



The Handbook of icddr,b Dhaka Hospital

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Dedicated to,

My fellow colleagues at icddr,b

Hope it helps

Chapter 1

General approach to a critically ill patient

1.1 Initial assessment → follow ABCDE

Check the followings:

1. **A** ppearance of the patient; such as, lethargic, gasping, having convulsion, rolling of eyeball, staring and such
2. **B** reathing: Respiratory status (airway obstruction: suction, hypoxia: O₂ support)
3. **C** irculation: Check pulse, BP, CRT, temperature and RBS
4. **D** ehydration status
5. **E** lse:
 - (a) Abdominal distension, or any signs of electrolyte imbalance
 - (b) Urine output, or, any history of taking concentrated ORS
 - (c) In case of adult patient, check BP and CVP; consider an ECG as well
 - (d) Look for other signs; for examples,
 - Pupillary reaction, jerks, planter response, features of meningism
 - (e) For elderly patients ask for chronic diseases and drug history, especially steroid.

1.2 Management outline

During assessment of nutritional status, please consider dehydration status. If a baby has some dehydration please add an extra 5–7.5% weight (equivalent to weight loss in some dehydration) with the measured weight to determine precise nutritional status.

1.2.1 Antibiotic

Please see the dedicated chapter/s.

1.2.2 Micronutrient

(for children with SAM)

1. Inj. MgSO₄: 0.1 ml/kg/day, for 5 – 7 days (IM)
2. Tab. Folic acid: 1.25 mg, once daily, for 10 days

3. Tab. Zinc 20 mg: 1 tablet, once daily, for 10 days (age >6 months)
 $\frac{1}{2}$ tab if age ≥ 2 months but <6 months
4. Cap. Vitamin A:
 - 2 months – <6 months : 50,000 IU, Stat
 - 6 months – <12 months : 100,000 IU, Stat
 - 12 months – 5 years : 200,000 IU, Stat

★ If measles, another dose on 2nd day
 ★ For eye changes due to malnutrition, on day 1, 2 and 14
5. Multivitamin drops:
 - Age <1 year: 0.5 ml, 12 hourly, for 10 – 15 days
 - Age ≥ 1 year: 1 ml, 12 hourly, for 10 – 15 days
6. Syr. Potassium Chloride (KCl): 4 mmol/kg/day, in 3 divided dosage, for 3 – 5 days (1 TSF = 7 mmol/l)
 - for quick dispense, ≈ 1 ml/kg

1.2.3 Complications

1. **Hypoglycemia:** 10% glucose, 5 ml/kg, IV Stat & 10% glucose 50 ml orally; 25 ml for infant.

Correction of repeated $\downarrow\downarrow$ glycemia correction in children

Look for features of infection.

- Symptomatic child
 - IV 10% glucose
 - + hourly glucose
 - Hourly diet
- Asymptomatic child
 - Oral 10% glucose
 - + hourly diet
- If ≥ 2 episodes of hypoglycemia
 - Send to ICU
 - Give correction
 - Repeat RBS 30 minutes later

In ICU: i.e. 3rd episode:

IV + Oral correction $\rightarrow \frac{1}{2}$ oral diet, hourly + $\frac{1}{2}$ IV (with 5% dextrose @3ml/kg)

\Downarrow

4th episode:

IV correction + Full IV (Fluid ration with 10% dextrose @3–4 ml/kg)

\Downarrow

5th episode:

IV correction + Full IV (Fluid ration with 12.5% dextrose @3–4 ml/kg)

\Downarrow

More episodes of hypoglycemia → **Consider referral**

*** Next step should be considered if a new hypoglycemic episode occurs within <24 hours of the previous one.

2. **Oral thrush:** Nystat oral drop, 0.5 – 1 ml, 6 – 8 hourly, 5 – 7 days
3. **Perianal excoriation:** Apply soothing agent, e.g. vaseline; if no response, Clotrimazole ointment, apply topically (at perianal region) 8 hourly, 5 – 7 days
4. **Rectal prolapse:** MgSO₄ compression, 6 hourly, 5 – 7 days

1.2.4 Diet

1. <6 months: Exclusive breast feeding,
and if non breast-fed modified infant formula (MIF): 10 ml/kg/feed; increase according to demand.
2. ≥6 months: for non breast-fed children, 10 ml/kg 2 hourly.

1.3 Dietary management

1. Children with marasmus and marasmic-kwashiorkor:
 - Day 1: 10 ml/kg/feed of milk suji (120 ml, 80 kcal/kg/day)
 - Day 2 – 3: 12 ml/kg/feed of milk suji (144 ml, 96 kcal/kg/day)
 - Day 4: 12 ml/kg/feed of milk suji 100 (144 ml, 144 kcal/kg/day), if no diarrhea
2. Children with kwashiorkor:
 - Day 1 – 3: 9 ml/kg/feed of milk suji (108 ml, 72 kcal/kg/day)
 - Day 4: 9 ml/kg/feed of milk suji 100 (108 ml, 108 kcal/kg/day), if no diarrhea
3. Adult: Rice suji, 150 – 200 ml, 2 hourly.

Energy content:

- Modified infant formula: 68 kcal/100 ml
- Milk suji: 67 kcal/100 ml
- Rice suji: 70 kcal/100 ml

1.4 Intravenous fluid management

Table 1.1: Dhaka method of assessing dehydration [1]

Parameters	Clinical findings	
Condition*	Irritable/less active*	Lethargic/comatose*
Eyes	Sunken	
Mucosa	Dry	
Thirst*	Thirsty*	Inability to drink*
Skin turgor*	Reduced*	
Radial pulse*		Uncountable/ absent*
Diagnosis	Some dehydration (If at least 2 signs, 1 key (*) sign are present)	Severe dehydration (If signs of some dehydration + 1 of key(*) signs are present)
Estimated body weight loss	5–10%	>10%

Dehydration assessment: Dhaka method

Indications for IV fluids Some dehydration correction to be given by oral G-ORS. However, in case of the followings, dehydration correction to be given with IV fluids.

1. Persistent/ frequent (>3 times/hour)/ repeated vomiting
2. Persisting dehydration even after giving repeated oral correction
3. Ileus
4. High purging (>15 ml/kg/hr) match
5. Diabetic ketoacidosis (NS)
6. Hyponatremia ($\text{Na}^+ < 110 \text{ mmol/l}$ or, $> 110 \text{ mmol/l}$ with symptoms)
7. Cerebral edema (3% NaCl in ICU)
8. Severe dehydration

Fluid calculations Please see the dedicated chapter.

1.5 Electrolyte imbalance

Please see the dedicated chapter.

1.6 Management of convulsion

Please see the dedicated chapter.

1.7 Regarding ionotropes

After correction of dehydration, if patient still remains in shock, start inotropes.

Dosage:

- Dopamine: 3 ml/kg in 50 ml fluid (**NS**)
start @ 8 ml/hr → 12 → 15 (as in single strength; gradually increase the dose according to vitals)
★★★ At single dilution, 8 ml/hr = $8\mu\text{g}/\text{kg}/\text{min}$.
- Adrenaline: 0.3 ml/kg in 50 ml fluid (**NS**)
start @ 0.5 ml/hr → 1 → 1.5 → 2 → 2.5 → 3 → up to 10 ml/min (single strength/dilution) [also titratable as, 1 → 2 → 3 upto 10]
★★★ At single dilution, 0.5 ml/hr = $0.05\mu\text{g}/\text{kg}/\text{min}$.
- Noradrenaline: 0.3 ml/kg in 50 ml fluid (**NS**)
start @ 0.5 ml/hr → 1 → 1.5 → 2 → 2.5 → 3 → up to 5 ml/min (single strength/dilution) [also titratable as, 1 → 2 → 3 upto 10]
★★★ At single dilution, 0.5 ml/hr = $0.05\mu\text{g}/\text{kg}/\text{min}$.

1.8 Resuscitating a patient

1. Start with ABC, i.e. airway, breathing and circulation
Keep the patient in lateral position, give O-P & N-P suction and O₂ inhalation if necessary
Application of airway tube or nasopharyngeal tube
★ for children, airway and breathing is more important
★ for adult, it is circulation instead.
2. Check RBS and SpO₂
3. If the baby is unresponsive, check heart/ pulse, and consider cardiopulmonary resuscitation (for children 15:2 and for adults 30:2)
4. Consider drugs: Every 3 – 5 minutes interval during resuscitation
 - (a) Inj. Atropine (1 amp: 1 mg/ml) (★ **maximum** 3 doses)
 - Children: $20\mu\text{g}/\text{kg}$ (**minimum**: $100\mu\text{g}$)
 - Adult: 1 amp
 - (b) Inj. Adrenalin (1:1000) (1 amp: 0.6 mg($600\mu\text{g}$))/ml) (★ **maximum** 5 doses, range: 3-5 doses)
 - Children: $10\mu\text{g}/\text{kg}$
 - Adult: 1 amp

5. Consider ABG, check RBS again
6. Search for reversible causes like, hypothermia, hypoglycemia, hypo or hyperkalemia, pulmonary embolism, toxins.
 - Adrenaline nebulization in **croup dose** (ASA: adrenaline, steroid, adrenaline); nebulization with adrenaline (1:1000): 0.5 ml/kg (max: 6 ml) + 6 ml NS (usually improves with 1 nebulization)
 - Steroid (prednisolone 2 mg/kg single dose)
 - If necessary, 2nd nebulization with adrenaline (1:1000) 0.5 ml/kg (max: 6 ml) + 6 ml NS.

Chapter 2

Fluid management: A medical emergency

2.1 Hypovolemic shock (Severe Dehydration)

1. SAM:

- (a) <2 months: ($\frac{1}{2}$ A/C + 5% Dex + 13 mmol/L K⁺)
 - i. 1st hr: @20 ml/kg (only IV)
 - ii. 2nd hr: @20 ml/kg (10 ml/kg IV + 10 ml/kg Oral)
 - iii. 3rd and 4th hrs: @10 ml/kg (Oral)
 - iv. Next 8 - 10 hrs: @5 ml/kg (Oral), or, upto dehydration correction
- (b) >2 months: (Full A/C + 5% Dex + 7mmol/L K⁺)
 - i. 1st hr: @20 ml/kg (only IV)
 - ii. 2nd hr: @20 ml/kg (10 ml/kg IV + 10 ml/kg Oral)
 - iii. 3rd and 4th hrs: @10 ml/kg (Oral)
 - iv. Next 8 - 10 hrs: @5 ml/kg (Oral), or, upto dehydration correction

2. Non-SAM:

- (a) <1 yr: (Full A/C or N/S)
 - i. 1st @30 ml/kg in 1 hr
 - ii. 2nd @70 ml/kg in 5 hrs
- (b) >1 yr: (Full A/C or N/S)
 - i. 1st @30 ml/kg in 1/2 hr
 - ii. 2nd @70 ml/kg in 2^{1/2} hrs

NB: In every case match purging or stool output is mandatory.

