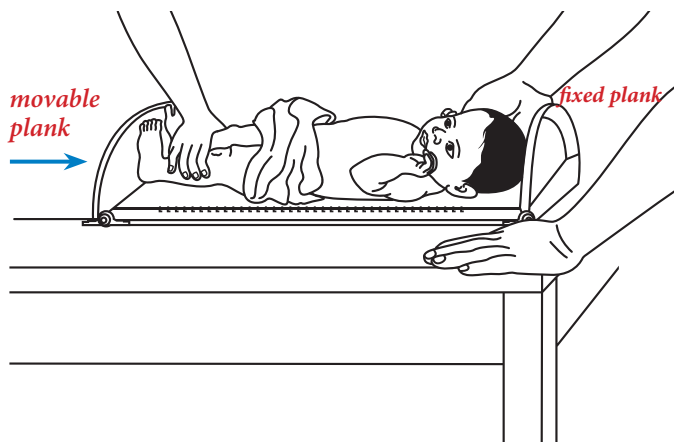


Figure 2.5 : Measuring the length of the infant with the help of the Infantometer

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.

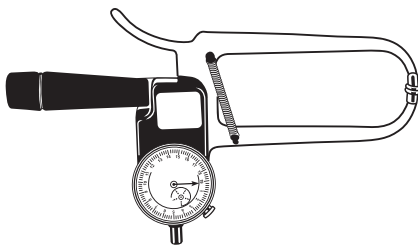


Figure 2.7 : Harpenden's Callipers

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 kwashiorkor 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 consistently 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 acromion.



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

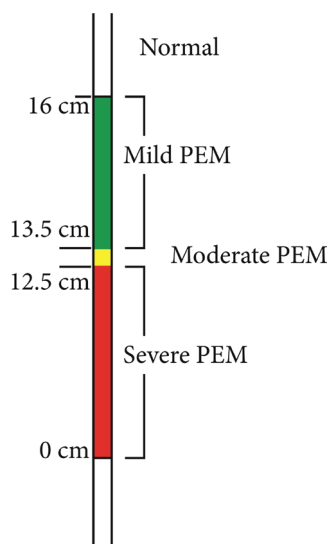


Fig 2.11 : Shakir's tape

➤ 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.

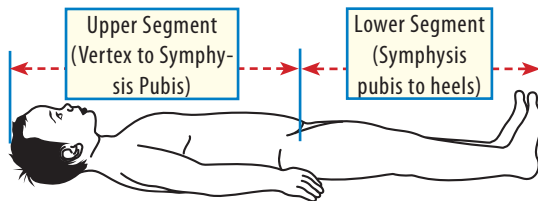


Fig 2.12 : Upper segment/Lower segment ratio

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-arm circumference Ratio Height

(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.

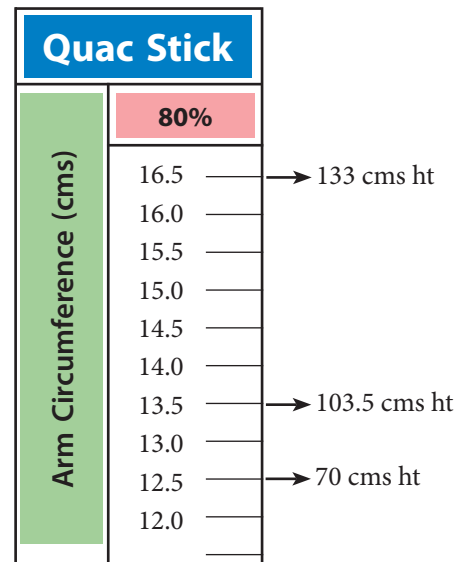


Fig 2.13 : Quac stick

➤ Kanawati & McLaren's Index

Mid arm circumference

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 kwashiorkor) & Jugular Venous Pressure (JVP) – important in CCF.

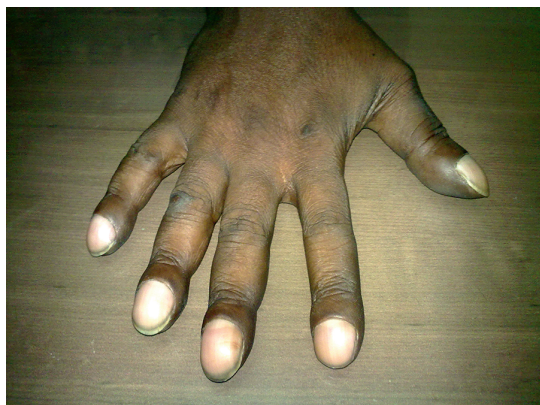


Fig 2.14 : Clubbing



Fig 2.15 : Icterus

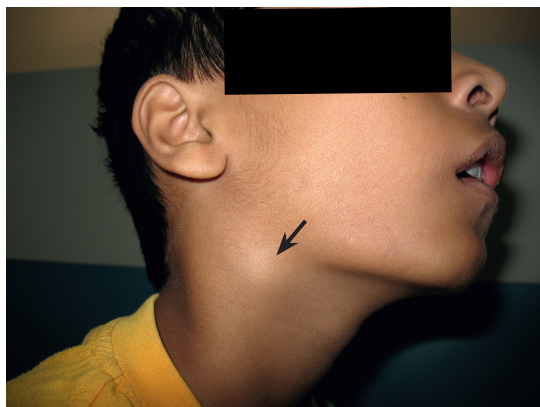


Fig 2.16 : Right Cervical lymphadenopathy

➤ Examination of Head, Face & Neck

▪ Shape of head

It is important in cases of craniosynosto-

sis (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 Fontanel

Open or closed; normal, bulging (raised ICT)

▪ Posterior Fontanel

It usually closes by 2–3 months of age. Delayed closure of Posterior fontanel 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.

It may be physiologically present in premature infants or in neonates and para-neonates. It is pathologically present in children with Rickets, Hydrocephalus and Vitamin A Poisoning.

■ Macewan's sign

It should be elicited only if the anterior fontanel is closed as it is positive in infancy due to open anterior fontanel. The skull is percussed with the finger & cracked-pot sound is heard. It is present (positive Macewan's sign) in case of raised ICT due to separation of sutures.

■ Transillumination of skull

Should be done in a dark room with a torch placed over the frontal region & occipital region.

- ❑ *In Frontal region:* If translucency exceeds 1 inch, it is abnormal.
- ❑ *In Occipital region:* If translucency exceeds half-an-inch, it is abnormal.

Abnormal translucency of skull may occur in hydrocephalus, subdural effusion, Hematoma etc.

■ Auscultation of skull

Look for bruits in the skull in patients with raised ICT.

■ Abnormalities of eyes, ears, nose, mouth & chin

e.g: Bitot's spots (Fig 2.18) in eyes in Vitamin A deficiency; Low-set ears (Fig 2.19) in Down's syndrome & other genetic malformations (Ears are considered low-set when the upper border of the pinna lies below the line drawn from the angle of the eye — see fig 2.19); Look for Otorrhea, wax & examine the tympanic membrane of each ear to detect perforations, glue ear etc.

- ❑ *Examine the buccal mucosa*

Koplik's spots (Bluish-white spots seen in the buccal mucosa near the opening of the parotid duct or on the palate) may be seen in Measles (Fig 2.20).



(Courtesy : Dr Mukesh Agrawal, Mumbai)
Fig 2.18 : Bitot's spots

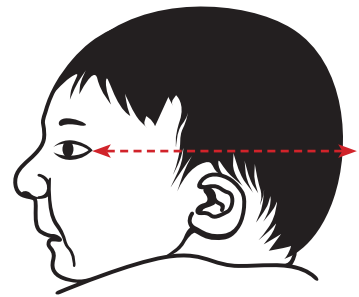


Fig 2.19 : Low-set ears

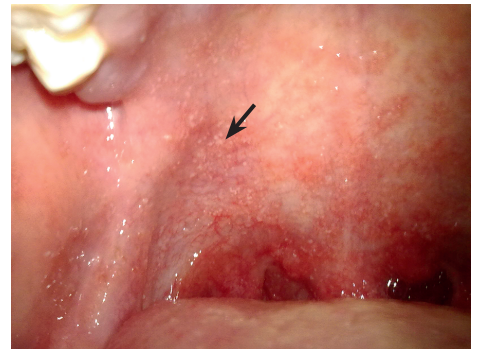


Fig 2.20 : Koplik's Spots

■ Examination of Mouth & Throat

- ❑ Look for evidence of *cleft lip* (Fig 2.21) or *cleft palate*.

Thrush (White patches which bleed on scraping) may be seen in neonates, in immunosuppressed children or in patients on prolonged antibiotic therapy.

Mouth ulcers (Fig 2.22) may be seen in Vitamin B deficiency, in children on Antibiotics, in immunosuppressed children or in children with Leukemia.



(Courtesy : Dr Siddhartha Shah, Mumbai)
Fig 2.21 : Bilateral Cleft lip



Fig 2.22 : Mouth ulcers

- ❑ Presence of *Angular stomatitis & cheilosis* (Fig 2.23) are suggestive of Vitamin B group deficiency

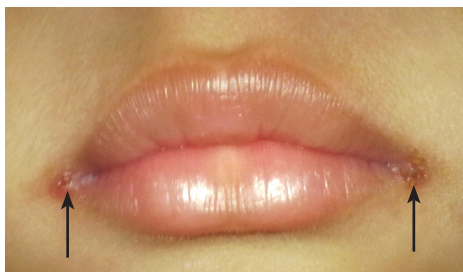


Fig 2.23 : Angular Cheilosis

- ❑ **Dentition:** Delayed primary dentition may either be due to hereditary causes or Vitamin D & Calcium deficiency. Hygiene of teeth & gums should also be determined. Bleeding from gums is indicative of Scurvy (Vitamin C deficiency).
- ❑ **Tongue:** Examine the colour of the tongue. *Beefy red tongue* is seen in Niacin defi-

ciency whereas *Magenta tongue* is seen in Riboflavine deficiency. *Strawberry tongue* (Fig. 2.24) is seen in Scarlet fever, Kawasaki's disease.



Fig 2.24 : Strawberry tongue

Tongue-tie occurs when the frenulum of the tongue is attached more anteriorly than normal (Fig. 2.25).

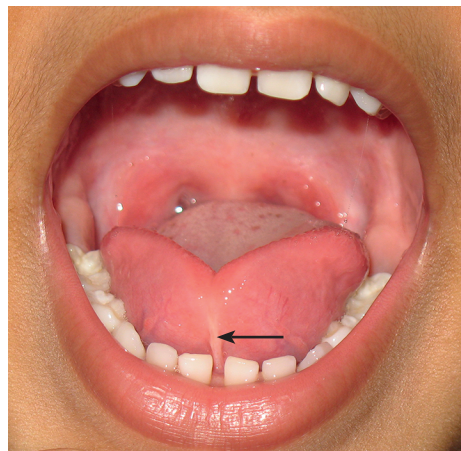


Fig 2.25 : Tongue-tie

Surgical intervention for tongue-tie is required only if the tongue-tie interferes with normal speech. This generally occurs when the frenulum is thick & cord-like (as in fig 2.25) & creates a groove at the tip of the tongue when an attempt is made to protrude the tongue.

Absence of papillae over the tongue (*Bald tongue*) is suggestive of Vitamin B₁₂ deficiency. *Coated tongue* is seen in chronic illnesses or in Enteric fever.

- ✧ *Examine the throat:* for evidence of pharyngitis or tonsillitis (Fig 2.26).



Fig 2.26 : Tonsillitis

■ Examination of the neck

- ✧ *Look for Swelling of the neck:* It may be seen in Diphtheria, Mumps or Cellulitis. Webbing of the neck may be seen in girls with Turner's Syndrome (Fig. 2.27)



Fig 2.27 : Webbing of the neck

- ✧ *Look for enlargement of the neck veins.* Measure the JVP (In patients with heart failure, the neck veins are distended and JVP is raised). Look for *abnormal venous pulsations*. Palpate the Carotid artery.
- ✧ *Palpate the lymph nodes* in both the anterior and posterior cervical triangles of the neck. Enlarged (Fig. 2.16), matted lymph nodes in the anterior cervical triangle of the neck frequently indicates Tuberculosis.
- ✧ Look for *enlargement of the Thyroid gland* (Fig 2.28) or other *abnormal swellings* in

the neck.



Fig 2.28 : Thyroid enlargement

► Evidence of Protein or Vitamin deficiency

- Look for signs of **PEM** (These are covered in detail in chapter on PEM).
- Look for signs of **Vitamin deficiency**
 - ✧ *Vitamin A deficiency* : Xerophthalmia or Bitot's spots (Fig 2.18).
 - ✧ *Vitamin B deficiency*: Angular stomatitis & cheilosis (Fig 2.23)
 - ✧ *Vitamin C deficiency*: Bleeding gums
 - ✧ *Vitamin D deficiency*: Delayed closure of anterior fontanel, bossing of skull (fig 2.29), rachitic rosary, bow legs (Fig 2.39), knock-knees (Fig 2.40), protruded abdomen (fig 2.30) etc.



Fig 2.29 : Bossing (protrusion) of the skull (arrow) in Rickets



Fig 2.30 : Abdominal protrusion in Rickets

► Examination of Skin, hair & nails

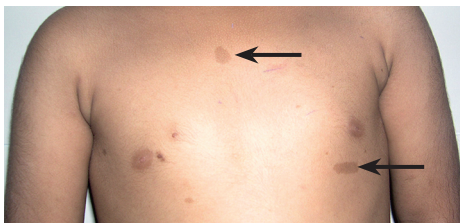
■ Examination of Skin

The skin should be examined for its:

- ❑ **Colour** : Depigmented lesions may be due to Vitiligo, Tinea Versicolour or Pityriasis alba whereas generalised depigmentation occurs in Albinism, Chediak-Higashi syndrome. Hyperpigmented lesions may be nevi, hemangiomas, petechiae, ecchymoses, Café-au-lait spots (Fig. 2.32) etc.



Fig 2.31 : Hemangioma



(Courtesy : Dr Mukesh Agrawal, Mumbai)
Fig 2.32 : Café-au-lait spots

- ❑ **Turgor** : to detect dehydration
- ❑ **Infections** : Pyoderma, Scabies (Fig 2.33), fungal infections etc.



Fig 2.33 : Scabies

- ❑ **Rash**: Measles, Chickenpox (Fig 2.34, 2.35)



Fig 2.34 : Maculo-Papular rash of Measles



Fig 2.35 : Vesicular rash of Chickenpox

- ❑ **Signs of Vitamin A deficiency** : Toad-skin
- ❑ **Signs of PEM** : covered in detail in chapter on PEM
- ❑ **Miscellaneous** : eg: Subcutaneous nodules (seen on extensor surfaces of the body in Rheumatic fever), Xanthomas and Xanthelasmas (seen in Hypercholesterolemia), Striae (seen in Cushing's syndrome) etc.

■ Examination of Nails

The nails should be examined to deter-

mine the presence of Pallor, Cyanosis, Clubbing, Chronic Iron deficiency [Platynychia (Fig. 2.36) or Koilonychia]. Brittleness of nails is seen in PEM. The nails may be absent in patients with Ectodermal dysplasia. Paronychia (Infections around the nails) is common in children with PEM.



Fig 2.36 : Platynychia

■ Examination of Hair

The hair should be examined for their colour, thickness, sparseness, brittleness (Hair are light-coloured, thin, sparse, brittle with areas of alopecia in PEM) & presence of lice (Pediculosis). Seborrheic dermatitis of scalp should also be noted, as extensive & resistant seborrheic dermatitis is frequently seen in HIV-positive children.

Excessive hair over the body may be seen in children with Cushing's syndrome, hypothyroidism and in certain chronic diseases.

► Examination of Bones, Joints & Spine

■ Examination of Bones

The bones should be examined for any swelling, deformities, fractures, tenderness at any site. [Tenderness in extremities may be seen in patients with injury or infection or in patients with Vitamin C deficiency (Scurvy)]. Limbs should be examined for deformities like bow-legs, knock-knees, club-feet (Talipes equinovarus) (Fig 2.37) & difference in the size of both the lower limbs (Limb-length inequality).

Limb-length inequality (Fig. 2.38) is common in Congenital dislocation of hips (CDH) which goes unnoticed at birth & in early life. *Swelling at the wrists* (Widening of the epiph-

ysis of the radius) is a sure sign of Rickets.

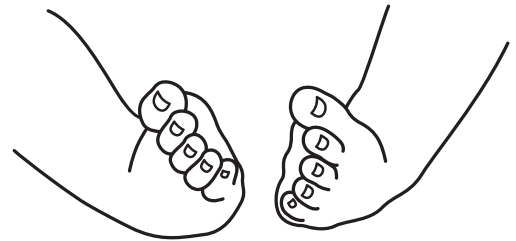


Fig 2.37 : Talipes Equinovarus (Club feet)



Fig 2.38 : Limb-length inequality

Bow-legs (Fig 2.39) are physiological till 2 years of life. They are considered to be pathological only when the distance between the medial aspect of both the knees exceed 10 cms when the medial malleoli of both the ankles are in close proximity to each other. Similarly, *Knock-knees* (Fig 2.40) are physiological between

2 to 4 years of age. They are considered to be pathological only when the distance between the medial aspect of the medial malleoli of both the feet exceed 10 cms when the two knees are in close proximity to each other.

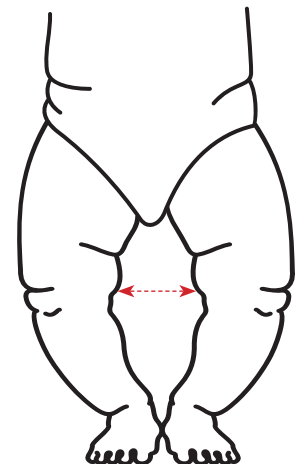


Fig 2.39 : Bow legs (Arrow shows the inter-condylar distance)



(Courtesy : Dr Mukesh Agrawal, Mumbai)
Fig 2.40 : Knock-knees

■ Examination of Joints

Joints should be examined for colour (redness indicates infection or inflammation), temperature (hot joints indicate infection or inflammation), Swelling, tenderness on palpation and limitation of movement. Joint examination is important in patients with Rheumatic Fever & in Septic Arthritis which may occur in malnourished children. Tuberculous arthritis, though rare, should also be kept in mind.

In *Septic* and *Rheumatoid arthritis*, the joints are red, hot, Swollen, tender and have limited movement due to pain. In *Rheumatic arthritis* (Rheumatic fever) there may be Arthralgia (Painful joints without any other signs of inflammation like heat or swelling) or Arthritis (however, swelling is not as great as in Septic or Rheumatoid arthritis).

■ Examination of spine

The spine should be examined to detect any swelling (Pott's spine), Tenderness (fractures of vertebrae) or deformities such as Kyphosis (Fig. 2.41), Scoliosis (Fig 2.42), Lordosis etc. Spine should also be examined to detect the presense of a sinus (spina bifida) or sac (Meningomyelocele) (Fig 2.43).

Movement of the spine should also be examined. The patient should be asked to bend forward and to sit up from a lyingdown position. *Limitation of motion* of the spine may be seen in cases of Meningitis, Osteomyelitis, fractures or Para-vertebral muscle spasms. *Excessive motion* of the spine is seen in patients with Hypotonia.



Fig 2.41 : Kyphosis

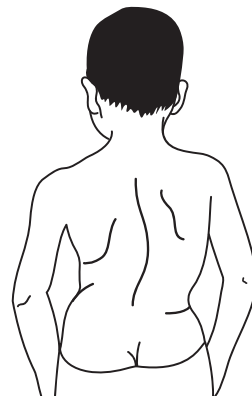


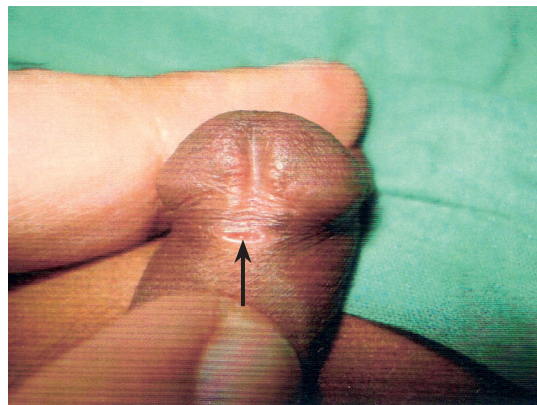
Fig 2.42 : Scoliosis



(Courtesy : Dr Mukesh Agrawal, Mumbai)
Fig 2.43 : Meningomyelocele

► Examination of Genitalia

The genitalia of the child should be examined to detect any abnormalities or diseases & to assess the sexual maturity in adolescents (table 2.19, 2.20). In boys, the penis should be examined for presence of Phimosis & Hypospadias (Fig. 2.44, 2.45). The scrotum should be palpated for the testes. Sometimes testis may be retractile (Fig. 2.46) or undescended (Fig 2.47).



(Courtesy : Dr Naresh Wadhwa, Mumbai)
Fig 2.44 : Hypospadias (Arrow shows urethral opening)

TABLE 2.19 : STAGES OF SEXUAL MATURITY IN GIRLS (TANNER'S)

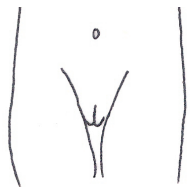
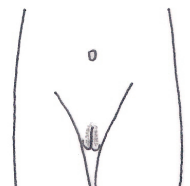
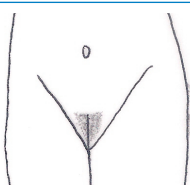
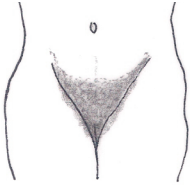
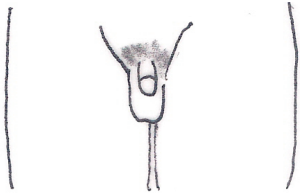
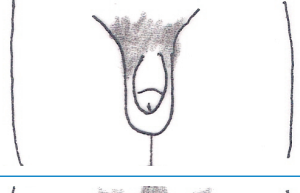
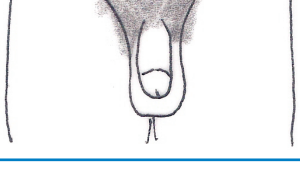
SMR Stage	Breasts	Image	Pubic Hair	Image
1	Pre-Pubertal		Pre-Pubertal	
2	Breast & nipple grow as a small elevation; areolar diameter increases.		Few, lightly-coloured hair appear on medial border of labia	
3	Enlargement of breast & areola with smooth contour		Hairs become dark & start curling.	
4	Nipple & areola grow to form a secondary elevation above the breast		The texture of hair become coarse, curly & they grow in amount	
5	Mature breasts with areola merging into the general contour of the breast & nipple projecting beyond it.		Hair spread to medial part of both the thighs forming an inverted triangle pattern (Adult pattern)	

TABLE 2.20 : STAGES OF SEXUAL MATURITY IN BOYS (TANNER'S)

SMR Stage	Testes & Scrotum	Image	Penis	Pubic Hair
1	Small (Pre-Pubertal)		Small (Pre-Pubertal)	Nil

TABLE 2.20 : STAGES OF SEXUAL MATURITY IN BOYS (TANNER'S)

SMR Stage	Testes & Scrotum	Image	Penis	Pubic Hair
2	Scrotum enlarges & darkens in color		Slight enlargement	Few, straight, mildly pigmented at the base of the penis
3	Becomes larger in volume		Becomes longer & thicker	Hair darkens, start curling & spread laterally
4	Scrotum becomes large & dark in colour		Becomes long & increases in size & breadth. Glans develops.	Almost adult-like but not spread to thighs
5	Matures into adult size		Matures into adult size	Hair spread to medial part of both the thighs (Adult pattern)

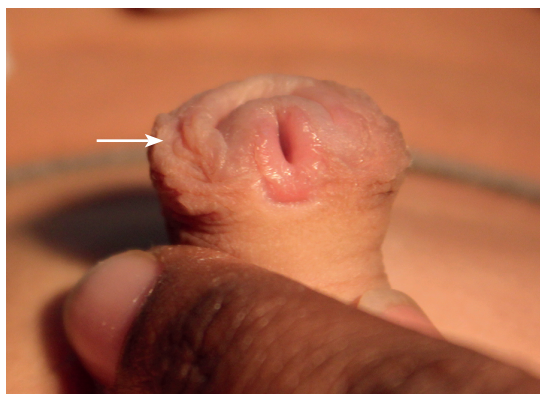


Fig 2.45 : Hypospadias with hooded Prepuce (arrow)

It is important to distinguish between them as undescended testis requires to be surgically

placed in the scrotum (undescended testis have a high risk of developing carcinoma). Hernia & hydrocoele should also be ruled out in boys.



Fig 2.46 : Retractable left-sided testis (arrow) with normal scrotum.

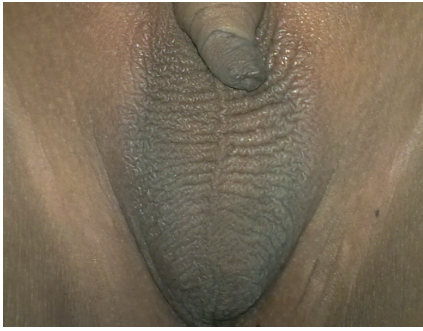


Fig 2.47 : Undescended testes with underdeveloped scrotum

► Assessment of Development

A detailed assessment of development is not required in all the cases. Only in patients suspected to have cerebral palsy or mental retardation, a thorough examination of the developmental milestones should be undertaken. A short history regarding achievement of developmental milestones like social smile, holding the head, sitting, standing etc from the mother can help determine whether the milestones are delayed or not.

The following important milestones should be achieved at the age-limits indicated below:

- Social smile : 2½ months.
- Head-holding : 3½–4 months.
- Sitting with support : 7–8 months.
- Sitting without support : 9 months.
- Standing : 1 year.
- Walking : 1½ years.

Basic Principles about Development:

- Development proceeds from head-to-toe. Thus, infants first develop head control followed by ability to grasp, sit, crawl, stand, walk.
- Primitive reflexes have to disappear first before voluntary activities can be achieved. eg. Reflexes like asymmetric tonic neck reflex should be lost before voluntary movements like rolling over can be achieved.
- The extensive & generalized activity of infants

when they are excited gradually changes into specific responses.

- Delay in achieving a single milestone need not necessarily imply mental retardation, however gross developmental delay is highly indicative of mental retardation.
- In preterm babies corrected age (conceptional age) should be used as the chronological age in the 1st year of life.

The developmental examination includes assessment of the following:

- Assessment of Milestones
- Primitive reflexes
- Assessment of muscle tone

MILESTONES

Gross Motor Milestones

To assess the Gross Motor Milestones (described in detail in Table 2.22 to Table 2.26), the child is put in various postures as described below & the child's development corresponding to his age is assessed.

The various postures in which the infant is placed are :

- *Ventral Suspension (Table 2.22)*: Infant is held away from the table in a prone position by supporting the abdomen with the examiner's palm. Look for flexion of the extremities & extension of the neck.
- *Prone position (Table 2.23)* : Place the child in a prone position on the table & look for the position of the head, upper limbs, pelvis & the lower limbs.
- *Pull-to-sit (Table 2.24)* : After making the child lie down on the table in a supine position, pull the child to a sitting position by holding both his hands & lifting him at the forearms
- *Sitting position (Table 2.25)*
- *Upright position (Standing or Walking) (Table 2.26)*

Fine Motor Milestones

The fine motor milestones are described in detail in Table 2.27.

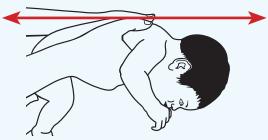
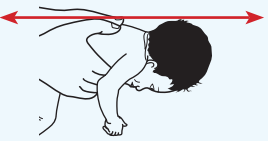
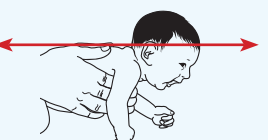
TABLE 2.21 : SUMMARY OF THE MILESTONES

TABLE 2.21 : SUMMARY OF THE MILESTONES									
Age	Gross Motor Milestones					Fine Motor Milestones	Social(Cognitive) Milestones	Language Milestones	
	Ventral suspension	Prone Position	Pull-to-sit	Sitting Position	Upright posture / Walking				
Birth	No head control	Head rotated to one side, pelvis high up & knees drawn up under the abdomen	Total head lag.	Back is rounded. Cannot lift up head	Walking reflex seen on holding the child in upright position	Hands remain closed. Grasp reflex present	Looks intently at the face of the speaking person	Responds to sound	
1½ mths (6 weeks)	Can lift head at same level as the rest of the body for some time	Head moves to the centre. Lifts chin above the ground. Pelvis lowers. Legs straighten.	Head-lag reduces slightly	Roundedness of back decreases. Occasionally lifts head.	Cannot bear weight & flexes at the knees	Opens hands spontaneously & occasionally. Grasp reflex weak but present	Social Smile appears	Smiles when someone speaks to him.	
3 months	Can lift head above the level of the rest of the body & maintain it for a long time	Lifts chin & shoulder above the ground. Pelvis flattens. Legs are fully extended.	Minimal head-lag	Back starts straightening. Lifts head up more often		Keeps hands open. Grasp reflex disappears	Recognizes mother. Becomes interested in surrounding objects (fans, lights). Follows activities of surrounding people.	Coos. Laughs loudly.	
4 months	This Posture is not used any further at these ages	Lifts upper part of the body above the ground by supporting weight on forearms	No head-lag. Head control achieved	Back Straight. Head control achieved	Can bear some weight if supported	Grasps objects placed in hand (Ulnar grasp)	—	Responds to the speaking person with continuous sounds—resembling conversation	
6 months		Supports upper body on hands with extended elbows. Rolls over from Prone-to-supine position	Lifts head above the couch without any support	Can sit with support	Can bear full weight if supported	Grasp gradually becomes radial. Plays with objects in hands	Smiles at his mirror image. Shows likes & dislikes.	Babbles (da, dada, ma, mama)	
7 months	This Posture is not used any further	Rolls over from Supine-to-Prone position	This Posture is not used any further	Can sit without support for a few minutes.		Transfers objects between the 2 hands	Stranger anxiety may appear.	Responds to name	
9 months		Crawls		Steady while sitting (Support of hands not required)	Pulls-to-stand	Pincer grasp achieved. All objects are brought to the mouth	Enjoys Peek-a-boo games. Resists pulling away of toys.	Mimics sounds. Understands simple speech.	
11 mths	This Posture is not used any further at these ages	—		—	Walks with support	Holds objects properly & releases them on command	Comes when called. Understands simple commands. Enjoys playing with children	Speaks Monosyllables	
12 months		—		—	Walks with broad-based gait				

TABLE 2.21 : SUMMARY OF THE MILESTONES

Age	Gross Motor Milestones				Fine Motor Milestones	Social(Cognitive) Milestones	Language Milestones
	Ventral suspension	Prone Position	Pull-to-sit	Sitting Position	Upright posture / Walking		
15 months	These Postures are not used any further at these ages				Walks well without support	Feeds himself. Shows body parts on asking. Explores surrounding	Mimics sounds of animals. Indecipherable speech
18 months					Can squat /kneel. Can negotiate steps upwards.	Mimics actions of others. Toilet training starts	Speaks atleast 6 words.
2 years					Runs well. Climbs onto sofa. Walks upstairs (2 feet on each step)	Wears simple garments. Plays with dolls. Interested in music.	Speaks 2–3 word sentences. Points to atleast 1 body part
3–4 years					Walks upstairs (1 foot/step). Walks downstairs (2 feet/step). Can ride a tricycle. Can walk backwards.	Can build a tower of 10 cubes. Copies a circle. Goodenough "Draw-a-man test" : 3–4 points.	Good Vocabulary (Speaks 6-word sentences). Knows age & sex.
4–5 years					Climbs upstairs & downstairs (1 foot/step). Can play Catch-ball. Can jump on 1 foot	Enjoys group play with other children	Very inquisitive. Can name common body-parts like face, hand etc.
5–6 years					Can skip rope with both feet. Can climb a tree. Can jump off multiple steps	Dresses without supervision. Domestic role-play. Makes friends	Speaks 10-word sentences. Names atleast 4 colors. Can count upto 10.
6-7 yrs					—	Copies a hexagon. Goodenough "Draw-a-man test" : 12–15 points.	—
7-8 yrs					—	Copies a kite	—
8-9 yrs					—	Copies a double-lined cross	—
9-10 yrs					—	Copies a Cylinder	—
11 years					—	Copies a Cube	—

TABLE 2.22 VENTRAL SUSPENSION

Age	Position of the infant	Image
Birth	The infant is unable to lift the head & the head droops down totally	
1½ months	The infant is able to lift & hold the head at the same level as the rest of the body for some time but is unable to maintain it for long	
3 months	The infant is able to lift & hold his head above the level of the rest of the body & he can maintain his head in this position for a longer time	

Prone Position

TABLE 2.23 PRONE POSITION

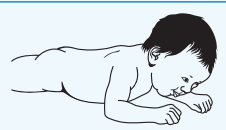
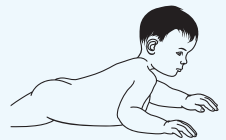
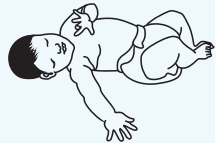
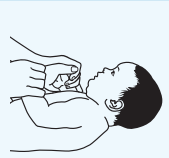
Age	Position of the infant	Image
Birth	The infant lies in a curled posture with his head rotated to one side, back rounded, pelvis high & knees pulled up under the abdomen	
1½ months	The head gradually shifts to the midline. The infant can lift his chin above the ground. The knees begin to straighten, hips extend & the pelvis starts lowering towards the couch	
3 months	The infant can lift his chin & shoulders above the ground. Legs are fully extended & the pelvis is flattened	
4 months	The child can lift his upper body well above the ground in such a way that its weight is supported by his forearm	
5–6 months	The child can lift his entire upper body above the ground with his weight supported by his hands alone keeping the elbows in total extension	

TABLE 2.23 PRONE POSITION

Age	Position of the infant	Image
6–7 months	Rolls over from Prone-to-supine position	
7–8 months	Rolls over from Supine-to-prone position	
9–10 months	Crawls on all fours	

Pull-to-sit Position

TABLE 2.24 PULL-TO-SIT POSITION

Age	Position of the infant	Image
Birth	Child is unable to lift his head even slightly & there is total head-lag	
1½ months	The head-lag slowly reduces	
3 months	There is minimal head-lag	
4 months	There is absolutely no head-lag & head-control is achieved	
5–6 months	The child is able to lift his head above the couch without any support	

Sitting Position

TABLE 2.25 SITTING POSITION

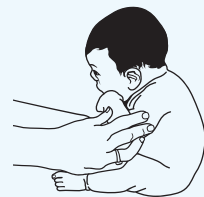
Age	Position of the infant	Image
Birth	The back is fully rounded & he is unable to lift his head	
1½ months	Roundedness of back decreases. The infant can lift his head up occasionally	
3 months	The back progressively starts straightening & the child can lift his head up easily & more often	
4 months	Back straightens. Head control is achieved	
6 months	Can sit momentarily with support	
7 months	Can sit momentarily without support	

TABLE 2.25 SITTING POSITION

Age	Position of the infant	Image
9 months	The child is steady while sitting & does not require to support himself with his hands	

Upright Position (Standing/Walking)

TABLE 2.26 UPRIGHT POSITION (STANDING/WALKING)

Age	Position of the infant	Image
Birth–2 months	<i>Walking reflex</i> is elicited in upright position — If the infant is held in the upright position such that its feet presses against the surface of the examination table, there is alternate flexion & extension of both the legs resembling normal walking. The walking reflex disappears by 8 weeks.	
2 months–4 months	The baby cannot bear his weight & flexes at the knees	
4 months–6 months	Can bear some weight if supported	
6–7 months	Can bear full weight on both legs if supported	

TABLE 2.26 UPRIGHT POSITION (STANDING/WALKING)

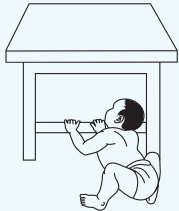
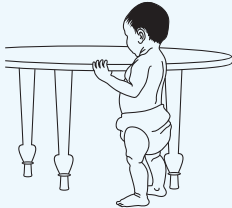
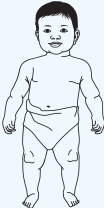
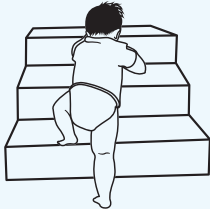
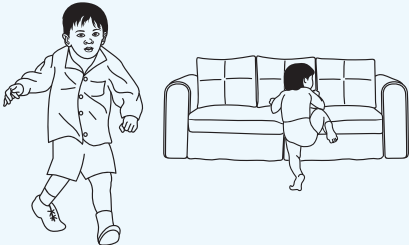
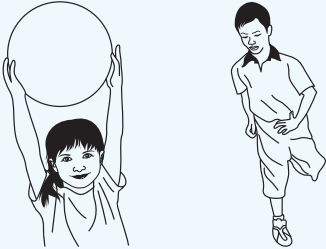
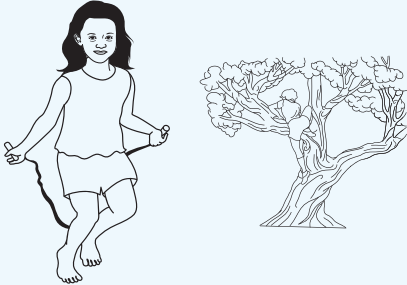
Age	Position of the infant	Image
9 months	Pulls to stand	
11 months	Can walk with support by holding the wall or furniture	
12 months	Walks with a broad-based gait	
15 months	Walks well without support	
18 months	➤ Can squat & kneel ➤ Can negotiate steps upstairs but has difficulty walking downstairs	
2 years	➤ Runs well without falling ➤ Walks upstairs, but only by putting 2 feet on each step ➤ Can climb onto the sofa & furniture	

TABLE 2.26 UPRIGHT POSITION (STANDING/WALKING)

Age	Position of the infant	Image
3–4 years	➤ Can walk upstairs like adults (1 foot per step), but requires 2 feet per step while walking downstairs ➤ Can walk backwards & also sideways ➤ Can ride a 3-wheeled cycle	
4–5 years	➤ Can climb both upstairs & downstairs like adults (1 foot per step) ➤ Can play Catch-ball ➤ Can jump on 1 foot	
5–6 years	➤ Can skip rope with both feet ➤ Can climb a tree ➤ Can jump off multiple steps	

Fine Motor Milestones

TABLE 2.27 FINE MOTOR MILESTONES

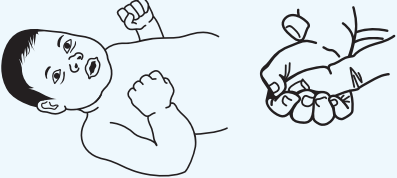
Age	Position of the infant	Image
Birth-6 weeks	Hands remain closed. Grasp reflex present.	
6-8 weeks	Opens hands spontaneously & occasionally. Grasp reflex weak but still present.	