2.2 Severe sepsis and Septic Shock

1. SAM:

- (a) 1st hr: @20 ml/Kg (Isotonic fluid)
- (b) 2nd hr: @20 ml/Kg (Isotonic fluid)

- (c) 3rd hr: @10 ml/Kg (**Whole blood**)
- (d) Next - Inotropes

2. Non-SAM:

- (a) 1st hr: @20 ml/Kg (Isotonic fluid)
- (b) 2nd hr: @20 ml/Kg (Isotonic fluid)
- (c) 3rd hr: @20 ml/Kg (Isotonic fluid)
- (d) Next - Inotropes

NB: Isotonic fluids - Acetate or Cholera saline (A/C), Normal Saline (N/S)

Contraindications of Cholera saline: Hyperkalemia, metabolic and respiratory alkalosis, hypocalcemia ($\downarrow \text{Ca}^{++}$), severe sepsis and septic shock.

2.3 Composition of several isotonic solutions

Table 2.1: Composition of Normal saline, Cholera saline and Hartmann's solution

NS		AC		HS	
Na ⁺	154 mmol/l	Na ⁺	134 mmol/l	Na ⁺	131 mmol/l
Cl ⁻	154 mmol/l	Cl ⁻	99 mmol/l	Cl ⁻	111 mmol/l
		K ⁺	13 mmol/l	K ⁺	5 mmol/l
		C ₂ H ₃ O ₂ ⁻	48 mmol/l	Ca ⁺⁺	2 mmol/l
				Cl ⁻	111 mmol/l
				HCO ₃ ⁻	29 mmol/l
Osmolarity	308 mOsm/l		294 mOsm/l		278 mOsm/l

Chapter 3

Convulsion management & Assessing level of consciousness

3.1 Management of convulsion

When a patient has convulsion, administer 1st dose Inj.Lorazepam/ Diazepam 0.1mg/kg/dose (Inj Lorazepam 0.1 mg/kg/dose) Stat,

and wait for 5 min for convulsion to resolve,

if convulsion persists,

↓

2nd dose Inj.Diazepam 0.2mg/kg/Dose (Inj Lorazepam 0.1 mg/kg/dose) slowly over 3–5 min,

and wait for another 5 min for convulsion to resolve,

if convulsion persists,

↓

Inj. Phenobarbitone 20mg/kg/dose Stat loading dose @1 mg/kg/min (over 20 – 30 minutes)

followed by 12 hrly maintenance @5mg/kg/day (2.5 mg/kg/dose),

if convulsion persists,

↓

Inj. Phenytoin 20mg/kg/dose Stat loading dose @1 mg/kg/min (over 20 – 30 minutes)

followed by 12 hrly maintenance @5mg/kg/day (2.5 mg/kg/dose),

if convulsion persists,

↓

Syr. Na⁺Valproate 20mg/kg/dose Stat loading dose

followed by 8 hrly maintenance @5mg/kg/day (1.67 mg/kg/dose),

if convulsion persists,

↓

Inj. Midazolam /Inj. Diazepam,

bolus @0.1 mg/kg over 2–3 minutes, then maintenance @0.1mg/kg/hr over 6-8 hrs

(if apnoea then **NO DIAZEPAM**)

★★★ If apnea after Lorazepam,

Inj. **Flumazenil** (@0.01 mg/kg/dose, can be repeated every 1 minute interval, maximum 4 times) may be given. [2]

3.2 Determining level of consciousness: GCS, AVPU

1. Adult:

The Glasgow Coma Scale (GCS) is used to describe the general level of consciousness in patients with traumatic brain injury (TBI) and to define broad categories of head injury.

The GCS is divided into 3 categories, eye opening (E), motor response (M), and verbal response (V). The score is determined by the sum of the score in each of the 3 categories, with a maximum score of 15 and a minimum score of 3, as follows:

$$\text{GCS score} = E + M + V$$

(a) **Eye opening scores:**

- 4: Spontaneously
- 3: To verbal command
- 2: To pain
- 1: No response

(b) **Best motor response scores:**

- 6: Obeys command
- 5: Localizes pain
- 4: Flexion withdrawal
- 3: Flexion abnormal (decorticate)
- 2: Extension (decerebrate)
- 1: No response

(c) **Best verbal response scores:**

- 5: Oriented and converses
- 4: Disoriented and converses
- 3: Inappropriate words; cries
- 2: Incomprehensible sounds
- 1: No response

Interpretation: Patients who are intubated are unable to speak, and their verbal score cannot be assessed. They are evaluated only based on eye opening and motor scores, and the suffix “T” is added to their score to indicate intubation. In intubated patients, the maximum GCS score is 10T and the minimum score is 2T.

The GCS is often used to help define the severity of TBI:

- Mild head injuries are generally defined as those associated with a GCS score of 13-15, and
- moderate head injuries are those associated with a GCS score of 9-12.
- A GCS score of 8 or less defines a severe head injury/coma.

These definitions are not rigid and should be considered as a general guide to the level of injury. [3]

2. **Children:** The **AVPU** scale (acronym from “alert, voice, pain, unresponsive”) is a system by which a health care professional can measure and record a patient’s responsiveness, indicating their level of consciousness.
 - (a) **Alert:** The patient is fully awake (although not necessarily oriented).
 - This patient will have spontaneously open eyes, will respond to voice (although may be confused) and will have bodily motor function.
 - (b) **Verbal:** The patient makes some kind of response when they are talked to, which could be in any of the three component measures of eyes, voice or motor.
 - For example, patient’s eyes open on being asked “Are you OK?”. The response could be as little as a grunt, moan, or slight move of a limb when prompted by the voice of the rescuer.
 - (c) **Pain:** The patient makes a response on any of the three component measures on the application of pain stimulus.
 - Such as a central pain stimulus like a sternal rub or a peripheral stimulus such as squeezing the fingers. A patient with some level of consciousness may respond by using their voice, moving their eyes, or moving part of their body (including abnormal posturing).
 - (d) **Unresponsive:** Sometimes seen noted as “Unconscious”, this outcome is recorded if the patient does not give any eye, voice or motor response to voice or pain. [4]

Chapter 4

Management of electrolyte imbalance

4.1 Sodium imbalance ($\uparrow\downarrow \text{Na}^+$)

1. Hyponatremia ($\downarrow \text{Na}^+$):

$\text{Na}^+ < 110 \text{ mmol/l}$ or, $> 110 \text{ mmol/l}$ with symptoms: 3% NaCl, 12 ml/kg over 4 – 6 hours (Maximum: 500 ml in adults)

Clinical features

- Headache
- Lethargy
- Nausea
- Depression of sensorium
- Stupor
- Seizures
- Coma

2. Hypernatremia ($\uparrow\uparrow \text{Na}^+$):

Clinical features

- Thirst
- Irritability
- Confusion
- Seizures
- Coma

Classification

- (a) Mild: $> 145 - \leq 150 \text{ mmol/l}$ (no need for correction)
- (b) Moderate: $> 150 - < 170 \text{ mmol/l}$ (need correction, manageable at LCU)
- (c) Severe: $\geq 170 \text{ mmol/l}$ (send to ICU)

- ★ Please add salt 1 gm/l in feed, if the baby has significant hypo (expect for SAM) or, hypernatremia
- ★ 25% diet to be curtailed at baseline, i.e. at the time when hyperNa⁺ correction starts.
- ★ If there is $\geq 10\%$ weight gain in absence of dehydration, 50% diet to be curtailed to prevent iatrogenic cerebral or pulmonary edema.

**** Na⁺ content:**

- G-ORS: 75 mmol/l
- $\frac{1}{2}$ NS: 77 mmol/l
- $\frac{1}{2}$ Acetate: 66 mmol/l

Formula for fluid volume calculation:

$$\frac{10}{\frac{|(\text{serum Na}^+) - (\text{Na}^+ \text{in given fluid})|}{(0.6 \times \text{body weight}) + 1}} \text{ l/day} \quad (4.1)$$

4.2 Potassium imbalance ($\uparrow\downarrow K^+$)

1. Hypokalemia ($\downarrow K^+$):

- (a) No clinical symptoms:

Oral KCl, 4 mmol/kg/day in 2 – 3 divided dosage for 5 days

- (b) Clinical symptoms present:

(e.g. ileus, head lag, bradycardia, ECG changes, or patient is NPO)

- $K^+ < 2$: 40 mmol/l KCl fluid
- $K^+ 2 - 2.5$: 30 mmol/l KCl fluid
- $K^+ 2.5 - 3.5$: 20 mmol/l KCL fluid

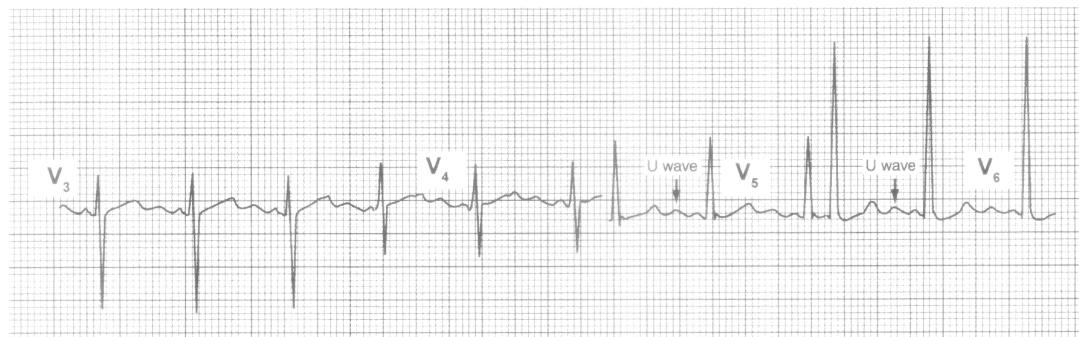


Figure 4.1: ECG in hypokalemia

- U – prominent in chest leads (most common), Others – ST depression, T is small or inverted, prolonged PR interval [5]

2. Hyperkalemia ($\uparrow\uparrow K^+$):

Serum $K^+ > 5.5 \text{ mmol/L}$, but prompt treatment is required when $> 6.5 \text{ mmol/L}$

Classification

- Mild: $> 5.6 - 6.5 \text{ mmol/L}$
- Moderate: $> 6.6 - 7.0 \text{ mmol/L}$
- Severe: $> 7 \text{ mmol/L}$