TABLE 2.27 FINE MOTOR MILESTONES

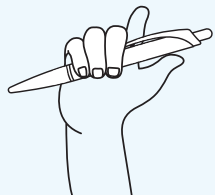
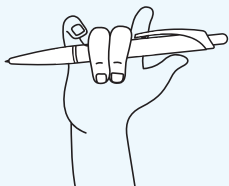
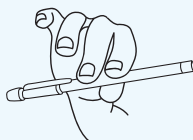
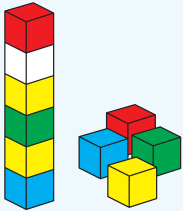
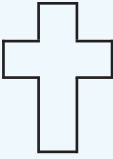
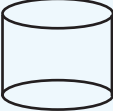
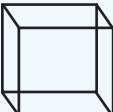
Age	Position of the infant	Image
3 months	Keeps hands open. Grasp reflex disappears.	
4 months	Grasps objects placed in his hand but cannot voluntarily pick up an object. Initially, object is held on the ulnar side of the hand (Ulnar grasp—see figure)	
5–6 months	Grasp gradually moves to the palmar side of the hand (Palmar grasp)	
6–7 months	Grasp gradually moves to the radial side of the hand (radial grasp) Transfers objects between the 2 hands.	
9 months	Pincer grasp achieved (Picks up objects between the tip of the thumb & index finger). All objects held are brought to the mouth.	 
1 year	Holds objects properly without dropping, but can release an object on command.	
15 months	Can build a tower of 2 cubes. Can feed himself with spoon. Able to drink liquids from glass or cup	

TABLE 2.27 FINE MOTOR MILESTONES

Age	Position of the infant	Image
18 months age	Can build a tower of 4 cubes. Scribbles haphazardly.	
2 years	Can build a tower of 6 cubes. Copies a horizontal line	
3 years	Can Build a tower of 10 cubes. Copies a circle Goodenough Test* : 3-4 points	
4 years	Copies a cross Goodenough Test : 5-6 points	
5 years	Copies a triangle Goodenough Test : 7-8 points	
6 years	Copies a Hexagon Goodenough Test : 12-15 points	
7 years	Copies a kite	
8 years	Copies a double-lined cross	
9 years	Copies a Cylinder	
11 years	Copies a Cube	

* Goodenough “Draw A Man” test is useful to test children after 3 years of age upto 10 years of age. The child is supposed to draw a man. There are a total of 51 items, each of which is given 1 point.

Social / Cognitive Milestones

- 1 month — Looks intently at the face of the person speaking to him (Fig 2.48)



Fig 2.48 : Infant looks intently on being spoken

- 1½–2 mths — Social smile (Fig 2.49)

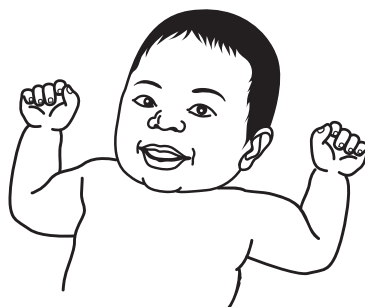


Fig 2.49 : Social Smile

- 3 months — Recognizes mother. Becomes interested in surrounding objects like fans, lights etc. Follows the activities of people walking around him
- 6 months — Smiles at his mirror image (Fig 2.50). Shows likes & dislikes.



Fig 2.50 : Child smiling at his mirror image

- 7 months — Stranger anxiety may appear.
- 9 months — Enjoys Peek-a-boo games. Resists pulling away of toys.
- 1 year — Comes when called. Understands simple commands. Enjoys playing with other children.
- 15 months — Feeds himself. Shows body parts on asking. Likes to explore his surroundings.
- 1½ years — Mimics action of others; Toilet training starts.
- 2 years — Wears simple garments. Plays with toys like dolls etc. Shows interest in music.
- 3 years — Can dress himself with simple clothes, but requires some help in wearing complex clothes.
- 4 years — Enjoys group play (Fig 2.51) with other children.

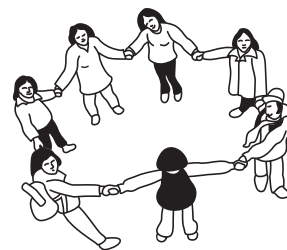


Fig 2.51 : Group play

- 5 years — Dresses without supervision. Domestic role play. Makes friends.

Language Milestones

- 1 month — Responds to sound
- 1½–2 mths — Smiles when someone speaks to him.
- 3 months — Coos, Laughs loudly
- 4 months — When spoken to, can respond with continuous sounds as if speaking to the observer.
- 5–6 mths — Babbles (da, dada, ma, mama)
- 7–8 mths — Responds to name.
- 9 months — Repeats (mimics sounds). Understands simple speech.

- | | | |
|------------|--|---|
| 1 year | — Speaks in Monosyllables (1-2 words) | ➤ Grasp reflex |
| 15–18 mths | — Imitates sounds of animals & birds. Indecipherable speech | ➤ Parachute reflex |
| 1½ years | — Speaks atleast 6 words | ➤ Landau's reflex |
| 2 years | — Begins speaking small 2–3 word sentences by combining words. Points to atleast 1 body part | ➤ Deep tendon jerks (Biceps & knee jerks) |
| 3 years | — Good Vocabulary; Can speak upto 6 word sentences; Knows age & sex. | ➤ Ankle clonus. |
| 4 years | — Extremely inquisitive. Knows & can name common body parts like face, hands, legs etc. | |
| 5 years | — Speaks atleast 10 word sentences; Names atleast 4 Colours. Can count upto 10. | |

Sphincter Control

Bowel Control is achieved before bladder control at about 1½–2 years.

Bladder Control:

- | | |
|----------|--|
| 1½ years | — Bladder control starts developing but he still wets his clothes intermittently |
| 2 years | — Most children achieve voluntary bladder control while awake, but more than half still wet their clothes at night |
| 3 years | — Can void urine without any help, by undressing alone. A significant number of children achieve night-time bladder control. |
| 5 years | — Majority are Dry by night. |

THE PRIMITIVE REFLEXES

There are more than 70 primitive reflexes described—however not all are useful. For routine examination of development & in the management of Cerebral Palsy (CP) the following reflexes are considered to be important. They are:

- Moro's reflex
- Rooting & Sucking reflexes
- Asymmetrical tonic neck reflex

Description Of The Primitive Reflexes

➤ Moro's reflex

The baby is held supine over the hand & arm with the palm supporting the head of the baby at an angle of approximately 45° from the bed (Fig 2.52) & then the head is allowed to fall back a short distance (by about 30°). The other method (Fig 2.54) is to lay the baby supine on the bed supporting the head with the palm of the hand a few cms above the bed & then suddenly releasing the head causing sudden extension of the neck & eliciting the reflex.

The reflex starts with abduction & extension of the arms along with the opening of the hands followed by a slow adduction & flexion of the arms resembling a hug (Fig 2.53). It is associated with crying & extension of the neck & movement of the legs.



Fig 2.52 : Eliciting the Moro's reflex



Fig 2.53 : Normal Moro's reflex seen in a normal child



Fig 2.54 : Alternative method of eliciting the Moro's reflex

The Moro's reflex appears after 28 weeks of gestation & disappears after 4 months of age. It is a vestibular reflex.

Table 2.28 : Abnormal/Asymmetric Moro's Reflex

Abnormal Moro's Reflex	Asymmetric Moro's Reflex
Preterm babies — reflex is incomplete with absence of adduction phase	Fracture of humerus or clavicle
Hypertonic CP — reflex is incomplete with little movement of arms	Infantile hemiplegia.
Brain damage (HIE) or maternal sedation — reflex is slow & incomplete	Erb's palsy.

➤ Grasp reflex

On stimulating of the palm of the hand by a finger (*Palmar grasp reflex*) (Fig 2.55), the infant flexes his fingers & grasps the stimulating finger. On stimulating the sole, the toes flex



Fig 2.55 : Palmar grasp



Fig 2.56 : Plantar grasp

(*Plantar grasp reflex*) (Fig 2.56). Care should be taken not to touch the dorsum of the hand or the foot while eliciting the reflex as then the fingers or the toes will extend & the reflex will not be elicited properly. The palmar grasp reflex disappears by about 4 months. Vigorous & persistent grasp reflex is seen in CP & Kernicterus.

➤ Rooting & Sucking reflexes

On stimulation of the infant's cheeks or the

lips or the angle of the mouth, the *Rooting reflex* (Fig 2.57) is initiated. On touching the lower lips, the lip lowers on the side of the stimulation & the tongue moves towards the lower lips. On touching the upper lip, the upper lip is elevated & the tongue moves towards the upper lips. The Rooting reflex is present at birth & disappears after 3–4 months of age.

The *Sucking reflex* (Fig 2.58) is elicited by putting a clean finger into the baby's mouth resulting in rhythmic brisk sucking.



(Courtesy : Dr Mukesh Agrawal, Mumbai)
Fig 2.57 : Rooting reflex



(Courtesy : Dr Mukesh Agrawal, Mumbai)
Fig 2.58 : Sucking Reflex

➤ Asymmetric tonic neck reflex (Fencing reflex)

In the supine posture, on rotating the head of the child on one side, the arm & leg on the same side of the rotated head extend, whereas they flex on the opposite side (Fig 2.59). The reflex appears at birth & disappears after 3–4 months. The reflex

is vigorous & persists for a longer time in patients with CP (Spastic CP).



Fig 2.59 : Asymmetric tonic neck reflex

► Parachute reflex

On holding the child in prone position & lowering him towards the bed (Fig 2.60) the arms of the baby extend (appears as if to prevent injury). This reflex appears at 7–9 months of age & remains life-long. It is incomplete in children with CP (whereas it is asymmetrical in infantile hemiplegia).

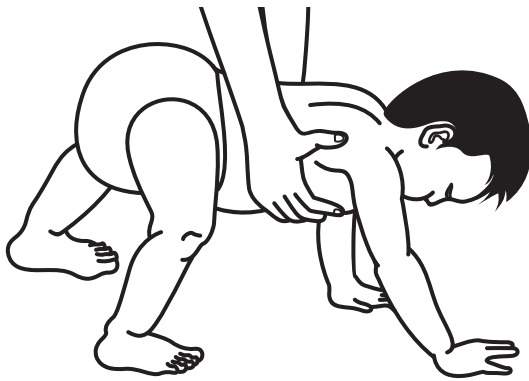


Fig 2.60 : The Parachute reflex

► Landau's reflex

On holding the child in prone position by supporting with the palm of the hand; the head, trunk, arms & legs extend (Fig 2.61). If the head

is lowered, the arms & legs begin to flex. This reflex appears after 6 months of age & disappears after 12–15 months of age. It is absent in cases of CP & mental retardation & also in disorders of muscle tone.

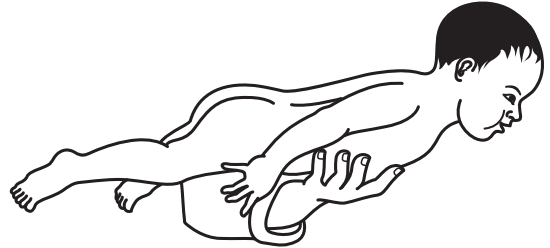


Fig 2.61 : Landau's reflex

► Deep tendon jerks & Ankle clonus

These are elicited as in adults. These are described later on in Examination of CNS. The tendon jerks are exaggerated & Ankle clonus may be present in spastic CP or Pyramidal tract lesions. The jerks may be absent in patients with HIE.

ASSESSMENT OF MUSCLE TONE

This is covered in detail later on in the examination of central nervous system. It is essential to test muscle tone in cases of CP as majority of children with CP are spastic (i.e. they have hypertonia). In addition to the usual methods of estimating muscle tone there are a number of other tests to assess muscle tone in infancy. They are described later in the chapter on examination of C.N.S.

SYSTEMIC EXAMINATION

Depending on the History, detailed examination of the particular system should be done.

Respiratory System

In the General Examination, special attention should be paid to Respiratory rate, rhythm, type of respiration, anemia, cyanosis & lymphadenopathy.

The **Upper respiratory tract** should also be examined thoroughly. This includes:

- Examination of Throat, tonsils & posterior pharyngeal wall

- Tenderness over the frontal &/or maxillary sinuses
- Movement of alae nasii

Examination of Chest

Inspection

In infants, inspection may be carried out with the child lying supine on the bed, but the best position for inspection in older children is the sitting position.

The following should be noted in inspection:

- *Shape of chest* :
Normal shape of chest in infants is circular. Look for:
 - Pigeon-shaped chest (Fig 2.62) : as in Rickets (Pectus carinatum).

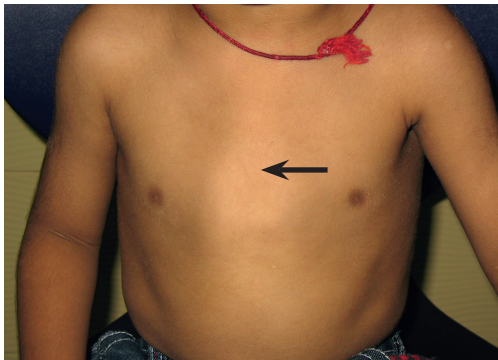


Fig 2.62 : Pigeon chest in a child with Rickets

- Barrel-shaped chest as in emphysema.
- Funnel-shaped chest (Fig 2.63) as in Marfan's syndrome (pectus excavatum).

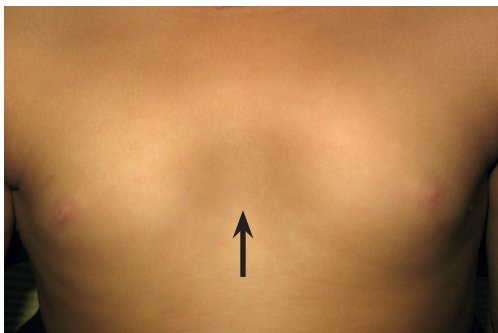


Fig 2.63 : Pectus Excavatum

- *Costochondral beading (Rachitic rosary) &/or Harrison's sulcus* : seen in Rickets (Fig 2.64)

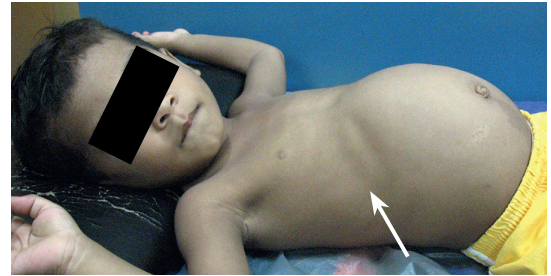


Fig 2.64 : Harrison's sulcus

- Localized areas of *retraction* (In collapse of lung) or *bulging* (In empyema) may be seen intercostally.
- Look at the *shoulders*. In fibrosis of lung on one side (seen in tuberculosis) drooping of shoulder may occur on the affected side.
- Examine the *spine* for kyphosis or scoliosis.
- Observe the *respiratory movements*: Whether equal on both the sides or not. Make a note of the respiratory rate & rhythm. Look for the use of accessory muscles of respiration. Also look for suprasternal, intercostal & subcostal retractions. They indicate obstruction of the airways either due to a foreign body or due to asthma.
- Detect the position of the *apex impulse*. In children it is usually located in the 4th Left Intercostal space just outside the midclavicular line. Its position can be altered in case of shift of mediastinum due to pulmonary pathology.
- Look for *Traille's sign*: The Traill's sign is the prominence of the tendon of the sternocleidomastoid muscle near the clavicle on one side. It occurs due to the deviation of trachea on the same side (Tracheal deviation is because of shift of mediastinum, probably due to any pulmonary pathology).
- Look for any *Pulsations, Dilated veins, Scars & Sinuses* over the chest.

Palpation

Verify the findings of inspection.

- The *respiratory movements* are assessed (Fig 2.65) by placing the hands over both the sides of the chest with the thumbs apposed to each other

in the midline. Then, the child is asked to take a deep inspiration & the movement of the two thumbs on both the sides is observed. (Look for equality of movements on the two sides).



Fig 2.65 : Assessing Respiratory movements by palpation

- Palpate the *trachea* by placing the middle finger in the suprasternal notch with the index & the ring finger over the site of attachment of the sternomastoid tendons to the medial ends of the clavicle on either side. Normally, the middle finger will touch the trachea in the center. If the trachea is deviated, the middle finger will slide into the space between the deviated trachea & the sternomastoid tendon.
- The position of the *apex beat* should be confirmed by palpation.
- *Tactile Vocal Fremitus*: The vocal fremitus is compared over both the sides by asking the child to speak one-one-one & palpating the chest over identical areas on the two sides. The equality (or inequality) of vocal fremitus is compared on the two sides. Vocal Resonance is more reliable & easier to perform than Tactile Vocal Fremitus.

Percussion

It is very difficult to elicit signs in young children with percussion due to the small chest & inability of the younger child to co-operate in the examination.

The areas percussed are:

- *Clavicular percussion* on either side.
- Determining the *liver dullness* on the right side & the *cardiac dullness* on the left side.
- Percussing *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 chest & the back (suprascapular, interscapular & infrascapular regions) are then auscultated to determine:

➤ Breath sounds

- **Intensity of breath sounds:** Whether normal, increased or decreased on either side.
- **Type of breath sounds**
 - ✧ *Vesicular sounds* (A long inspiration is followed by a short expiration without a pause) are normal (Fig 2.66).



Fig 2.66: Vesicular breath sounds

- ✧ *Bronchial breath sounds* (A low intensity inspiration & a loud expiration occupy the same duration of time & are separated by a definite pause) are heard in Consolidation or a large Cavity (Fig 2.67).



Fig 2.67 : Bronchial breath sounds

- ✧ *Broncho-vesicular sounds* (Expiration is louder & longer than inspiration & there is no pause between the two) are heard in Bronchial asthma & Emphysema (Fig 2.68).

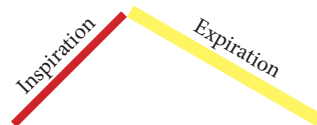


Fig 2.68 : Broncho-vesicular breath sounds

➤ Vocal Resonance

The child is asked to repeat one-one-one (cry

of a smaller child suffices) & the chest & back on both the sides are auscultated for the quality of the sounds.

Table 2.29 : Changes In Vocal Resonance

Increases In	Decreases In
Consolidation	Pleural effusiox
Superficial cavity	Pneumothorax
	Emphysema
	Collapse / fibrosis
	Bronchial obstruction

Other alterations in the vocal resonance are:

- *Whispering pectoriloquoy*: Whispered sound is heard clearly on auscultation. Occurs in Cavitory tuberculosis.
- *Bronchophony*: The vocal resonance increases but the sounds are muffled . Occurs in Pneumonia.
- *Aegophony*: Shuddering Nasal quality of sound like a goat bleating. Occurs above the level of Pneumothorax & Pleural Effusion.