Cause

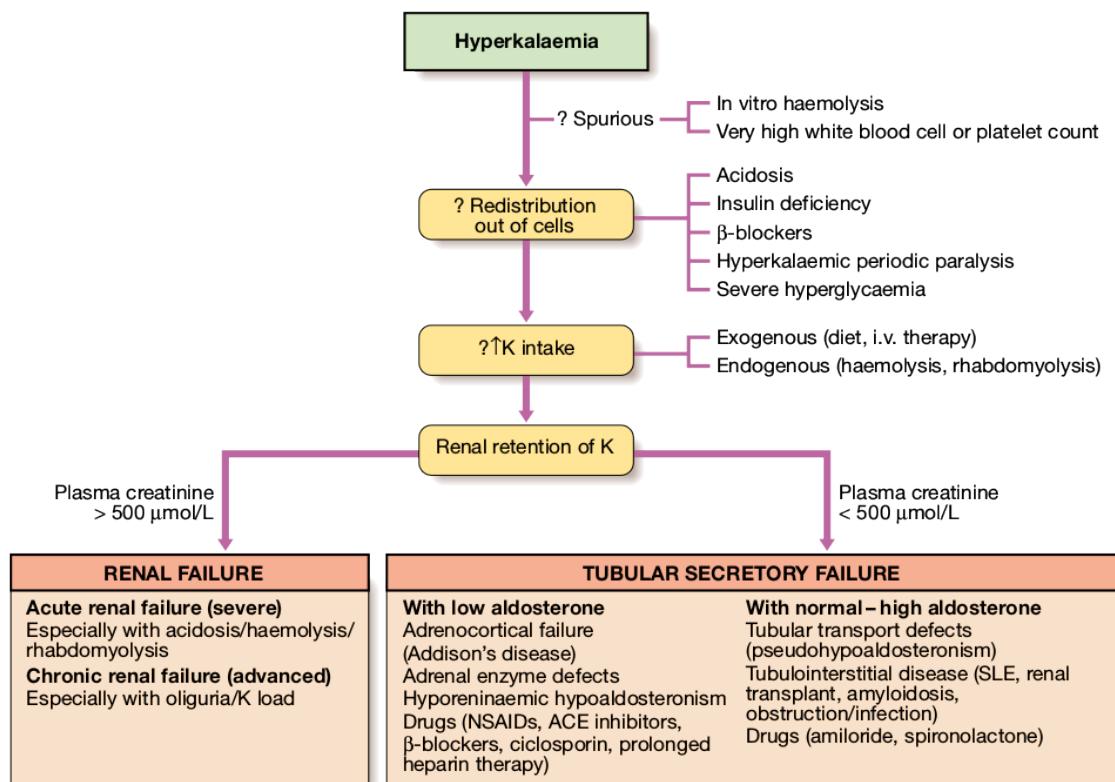


Figure 4.2: Diagnostic decision tree for hyperkalaemia. Creatinine of $500 \mu\text{mol/L} = 5.67 \text{ mg/dL}$. [6]

Clinical features

- ◊ Cardiovascular: Arrhythmia (bradycardia)
- ◊ Neuromuscular: Muscle weakness, paralysis, paraesthesia.
- ◊ Gastrointestinal: Nausea, vomiting, ileus.

Note: The clinical features results from net decrease in membrane excitability occur because of persistent depolarization that inactivates sodium channels in the cell membrane.

ECG findings Look for the followings in ECG,

- **P wave:** Loss of P wave
- **PR interval:** Prolongation (>0.2 second)
- **QRS complex:** Widening gradually leading to “sine wave” (usually in severe hyperkalaemia, duration >0.1 second)
- **ST segment:** Depression
- **T wave:** Tall, peaked (usually seen in mild hyperkalaemia; best seen in chest leads)

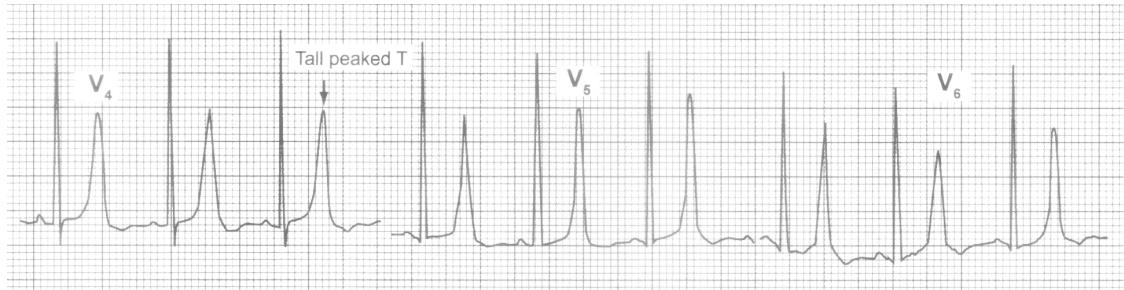


Figure 4.3: ECG in hyperkalemia

- T – tall, peaked and tented (in chest leads), P – wide, small, ultimately absent, PR interval – prolonged, QRS – wide, slurred and bizarre [5]

Management

- (a) Stop all extraneous potassium, except potassium containing food (it is possible to give K^+ free diet) and drugs, which may go unrecognized. (Active intervention might not be required if serum potassium level is between 5.5 to 6.0 mmol/l which may be corrected by rehydration therapy itself)
- (b) If serum K^+ is >6.5 mmol/l:
 - If serum K^+ is >6.0 to 6.5 mmol/l only Salbutamol could be given
 - Calcium gluconate (10%):** 0.5ml to 1.0 ml/kg over 2 to 5 minutes intravenously
Note: It counteracts cardiac toxicity (counteracts the membrane effect of hyperkalaemia, and thereby stabilizes myocardium and prevents arrhythmias). The protective effect of calcium begins within minutes, but it is effective only for an hour. It should be used even in mild form of hyperkalaemia (ECG should be monitored while it is being administered)
 - Salbutamol (nebulisation or spray):** 2.5 to 5 mg of salbutamol solution mixed with 2.5 ml of distilled water for nebulisation is very effective in lowering K^+ levels for up to 2 to 4 hours.
Note: It increases potassium movement into the cells by increasing the activity of Na-K-ATPase).
 - Insulin and glucose:** Intravenous administration of dextrose 0.5 gram/kg body weight + insulin 0.3 (0.15 IU/kg bodyweight) unit per gram of dextrose over 30 minutes.
e.g. For a child with a body weight of 5.0 Kg- 2.5 grams of glucose (25 ml of 10% or 10 ml of 25% dextrose) plus 0.75 unit (5×0.3) insulin.
Note: Glucose with insulin facilitates entry of potassium into cells by activating the Na-K-ATPase in the cell membrane. Onset of action occurs in approximately 5 to 10 minutes and duration is 4 to 6 hours.

- iv. **NaHCO₃**: (*Not routinely practiced*) 1 to 2 mEq/Kg body weight over 3 to 5 minutes intravenously.

Note: It increases the pH and shifts K⁺ into the cells. The effect begins in 5 to 15 minutes and lasts for 1 to 2 hours. It is generally not effective in patients with end-stage renal disease

(**Caution:** Calcium gluconate solution is not compatible with NaHCO₃. Thus, the IV line should be flushed between these two infusions. (**It should not be given in lobar pneumonia and/or alkalosis**).

- (c) **Other treatment option** (if above all measures fail)

- i. **Kayexalate** (sodium polystyrene resin): In the absence of contraindication (please see below) it can be given in a dose of 1g /Kg orally or rectally in 20% to 30% sorbitol or 10% glucose.

(Note: It binds K⁺ in the gut and thereby permanently removes K⁺).

Caution/contraindication: Patients with GI motility disorder (e.g. diarrhoea), hypovolaemia or uraemia since it may precipitate colonic necrosis.

- ii. **Dialysis:** When the above measures fail.

(Note: If needed referral is mandatory)

- (d) Should check renal function along the way.

4.3 Hypocalcemia ($\downarrow \text{Ca}^{++}$)

IV bolus calcium with calcium gluconate 0.5 – 1 ml/kg, followed by oral calcium supplement.

★★ Intravenous calcium should be given slowly after diluted with normal saline (NS). And, keep an eye on ECG monitor to avoid iatrogenic bradycardia/ arrhythmia.

★ For symptomatic patients, IV can be repeated for 3 – 4 times.

4.4 Hypomagnesemia ($\downarrow \text{Mg}^{++}$)

Correction is given if Mg^{++} is very low.

Bolus with 50 mg/kg MgSO_4 , diluted with NS (not more than 2 gm), IV slowly over 20 – 30 minutes. Then, maintenance with 30 mg/kg MgSO_4 over 6 – 8 hour, which could be continued for a day.

★★ Please monitor ECG, BP and tendon reflexes and postpone bolus if the patient is in shock.

★ 1 ampule contains, 5 ml = 2.5 gm.

Chapter 5

Antibiotics choice in Sepsis, Penumonia and HAIs

5.1 Diagnosis and management of sepsis, severe sepsis and septic shock

by Dr. Mohammod Jobayer Chisti

5.1.1 Definition

5.1.1.1 Sepsis

(Diagnosis should be done in absence of dehydration)

- Presence of signs and symptoms of inflammation and infection **plus**,
- Hyperthermia or hypothermia (temperature $>38.5^{\circ}\text{C}$ or $<35.0^{\circ}\text{C}$ respectively) **plus**,
- Tachycardia (HR: neonate 180/min, infant $>160/\text{min}$, 1-5 years $>140/\text{min}$, >5 years $>90/\text{min}$) **plus**,
- Either bounding pulses **or**,
altered mental status **or**,
hypoxemia in absence of pneumonia **or**,
abnormal WBC count ($>12 \times 10^9/\text{L}^*$ **or**, $<4 \times 10^9/\text{L}$ **or**,
band and neutrophil ratio ≥ 0.1) **or**,
increased serum lactate level.

5.1.1.2 Severe Sepsis

(Diagnosis should be done in absence of dehydration)

- Sepsis **plus**,
- Presence of poor peripheral perfusion (cold periphery and weak/absent peripheral pulses and capillary refill time >3 second) **or**,
- Hypotension (MAP <50 mm Hg in children and MAP <65 mm Hg in adults)

5.1.1.3 Septic shock

(Diagnosis should be done in absence of dehydration)

- Sepsis - induced hypotension (MAP <50 mm Hg in children/ <65 mm Hg in adults) persisting despite adequate fluid resuscitation

[*abnormal WBC count for infancy $>15 \times 10^9 / L$;
MAP: (DBP $\times 2 + SBP)/3$]

5.1.2 Antibiotics management

5.1.2.1 Sepsis with Pneumonia

- **Children:** β -lactam [ceftriaxone 100mg/kg (max: 4gm)]
+ fluroquinolones [levofloxacin 10 mg/kg (max:500 mg)] daily
[If s. sepsis/ s. shock: + metronidazole (7.5 mg/kg; max:400 mg/dose) 8 hrly]
- **Adult:** β -lactam (ceftriaxone: 4gm)
+ fluroquinolones (levofloxacin 500 mg) daily
[If s. sepsis/ s. shock: + metronidazole (400 mg I.V) 8 hrly]

5.1.2.2 Sepsis without Pneumonia

- **Children:** β -lactam [ceftriaxone 100mg/kg (max: 4gm)]
+ aminoglycocide [gentamicin 7.5 mg/kg once daily (max:80 mg)]
[If s. sepsis/ s. shock: + metronidazole (7.5 mg/kg 8 hrly; max:400 mg/dose)]
- **Adult:** β -lactam (ceftriaxone: 4gm)
+ aminoglycocide (gentamicin: 80 mg I.V) 8 hrly
[If s. sepsis/ s. shock: + metronidazole (400 mg I.V) 8 hrly]

5.1.3 Fluid management

- **Goal:** Rescue from organ dysfunction.
 - **MAP:** >50 mm Hg in children/ >65 mm Hg in adults and
 - **UO:** >1.0 ml/kg per hour in children/ UO >0.5 ml/kg per hour in adults)
- **Fluid choice:** IV infusion of isotonic solution (Ringer's lactate/normal saline)
 - **Non-SAM children:** 20ml/kg within 1/2 hour (can be repeated for the 3rd time if goal is not achieved)
 - **SAM children:** 20ml/kg within 1 hour (can be repeated for the 2nd time if goal is not achieved; blood transfusion should be given if goal is not achieved after 2nd bolus; if blood is not available or blood transfusion is delayed manage the child as septic shock; however when blood is available transfuse blood even the patient is getting inotrope)
 - **Adults:** 30 ml/kg within 1/2 hour; if goal is not achieved please open CV line and consider 7.5 ml/kg if CVP <10 cm H₂O)

High-flow oxygen supplementation, even if SpO₂ saturation is normal

- **Management of septic shock:**

– Inotrope(s):

* for Children:

- Start dopamine and titrate; if goal is not achieved;
- 2nd line: Adrenaline,
- 3rd line: Nor-adrenaline

* for Adults:

- Start with Nor-adrenaline and titrate; if goal is not achieved;
- 2nd line: Adrenaline

If all the inotropes fail (inotropes resistant septic shock), start steroid: hydrocortisone.

5.1.4 Summary

Summary of progression of sepsis and its consequences and management.

Goal: Survive from organ dysfunction

* MAP: >50 mm Hg in children, and >65 mm Hg in adults and

* UO: >1.0 ml/kg per hour in children, and >0.5 ml/kg per hour in adults

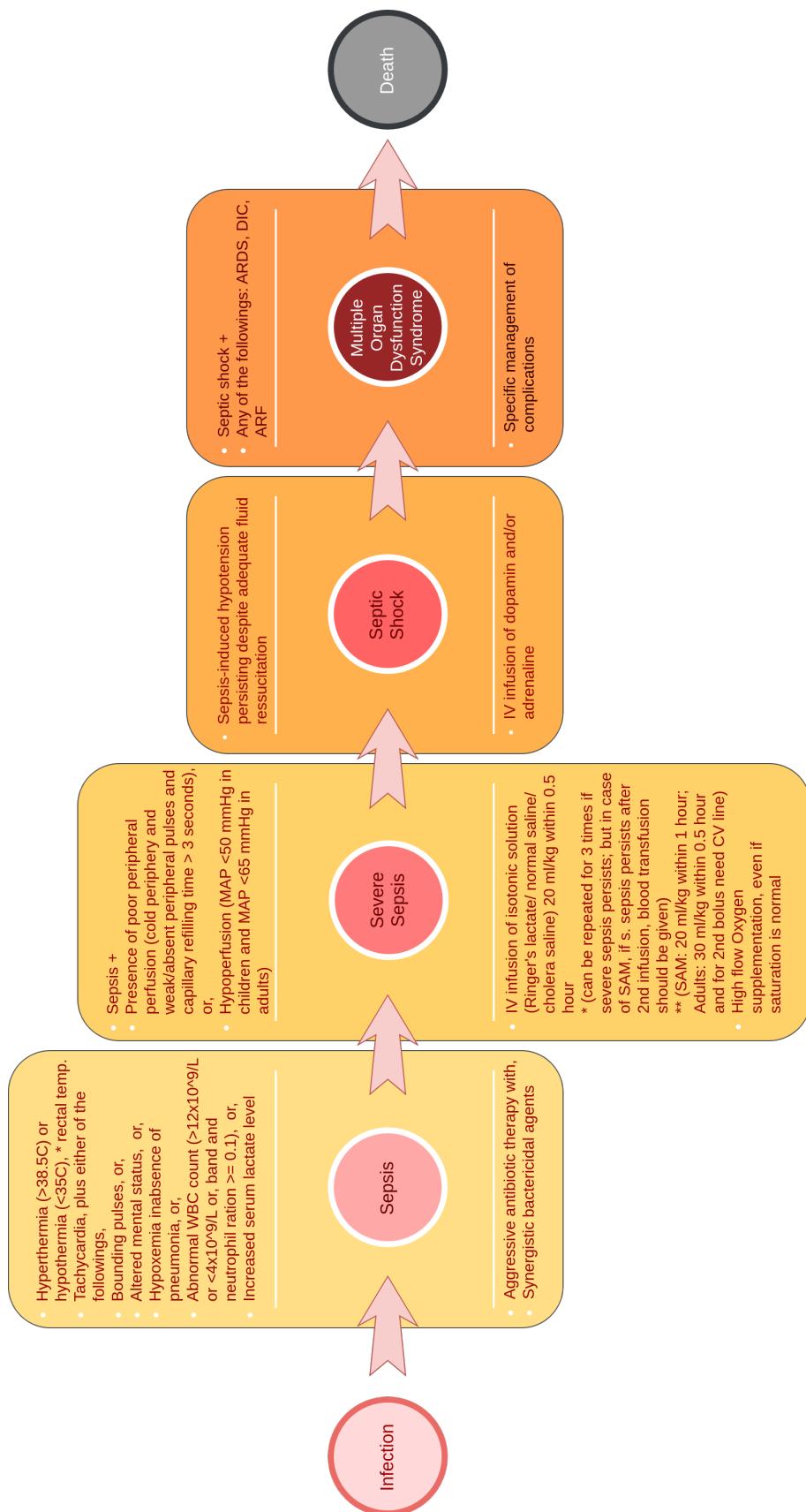


Figure 5.1: Summary of progression of sepsis and it's consequences and management

5.1.5 Antibiotics outline in sepsis & severe sepsis

5.1.5.1 Age >2 months – 5 years

1. Sepsis only:

- (a) **1st line:**
 - i. **Non-SAM:** Inj. Ampicillin (200 mg/kg) + Gentamycin (7.5 mg/kg)
 - ii. **SAM:** Inj. Ceftriaxone (100 mg/kg) + Gentamycin (7.5 mg/kg)

2. Severe sepsis:

- (a) **2nd line:** Inj. Ceftriaxone + Gentamycin
- (b) **3rd line:** Inj. Ceftazidime + Amikacin
- (c) **4th line:** Inj Imipenem / Meropenem
+ Inj. Metronidazole (in case of severe sepsis)

5.1.5.2 Age ≤2 months

1. Sepsis only:

- (a) **1st line:**
 - i. **SAM & Non-SAM:** Inj. Ampicillin (200 mg/kg) + Gentamycin (7.5 mg/kg)

2. Severe sepsis: 1st IV fluid then following →

- (a) **2nd line:** Inj. Ceftazidime + Amikacin
- (b) **3rd line:** Inj. Imipenem / Meropenem

NB: 2nd, 3rd or 4th line will be considered if clinical deterioration **after at least ≥24 hrs**, or, no improvement **after >72 hrs.**

5.2 Management of Pneumonia in icddr,b Hospital

5.2.1 Definition

1. Pneumonia

- (a) h/o cough
- (b) Fast breathing (age specific)
 - <2 months ≥ 60 breaths/min
 - 2–11 months ≥ 50 breaths/min
 - >1 year ≥ 40 breaths/min
- (c) Lower chest wall indrawing

2. Severe Pneumonia

- (a) h/o cough
- (b) Fast breathing
- (c) Lower chest wall indrawing
+
- (d) $\text{SpO}_2 <90\%$ without O_2
- (e) Severe respiratory distress (e.g. grunting, very severe chest indrawing)
- (f) Inability to breastfeed or drink (<50% according to weight)
- (g) Lethargy or unconscious,
- (h) Convulsions
- (i) SAM

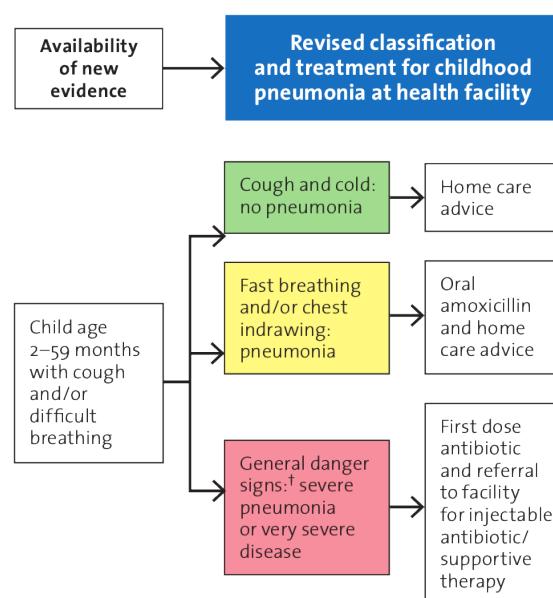


Figure 5.2: Revised classification and treatment of childhood pneumonia at health facility;
 † Not able to drink, persistent vomiting, convulsions, lethargic or unconscious, stridor in a calm child or severe malnutrition. [7]

5.2.2 Common organisms in Pneumonia

1. CAP /Early onset Pneumonia

(a) Bacteria:

- i. *Streptococcus/ Staphylococcus*
- ii. *Mycoplasma/ Chlamydia/ Klebsiella/ Legionella*
- iii. *Coxiella/ Actinomyces*

(b) Virus:

- i. *Influenza/ Parainfluenza*
- ii. Measles/ Varicella/ Herpes simplex
- iii. CMV/ Adenovirus/ Corona

2. Late onset HAP

- (a) Gram negatives: *E.Coli/ Pseudomonas/ Klebsiella/ Acinetobacter*
- (b) *Staphylococcus aureus* (including MRSA)
- (c) Anaerobes:
 - i. Gram Positive cocci: *Peptostreptococcus*
 - ii. Gram Negative cocci: *Veillonella*
 - iii. Gram Positive Bacilli
 - A. Spore forming - *Clostridium*
 - B. Non-spore forming - *Actinomyces/ Propionibacterium/ Lactobacillus*
 - iv. Gram Negative Bacilli - *Bacteroides fragilis/ Prevotella/ Fusobacterium*

CAP: Community Acquired Pneumonia

HAP: Hospital Acquired Pneumonia (new episode of pneumonia occurring ≥ 48 hours after hospital admission)

- **Early onset:** Occurring ≤ 96 hours of admission
- **Late onset:** Occurring ≥ 96 hours of admission

5.2.3 Childhood Pneumonia and Severe Pneumonia

1. S. pneumonia without hypoxia:

Ampicillin (50 mg/kg/dose; max: 500 mg) 6 hrly
+ Gentamycin (7.5 mg/kg; max: 80 mg) OD, IV/IM

2. S. pneumonia with hypoxia:

• Bubble-CPAP, then,
Ampicillin (50 mg/kg/dose; max: 500 mg) 6 hrly
+ Gentamycin (7.5 mg/kg; max: 80 mg) OD, IV/IM
+ Bubble CPAP O₂ therapy (in hypoxemia (SpO₂<90%)/ grunting respiration[†])
↓

If deteriorates: Ceftriaxone (80 mg/kg) IV OD + Levofloxacin (10 mg/kg) IV OD

NB: If severe pneumonia improves (no co-morbidities needing treatment; CRT < 3sec, RR normal (according to age), SpO₂>90%, T<37°C for 24 hrs, feeding orally), the patient should be discharged with medication with ambulatory care.

3. Duration: 5 – 7 days

† Grunting: Low- or mid-pitched, expiratory sound caused by sudden closure of the glottis during expiration in an attempt to maintain FRC (functional residual capacity). [8]

NB: Children with pneumonia (non-severe) should be treated with oral amoxycillin (40 mg/kg per dose; max: 500 mg; 12 hrly for 5 days) and if there is no dehydration or diarrheal complication(s), the patient should be treated at home, otherwise at SSU.

↓

In SAM, if 2nd line fails, screen for TB (following national guideline).

↓

If no evidence of TB is found, consider Ceftazidime + Amikacin/ Imipenem/ Meropenem to cover MDR Gram (-)ve organisms (Fellows should consult with senior physicians before prescribing these drugs).

* Evaluate for CHD, especially if BCPAP is required for >7 days.