► Other Abnormal Sounds

The other abnormal sounds to be looked for are:

- *Rales*: These are crackling sounds which are heard in Pneumonia, Bronchiectasis, Pulmonary abscess, Cavity, Pulmonary edema & Left-sided heart failure.
- *Rhonchi/Wheeze*: Rhonchi are continuos musical sounds due to air passing through narrowed airways & are heard in Bronchial asthma, Foreign body obstructing the bronchus & in bronchitis.
- *Pleural rub*: Harsh, creaking sound heard all over the chest (audible during inspiration & expiration but disappears on breath holding) associated with pain & tenderness heard in early stages of Pleural effusion.

Cardio-Vascular System

In the General examination special attention should be paid to Pulse, BP, JVP, Cyanosis & Edema feet.

Inspection

- Observe the *precordium*: In Chronic Cardiomegaly, there is bulging of the precordium (Fig 2.69).



Fig 2.69 : Bulging Precordium in Cardiomegaly

- Look for the *apex impulse*.
- Look for *pulsations & dilated veins* over the chest. Note down the area in which the pulsations are present the direction in which the blood flows in case of dilated veins.

Palpation

► Apex beat

- *Position of the apex beat*: In children it is normally located in the 4th Left Intercostal space just outside the mid-clavicular line.
- *Character of the apex beat*: Whether it is Normal, Heaving or Tapping. A Heaving apex beat is seen in Left ventricular hypertrophy whereas a tapping apex beat is usually due to a palpable 1st heart sound which occurs in Mitral stenosis.

► Parasternal Heave & Diastolic Shock

Parasternal heave is a heaving impulse in the left parasternal region synchronized with systole & occurs in Right Ventricular enlargement.

Diastolic shock is a palpable 2nd Heart sound in the Pulmonary area. If the pulmonary component of the 2nd heart sound is loud it is usually due to Pulmonary hypertension whereas a loud aortic component is usually due to Systemic hypertension.

► Thrills

A loud murmur which becomes palpable through the chest wall is known as a *Thrill*. It has a typical vibratory sensation like the purring of a cat. Note the site of the thrill (Mitral area, Pulmonary area etc.) & the timing of the thrill in relation to the cardiac cycle (Pansystolic, Systolic, Diastolic etc.)

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. If the upper border extends beyond the 2nd I-C space, it is indicative of Pericardial Effusion, Aortic aneurysm etc. If the left border extends beyond the apex beat or the right border extends to the right parasternal region, it is indicative of Pericardial Effusion.

Auscultation

Auscultation should not only cover the mitral, tricuspid, aortic or pulmonary areas; but should also include the 3rd & the 4th parasternal areas on both the sides, the neck, the thyroid gland, axillary region & the back (for e.g. the pansystolic murmur of Mitral regurgitation is heard best in the mitral area but radiates to the axilla & in some cases to the back also).

► Heart sounds

Clinically two heart sounds (1st & 2nd) are usually audible, although in certain cases a 3rd or even a 4th heart sound may be heard. The 1st heart sound (due to the closure of the mitral & the tricuspid valves) is single & is best heard in the mitral area. The 2nd heart sound (due to the closure of the aortic & the pulmonary valves) is split (because there is a time lag between the closure of the aortic valve & the pulmonary valve) & is best heard in the aortic & pulmonary areas. In children below 6 months of age, the pulmonary component of the 2nd heart sound (P₂) appears louder than the aortic component (A₂).

The 3rd heart sound (S₃) is normally inaudible. It may be audible in a few normal children as well as in Mitral or Tricuspid regurgitation & in CCF. It is heard when there is increased flow of

blood into the ventricles during diastole due to any reason.

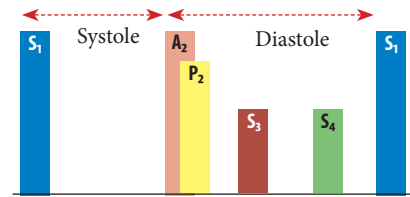


Fig 2.70 : Timing of the heart sounds in the cardiac cycle

The 4th heart sound (S₄) is rarely heard & may be detected in Pulmonary hypertension or severe Pulmonary stenosis. It represents the atrial contraction.

The following things should be noted while auscultating the heart sounds:

- *Intensity of the heart sounds* (Loud or soft)
- *Splitting of the sounds* (especially the 2nd heart sound) [Table 2.30]. Whether the split is normal or wide; whether the split is fixed (equal during inspiration & expiration) or variable (varies with respiration); whether the split is reversed (P₂ occurs earlier than A₂).
- Presence or absence of 3rd & 4th heart sounds.

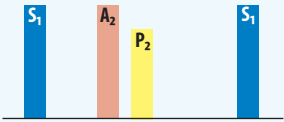
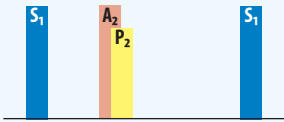
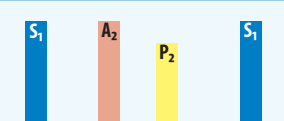
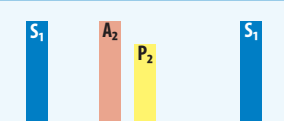
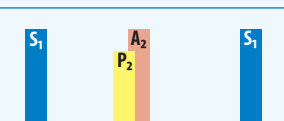
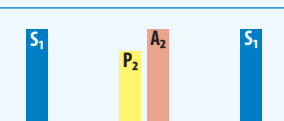
► Murmurs

Murmurs occur due to turbulent blood flow. The turbulence may either be due to a diseased or abnormal valve or a defect (hole) in the heart muscle.

The following things should be noted:

- *Timing of the murmur in relation to the cardiac cycle* : e.g. systolic, diastolic, continuous etc.
- *Grading the intensity of the murmur* : From grade 1 to 6, grade 1 being barely audible to grade 6 which is heard with the stethoscope not touching the chest wall. All murmurs above grade 4 are associated with a thrill.
- *Site of maximum intensity of the murmur* : e.g. Mitral area in Mitral stenosis.
- *Radiation of the murmur to a particular site*: e.g. the murmur in mitral regurgitation is radiated to the axilla & also to the back.

Table 2.30 : Variations in the Splitting of the heart sounds

Type of Split	Inspiration	Expiration
Normal		
Wide & fixed		
Wide & variable		
Reversed		

- *Posture in which the murmur is best heard* : e.g. the mid-diastolic murmur of mitral stenosis is best heard with the patient turned on the left side.
- *Change in the murmur with changes in respiration*: All murmurs originating from the right side of the heart become louder during inspiration (due to increased stroke output of the right heart during inspiration). Similarly, all murmurs from the left side of the heart become louder during expiration (e.g. the early diastolic murmur of aortic regurgitation is best heard along the left sternal edge with the patient bending forward & breathing out).
- *Change in murmur with exercise*: e.g. the mid-diastolic murmur of mitral stenosis becomes louder following exercise.

➤ Miscellaneous sounds

▪ Ejection clicks

Ejection clicks are clicking sounds heard best in the aortic or the pulmonary area just

after the 1st heart sound. They are due to opening of the diseased aortic or pulmonary valves.

- ❏ *Aortic ejection click*: Heard best in the aortic area & transmitted to the apex. Occurs in Co-arctation of aorta, aortic stenosis or aortic regurgitation.
- ❏ *Pulmonary ejection click*: Heard best in the pulmonary area. Occurs in pulmonary stenosis or pulmonary hypertension.

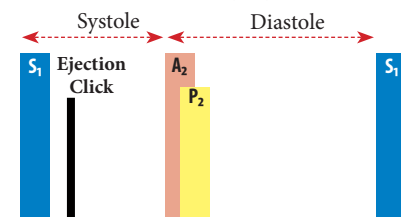
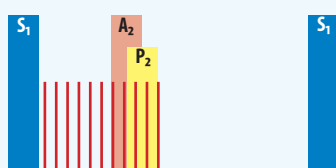
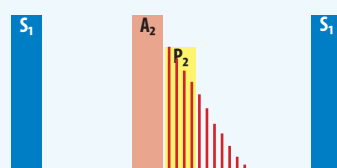
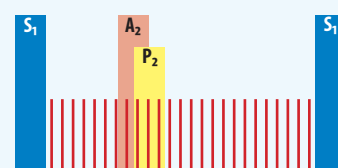
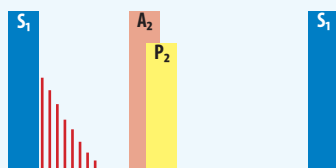
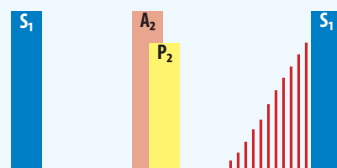
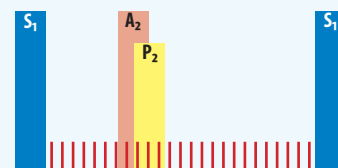


Fig 2.71 : Representation of the location of Ejection click in the cardiac cycle

▪ Opening Snap

It is a snapping sound which occurs due to the forceful opening of the diseased valve

Table 2.31 : Timing of the murmur in relation to the cardiac cycle

Systolic Murmurs	Diastolic murmurs	Continous murmurs
		
Pansystolic murmur	Early Diastolic murmur	Continous murmur
		
Early Systolic murmur	Mid-diastolic murmur with pre-systolic accentuation	Venous Hum

(mitral or tricuspid) as in mitral or tricuspid stenosis. It is heard best just medial to the apex after the 2nd heart sound.

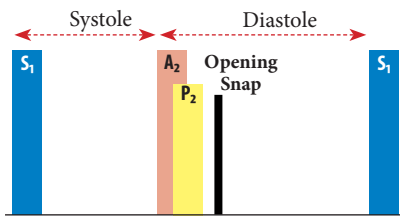


Fig 2.72 : Representation of the location of Opening snap in the cardiac cycle

■ Pericardial Rub

It is a coarse, leathery, superficial, to-and-fro sound heard throughout the cardiac cycle & all over the chest which is unaffected by respiration but becomes louder in the sitting position & changes in intensity on application of pressure over the chest by the stethoscope. It is heard in early stages of Pericardial Effusion.

Alimentary System (Per-Abdominal Examination)

Special attention should be paid to pallor, icterus, lymphadenopathy, edema feet & signs of liver-

cell failure (such as spider naevi, palmar erythema, parotid swelling, flapping tremors etc) in general examination.

Inspection

The abdomen should be inspected for the following :

- *Shape of the abdomen:* Whether it is normal, scaphoid (sunken) or distended. Scaphoid abdomen is seen in PEM. Distension of abdomen is seen in obese persons; in ascites; with organomegaly (hepatomegaly/splenomegaly); in rickets
- *Movements of the abdomen:* The abdominal movements occur with respiration. They are absent in peritonitis.
- *Peristaltic movements:* Exaggerated peristaltic movements are seen in pyloric stenosis, Hirschsprung's disease or obstruction of the intestines due to any cause.
- *Umbilicus:* Normal or everted (in ascites). Presence of umbilical hernia (Fig 2.73), umbilical granuloma or discharge of serous fluid or blood from the umbilicus should be noted. Persistent urachus leads to discharge of urine from the umbilicus.
- *Abnormal pulsations; scars or sinuses* over the abdomen if any should be noted.



Fig 2.73 : Umbilical hernia

- **Dilated veins:** In case of portal hypertension, dilated veins are seen periumbilically with flow of blood away from the umbilicus (*caput medusae*) whereas in superior or inferior vena cava obstruction, dilated veins are seen in the flanks. In SVC obstruction, flow of blood is above downwards, whereas in IVC obstruction, it is below upwards.



(Courtesy : Dr Siddhartha Shah, Mumbai)
Fig 2.74 : Dilated abdominal veins

Palpation

The child should relax & be co-operative during palpation as crying would lead to the abdomen being tense & the findings unreliable.

- Look whether on gentle palpation, the abdomen is *Normal* or there is *Tenderness* (child may wince or cry), *Guarding* or *Rigidity*.
- **Palpation of various organs**

The following organs are palpated. In massive ascites, *dipping method* (palpation with both the hands) is used to displace the fluid.

- **Liver :** Whether it is normal (Liver is normally palpable upto 1 inch below the costal margin in the right mid-clavicular line upto first 2–3 years of age); enlarged (determine the span of the liver); rounded or sharp edge; borders; consistency (soft, hard, nodular) & tenderness over the liver.



Fig 2.75 : Palpation of the liver

- **Spleen :** Normally just palpable in neonates & paraneonates. Later on, a palpable spleen denotes splenomegaly. [Should be palpated in supine & right lateral position (hooking method) to detect mild splenomegaly.]
- **Kidneys :** Palpated bimanually.
- Palpation of *any lump* (if present) over the abdomen (site—quadrant of abdomen; size, shape, consistency, tenderness, movements of the lump with respiration & in relation to skin, underlying & adjoining structures etc).

Percussion

While percussing the abdomen; the presence of *Shifting dullness*, *horse-shoe shaped dullness* or *fluid thrill* should be noted. Any *abnormal mass* should also be percussed to determine whether it is cystic or not.

In ascites, depending on the amount of fluid present, various types of dullness are seen. Thus in case of minimal fluid accumulation, *puddle sign* should be elicited with the child on his elbows & knees. Shifting dullness & horse-shoe shaped dullness are seen with moderate ascites. In massive ascites (with a tense abdomen) fluid thrill will be present.

Auscultation

- *Peristaltic sounds* should be auscultated. They are best heard just to the right of the umbilicus. They may be normal (2–3/minute) / decreased / absent (Paralytic ileus) or exaggerated. (In gastroenteritis or obstruction of distal bowel).
- *Vascular Sounds*: Common vascular sounds heard in abdominal auscultation are bruits & venous hum. Bruits over the abdomen may be present due to aortic aneurysms. Bruits over liver suggest tumour or telangiectasia. Venous hum in the epigastric region may be heard in portal hypertension due to blood flowing through the porto-systemic circulation.

Central Nervous System

CNS Examination is different from that of the other systems as the routine sequence of inspection, palpation, percussion, auscultation is not followed.

In the General examination, special attention should be paid to examination of Head, face & neck (discussed earlier in general examination). Examination of spine is equally important. Vital parameters, anemia, cyanosis etc should also be looked into. Developmental assessment & Elicitation of primitive reflexes is very important in all CNS cases.

Higher Functions

- *Consciousness*: The level of consciousness should be determined (normal, drowsy, stuporous etc.). This is discussed earlier in General examination.
- *Intelligence & Memory*: In a younger child, the alertness of the child is an indirect indication of the intelligence of the child. In older children, intelligence can be determined by asking them to add 2+3 or subtract 3 from 5 mentally. The memory can be determined by asking them the names of their parents or asking them to repeat a small sequence of digits forwards & backwards.
- *Orientation of time, place & person*: The older child should be able to tell the time (day or night, day of week), the location of the residence or his school & recognize a person (for e.g. the examiner is a doctor)
- *Speech*: Inability to speak is known as aphasia.

Damage to the cortical speech center (Broca's area) of the brain causes aphasia. Inability to speak properly (dysarthria) may occur due to Cerebral Palsy, Bulbar palsy, Cleft palate etc. Look out for stuttering, stammering, slurring & staccato speech. Nasal twang in speech occurs in cleft palate or in vagus nerve paralysis.

Cranial Nerves Examination

Examination of the cranial nerves requires cooperation from the child. Hence, it may not be possible to examine all the cranial nerves in younger children.

1st Cranial Nerve (Olfactory Nerve)

Each nostril should be tested individually for the sense of smell using non-irritant substances like coffee, chocolates etc. (Irritating substances stimulate the trigeminal nerve & hence should be avoided).

2nd Cranial Nerve (Optic nerve)

- *Visual acuity*: It is not possible to test visual acuity in children below 3–4 years of age using the standard Snellen's charts. In older children, Snellen's charts are used to test distant vision whereas Jaeggard's charts are used to test near-vision.
- *Field of vision*: The field of vision is tested by the confrontation method in children above 3–4 years of age. Perimetry test is possible only in children above 9–10 years of age.
- *Colour vision*: Is tested by Ishihara's pseudoisochromatic plates in children above 3 years of age.
- *Fundus examination*: Fundus should be examined with the ophthalmoscope after pupillary dilatation to determine whether the disc is normal or the presence of papilledema, retinal hemorrhages, chorioretinitis, choroidal tubercles or cherry-red spot (Tay-Sach's disease)

3rd(Oculomotor), 4th(Trochlear) & 6th(Abducent) Cranial nerves

- Examine the *external ocular movements* by asking the child to look at the examiner's finger without moving the head. The finger is then moved horizontally sideways & vertically up & down.
- Look for *Nystagmus* while checking the external ocular movements. The Nystagmus is usually horizontal in Cerebellar lesions, vertical in brain-

stem lesions & rotatory in labyrinthine lesions.

- Look for *Ptosis* or *Diplopia* (These occur in 3rd nerve paralysis) or *squint*.
- Examine the *pupils* of each eye for the shape, size, response to light & accommodation & equality.

5th cranial Nerve (Trigeminal nerve)

The 5th cranial nerve (3 branches : Ophthalmic, Maxillary & Mandibular) is tested by examining:

- *Sensations over the face on either side* : the sensory function of the 3 branches are tested separately & bilaterally (over the forehead, over the cheeks & over the chin). Pain, touch & temperature are all tested with the help of a pin, cotton & hot & cold test tubes respectively.
- *The motor function* is tested by examining the Masseter, Temporalis & Pterygoid muscles. To test the Masseter & Temporalis ask the child to clench his teeth. The masseters & temporalis do not become prominent on the affected side. To test the pterygoids, the child is asked to open his mouth. In paralysis of pterygoid muscle, the jaw is deviated towards the paralyzed side (Pushed by the opposite pterygoid muscle).
- *Conjunctival & corneal reflexes*: Lost on the affected side.
- *Jaw jerk*: Lost in peripheral trigeminal nerve lesion & brisk in pyramidal tract lesion above the trigeminal nerve nucleus.

7th Cranial nerve (Facial nerve)

The *sensory function* is tested by examining the taste sensation (sweet, salty, sour & bitter) on the anterior $\frac{2}{3}$ rd of the tongue.

The *motor function* is tested by examining the facial muscles. (Table 2.32).

In UMN paralysis, forehead, eyes & facial expressions are spared due to bilateral representation of the upper part of the face in the cortex. In LMN paralysis there is total facial palsy because all motor functions are lost — as seen commonly in Bell's palsy (Fig. 2.76). Bilateral facial palsy (Mask-like face with bilateral Bell's phenomenon & dysarthria) is common in Guillain-Barré syndrome.

Table 2.32 : Testing The Motor Function Of Facial Nerve

Elicitation	Result of loss of function (On the affected side)
Raise the eyebrows (look up)	Loss of wrinkles on the forehead
Close the eyes tightly with the examiner attempting to open them	Bell's phenomenon (Fig 2.76) (eyeball turns upwards & outwards on closing the eyes tightly)
Show the teeth	Drooping of the angle of the mouth on the affected side with asymmetry of the face
Blow the cheeks. The examiner then taps on the cheeks with his finger	Air leaks out on the paralyzed side



Fig 2.76 : A case of left-sided Bell's Palsy

8th Cranial Nerve (Auditory Nerve)

In infants, the auditory function is assessed by making some sound (like that of a bell) on either side & noting the response of the child like turning of the head toward the sound, startling, cessation of activity etc. In older children, hearing is tested with Rinne's & Weber's test (Table 2.33)

- *Rinne's Test* : Place a vibrating tuning fork (256 Hz) in front of the ear (Air conduction) & then place it over the mastoid bone on the same side (Bone Conduction)

- **Weber's Test** : The vibrating tuning fork is placed over the center of the patients's forehead.

The interpretation of *Rinne's & Weber's* test is shown in Table 2.33.

Table 2.33 : Rinne's Test & Weber's Test

Result	Rinne's Test	Weber's Test
Normal	Air conduction better than bone conduction	Vibrations heard equally on both sides
Sensori-neural deafness	Both air & bone conduction are decreased, but air conduction is better than bone conduction	Vibrations are heard better on the healthy side
Conduction deafness	Bone conduction is better than air conduction	Vibrations are heard better on the affected side.

9th (Glossopharyngeal) & 10th (Vagus) Cranial Nerves

- **Sensory function**: Test the sensations (superficial & taste) over the posterior $\frac{1}{3}$ rd of the tongue.
- **Motor function**: Look for the palatal movements on both the sides after asking the patient to open his mouth & saying 'ah'. Normally the uvula is in the center, but deviates to the normal side in case of paralysis of the palatal muscles.
- **Affection of the vagus nerve** causes dysphagia, loss of swallowing reflex, drooling, nasal twang in voice, regurgitation of feeds through the nose etc.
- **Gag reflex**: Tested by stimulating the pharynx with a tongue depressor. The normal response is gagging. It is lost in 9th & 10th nerve lesions.

11th (Accessory) Cranial Nerve

The accessory nerve is examined by testing the sternocleidomastoid & trapezius muscles. The *sternocleidomastoid* is tested by asking the child to rotate his chin against pressure. The *trapezius* is tested by asking the child to shrug his shoulders against resistance.

12th (Hypoglossal) Cranial Nerve

The hypoglossal nerve is tested by examining the tongue at rest & the movements of the tongue after protrusion from the mouth. In paralysis on one side,

the tongue deviates to the paralyzed side on protrusion due to the unopposed action of the opposite genioglossus muscle. At rest, there is atrophy with fibrillations & fasciculations on the affected side of the tongue.

Motor system examination

Posture of the limbs

The child may adopt a particular posture due to changes in the muscle tone. For e.g. in decerebrate rigidity, there is extension of all the 4 limbs with internal rotation of the arms & plantar flexion of the feet.

Nutrition of the muscles

Assess whether the muscles are normal, atrophied (wasted) or hypertrophied. The nutrition of the muscles can be gauged by measuring the circumference of the limbs at the same site on both the limbs. Atrophy of the muscles is generally seen in LMN lesions, PEM & Systemic diseases like Tuberculosis. Common causes of LMN lesions are Poliomyelitis, muscular dystrophy etc. Hypertrophied muscles are seen in Duchenne muscular dystrophy (DMD).

Tone of the muscles

Tone of the muscles in older children can be tested by 4 different ways. This is discussed below in Table 2.34.

Table 2.34 : Tests to assess Tone of Muscles

Tests	Normal	Hypotonia	Hypertonia
Palpation of muscles	Normal	Flabby	Rigid
Posture of limb	Normal	Limp	Stiff
Resistance to passive movements	Normal	Decreased	Increased
Range of passive movements	Normal	Increased	Decreased

In Infants, the tone is assessed by the following tests (Also helpful in early diagnosis of spastic CP).

- **Scarf Sign**: It is used to assess the tone of the muscles of the upper limbs. With the infant lying

supine, the upper limb (with the elbow flexed) is pulled across the chest holding at the hand. Normally, in infants less than 3 months old, the elbow does not cross the midline, between 4–6 months it crosses the midline & beyond 6 months it crosses the anterior axillary line. In hypotonia, the elbow crosses the above limits whereas in hypertonia, it will be far less than the above limits.

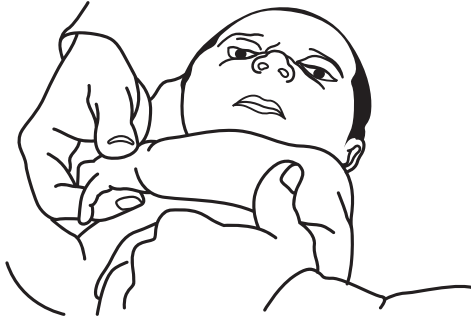


Fig 2.77 : Scarf sign

- **Heel-to-ear manoeuvre** : In the supine position, lift the leg upwards & towards the ears without lifting the pelvis above the table. In hypotonia, there will be no resistance while performing the test whereas in spasticity, it will be very difficult to perform the above manoeuvre.

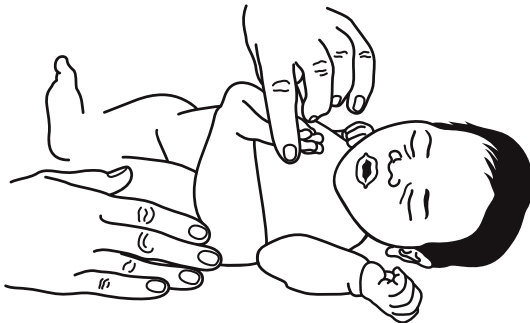


Fig 2.78 : Heel-to-ear manoeuvre

- **Adductor angle** : In the supine position & with the legs extended, both the hips are abducted fully by holding at the knees with the thumb or the index fingers (so that the knees are extended). The adductor angle is the angle between the two thighs. It is 40° – 75° below 3 months of age, 75° – 110° between 4–6 months, 110° – 150° between 7–9 months & 140° – 160° above 10 months. The adductor angle is narrow in case of

hypertonia & broad in case of hypotonia.

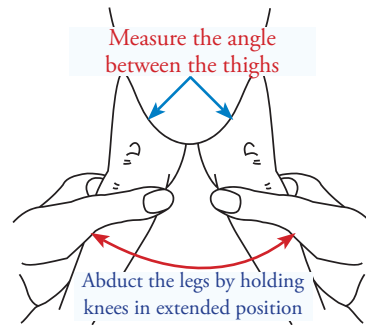


Fig 2.79 : Adductor angle

- **Popliteal angle** : In the supine position, the thigh of one of the legs is placed on the infant's abdomen & the knee is flexed. Then, by holding the foot with one hand while the other hand steadies the thigh, the leg is extended till there is resistance to further extension. The angle formed at the posterior part of the knee at the junction of the thigh & leg is known as the Popliteal angle. If the angle fails to increase in infancy, it indicates hypertonia.

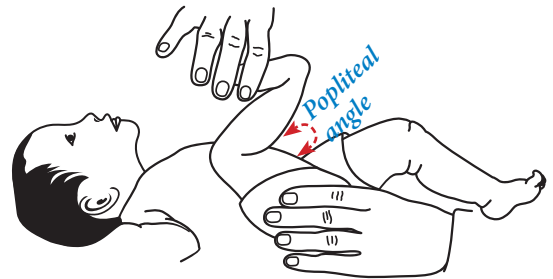


Fig 2.80 : Popliteal angle

- **Ankle dorsiflexion** : The foot is dorsiflexed on the anterior aspect of the leg by pressing the thumb over the sole. The angle between the dorsum of the foot & the anterior aspect of the leg is measured. (Generally, it is 60° – 75° during infancy). The angle is more in case of hypertonia & less in hypotonia.

Power of the muscles

In infants & young children, it may not be possible to test the power of individual muscles (Table 2.35) or muscle groups due to inability of the child to comprehend what the examiner wants to do. An indirect assessment of the power in all the limbs can be done by observing the spontaneous movements

of the child while in bed, when he gets up from the supine to the sitting position (whether he supports himself with the arms or not); how he holds an object, whether he refuses to use a particular hand (hemiplegia or monoplegia); how he walks (e.g. Circumduction gait in case of hemiplegia).

In older children, active movements at all joints should be tested with & without resistance. (Table 2.35) & (Figures 2.81 & 2.82).

Table 2.35 : Tests to Assess the Power of Individual Muscles (Muscle groups)

Muscle To Be Tested	Mode Of Testing The Muscle
Deltoids	Abduction of arms from rest to horizontal position
Biceps	Flexion of elbow joint with the forearm in supinated position
Triceps	With the elbow fully flexed, ask the child to extend the arm.
Gluteus maximus	In Prone position, patient attempts to lift his knee off the bed against resistance
Quadriceps	In the supine position & with the knee partially flexed, the patient attempts to extend his knee against resistance
Hamstrings	In the prone position, the patient tries to flex his knee against resistance
Gastrocnemius & Soleus	In the supine position & with the knees extended, the patient attempts to push down the sole of the foot against resistance
Tibialis anterior	In the supine position & with the knees extended, the patient attempts to dorsiflex his foot against resistance

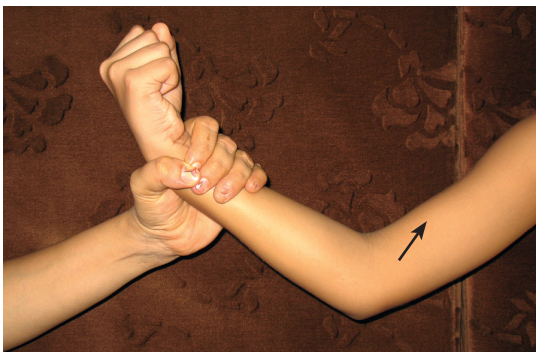


Fig 2.81 : Assessing the power of the right biceps muscle



Fig 2.82: Assessing the power of the Tibialis anterior muscle

Power is graded from 0 to 5 (Table 2.36).

Table 2.36 : Grading of Power

Grade	Movement
0	None
1	Flickering movement
2	Movement possible after elimination of gravity
3	Movement possible against gravity but not against resistance
4	Movement possible against gravity & against mild-to-moderate resistance
5	Normal Power

Co-ordination

Co-ordination can be tested only in children above 6–7 years of age & only when the Power of the muscles is equal to or above Grade 3. Co-ordination is examined by doing the following tests:

► Tests to distinguish between Sensory & Cerebellar ataxia

- **Rhomberg's test:** Ask the patient to stand with the feet close together with the eyes open & closed. If he stands with the eyes open but sways when they are closed, it is known as *Positive Rhomberg's sign* (seen in *sensory ataxia*). If he sways even with his eyes open, it is due to *cerebellar ataxia*.
- **Tandem Walking:** Patient is asked to walk in a straight line placing one foot closely in front of the other with both the eyes open & closed. If the patient walks properly with eyes open, but sways on closure of the eyes, it is sensory ataxia. If the patient sways even with the eyes open, it is cerebellar ataxia.

► **Further tests for Cerebellar ataxia**

- *Gait of the patient:* Observe the gait — whether the patient is ataxic & has a broad-based gait.
- *Finger-nose test:* The child is asked to abduct his arm fully & then to alternately touch his nose & the examiner's finger (the examiner moves his finger in different directions). Look for tremors & dysmetria (finger missing the target).
- *Dysdiadochokinesia:* Patient is asked to alternately supinate & pronate his hands briskly. In cerebellar lesions, he is unable to do so & does the test very slowly.
- *Knee-heel test:* Patient is asked to put the heel of one foot on the knee of the other leg & then push it along the shin (Fig 2.83) upto the dorsum of foot. Look for tremors & dysmetria.



Fig 2.83: Knee-heel test

- *Rebound test:* The patient's shoulder & elbow are flexed & the examiner pulls at the wrist against resistance & then suddenly releases it. Normally the triceps checks further flexion.

In cerebellar lesions, this is abolished & the patient may hit himself.

Involuntary movements

Look for Abnormal movements. They are:

- *Tremors:* Regular, rhythmic, repetitive oscillations of a part of a body around a fixed point, usually in one plane.
- *Athetosis:* Slow, involuntary, writhing movements more marked in distal extremity, consisting of alternate pronation & supination & flexion & extension of limbs (under cover of hypotonia)
- *Ballismus:* Violent flinging or rotational excursion of limbs, usually proximal (usually upper limbs). When limited to one side of the body it's called Hemiballismus.
- *Myoclonus:* Involuntary, repetitive, instantaneous, shock-like contractions of muscles or group of muscles.
- *Chorea:* Rapid, jerky, involuntary, quassi-purposive, non-repetative movements which are increased by stress & disappear during sleep (under cover of hypotonia)
- *Dystonia:* Simultaneous contraction of agonist & antagonist group of muscles which results in abnormal postures that are transiently sustained.
- *Tics:* Spasmodic, involuntary, repetitive, stereotyped non-rhythmic movements which are exacerbated by stress & may affect any muscle group.

Reflexes

Superficial Reflexes

Tests for Superficial reflexes are shown in Table 2.37

Table 2.37 : Tests To Assess Superficial Reflexes

Superficial Reflexes	Method Of Elicitation	Response
Plantar reflex* (S ₁)	Stroke the lateral border of the sole of the foot from the heel to the toes.	Normal response is Plantar flexion of all the toes. In pyramidal lesions, there is dorsiflexion of the big toe with fanning of the other toes
Abdominal reflexes (D ₆₋₁₂)	Stroke the skin of the abdomen from the lateral end towards the midline	Contraction of the abdominal muscles of the same side towards the site of stimulation.
Cremasteric reflex (L _{1,2})	Stroke the skin of the medial side of the thigh from above downwards	Contraction of cremasteric muscle & elevation of the testicle on the stimulated side
Anal Reflex (S ₄₋₅)	Stroke the skin in the perianal region	Contraction of the anal sphincter.

*In infants less than 2 years of age, the plantars may be extensors bilaterally. This is a normal response in infants. However, unilateral extensor plantar response is definitely pathological

The absence of superficial reflexes usually indicates:

- Pyramidal lesions above the level of the reflex arc in the spinal cord.
- Lesions at the level of the reflex arc

Thus for e.g. absence of Cremasteric reflex ($L_{1,2}$) indicates pyramidal lesions above the level of $L_{1,2}$ or lesion in the spine at the level of L_{1-2} .

Deep Tendon reflexes

The Deep Tendon reflexes are elicited in older children by tapping at specific sites as discussed in Table 2.39 & Figures 2.84 & 2.85, with the help of a hammer. In infants & younger children, the reflexes may be elicited with the finger of the examiner or the edge of diaphragm of the stethoscope instead of the hammer.

Reflexes can be graded as described in Table 2.38

Table 2.38 : Grading of Reflexes

Absent reflexes	0
Sluggish reflexes (seen with reinforcement*)	1+ (+)
Normal	2+ (++)
Brisk	3+ (+++)
Brisk with clonus	4+ (++++)

*Reinforcement of Jerks is achieved by asking the patient to clench the teeth or fists or by Jendrassik's manoeuvre (flexing the fingers of the two hands against each other & pulling in the opposite direction)



Fig 2.84 : Method of eliciting the Biceps reflex



Fig 2.85 : Method of eliciting the Patellar reflex

Table 2.39 : The Deep Tendon Reflexes & their Mode of Elicitation

Reflex	Nerve & Spinal Level	Elicitation	Response
Biceps	Musculocutaneous (C_{5-6})	Tap the biceps tendon after partial flexion & pronation of the elbow	Further flexion of the elbow & visible contraction of the biceps muscle
Triceps	Radial (C_{7-8})	Tap the triceps tendon just above the elbow after flexing the elbow above the chest	Extension of the elbow & visible contraction of the triceps muscle
Supinator	Radial (C_{7-8})	Tap the brachioradialis tendon at the lower end of the radius after partial flexion & pronation of the elbow	Further flexion & pronation of the elbow & visible contraction of the brachioradialis muscle
Knee jerk	Femoral (L_{3-4})	Tap the quadriceps tendon just below the knee after partially flexing the knees & supporting them with the hands in the supine position	Extension of the knees & visible contraction of the quadriceps muscle
Ankle	Sciatic nerve (S_{1-2})	Tap the tendo-achilles after partially flexing the knee & externally rotating the leg	Plantar flexion of the ankle & visible contraction of the gastrocnemius muscle

Table 2.40 describes various causes of absent & brisk deep Tendon reflexes

Table 2.40 : Causes of Absent & Brisk Deep Tendon reflexes

Absent Deep Tendon reflexes	Brisk Deep Tendon reflexes
Lower motor neuron lesions	Upper motor neuron lesions (Pyramidal lesions)
Severely Spastic children (Cerebral Palsy)	Tetanus or Strychnine poisoning
Contracture of muscles	Hysteria
Stage of neuronal shock in upper motor neuron lesions	In small children, the reflexes may frequently be exaggerated without any reason

Sensory System Examination

It is difficult to examine the sensations in infants & young children. In infants only the pain sensation can be determined.

The following sensations should be tested & compared at identical sites on both the sides of the body.

Superficial sensation

- *Touch sensation:* Tested with cotton wool
- *Pain sensation :* Tested with pin prick
- *Temperature sensation :* Tested with two test-tubes (hot & cold)

Deep sensations

- *Vibration:* A vibrating tuning fork (128hz) is placed on some bony prominence of the body.
- *Position:* Close the patient's eyes & flex his great toe passively & ask him to put the other toe in the same position.

Cortical sensations

- *Tactile localization:* Ask the patient to accurately locate the site of stimulation of skin with finger tip.
- *Tactile discrimination:* Tested by simultaneously touching 2 areas of the skin with 2 pins (pin-ends). Normally tactile discrimination is appreciated best over the tips of the fingers (4–6mm) & least over the back.
- *Stereognosis:* Ability to recognize familiar objects

such as coins, keys, etc. by recognition of their shape, weight & form. Loss of this ability is called as astereognosis.

Signs of meningeal Irritation

➤ Neck Stiffness

It is tested by passively flexing the neck of the child in the supine position (Fig 2.86). The older child can be asked to touch his chin to his chest. In a crying infant, the head is brought beyond the edge of the table & then the neck is flexed to test for neck stiffness.

Neck stiffness is present if there is resistance to passive flexion of the neck & pain occurs on forcible attempt to flex the neck.

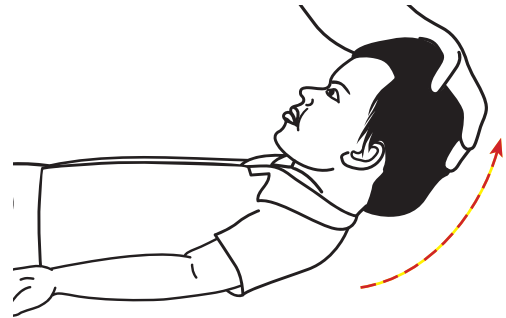


Fig 2.86: Eliciting Neck Stiffness

Causes of neck stiffness are discussed later in chapter 3 on D/D of abnormal symptoms & signs.

➤ Kernig's Sign

In the supine position, with the hips & knees in flexed position, extend the knees. Normally this is possible upto 140°. It is restricted in meningitis.