↓

If 3rd line fails and have hypoxemia, consider *Pneumocystis jiroveci* pneumonia (**PJP**), with the following regimen:

- Systemic *Pneumocystis jirovecii*:

Co-trimoxazole: 6–20 TMP/kg/day 6–8 hrly PO, usually 20 mg/kg (1 TSF = 40mg TMP)

↓

If no evidence of PJP is evident, consider empiric therapy (?? no empiric therapy) with anti-TB (Fellows should consult with senior physicians before prescribing these drugs).

5.2.4 Adult Pneumonia

1. **Low severity (CURB65 = 0–1):** Tab. Levofloxacin per oral OD, Dose: 750 mg, if weight ≥ 50 kg; 500 mg, if weight < 50 kg
2. **Moderate severity (CURB65 = 2):** Tab. Levofloxacin per oral OD, Dose: 750 mg, if weight ≥ 50 kg; 500 mg, if weight < 50 kg
3. **High severity (ICU) (CURB65 ≥ 3):**
Inj. Ceftriaxone 2 gm OD + Levofloxacin 500 mg IV OD.
⇒ Switch to, oral Levofloxacin 750 mg orally OD + Cefixime 400 mg orally OD (if patient can take orally)
4. **Duration:** 7 – 10 days

NB: CURB65 (C: Confusion, U: blood urea, R: respiratory rate, B: blood pressure, 65: age) score.

- 1 for confusion,
- 1 for urea (>7 mmol/l),
- 1 for RR≥30/min,
- 1 for BP (systolic<90 or diastolic<60 mmHg) and
- 1 for age≥65 yrs.

However, here only CRB65 is used instead of CURB65 (as blood urea is not measured until it is indicated otherwise)

NB: Azithromycin instead of Levofloxacin should be used in adults who are highly likely to have TB.

5.3 Hospital Acquired Infection

by Dr. Mohammad Jobayer Chisti

5.3.1 Definition and types

Definition An infection that occurs after 48 hours of admission in a patient during hospitalization which was not present or incubating at the time of admission. This includes infection acquired at the hospital but appearing after discharge (3 days after discharge).

Most common types

- UTI (fever/ dysuria/ abdominal pain/ vomiting + positive urine C/S with $\geq 10^5$ bacteria/ml)
- Pneumonia (following WHO classification of clinical pneumonia and new infiltrates in CXR consistent with infection)
- Sepsis (please follow the definition of sepsis cascade in our hospital guideline)

5.3.2 Etiology

1. **Early onset:** Clinical features appear >48 hours but <96 hours of hospitalization

- Enterobacteriaceae (*E. coli, Klebsiella, Proteus, Salmonella, Enterobacter*)
- *Haemophilus influenzae*
- *Streptococcus pneumoniae*
- MSSA
- Viruses (Respiratory syncytial virus, Rotavirus, Enterovirus)

2. **Late onset:** Clinical features appear ≥ 96 hours of hospitalization

- *Pseudomonas*
- *Acinetobacter spp.*
- MRSA
- Enterobacteriaceae
- Viruses (Respiratory syncytial virus, Rotavirus, Enterovirus)
- Parasites and fungus (*Giardia lamblia, Aspergillus spp., Cryptosporidium*)

5.3.3 Risk of MDR HAI

- Late onset
- Ventilator associated pneumonia
- Prior antibiotic therapy
- Co-morbidities
- Eventual organ failure

5.3.4 Choice of antibiotics

1. Early onset:

- (a) **Children:** 3rd generation of cephalosporin (ceftriaxone: 80 mg/kg IV OD); or, fluroquinolone (levofloxacin: 10 mg/kg IV OD)
- (b) **Adult:** 3rd generation of cephalosporin (ceftriaxone IV 2 gm OD); or, fluroquinolone (levofloxacin: 750 mg for weight ≥ 50 kg, 500 mg for weight < 50 kg)

2. Late onset:

- (a) **Children:** Anti-pseudomonal agent (Inj. Ceftazidime (150 mg/kg/day 8 hourly, *i.e. 50 mg/kg/dose 8 hourly*), + anti-pseudomonal fluroquinolone (Ciprofloxacin: 10 mg/kg IV OD) or aminoglycoside (Amikacin (25 mg/kg STAT; then, 18 mg/kg/day – OD)); + if risk of MRSA, add vancomycin/ linezolid)
- (b) **Adult:** Anti-pseudomonal agent (ceftazidime: 1 gm IV 8 hourly), + anti-pseudomonal fluroquinolone (ciprofloxacin: 500 mg IV OD), or, aminoglycoside (amikacin: 500 mg IV 12 hourly), + if risk of MRSA add vancomycin/ linezolid

NB: • If culture positive, treat with sensitive antibiotic(s) for 14 days (UTI for 7 days).
• However, if no growth in C/S and CBC shows viral picture and patient becomes asymptomatic for 48 hours, discharge can be given without antibiotics.
• On the other hand, if no growth, and CBC indicates bacterial picture, and patient becomes asymptomatic for 48 hours, the individual should be discharged after 7 days of treatment.

Chapter 6

Management of Gaspings, Intubation, Extubation

6.1 A young patient came with gasping respiration, what to do next?

1. Shout for help and get an Ambu bag ready
2. Check if the patient is conscious or unconscious
3. Check airway
4. Check for adequate breathing (look, listen, feel)
5. If inadequate breathing, give 5 rescue breaths
6. Check for a pulse, or signs of circulation
7. If inadequate circulation, start BLS
8. By this time, check RBS, secure a channel and put the patient on a monitor
9. Keep the suction tube beside the bed
10. If still gasping (3–4/min), then continue rescue breathing
11. Think of cuffed endotracheal tube (ETT) intubation
Preparation of cuffed endotracheal intubation. However, for small babies uncuffed ETT are used instead.
 - (a) Bring appropriate size ETT (e.g. 4.5)

$$\text{ETT size} = \frac{\text{Age (years)}}{4} + 3 \quad (6.1)$$

- (b) Guide wire
- (c) Laryngoscope, along with the additional one
- (d) Lubricant or, gel
- (e) Put a pillow under head, if required
- (f) Tape or, tie or, knot

- (g) Syringe, to inflate the cuff of ETT. For children, uncuffed ETT are used, and for adults cuffed ETTs are used instead. However, try inflating the cuff before introduce, to see if there is any leakage, and how much air is required (on average 5-10 cc air is enough).
 - (h) Drugs
 - i. To ease intubation:
 - A. Ketamine (2 mg/kg) (★ beware, it can cause hyperK⁺)
 - B. Suxamethonium (2 mg/kg)
 - ii. For rescue purpose:
 - A. Atropine (1 amp: 1 mg/ml) (★★ maximum 3 doses)
 - Children: 20 μ g/kg (★★minimum: 100 μ g)
 - Adult: 1 amp
 - B. Adrenaline (1:10000) (1 amp: 0.6 mg/ml) (★★ maximum 5 doses, 3-5 doses)
 - Children: 10 μ g/kg
 - Adult: 1 amp
12. After intubation, check it's position (by CXR). It may also be seen by observing whether the chest movement is symmetrical, or, by listening to the breath sounds (bilaterally) and over the abdomen (where breath sound should be absent), or, by fogging of the tube.
 13. During the intubation, it might be helpful to ask the assistant to hold the head, and sometimes press on the cricoid cartilage, to get a better view of the tracheal opening
 14. If the patient is a pregnant female, put the patient in a left or right lateral position. And, in pregnancy both Ketamine and Suxamethonium can be used safely

6.2 Initial ventilator setup

Check for leaks and then, check if O₂ is flowing.

Table 6.1: Initial ventilator setup

	Adults	Children
Mode	SIMV/V	SIMV/P
FiO ₂	100	100
VT (ml/kg)	6 – 8	6–8
RR (/min)	16 – 18	<30 (neonate, 30–40)
PEEP (cm H ₂ O)	5	5
I:E	1:2	—
Peak pressure (cm H ₂ O)	≤35 (25–30)	—
Peak flow	—	50
Control /limit pressure (cm H ₂ O)	—	20 – 25
Pressure support	—	< Control/limit pressure
Inspiratory time	—	0.55 – 0.7 (up to 1; Neonate 0.35 – 0.6)
Trigger	—	(-1)
Body weight (child)	—	6.5 kg (minimum)

★ Length of insertion of ETT (endotracheal tube) up to incisor teeth or, lips is roughly 2^{1/2} of the ETT size.

★ After intubation, advice for tracheal aspiration for C/S and CXR.

6.3 Extubation steps

1st do the ABG. Now, if the indications of intubation improves, e.g. mentation, respiratory acidosis, then consider extubation following the following steps

↓
CPAP (2 to 3 hours) in ventilator

↓
“T” piece (2 to 3 hours)

↓
Nebulization with Adrenaline (**Croup dose** with ASA (adrenaline, steroid, adrenaline) nebulization with adrenaline (1:1000): 0.5 ml/kg (max: 6 ml) + 6 ml NS
(usually improves with 1 nebulization)

and

steroid (IV Dexamethasone / Hydrocortisone @ 5 mg/kg)

↓

CPT-suction

↓

BCPAP

6.4 Conversion of VBG to ABG

From central venous sample:

Venous (CVC)	Arterial
pH	add 0.04
pCO ₂	subtract 4
HCO ₃	
Lactate	
SpO ₂	add 30%

This is also known as the **Rule of Fours**.

Chapter 7

ECG can be read easily, if a logical approach is taken

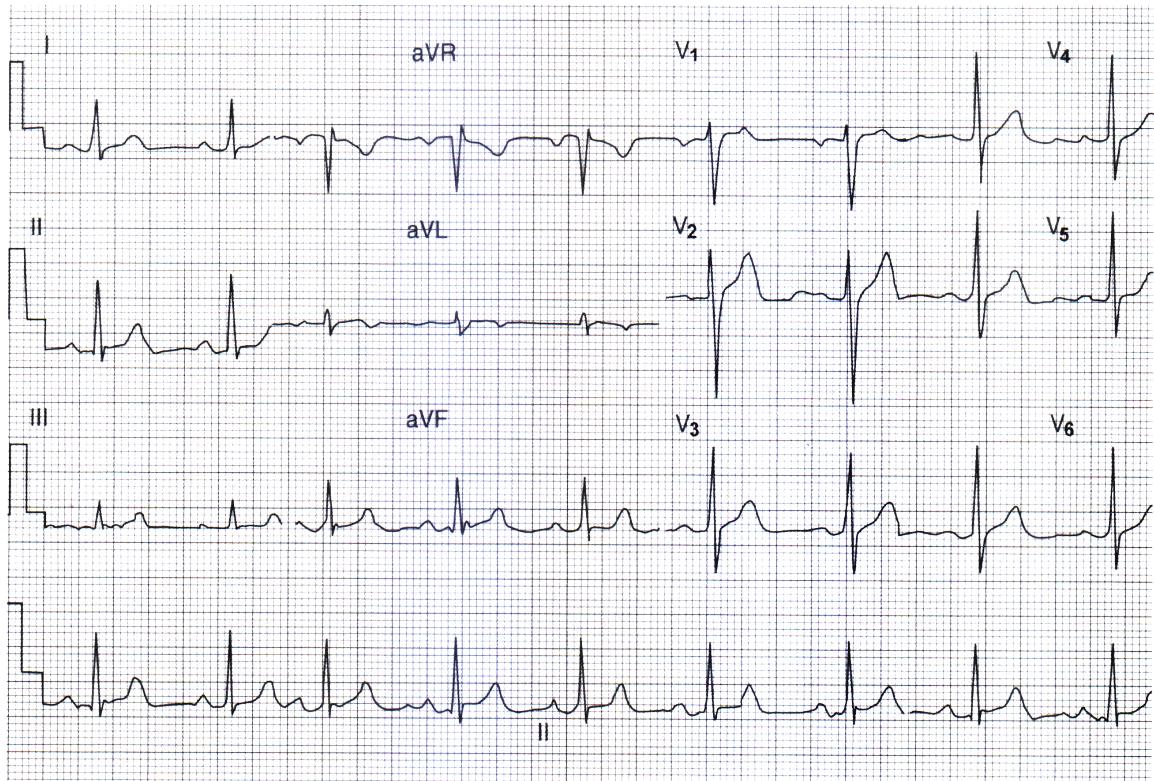


Figure 7.1: A standard normal 12-lead ECG [5]

Before even reading the ECG

Check the following:

- **Standardization:** The ECG machine should be set at 1mV, a 10 mm standardization mark, and the paper should be running at 25mm/sec.
- **Lead attachment error or a Dextrocardia:** The “T”-wave in aVR lead should face downward in a normal person. If it faces upward, check for “R”-waves in chest leads. In real dextrocardia, the “R”-wave should be regressive from lead V1 to V6. The usual “R” progression will be absent here.