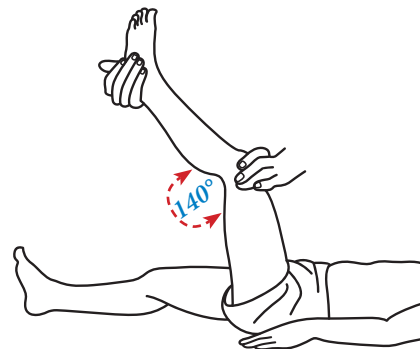


Fig 2.87: Eliciting the Kernig's sign

➤ **Brudzinski's Sign**

On flexion of the neck in supine position, there is flexion of the hips & knees in case of meningitis (Fig 2.88). Also, on flexion of one leg the other leg also flexes in meningitis.

Cerebellar Signs

Cerebellar lesions are usually characterized by Staccato speech, Ataxic gait, Hypotonia, Nystagmus & Inco-ordination (The various tests for examining co-ordination are already discussed previously).



Fig 2.88: Eliciting Brudzinski's sign

§§§

The following is an account of the common causes of symptoms as encountered in day-to-day practice. This is by no means an exhaustive list as it tries to enlist only the common causes seen in day-to-day practice.

3.1: D/D of Common Symptoms

Abdominal Distension



Fig 3.1 : Abdominal distension in a 1½ year old child

- Gaseous distention (due to aerophagy, intestinal infections)
- Hypotonia (e.g. Malnutrition, Rickets etc.)
- Chronic constipation (Faecoliths)
- Obesity

In the above conditions, the abdominal distension is usually non-progressive.

- Ascites
- Lump in the abdomen
- Acute abdomen (Surgical abdomen) (e.g. Paralytic ileus, Intestinal obstruction, Peritonitis)

In the above 3 conditions, the distension is progressive & requires urgent intervention

Abdominal Pain

- Infant colic
- Gastro-enteritis
- Hepatitis
- Parasite infestation
 - e.g. Ascariasis, Amebiasis
- Gastritis / Peptic ulcer
- Chronic constipation
- Functional
- Surgical Causes
 - e.g. : Ureteric / Renal colic (Calculi)
 - : Biliary colic (cholelithiasis)
 - : Intestinal obstruction (Intussusception)
 - : Appendicitis
 - : Hernias
 - : Pancreatitis
- Sickle-cell crisis
- Lead poisoning

Altered Taste

The Commonest Cause for Alteration of Taste is Drugs. The term for altered taste is 'Dysgeusia'.

The following are some of the common causes of Altered Taste.

- Drugs
 - Antihistamines
 - Metronidazole
 - Ethambutol
 - Griseofulvin
 - Acetazolamide
 - Phenytoin
- Zinc Deficiency
- GERD
- Liver Failure
- Renal Failure
- Cushing's Syndrome
- Hyperthyroidism
- Familial Dysautonomia
- Turner's syndrome

Anorexia

- Physiological : The decreased appetite of toddlers (due to decreased growth) as compared to infants may be regarded by some parents to be of concern.
- Infections : Febrile illness, Tuberculosis
- Liver diseases : Hepatitis
- Renal diseases : Uraemia due to chronic renal failure
- Endocrinopathies : Hypothyroidism
- Drugs : Digitalis
- Malignancy : Leukaemias, Lymphomas
- Psychiatric disorders : Depression etc

Back Pain

- Bad Posture : Causes Ligamentous Strain & Muscle Spasm
- Severe Athletic Exercises or weight-bearing exercises : May cause Intervertebral disc lesions or ligamentous strain
- Rickets
- Inflammatory conditions : Ankylosing Spondylitis, Spondyloarthritis, Rheumatoid arthritis, Discitis
- Scheurmann's disease
- Scoliosis
- Malignancy
- Pain due to Abdominal Conditions Radiating to the back
- Psychological

Bleeding

Can be classified into Generalized bleeding (i.e. bleeding at more than one site) or localized (at one site only).

Generalized bleeding

- *Mucous membrane bleeds*: i.e. petechiae — usually signify Platelet disorder.
e.g. : Leukaemia, ITP, Aplastic anaemia, Other rare platelet disorders.
- *Deep-seated bleeds* : i.e. Hematomas, hemarthro-

ses etc. — usually signify Coagulation disorders.
e.g. : Coagulation Factor deficiency (Hemophilia A, B), DIC, Septic Shock

Localized bleeding (at one site only)

- *From Nose (Epistaxis)*
 - Picking the nose (trauma)
 - Foreign body in nose
 - Hypertension
- *From Gums* : Scurvy
- *From lungs (Hemoptysis)*
 - Tuberculosis
 - Bronchiectasis
- *From Upper GI tract (Hematemesis)*
 - Liver cell failure
 - Drugs causing severe gastritis
- *From Rectum*
 - Fissures
 - Piles (uncommon)
 - Polyps

Blue Eyes (Sclera)

- Infants below 1 year of age
- Osteogenesis imperfecta
- Marfan's syndrome
- Ehler-Danlos syndrome
- Rarely, Iron-deficiency anemia

Chest Pain

Thoracic Causes

- Trauma
- Costochondritis

Intrathoracic Causes

- *Diseases of respiratory system*
 - Pneumonia
 - Pleurisy
 - Pneumothorax
 - Collapse of lung
 - Pulmonary embolism
- *Diseases of heart & blood vessels*
 - Pericarditis
 - Valvular lesions

- Aortic aneurysm
- Aortitis
- *Diseases of Mediastinum* : Mediastinal emphysema
- *Diseases of Oesophagus*
 - Oesophagitis
 - Achalasia
- *Referred Pain* : From abdomen
 - Peptic ulcer
 - Liver abscess
 - Pancreatitis
- *Psychogenic or Functional*

Constipation

- **Organic causes:**
 - Imbalanced diet —Decreased Fibre intake
 - Recent acute illness & poor oral intake
 - *Intestinal Causes* : □ Hirschprung's disease
(*Surgical causes*) □ Rectal/anal stenosis
□ Stricture
 - *Metabolic Causes* : □ Dehydration
□ Hypocalcemia
□ Hypokalemia
 - *Endocrinal Causes*: Hypothyroidism
 - *Drugs* : Calcium preparations, Opioid derivatives, anticholinergics etc.
 - *Due to severe painful defaecation* : e.g. Anal fissures.
- **Non-Organic** : Functional/Habitual Constipation
Psychiatric illness

Convulsions

- *Febrile Convulsion*
 - Commonest Cause (between 6 months–5 years of age).
- *Intracranial Infections*
 - Bacterial (Pyogenic) Meningitis
 - Viral Encephalitis
 - Tuberculous Meningitis
 - Brain abscess (Localized seizures)
- *Metabolic Causes*
 - Hypoglycemia

- Hypocalcemia
- Hypomagnesemia
- Hyponatremia / Hypernatremia
- Pyridoxine dependency
- Inborn errors of Metabolism — e.g. Maple Syrup Urine Disease, Phenylketonuria
- Organic acidemias
- Mitochondrial disorders — e.g. Leigh's disease
- Storage disorders — e.g. Gangliosidosis
- *Structural abnormalities*
 - Sturge-Weber Syndrome
 - Neurofibromatosis of the brain
 - Tuberous Sclerosis
 - Lissencephaly / Schizencephaly
- Birth asphyxia (HIE)
- Trauma & CNS hemorrhage
- Hypertensive encephalopathy
- *Drug-associated seizures* — e.g. Overdose of Theophylline / aminophylline. Sudden Withdrawal of benzodiazepines / barbiturates
- *Unknown* : Idiopathic Epilepsy

Coma

Causes not usually associated with Focal Neurological Deficit

Normal CSF	Abnormal CSF*
➤ Head injury/concussion ➤ Septicemia ➤ Post-ictal ➤ Hypertensive encephalopathy ➤ Metabolic encephalopathy ▪ Hypoglycemia / Hyperglycemia ▪ Hypoxia / Hyperoxia ▪ Hyponatremia / Hypernatremia ▪ Renal Failure ▪ Hepatic Coma ➤ Shock ➤ Poisoning with narcotics ➤ Drugs — Salicylates, Barbiturates	➤ CNS infections ▪ Meningitis ▪ Encephalitis ➤ Subarachnoid hemorrhage ➤ Midline brain tumours ➤ Hydrocephalus ➤ Lead poisoning

Causes associated with Focal Neurological Deficits

Normal CSF	Abnormal CSF*
➤ Vascular — Cerebral arterial occlusion ➤ Todds Paralysis ➤ Demyelinating disorders ➤ Cerebral Contusion	➤ Infections — Brain abscess / Subdural empyema ➤ Vascular — AV Malformations ➤ Brain tumours ➤ Trauma with Intracranial hemorrhage

*Abnormal CSF—CSF picture showing abnormal pressure / cells/ proteins

Cough**➤ Pulmonary causes**

- *Respiratory Tract Infection*
 - Acute URTI or LRTI
 - Chronic Infection — Sinusitis, adenoiditis,
 - Tuberculosis
 - Bronchiectasis
 - Lung abscess
- *Hyper-reactive airways* : Asthma
- *Respiratory tract irritation*
 - Aspiration syndromes
 - Foreign body

➤ Extrapulmonary Causes : Cause Cough by external pressure on Trachea & bronchi

- *Cardiac Causes* :
 - L→R shunts
 - Cardiomegaly
 - Left Ventricular Failure
- *Vascular causes* : Aortic aneurysms
- *Mediastinal causes* : Mediastinal lymphadenopathy

➤ Reflex Causes : Foreign body or wax in external ear (by irritation of Vagus nerve)**➤ Psychogenic Causes****Deafness**

Deafness may be partial or complete. The causes of Deafness can be divided into two categories.

Acquired & Congenital**➤ Causes of Acquired Deafness are :**

- Extreme Prematurity

- Hypoxic-ischemic disease of Newborn
- Neonatal Jaundice
- Prolonged Nasotracheal Intubation
- Recurrent Otitis Media
- Glue Ear
- Severe Adenoids
- Infections such as Measles, Mumps, Meningitis etc.
- Trauma
- Drugs : Aminoglycosides, Furosemide
- Repeated exposure to very loud noise

➤ Causes of Congenital Deafness are :

- Familial (Genetic)
- Mental Retardation
- Cerebral Palsy
- Prenatal : Diseases or Drugs in the Mother during pregnancy can adversely affect the fetus.

Maternal Diseases	Maternal Drugs
▫ Rubella	▫ Aminoglycosides
▫ Syphilis	▫ Quinine
▫ Chickenpox	▫ Vancomycin

- Down's Syndrome
- Hypothyroidism
- Cleft Palate
- Albinism
- Osteogenesis imperfecta
- Various syndromes like : Pierre Robin Syndrome, Alport's Syndrome, Kallman's Syndrome, Refsums disease, Lowe's Syndrome.

Delayed Micturition In Newborns

$\frac{2}{3}$ rd of all children pass urine within 12 hours after birth; $\frac{1}{4}$ th in the next 12 hours & only 7% after 24 hours.

Causes of delayed micturition in Newborns are :

- Dehydration (Due to fluid Restriction)
- Bilateral renal Agenesis. (Associated with empty bladder & absence of ascites)
- Bilateral Renal Vein Thrombosis
- Tubular / Cortical Necrosis
- Nephritis

Delayed Puberty in Boys & Girls		
Causes	Boys	Girls
Hereditary/Familial	› Normal Variant	› Normal Variant
Dietary deficiency	› Malnutrition	› Malnutrition
Chronic diseases	› Asthma › Valvular heart disease › Tuberculosis › Cystic fibrosis	› Asthma › Valvular heart disease › Tuberculosis › Cystic fibrosis
Pituitary diseases	› Craniopharyngioma	› Craniopharyngioma › Gonadotrophin deficiency
Syndromic conditions	› Klinefelter's Syndrome › Noonan's Syndrome › Prader-Willi Syndrome	› Turner's Syndrome
Miscellaneous causes	› Mumps › Drugs (Cyclophosphamide) › Torsion of Testis › Undescended Testis	› Testicular feminization Syndrome › Drugs

- › Congenital Nephrotic Syndrome
- › Urethral Diverticulum

Delayed Puberty (See table)

Diarrhea

Acute Diarrhea

- › Infectious
 - Local infection : Gastroenteritis
 - Systemic infection
- › Antibiotic associated e.g. Following ampicillin use
- › Indigestion

Chronic Diarrhea

- › Lactose Intolerance :
 - Post-infectious (common)
 - Primary lactase deficiency
- › Cow's milk allergy
- › Celiac disease
- › Giardiasis
- › AIDS
- › Inflammatory bowel disease
- › Irritable bowel syndrome

Drowsiness

- › Lack of sleep
- › Excessive Fatigue
- › Drugs
 - Antihistamines
 - Anticonvulsants
 - Tranquillizers
- › High fever
- › Infectious diseases
 - Meningitis
 - Encephalitis
- › Metabolic disorders
 - Dehydration
 - Uremia
 - Hypoglycemia
 - Hypokalemia
 - Hepatic failure
 - Diabetic Ketoacidosis (DKA)
- › PEM — esp. Kwashiorkor

Dryness of Mouth

- › Dehydration
- › Mouth-breathing (During Common cold or in

- Enlarged Adenoids)
- Drugs
 - Antihistamines ▪ Anticholinergics
 - Anticonvulsants ▪ Atropine
 - Tranquillizers ▪ Codeine
- Sjogren's Syndrome
- Psychological

Dyspnea (Breathlessness)

Breathlessness not associated with exertion

- *Respiratory causes*
 - Pneumonia
 - Pleural Effusion
 - Pneumothorax
 - Bronchial asthma
- Metabolic causes — Acidosis of any cause
- Psychogenic hyperventilation

Breathlessness due to exertion

- *Cardiac causes*
 - Congenital heart disease
 - Rheumatic heart disease
- *Respiratory diseases*
 - Asthma
 - Pulmonary fibrosis
- *Hematological causes*
 - Anemia

Epistaxis

Local Causes	Systemic Causes
➤ Direct trauma or nose-picking ➤ Nasal diseases ➤ Rhinitis ➤ Diphtheria ➤ Tumours ➤ Polyps ➤ Foreign body in nose	➤ Bleeding diathesis ➤ Severe hepatic failure ➤ Tuberculosis or Pertussis ➤ Hypertension

Excessive Crying

- Hungry Infant
- Intestinal Colic

- Respiratory Distress in Infants — e.g. Blocked Nose, Bronchitis, Bronchiolitis
- Earache/ Headache etc. in infants
- Acute abdomen
 - Intussusception
 - Obstructed hernia
 - Torsion of Testis
 - Intestinal obstruction
 - Acute appendicitis
- Intracranial infection like Meningitis, Raised Intracranial Tension
- Fractures / Trauma
- Following Vaccination — e.g. : DPT vaccination due to Pertussis component may cause persistent crying in few infants

Excessive Salivation With Drooling

- Mouth breathing
- Teething
- Stomatitis
- Mental Retardation
- Cerebral Palsy
- Drugs — e.g. Dicyclomine, Clonazepam, Haloperidol
- Dysautonomia

The following are causes of Drooling due to failure to swallow the Saliva :

- Bulbar palsy
- Facial Palsy
- Myasthenia gravis
- Oesophageal atresia
- Diseases like Diphtheria, Rabies & Bulbar Polio

Excessive Sweating

- Over-clothing
- Fever
- Rickets (Sweating over the forehead)
- Hypoglycemia
- Thyrotoxicosis
- Neuroblastoma
- Frey's syndrome — Sweating & flushing over the

face (Distribution of the auriculotemporal nerve) on eating food

- Drugs
 - Analgesics
 - Antihistaminics
 - Tricyclic Antidepressants
 - Anticholinergics
 - Phenothiazines
 - Overdosage of Thyroxine during treatment of Hypothyroidism

Fever

- Due to Biological factors :
 - Infections caused by Bacteria/ Virus/ Fungus/ Protozoa. e.g. URTI/ LRTI / UTI / CNS infection — Meningitis etc.
 - Vaccines
- Direct injury to body tissues — e.g. Burns or Trauma
- Inflammatory causes
 - Inflammatory bowel disease
 - Autoimmune disorders — e.g. JRA, SLE etc
- Metabolic causes — Uremia, Gout
- Endocrinopathies like Thyrotoxicosis
- Malignancies
- Drugs
- Other rare miscellaneous causes

Gingivitis

- Dental Caries
- Malocclusion of Teeth or Overcrowding or Teeth
- Infections like Herpes, Moniliasis (Thrush) & Staph. Aureus infections
- Scurvy
- Mouth breathing
- Drugs — Phenytoin

Gynaecomastia

Enlarged breasts in Boys may be seen in the following conditions :

- Newborns — Normal during the 1st week of life
- Puberty

- Pituitary diseases — like Acromegaly
- Thyrotoxicosis
- Hepatic cirrhosis
- Renal Failure
- Drugs
 - Cytotoxic Drugs
 - Digitalis
 - INH
 - Gonadotrophins
 - Oestrogens & Progesterones
 - Spironolactone
 - Tranquillizers
- Adrenal or Testicular Tumour
- Klinefelter's Syndrome



Fig 3.2 : Gynaecomastia in 12-year old male child

Haemetemesis

- Oesophagitis & Oesophageal Varices
- Gastric ulcer & Duodenal ulcer
- Gastritis due to drugs like NSAID's
- Tumours
- Bleeding Dyscrasias
- Liver cell failure
- Septicemia

Haematuria

Haematuria can occur due to Systemic Disorders or Due to Diseases related to the Urinary Tract.

Systemic Disorders

- Bleeding Dyscrasias
- Infective Endocarditis
- Drugs — Anticoagulants / Antiplatelet agents
- Exercise (excessive)

Diseases related to the Urinary Tract

- *Kidney (Renal) Disorders*
 - Acute Glomerulonephritis
 - Acute Pyelonephritis
 - Stones (Calculus)
 - Henoch-Schonlein Purpura (HSP)
 - Hemolytic-Uremic Syndrome (HUS)
 - SLE
 - Trauma
 - Tumour
- *Collecting System Disorders (involving Ureter, Bladder & Urethra)*
 - Calculus ▪ Foreign body
 - Infection ▪ Tumour
 - Trauma

Haemoptysis

Haemoptysis means presence of blood in cough. The blood in cough can originate either from the Upper Respiratory Tract or the Lower Respiratory Tract.