Background knowledge

1 big square = 0.2 sec

1 small square = 0.04 sec

P wave : <3 small square (0.12 sec)

PR interval : 3 - 5 small square

QRS : <2.5 small square

QT_c : <0.44 sec (male) and <0.46 sec (female)

$$QT_c = \frac{QT}{\sqrt{RRinterval}}$$

Logical approach to reading an ECG

Rate	P wave	Others
Rhythm	PR interval	
Axis	Q waves	
	QRS complex	
	ST segment	
	T wave	

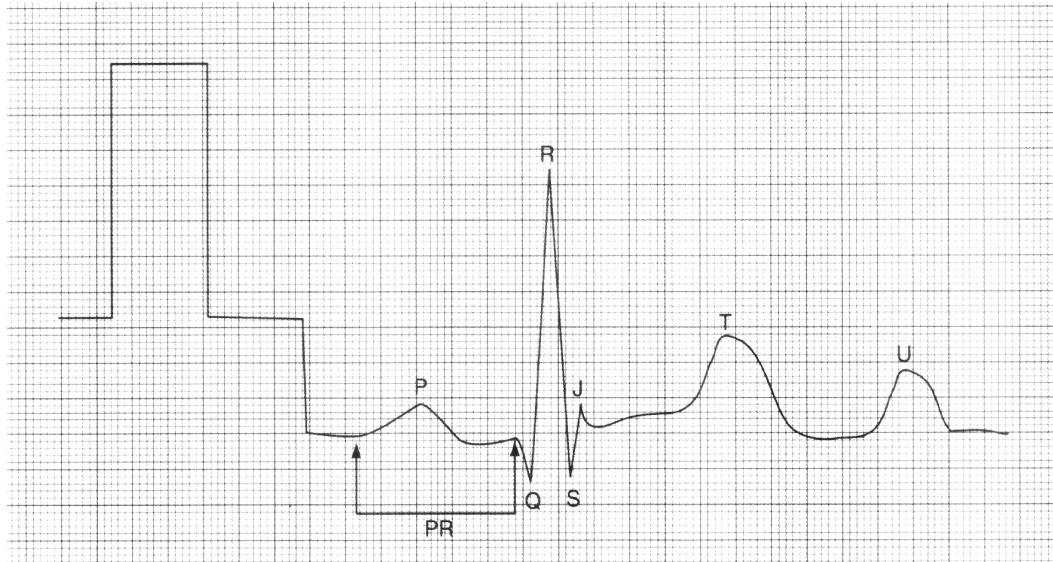


Figure 7.2: Waves and segments of ECG [5]

7.1 Rate

Divide 300 by the number of big squares between QRS complex. (If the rate is irregular then, average over several QRS complexes)

e.g. 6 big squares between QRS complex,

Rate = $300/6 = 50$ bpm

3 big squares between QRS complexes,

Rate = $300/3 = 100$ bpm

7.2 Axis

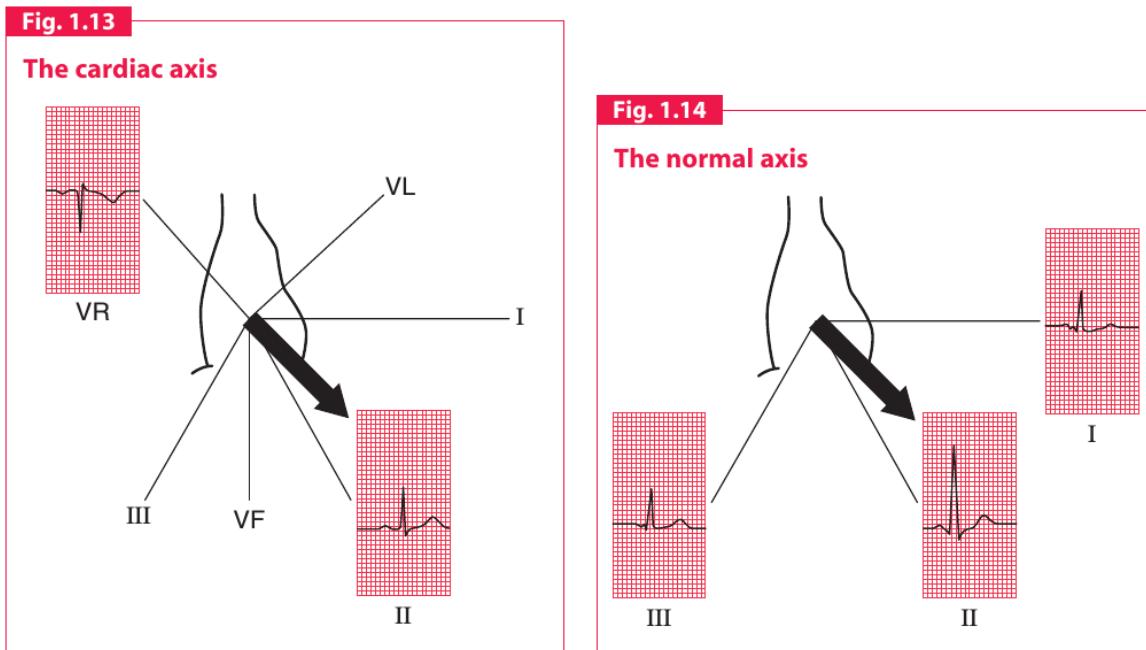


Figure 7.3: Normal cardiac axis [9]

Simple way Look at the QRS complex in leads, I, II and III.

Positive means, the bit above the line is larger than the bit below. And, negative means the bit below the line is greater than the bit above the line.

Table 7.1: Axis deviation chart

Leads	Left Axis Deviation	Right Aaxis Deviation
I	(+ve)	(-)ve
II	(-)ve	
III	(-)ve	(+)ve

Formal way The axis is a 90° to the isoelectric line in the direction of the most positive lead.

- Look at the QRS complexes in lead I, II, III, aVR, aVL and aVF.
- The isoelectric lead is that lead, in which the bit above the line is most nearly equal to the bit below the line.
- Look for the most positive lead.
- Read off the axis from the diagram below
- Normal axis is from -30° to $+90^\circ$.

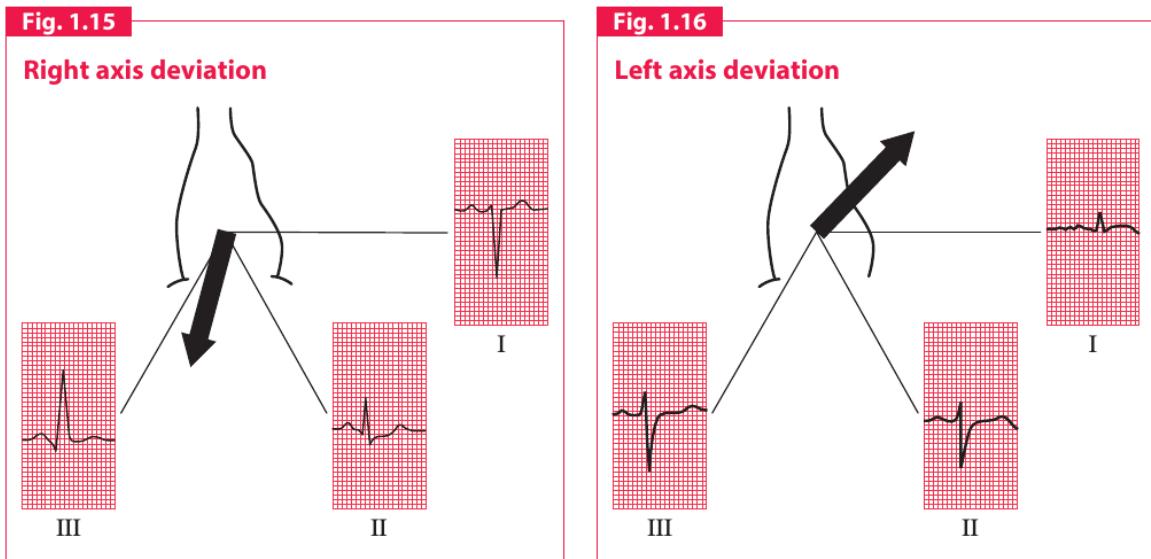


Figure 7.4: Left axis deviation and right axis deviation [9]

7.3 Rhythm

The rhythm is either **REGULAR** or **IRREGULAR**

FAST (>100 bpm)	NORMAL (60-100 bpm)	SLOW (<60 bpm)
<i>tachycardia</i>	—	<i>bradycardia</i>

1. Rhythm is **REGULAR**, \Rightarrow One P wave per QRS?
 - (a) Yes \rightarrow Sinus rhythm. \Rightarrow Now, rate is,
 - i. Fast \rightarrow Sinus tachycardia
 - ii. Slow \rightarrow Sinus bradycardia
 - (b) No \rightarrow Regular rhythm
2. Rhythm is **IRREGULAR**, \Rightarrow No P wave at all!!
 - (a) Yes \rightarrow Is that rhythm irregularly irregular?
 - i. Yes \rightarrow Atrial fibrillation (Better to be checked by marking out on paper)
 - (b) No \rightarrow Irregular rhythm

7.4 P wave

1. Presence or absence
 - (a) Present \rightarrow 1 per QRS + normal PR \Rightarrow Sinus rhythm
Otherwise, please look at PR interval
 - (b) Absent \rightarrow Rhythm irregularly irregular \Rightarrow Atrial fibrillation
Otherwise, concentrate on QRS complex

2. Shape

- (a) Normal
- (b) Peaked → right atrial enlargement ⇒ P pulmonale
(Best seen in lead II, III, aVF, V1, V2)
- (c) m-shaped → left atrial enlargement ⇒ P mitrale
- (d) Inverted (i.e. negative in the leads in which it is usually positive) ⇒ Depolarization in the atria towards unusual direction and that the pacemaker is not in the sinus node, rather located elsewhere in the atrium, in AV node or below this or there is dextrocardia.

7.5 PR interval

PR interval is measured from the start of the P wave to the start of the QRS complex.

PR interval can be,

SHORT	NORMAL	LONG
<3 small squares	≥3 or ≤5 small squares	>5 small squares

1. **Short PR interval** → Part of a *pre-excitation syndrome*. If so, look at QRS complex for a δ -wave

- (a) δ -wave absent ⇒ Describe as “Pre-excitation present”
- (b) δ -wave present (slurred start of QRS complex) ⇒ Wolff-Parkinson-White syndrome
 - i. If QRS positive in lead V1 ⇒ WPW type A (above the line)
 - ii. If QRS negative in lead V1 ⇒ WPW type B (below the line)

2. **Long PR interval** → Part of a *Heart block syndrome*, which can be,

- (a) First (1°) degree heart block: Prolonged PR interval only
- (b) Second (2°) degree heart block:
 - i. Mobitz Type I (Wenkebach)
 - Increasing prolongation of PR interval followed by a dropped beat
 - Usually benign, needs no treatment
 - ii. Mobitz Type II
 - Dropped beat with no previous prolongation of PR interval
 - May proceed to complete heart block. Usually needs pacing.
 - iii. Advanced AV block
 - Regular number of P waves per QRS, e.g. 2:1, 3:1
 - May proceed to complete heart block. Usually needs pacing.
- (c) Third degree 3° (Complete heart block)
 - No relationship between QRS and P waves

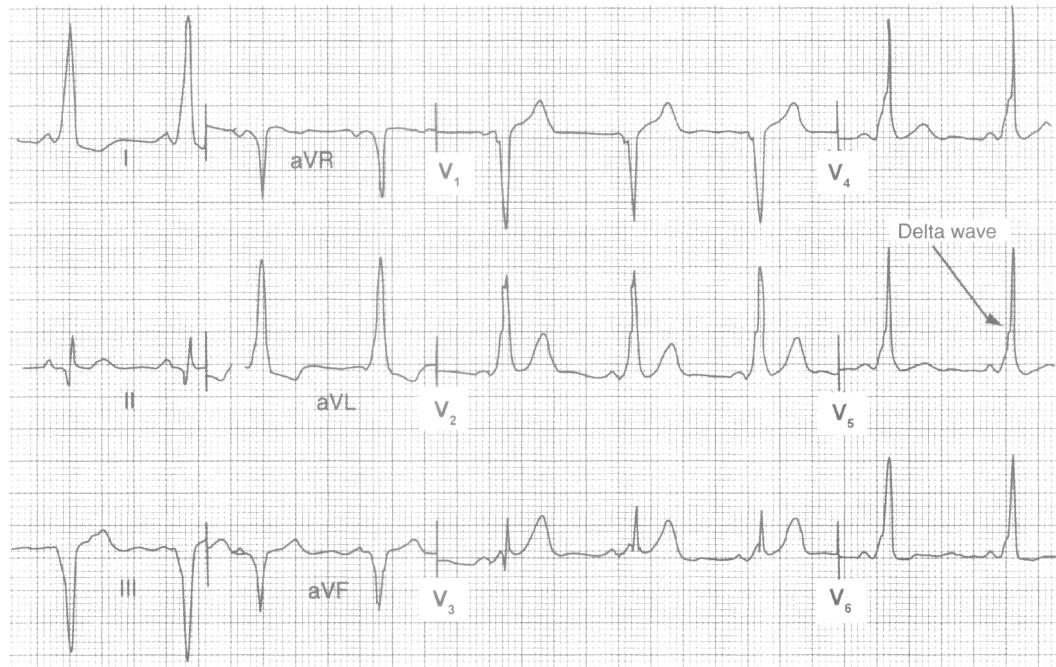


Figure 7.5: WPW syndrome type A;

- PR – short (<0.12 sec), QRS – wide, δ wave – in the upstroke of QRS (slurred QRS), Q wave – may be present in lead II, III, aVF (confused with inferior MI) [5]



Figure 7.6: First degree heart block;

- PR – prolong (>0.22 sec, normal: 0.12 – 0.20 sec), QRS – normal, Rhythm – normal [5]

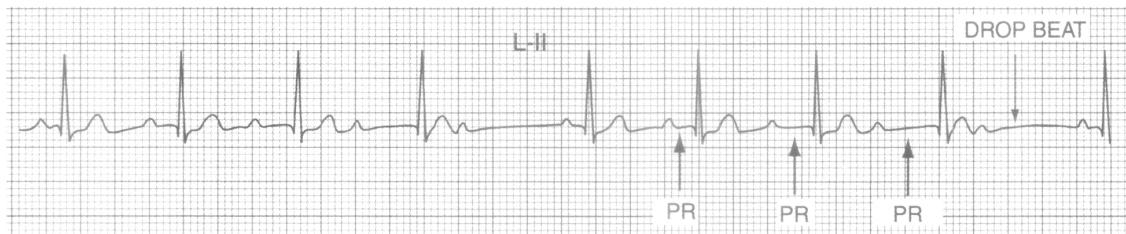


Figure 7.7: Second degree heart block, Mobitz type I (Wenkebach's phenomenon);

- Progressive lengthening of PR interval followed by absent QRS complex (one P is not followed), PR – constant, RR – irregular (Progressive shortening of RR interval until block occurs) [5]

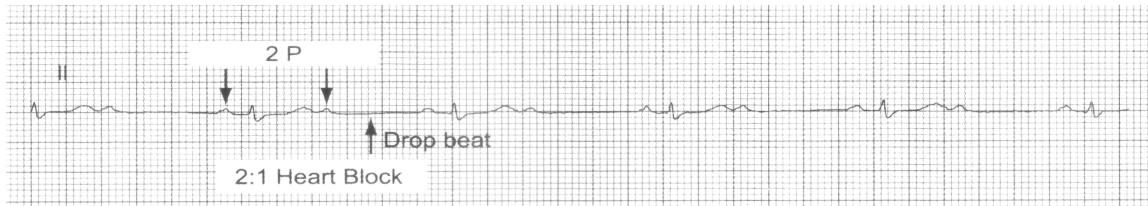


Figure 7.8: Second degree heart block, Mobitz type II

- Some P waves are not followed by QRS complexes, PR interval is constant (also PP interval is constant), QRS – wide [5]

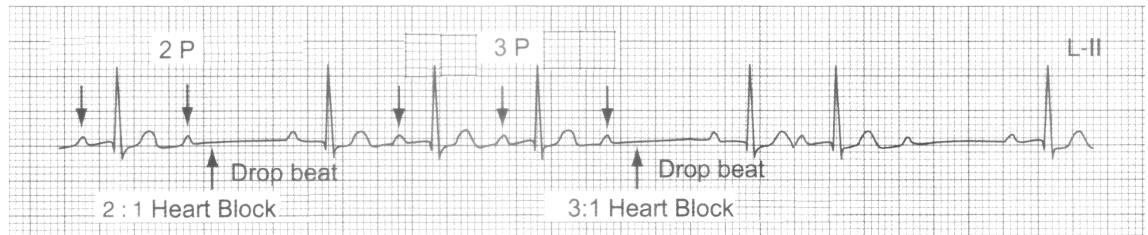


Figure 7.9: Second degree (2:1 or 3:1) heart block

- Some P waves are not followed by QRS complexes, PR interval is constant (also PP interval is constant), QRS – wide (In 2:1 AV block, alternative P wave is conducted. It may be 3:1, 4:1) [5]



Figure 7.10: Complete (third degree) heart block

- Arterial rate – 80/min (PP interval), Ventricular rate – 35/min (RR interval), PP interval – constant, No relationship between P wave and QRS complex (PR looks variable) [5]

- The QRS complexes are an escape rhythm. They can either be narrow (<3 small sq) or broad (>3 small sq)
 - i. Narrow complex escape rhythm
 - Caused by block of the AV node, or, a proximal block of the bundle of His
 - Escape rhythm is usually 50-60 beats/min, which is adequate,
 - Etiology:
 - Congenital
 - Ischaemic heart disease (acute or chronic)
 - Diphtheria, Rheumatic fever
 - Digoxin toxicity, excess β -blockade
 - Aortic calcification
 - Endocarditis
 - R_x :
 - Treatment of cause, otherwise may not be necessary
 - Pacemaker if symptomatic
 - Many units pace even without symptoms
 - ii. Broad complex escape rhythm
 - Block is at a low down position, in His-Purkinje system
 - Escape rhythm is usually slow (15-45 bpm) with dizziness and blackouts (Stock Adams attacks)
 - R_x :
 - All need pacemaker

7.6 Q wave

Q waves can be,

PRESENT	ABSENT	PRESENT
Not pathological	–	Pathological

Q waves are normal in lead, aVR, V1 and sometimes in lead III.

A pathological Q wave is >1 small sq wide, and/or, 2 small sq deep (Or, 25% of the following R wave).

Pathological Q waves are sometimes caused by full thickness infarction of the myocardium.

The distribution of the Q wave in ECG gives a clue to the location of the infarct.

7.7 QRS complex

QRS complex can be,

Normal or broad (in width)
Normal or tall (in height)

Table 7.2: Q wave and corresponding location of the infarct

Lead	Site
V3 – V4	Small anterior
V2 – V5	Large anterior
V1 – V3	Antero-septal
I, aVL, V4 – V6	Antero-lateral
I, II, aVL	Lateral
II, III, aVF	Inferior
V1 – V2	Posterior (reciprocal, i.e. mirror image = R wave)

1. **P wave absent:** May be simply described as,

- Narrow or broad,
- Regular or irregular
- Tachy or bradycardia

A broad complex tachycardia \Rightarrow VT

A narrow complex tachycardia \Rightarrow SVT (until proven otherwise)

2. **P wave present + QRS broad:** Bundle branch block

Could be either *Right Bundle Branch Block*, or, *Left Bundle Branch Block*

This is important, as LBBB makes the rest of the ECG uninterpretable.