Upper Respiratory Tract (Mouth, Pharynx & Larynx) Disorders

- Trauma
- Infection
- Malignancy

Lower Respiratory Tract Disorders (True Haemoptysis)

- *Respiratory causes*
 - Respiratory Tract Infections
 - Pneumonia ▫ Lung abscess
 - Tuberculosis ▫ Bronchiectasis
 - Pulmonary Embolism

- AV Malformations
- Foreign Body
- *Cardiac Causes*
 - Left ventricular failure — causing Pulmonary edema
 - Pulmonary Hypertension
- *Congenital Causes*
 - Pulmonary Sequestration
- *Bleeding Dyscrasias*
 - Leukemia
 - Idiopathic Thrombocytopenic Purpura (ITP)
- *Drugs : Antiplatelet & Anticoagulant Drugs*
- *Trauma*
 - Contusion
 - Fractured Trachea / Bronchus
 - Following Intubation, Bronchoscopy etc.
- *Inflammatory causes*
 - SLE
 - Henoch-Schonlein Purpura
 - Goodpasture's syndrome

Halitosis

- Foreign body in the Nose
- Atrophic Rhinitis
- Septic conditions in the Nose, Mouth, Sinuses
- Consumption of Garlic or Onions
- Diseases such as Tonsillitis or Diphtheria
- Drugs
 - Heavy Metals like Lead, Mercury, Bismuth
 - Alcohol

Headache

- *Intracranial Causes*
 - Meningitis
 - Intracranial SOL (tumour)
 - Head injury
 - Increased ICT — Benign raised ICT
 - Decreased ICT — Post-LP Headache
- *Extracranial Causes (Referred pain)*
 - Eyes — Refraction errors
 - Paranasal sinuses — Frontal/Maxillary sinusitis

- Rheumatological — T-M joint inflammation, as in Juvenile Rheumatoid Arthritis (JRA)
- Teeth — Dental root abscesses
- In acute febrile illnesses
- Migraine
- Tension headache
- Functional

Hiccupps

- Normal in infants, especially after feeding
- Following an acute respiratory infection
- Diaphragmatic Pleural Effusion
- Subphrenic abscess
- Peritonitis
- Uraemia
- Encephalitis
- Brain Tumours
- Drugs

Hoarse Voice

- Prolonged Crying or Shouting
- Acute Infectious Laryngitis
- Laryngitis due to Diphtheria, Tuberculosis etc.
- Wernig-Hoffman's Syndrome
- Trauma due to Intubation
- Enlarged Mediastinal Lymph Nodes
- Steroid Inhalers
- Cretinism
- Rickets
- Foreign body
- Myaesthesia Gravis
- Congenital defects such as Laryngeal webs, cysts or tumours

Jaundice

Can be classified into :

- **Hemolytic (Pre-hepatic) Jaundice**
 - *RBC Membrane defects* : Spherocytosis, Elliptocytosis
 - *RBC Enzyme defects* : G₆PD Deficiency
 - *Globin chain synthesis defect* : Thalassemias
 - *Acquired hemolysis* : due to drugs like Sulfa,

Penicillin, antimalarials

➤ Hepatocellular (Hepatic) Jaundice

- Neonatal Jaundice
- Viral Hepatitis
- Hypothyroidism
- Galactosemia
- Crigler-Najjar Syndrome
- Gilberts disease
- Drugs — like AKT Novobiocin, Pregnanediol
- Sepsis
- IU infection — like TORCH Infections

➤ Obstructive (Post-hepatic)

- Biliary atresia
- Choledochal Cyst
- Inspissated bile
- Strictures & Calculus in biliary tree
- Drugs
- Alpha-1 antitrypsin deficiency
- Dubin Johnson Syndrome
- Rotor Syndrome



Fig 3.3(a) : Yellowish discolouration of skin in jaundice



Fig 3.3(b) : Yellowish discolouration of sclera in jaundice

Joint Pain / Swelling

- Trauma
- Post-infectious arthritis / Septic arthritis
- Tuberculous arthritis

- Reactive arthritis
- Juvenile Rheumatoid arthritis (JRA)
- Rheumatic fever
- Hemophilia

Obesity

- *Simple Obesity* — Caused due to imbalance between food intake & energy output (Increased intake along which decreased exercise)
- *Familial*
- *Metabolic Diseases / Endocrine Diseases*
 - Hypothyroidism
 - Hypopituitarism
 - Cushing's syndrome
- *Drugs* — e.g. Sodium Valproate
- *Rare Syndromes*
 - Prader-Willi Syndrome
 - Laurence-Moon-Biedel Syndrome
 - Turner's Syndrome
 - Carpenter's Syndrome
- *Obesity due to physical disability causing decreased exercise*
 - Cerebral Palsy
 - Duchenne Muscular Dystrophy



Fig 3.4 : Morbidly-obese 5 year-old girl weighing 42 kgs.

Oedema

➤ Generalized Oedema

- *Cardiac causes* : CCF, Left ventricular failure
- *Renal causes* : Nephrotic syndrome, Acute nephritis
- *Hepatic causes* : Portal hypertension, Cirrhosis of liver
- *Endocrine causes* : Hypothyroidism
- *Allergic causes* : Angioneurotic edema
- *Nutritional causes* : Anemia, Hypoproteinemia, Beri-Beri

➤ Localized Oedema

- *Traumatic* : Fracture, Ligament tears
- *Inflammatory* : Abscess, Cellulitis
- *Lymphatic* : Filariasis / Post-operation / Metastasis causing pressure on Lymph Nodes
- *Venous* : Venous Thrombosis, Varicose Veins
- *Metabolic* : Gout



Fig 3.5 : Pedal edema with characteristic pitting of skin

Oliguria / Anuria

Oliguria / anuria can be because of poor formation of urine (Pre-renal & renal) or Retention of urine (Post-renal)

Poor formation of Urine

Poor formation of urine occurs due to causes which hamper blood supply to the kidney (Pre-

renal) or due to renal diseases per se (Renal).

The causes of Poor formation of urine are summarized in the table below. Of the two, pre-renal causes predominate with diarrhea & dehydration being the major causes behind oliguria in children.

Pre-Renal	Renal
Hypovolemia › Diarrhea & Dehydration › Hemorrhage › Burns › Hypoproteinemia Hypotension › Septicemia › DIC › Heart failure Hypoxia › Pneumonia › Respiratory Distress Syndrome	› Glomerulonephritis › Acute Tubular necrosis › Nephrotic Syndrome › HUS (Hemolytic-Uremic Syndrome) › Tumours

Retention of Urine (Post-renal)

- › *Urinary outlet obstruction*
 - PU valves
 - Phimosis (In males)
 - Meatal Stenosis (In males)
- › *Neurological Problems*
 - Poliomyelitis
 - Guillain-Barré Syndrome (GBS)
 - Transverse myelitis
- › VUR (Vesico-ureteral reflux)
- › Stones & blood clots
- › Antispasmodic drugs

Photophobia

- › Foreign body in the Eye
- › Corneal Infection or Corneal Ulcer
- › Conjunctivitis
- › Iridocyclitis
- › Meningitis
- › Vitamin A deficiency
- › Albinism
- › Drugs — e.g. Atropine Eye Drops, PAS
- › Congenital Glaucoma

Precocious Puberty

Boys : Precocious Puberty in Boys signifies an Organic disease in the majority of the cases. The cause can be either in the Pituitary gland/ Hypothalamus or the Adrenal Gland. If the Penis as well as the testes are fully developed the cause is Intracranial. If the Penis is fully developed but the testes are undeveloped, the cause is Adrenal.

Causes :

- › Constitutional or Familial
- › *Intracranial Causes*
 - Tumour in the Hypothalamus
 - Hydrocephalus
 - Sequelae of Encephalitis
- › Congenital Adrenal Hyperplasia
- › Testicular Tumour
- › Hypothyroidism
- › *Drugs*
 - Androgens — Will cause *Isosexual* Precocious Puberty
 - Oestrogens — Will cause *Heterosexual* Precocious Puberty

Girls : Precocious Puberty in Girls is Constitutional in the majority of cases. It can be *Isosexual* (Secondary Sexual characters are that of a female) or *Heterosexual* (secondary sexual characters resembling those of males).



Fig 3.6 : Precocious thelarche seen in a 2½ year old girl

Causes :

- Constitutional
- *Intracranial Causes*
 - Tumours
 - Hydrocephalus
- *Adrenal Causes*
 - Adrenocortical tumour
 - Congenital adrenal hyperplasia (Heterosexual)
- Hypothyroidism
- Hepatic Carcinoma
- Ovarian Tumour (Heterosexual)
- Albright's Syndrome
- *Drugs*
 - Anabolic steroids
 - Hormones

Refusal To Feed

- *Local causes* : Oral thrush, Oral ulcers, Glossitis, Stomatitis
- *Acute Infections* : Meningitis, Pneumonias etc.
- Chronic infections / Worm infestation
- Tuberculosis
- Chronic Cardiac, Hepatic or Renal Diseases
- Forced feeding (Well-grown child)

Short Stature

Causes of short stature will be discussed elsewhere in the text along with the case presentation.

Sneezing

Sneezing occurs very frequently in normal newborn babies & in the first 2 months of life. It should not be confused with Rhinitis.

Causes of Sneezing are :

- Common cold (Commonest Cause — Especially at the onset)
- Allergic Rhinitis
- Foreign body in the nose
- Rare Causes include :
 - Post-Encephalitis
 - Epilepsy (as Aura of Temporal lobe Epilepsy)

Stomatitis

- *Drugs*
 - Antibiotics (Sulfa group; Tetracycline; Lincomycin)
 - Non-steroidal anti-inflammatory drugs
 - Steroids (esp. Inhaled steroids)
 - Antimetabolites (e.g. Vincristine, Actinomycin D)
 - Griseofulvin
- *Vitamin deficiency* : Vitamin B complex deficiency (esp. Riboflavin deficiency)
- *Infections*
 - Candidiasis
 - HIV
 - Herpes
 - Vincent's infection
- *Allergic Reactions* including Stevens Johnson's Syndrome
- Aphthous Ulcers
- Kawasaki's Syndrome



Fig 3.7 : Aphthous ulcer

Stridor

- *Inflammatory lesions*
 - Croup
 - Epiglottitis
 - Diphtheria
 - Pharyngeal / retropharyngeal abscess
- Foreign body impacted in upper respiratory tract. e.g. In Larynx above the level of vocal cords.

- Angioedema (Allergic in nature)
- Congenital lesions like Vascular rings, stenosis
- Pressure due to Thyroid enlargement (Goitre)
- Tumours

Sudden Loss of Vision (Amaurosis)

- Trauma
- Infection
- Raised ICT
- Encephalopathy
- Demyelination
- Toxin
- Vasculitis
- Malignancy

Tall Stature

- Constitutional or familial
- Gigantism
- Klinefelter's Syndrome
- Marfan's Syndrome
- Pituitary Adenoma
- XYY Syndrome

Torticollis

➤ Due to Bone & Joint Involvement

Torticollis can occur due to involvement of the cervical vertebra & joints in injury or disease.

- Trauma
- Scoliosis
- Tumour
- Osteites
- Chronic Juvenile Rheumatoid arthritis
- Rare Syndromes like the Klippel-Feil Syndrome.

➤ Due to Muscular Involvement

- *Congenital Torticollis* : It occurs due to a sternomastoid tumour. The sternomastoid tumour occurs due to pressure exerted against the sternomastoid muscle in utero.
- Poliomyelitis

- *"Rheumatic" neck (Stiff neck)* : Probably viral Myositis in nature

➤ Due to Soft tissue involvement

Abscesses like Tonsillar or Retropharyngeal abscesses may cause Torticollis either due to their mass or due to muscle guarding.

➤ Intracranial causes

- Tumour in the Posterior Fossa
- AV malformation in the brain

➤ Drugs

➤ Psychological causes

- Hysterical
- Tics
- Rarely it may be due to Habit

➤ Other rare causes like :

- Spasmodic Torticollis
- Paroxysmal Torticollis
- Ocular Torticollis

Vertigo

➤ Benign Paroxysmal Vertigo

Sudden attack of vertigo lasting for a few minutes associated with vomiting & nystagmus, occurring in children between 1–3 years of age.

The cause is unknown & Investigation such as EEG are normal.

➤ Epilepsy — esp. Temporal lobe epilepsy

➤ Prodromal Symptom in :

- Migraine
- Hypoglycemia

➤ Drugs

- | | |
|-------------------|-----------------|
| ▪ Antihistaminics | ▪ Metronidazole |
| ▪ Anticonvulsants | ▪ NSAID's |
| ▪ Aminophylline | ▪ Piperazine |
| ▪ INH | ▪ Quinine |
| ▪ Betablockers | ▪ Salicylates |

➤ Due to Auditory Pathology

- Chronic Otitis Media
- Labyrinthitis

- *Due to CNS Pathology*
 - Brain Tumour
 - Post-Encephalitis / Post-Meningitis Sequelae
 - Cerebellar Lesions
 - Multiple Sclerosis
 - Following Head Injury

Vomiting

- *Infections*
 - Gastroenteritis
 - Appendicitis
 - Pancreatitis
 - UTI
 - Hepatitis
 - Meningitis
- *Surgical Abdomen (Acute abdomen)*
 - Intestinal Obstruction
 - Peritonitis
- *Feeding problems* : Force Feeding
- *CNS Disorders* : Head Injury / SOL (Raised ICT)
- *Post-tussive* : Following Persistent Cough
- *Drugs*
 - NSAID's
 - Metronidazole
 - Steroids
 - Aminophylline
- *Miscellaneous*
 - Psychogenic
 - CCF

Weight Loss [Failure to Thrive]

- *Deficient intake of food*
- *Poor absorption of food*
 - Vomiting
 - Diarrhea
 - Malabsorption syndromes
- *Infectious Causes* : Pulmonary Tuberculosis
- *Endocrine Causes* : Diabetes Mellitus, Thyrotoxicosis
- *Intestinal causes*
 - Amebiasis
 - Worm infestation

- Ileocaecal Koch's
- *Hepatic & Pancreatic causes*
 - Cirrhosis
 - Pancreatitis
- *Cardiac Causes* : CCF
- *Metabolic Causes* : Chronic Renal Failure
- *Hematological Causes* : Anemia
- *Malignancies* : Leukemia

3.2 : D/D of Important Abnormal Signs

Angular Cheilosis

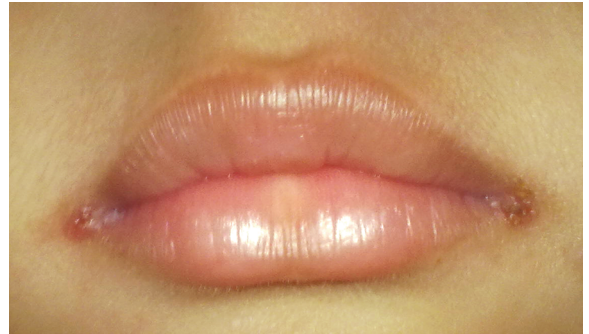


Fig 3.8 : Angular Cheilosis

- Riboflavin deficiency
- Drooling of Saliva
- Fungal infection
- Syphilitic Rhagades

Appearing & Disappearing Abdominal Masses

- Urinary bladder
- Hydronephrosis
- Fecal masses
- Intussusception
- Hernia
- Mobile Spleen
- Round worms
- Hydrometrocolpos

Beading of Ribs

- Rickets
- Scurvy
- Skeletal dysplasias

- *In Marasmic Child* — Palpable Costochondral Junction

Bossing of Skull

- Rickets
- Chronic Hemolytic anemia : e.g. Thalassemia major
- Congenital Syphilis
- Cleido-cranial dysostosis
- Hurlers syndrome
- Achondroplasia



Fig 3.9 : Bossing of skull in a child with Rickets.
(Note protrusion of the forehead beyond the imaginary line)

Bow Legs

Bowing of legs is said to be abnormal if the gap between the medial femoral condyles is >10 cms when the legs are extended & the internal malleoli are in contact with each other with the child lying in supine position.

Causes of Bowing of legs are :

- Normal — In late infancy
- Rickets
- Renal Osteodystrophy
- Caffey's disease
- Blount's disease

Bulging Anterior Fontanel

- *Physiological* : In a crying infant
- *Raised ICT* : Intra-cranial SOL

- Hydrocephalus
- Hypervitaminosis A
- Following steroid therapy
- Hyperparathyroidism

Brownish-Yellow Discolouration of Teeth

- Tetracycline therapy
- Iron therapy
- Tooth Caries
- Fluorosis
- Poor dental hygiene
- Kernicterus



Fig 3.10 : Brownish-Yellow discolouration of teeth

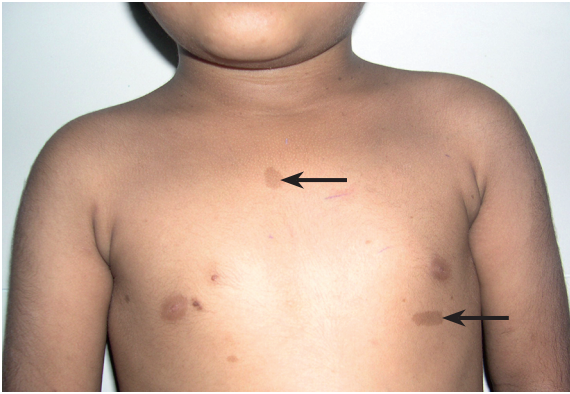
Brittle Hair

- Kwashiorkor
- Chronic debilitating disease
- Cretinism
- Hypervitaminosis A
- Congenital Syphilis
- Copper & Zinc deficiency

Café-Au-Lait Spots

Café-au-lait Spots are considered significant only if they satisfy the following criteria :

- *Prepubertal* : >5 mm in size & 5 in number
- *Post pubertal* : >15 mm in size & 6 in number
- Isolated Café-au-lait spot >15 cms in size
- Any Café-au-lait spot in the centre of the body
- Café-au-lait spot associated with Neurofibromatosis



(Courtesy : Dr Mukesh Agrawal, Mumbai)
Fig 3.11 : Café-au-lait spots on the chest

Causes of Café-au-lait spots

- Neurofibromatosis
- McCune-Albright syndrome
- Ataxia-Telangiectasia
- Tuberous sclerosis
- Gaucher's disease
- Chediak-Higashi Syndrome
- Fanconi's Anemia

Cataract

- *Prematurity (Commonest Cause)*
- *Hereditary* (Familial, Idiopathic)
- *Chromosomal anomalies*
 - 13, 18 & 21 Trisomy
 - Turners Syndrome
- *Developmental anomalies* : Persistent strand of pupillary membrane
- *Congenital infections*
 - TORCH* Infections
 - Syphilis
- *Metabolic Causes*
 - Hypocalcemia
 - Juvenile onset Diabetes Mellitus
 - Hypoparathyroidism
 - Galactosemia

* TORCH stands for Toxoplasmosis, Rubella, CMV & Herpes Simplex

- Wilson's disease
- Mucopolysaccharidosis
- *Drugs* : Steroids
- *Trauma*
 - Contusion
 - Penetrating injury
- *Toxic agents* : Radiation



(Courtesy : Dr Mukesh Agrawal, Mumbai)
Fig 3.12 : Congenital Cataract

Cat's Eye Reflex (White Reflex in Eyes)

- *Lens* : Cataract
- *Uveal Tract*
 - Persistent hyperplastic primary vitreous
 - Organized hemorrhage in the Vitreous
- *Retina*
 - Retinoblastoma
 - Retinal detachment
 - Retinal scars
 - Retinopathy of prematurity
 - Retinal dysplasia

Clubbing

Causes of Clubbing

- *Cardiac Causes*
 - Cyanotic Congenital Heart Diseases e.g. Fallot's Tetralogy
 - Infective endocarditis
- *Respiratory Causes*
 - Bronchiectasis

- Empyema (Chronic)
- Lung Abscess
- Pulmonary Tuberculosis
- *Intestinal Causes*
 - Crohn's Disease
 - Ulcerative Colitis
- *Hepatic Causes* : Cirrhosis (esp. in Biliary Cirrhosis)
- *Endocrinal Causes* : Hypothyroidism (Myxedema)
- *Other Causes*
 - Malabsorption Syndrome
 - Idiopathic
 - Familial

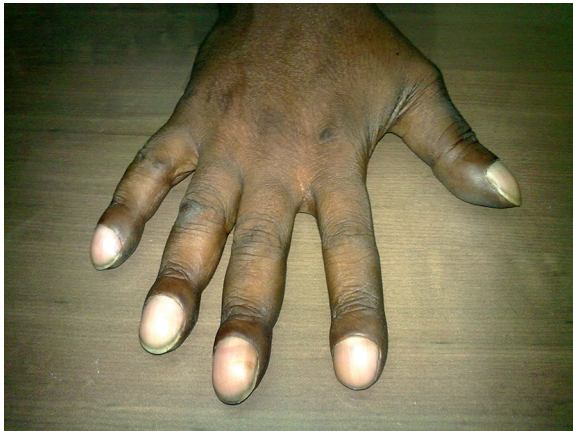


Fig 3.13 (a) : Clubbing of fingers in a patient with tuberculosis



Fig 3.13 (b) : Close-up of the same patient showing Grade III clubbing

Grades of Clubbing

- I : The nail bed appears softened
- II : The angle of the nail bed is obliterated
- III : Parrot-beak / Drum stick appearance

IV : Hypertrophic osteo-arthritis

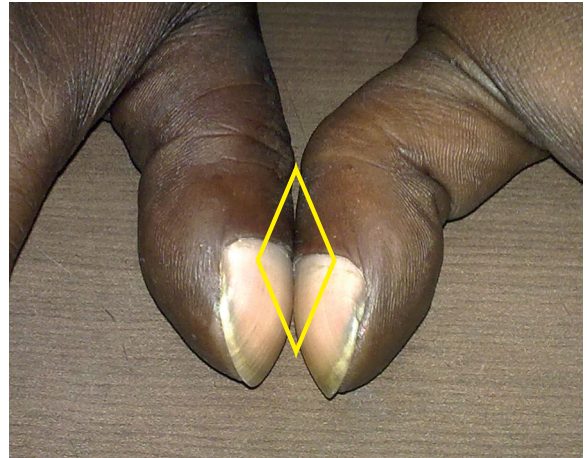


Fig 3.14 : Obliteration of Schamroth's window in Clubbing

Craniotabes

- Physiological
- Rickets
- Hydrocephalus
- Hypervitaminosis A
- Osteogenesis Imperfecta
- Congenital Syphilis

Cyanosis

Central Cyanosis

- *Respiratory Causes*
 - Any lung pathology with severe involvement of the lung parenchyma. e.g. Severe pneumonia, bronchopneumonia.
 - Collapse of Lung due to any cause
- *Cardiac Causes*
 - Cyanotic congenital heart diseases e.g. Fallot's tetralogy
 - CCF
 - ASD/VSD/PDA with reversal of shunt (Eisenmenger's physiology)

Peripheral Cyanosis

- Shock
- Local vasoconstriction due to any cause
- Polycythemia

Miscellaneous Causes (Abnormal Pigments)

- Methaemoglobinemia

Delayed Closure of Anterior Fontanel

- Preterm infants
- IUGR infants
- Malnutrition
- Rickets
- Cretinism
- Hydrocephalus
- Down's Syndrome
- Thalassemia Major
- Congenital Syphilis
- Skeletal Dysplasias
 - Osteogenesis imperfecta
 - Cleidocranial dysostosis
 - Achondroplasia
 - Pyknodysostosis
- Mucopolysaccharidosis
- Trisomy 13 & 18

Depressed Nasal Bridge

(Courtesy : Dr Mukesh Agrawal, Mumbai)

Fig 3.15 : Depressed nasal bridge seen in Down's syndrome

- Down's Syndrome
- Thalassemia major
- Hypothyroidism (Cretinism)
- Congenital syphilis
- Skeletal dysplasias
- Mucopolysaccharidosis
- Familial

Down-Slanting (Anti-Mongoloid) Eyes

Eyes are known as down-slanting when the outer

canthii of both the eyes lie below the line joining the inner canthii of the two eyes (Fig 3.16). Causes are :

- Trisomy 18 (Edward's Syndrome)
- Cri-du-chat syndrome
- Turner's syndrome
- Apert's syndrome

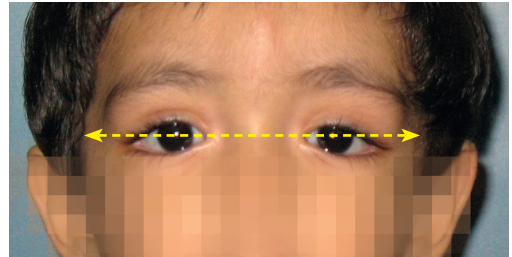


Fig 3.16 : Down-slanting (anti-mongoloid) eyes

Downward deviation of Eyes

- Hydrocephalus
- Kernicterus
- Premature infants

Early Closure of Anterior Fontanel

- Craniosynostosis
- Primary microcephaly

Epiphyseal Widening

Fig 3.17 : Epiphyseal widening seen in Rickets

- Rickets
- Metaphyseal dysostosis
- Congenital epiphysial dysplasia
- Rubella, CMV Infection
- Copper deficiency

Exophthalmos

- Thyrotoxicosis
- Retro-orbital hemorrhage
- Orbital cellulitis & abscess
- Cavernous sinus thrombosis
- Crouzon's disease
- Neuroblastoma Metastasis
- AV aneurysm

Hypothermia

- Exposure to Extreme Cold
- Septicemia
- PEM
- Hypothyroidism
- Hypoglycemia
- Drugs

Hypotonia of Limbs

LMN Lesions

- *Ant horn cell*
 - Poliomyelitis
 - Spino-muscular atrophy
- *Peripheral nerve*
 - Guillain-Barré Syndrome
 - Polyneuropathy
 - Familial dysautonomia
- *Neuro-muscular Junction*
 - Myasthenia gravis
 - Botulism
- *Muscle*
 - Congenital Myopathy
 - Polymyositis
 - Glycogen storage disorders
 - Hypothyroidism

UMN Lesions

- Stage of Spinal Shock
- Cerebral palsy (Hypotonic CP)
- Intra-ventricular hemorrhage
- Storage disorders

- Metabolic Causes
 - Hyperammonemia
 - Hyperglycemia
 - Hypercalcemia
 - Organic Acidemia
 - Hypocalcemia
 - Renal Tubular Acidosis
- Cerebellar disease
- Trisomies (13, 18 & 21) e.g. Down's Syndrome
- Flaccid Coma

Mixed

- Krabbe's disease
- Zellweger's Syndrome

Hyperplasia of Gums

- Poor oral hygiene
- Scurvy
- Phenytoin therapy
- Hurler's Syndrome
- Histiocytosis



Fig 3.18 : Hyperplasia of lower gums

Hypertelorism

- Down's Syndrome
- Cretinism
- Thalassemia Major
- Turner's Syndrome
- Cri-du-chat syndrome
- Noonan Syndrome

- Racial
- Rubinstein-Taybi Syndrome

Hypertonia

- All UMN lesions after the stage of spinal shock including Cerebral Palsy (Spastic form)
- Extrapyramidal Causes : Cogwheel rigidity
Lead-Pipe rigidity
- Tetanus
- Strychnine poisoning
- Hysteria
- Local causes
 - Arthritis
 - Infections
 - Trauma etc.



(Courtesy : Dr Mukesh Agrawal, Mumbai)

Fig 3.19 : Hypertonia of lower limbs seen in Cerebral Palsy

Hyperventilation

- Hypernatremic Dehydration
- Metabolic Acidosis
- Diabetic Acidosis
- Uraemia
- Drugs
 - Salicylates
 - Aminophylline

- Reye's Syndrome
- Hysteria

Hypotelorism

- Genetic variant
- Cyclops
- Scaphocephaly
- Ethmocephaly
- Holoprosencephaly

Lacrimation

- Trauma
- Foreign body in the eye
- Infections of the Eye
 - Conjunctivitis
 - Conjunctival or Corneal Ulcers
 - Phlyctenular Conjunctivitis
- Associated with Rhinitis (Common cold)
- In Measles
- Strong Odours
- Facial Palsy
- Due to chronic Blepharitis
- Due to Eye strain
- Drugs

Large Head (Macrocephaly)

- *Conditions associated with increase in weight of brain*
 - Megalencephaly
 - Hydrocephalus
 - Gigantism
 - Achondroplasia
 - Storage disorders
 - Tay-Sachs disease
 - Subdural haematoma
 - Intracranial SOL
 - Arachnoid Cysts
- *Skeletal Disorders Causing Macrocephaly*
 - Achondroplasia
 - Pyknodysostosis
 - Cleidocranial Dysostosis



(Courtesy : Dr Mukesh Agrawal, Mumbai)
Fig 3.20 : Macrocephaly seen in a hydrocephalic child

- Hurler's Syndrome
- Cerebral Gigantism

Limitation Of Joint Movement

- Diseases of the Joint
 - Arthritis (JRA)
 - Congenital dislocation of the hip
- Contracture of Muscles
- Hypertonia
- Cerebral Palsy
- Diabetes Mellitus
- Myotonic Dystrophy
- Nail Patella Syndrome, Hurler's syndrome etc.

Lock-Jaw (Trismus)

- Tetanus
- Strychnine poisoning
- T-M joint arthritis
- Brain Tumour
- Phenothiazine overdose
- Encephalitis

Low-Set Ears

- Down's Syndrome
- Trisomy 13 & 18
- Turner's Syndrome
- Cri-du-chat Syndrome
- Carpenter Syndrome
- Apert Syndrome
- Renal agenesis

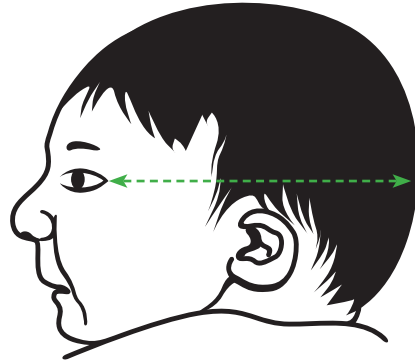


Fig 3.21 : Low-set ears (Pinna lies below the imaginary line extending from the outer canthii of the eyes)

Lymphadenopathy

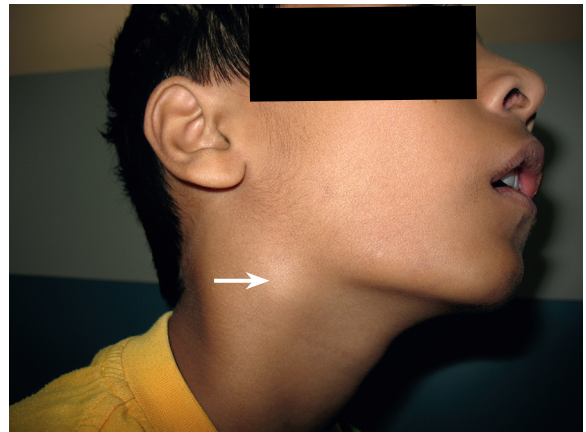


Fig 3.22 : Cervical lymphadenopathy

- Any infection in the drainage area of the lymph nodes (bacterial, viral, fungal or protozoal in nature)
- Acute systemic bacterial infection
- Acute systemic viral infection – Infectious mononucleosis, Rubella, HIV etc.
- Chronic infection — e.g. Tuberculosis
- Lymphoreticular malignancy — e.g. Lymphoma, Leukemia etc.

Macroglossia

- Down's Syndrome
- Hypothyroidism
- Mucopolysaccharidosis
- GSD (Glycogen-Storage disorders)

- DMD (Duchenne Muscular dystrophy)

Macro-Orchidism (Large Testis)



Fig 3.23 : Macro-orchidism in a 8-month old child

- Hypothyroidism
- Testicular tumours
- Precocious puberty
- Congenital syndromes like Fragile 'X' syndrome
- Occasionally in Henoch-Schonlein purpura

Membrane Formation In Throat (White Membrane in Throat)

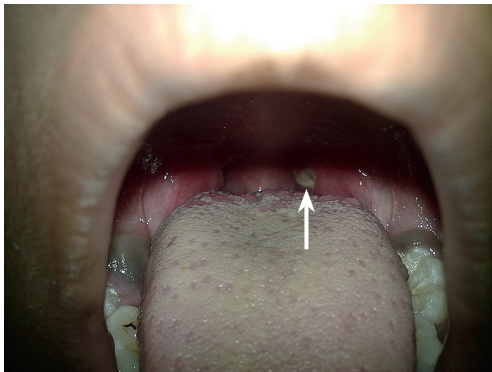


Fig 3.24 : White membrane seen in Streptococcal tonsillitis

- Bacterial infection : Streptococcal infection
Diphtheria
- Viral infection : Ebstein-Barr Virus
- Fungal infection : Candida

Microcephaly

Causes of Microcephaly are discussed in Chap 5.



(Courtesy : Dr Mukesh Agrawal, Mumbai)

Fig 3.25 : Microcephaly

Micrognathia (Small Jaw)

- Pierre-Robin Syndrome
- Rubinstein-Taybi Syndrome
- Cri-du-chat Syndrome
- Di-George Syndrome
- Fetal alcohol Syndrome
- Trisomy 13
- Trisomy 18

Micro-Orchidism (Small Testis)

- Hypothalamic diseases
- Hypopituitarism
- Klinefelter's syndrome (XXY)
- Rudimentary testes syndrome
- Radiation
- Chemotherapy
- In a vast number of genetic syndromes

Micropenis

- Klinefelter's Syndrome
- Down's Syndrome
- Prader-Willi Syndrome

- Carpenter's Syndrome
- Cornelia-de-lange syndrome
- X-linked hypogammaglobulinemia
- Hypopituitarism



Fig 3.26 : Micropenis

Neck Stiffness

- *CNS Causes*
 - Meningitis
 - Encephalitis
 - Posterior fossa lesion
 - Trauma
 - Herniation of brain stem
- *Spinal Causes*
 - Koch's spine
 - Retropharyngeal abscess
 - Lymphadenitis adjacent to vertebral column
- *Systemic Infection*
 - Meningismus (e.g. associated with Typhoid, Apical Pneumonia)
 - Poliomyelitis
 - Tetanus
- *Others*
 - Post-LP (Lumbar Puncture)
 - Voluntary neck rigidity
 - Hysterical
 - Drugs — Phenothiazines
 - Strychnine poisoning

Nystagmus

- On looking outside from a Moving Vehicle

- Visual Defects
- Astigmatism
- Albinism
- Hypothyroidism
- Congenital Nystagmus
- Drugs—Anticonvulsants, Salicylates
- Cerebellar Ataxia
- Cerebellar Tumour or abscess

Pigeon-Shaped Chest

- Congenital
- Rickets
- Skeletal dysplasia
- Emphysema
- Chronic Respiratory Distress
- Mucopolysaccharidosis-Type IV
- Massive Cardiomegaly
- Marfans Syndrome
- Noonan Syndrome

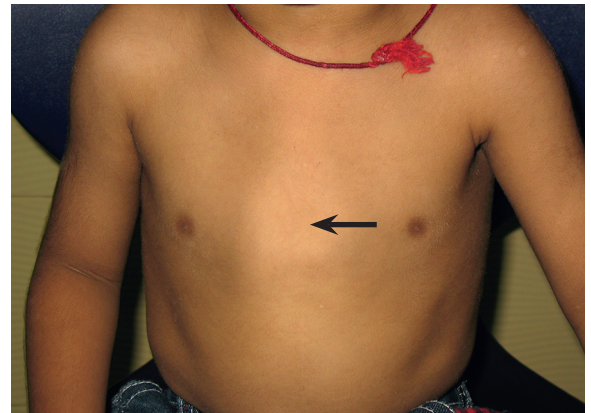


Fig 3.27 : Pigeon-shaped chest in a child with Rickets

Precordial Bulge

- | | |
|------------------------|---------------|
| ➤ Cardiomegaly | ➤ Scoliosis |
| ➤ Pericardial Effusion | ➤ Rickets |
| ➤ Retrocardiac tumours | ➤ Cellulitis |
| ➤ Mediastinal tumour | ➤ Lipoma |
| ➤ Skeletal Dysplasias | ➤ Rib Tumours |

Proptosis

- Thyrotoxicosis
- Trauma—Fracture of Base of Skull
- Orbital Cellulitis
- Ethmoidal Sinus Inflammation (Ethmoiditis)
- Dermoid Cysts
- Orbital encephalocele
- Tumours such as Neuroblastoma, Retinoblastoma, Teratomas, Gliomas etc.
- Cavernous Sinus Thrombosis
- AV aneurysms
- Craniosynostosis

Ptosis

- Myasthenia gravis
- Horner's Syndrome
- Noonan Syndrome
- Myotonic Dystrophy
- Congenital Ptosis
- Oculomotor Palsy



Fig 3.28 : Congenital Ptosis of Right Eye

Puffiness Of Eyes

- Hypoproteinemia
- CCF
- Angioneurotic edema
- Constrictive Pericarditis
- Hypothyroidism (Myxedema)
- Spasmodic Cough
- Cavernous sinus Thrombosis
- Conjunctivitis
- Familial

Purpura

- *In Neonates*
 - Septicemia
 - DIC
 - Maternal infections — CMV, Rubella, Toxoplasmosis, AIDS
 - Maternal autoimmune diseases — like thrombocytopenia
 - ABO Incompatibility
 - Congenital Leukemia



(Courtesy : Dr Mukesh Agrawal, Mumbai)
Fig 3.29 : Purpuric spots on the legs

- *After the Neonatal Period*
 - Trauma
 - Leukemia
 - Idiopathic Thrombocytopenic Purpura
 - Henoch-Schonlein Purpura (HSP)
 - Due to Drugs
 - Meningococcemia
 - Septicemia
 - Uremia
 - Hemolytic Uremic Syndrome
 - Hemophilia
 - Aplastic Anemia
 - Scurvy

Scoliosis

- *Postural Scoliosis*
 - Commonest type. Scoliosis usually disappears when the patient bends down.

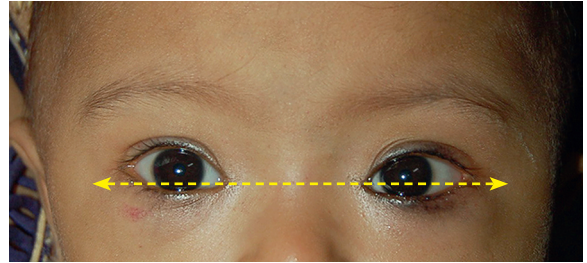
- *Compensatory Scoliosis*
 - This occurs due to any cause which leads to shortening of one of the legs (Unequal length of legs)
- *Scoliosis which persists when the child bends down is known as Structural Scoliosis. Its **Causes** are :*
 - Poliomyelitis
 - Muscular Dystrophy
 - Marfan's syndrome
 - Osteogenesis Imperfecta
 - Hemivertebra
 - Idiopathic

Short Neck

- Obesity (False appearance due to folds of adipose tissue)
- Down's syndrome
- Turner's syndrome
- Hurler's syndrome
- Noonan syndrome

Upward-Slanting Eyes (Mongoloid Slant)

The eyes are known to be upslanting if the outer canthii of the two eyes lie above an imaginary line joining the inner canthii of the two eyes (Fig 3.30).



(Courtesy : Dr Mukesh Agrawal, Mumbai)
Fig 3.30 : Mongoloid slant of eyes in Down's syndrome

Causes are :

- Racial (In Mongols)
- Down's Syndrome
- Prader-Willi Syndrome
- Ectodermal Dysplasia