(a) **Informal way:** Turn the ECG 90° to the right, and look at V1,

\rightarrow If it points right, then it is *Right Bundle Branch Block*

\rightarrow If it points left, then it is *Left Bundle Branch Block*

(b) **Formal way:** Look at lead V1 and V6

Right Bundle Branch Block has a M pattern in V1 and a W pattern in V6

Left Bundle Branch Block has a W pattern in V1 and a M pattern in V6

	LBBB	RBBB
V1	W	M
V6	M	W
<i>Mnemonic</i>	<i>WiLLiaM</i>	<i>MoRRoW</i>

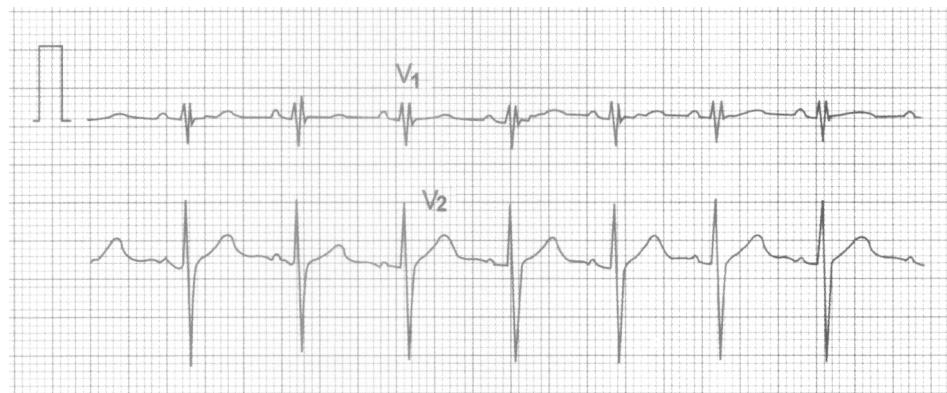


Figure 7.11: Partial RBBB (QRS <0.12 sec)• RSR – in V₁ and V₂ (M pattern) [5]

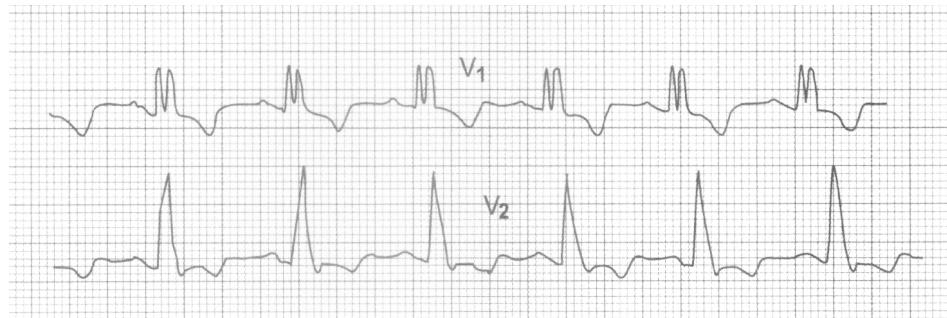


Figure 7.12: Complete RBBB (QRS >0.12 sec) [5]

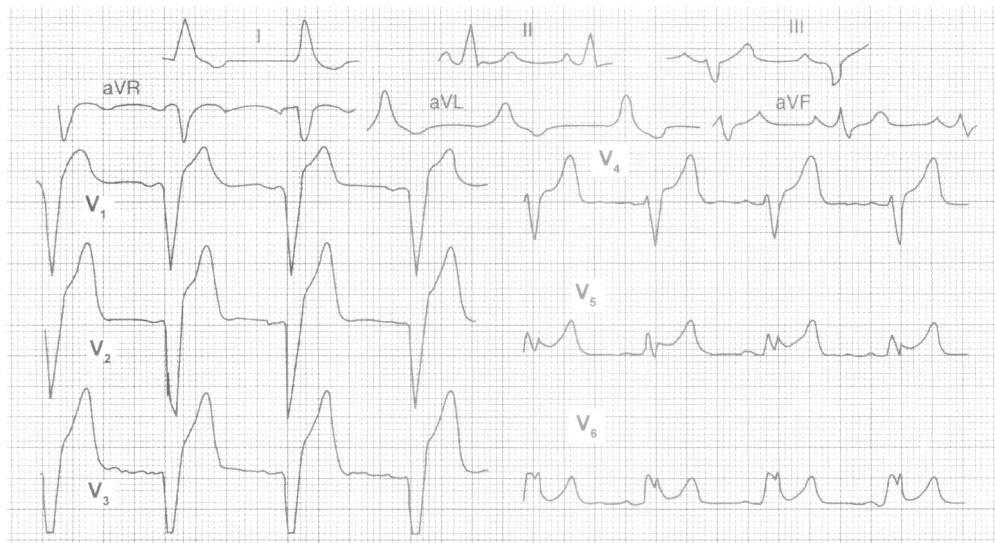


Figure 7.13: LBBB

- RSR – in V₅ and V₆, also in I₁ and aVL (M pattern), QRS – wide (>0.12 sec, 3 small squares), QRS looks wide from I₁ to all leads [5]

3. **QRS tall:** Tall QRS complexes *may be* a sign of ventricular hypertrophy, although it is **not diagnostic**.

(a) **LVH:** LAD + (S in V₁ or V₂ + R in V₅ or V₆) > 40 mm

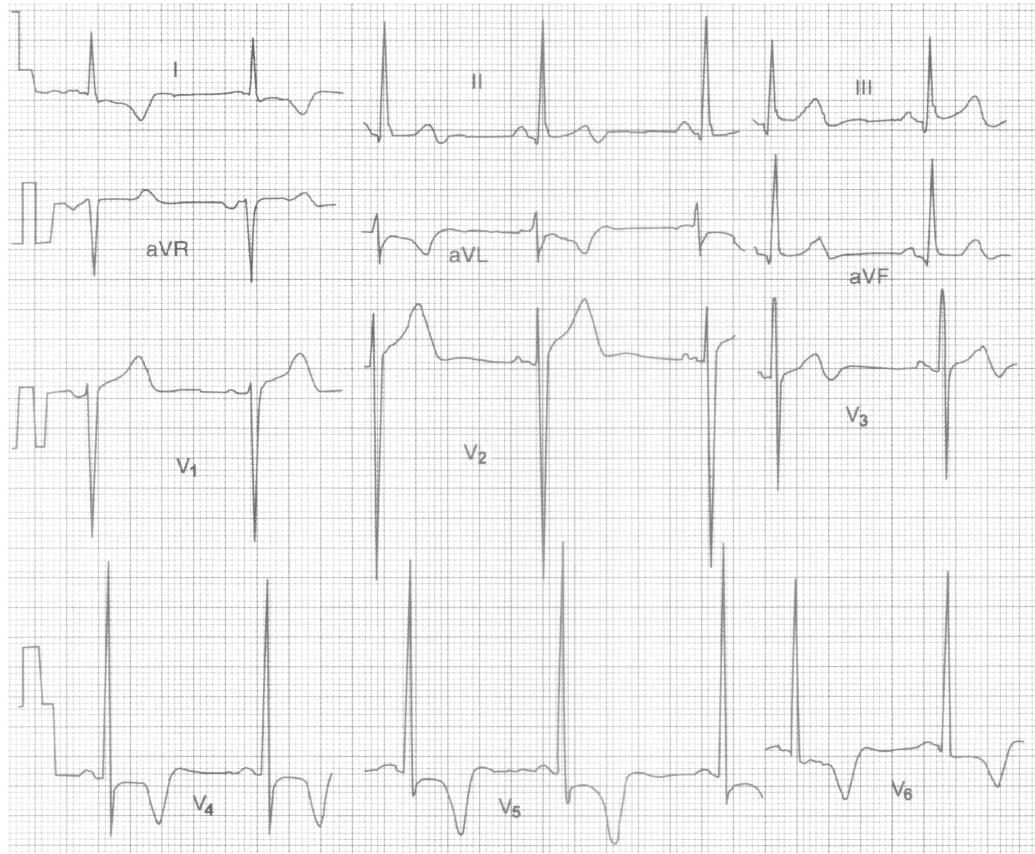


Figure 7.14: Left ventricular hypertrophy

- S in V₁ + R in V₆ or V₅ > 35 mm (S V₁ + R V₆ > 35 mm, for age > 25 years); [5]

(b) **RVH:** RAD + (R in V₁ + S in V₆) > 11 mm

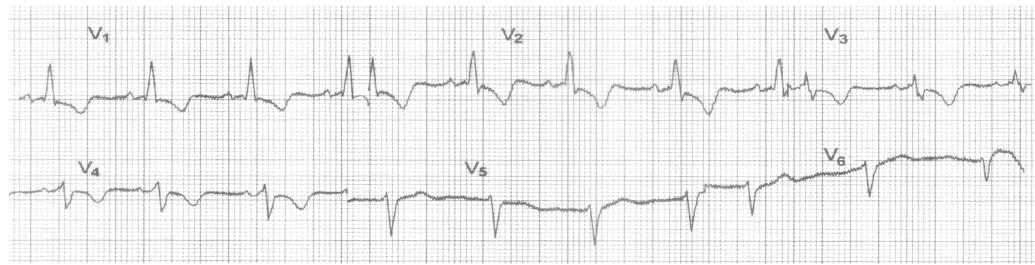


Figure 7.15: Right ventricular hypertrophy

- Tall R wave in V₁ > 7 mm (also deep S in V₅ or V₆) [5]

7.8 ST segment

ST segment can me normal, elevated or depressed.

1. **ST elevation:** Most commonly seen in

- Myocardial infarction
- Pericarditis

- **Myocardial infarction:** >1 mm in chest leads, or, >2 mm in limb leads, in 2 or more leads.

The affected leads show the area of infarct

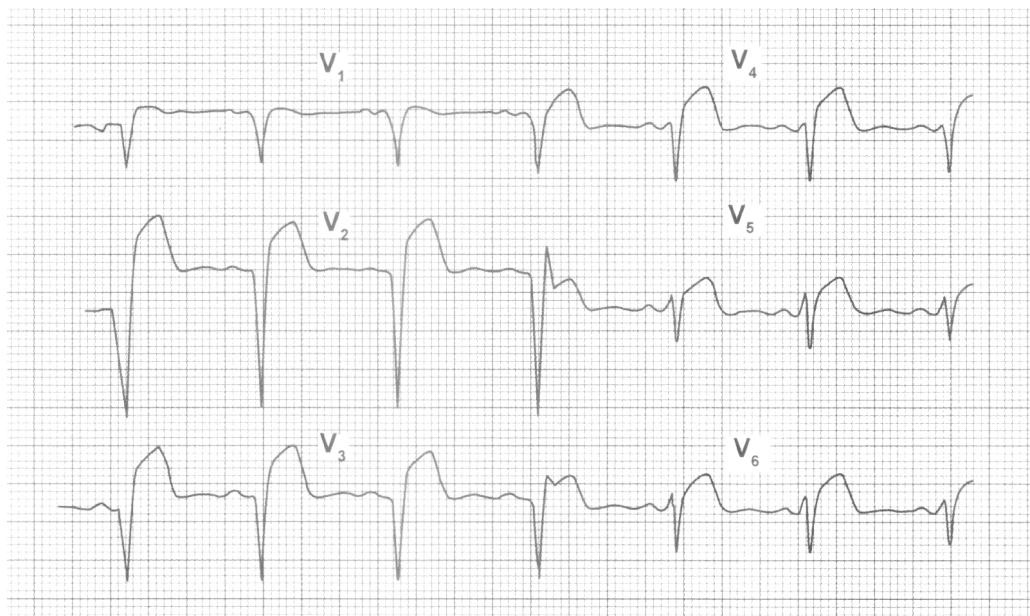


Figure 7.16: Acute anterior MI (fully evolved case)

- ST elevation (with upward convexity), Pathological Q wave, T inversion [5]

- **Pericarditis:** Usually all or most of the leads, with saddle shaped or concaved upwards.

2. **ST depression:** It is a non-specific finding seen in

- Ischaemia
- Strain
- Contusion.

7.9 T wave

The T wave can be normal or inverted.

T inversion is a non-specific finding seen in,

- Ischaemia
- Other

The classical pattern of myocardial infarction is,

ST elevation	minutes
T inversion	hours
Q wave	days

7.10 Others

- Sinus arrhythmias

1. **Sinus arrhythmia:** Pulse rate varies with inspiration and expiration,
 - *Inspiration* sucks blood into heart, therefore to accommodate *rate increases*
 - *Expiration* slows blood into heart, therefore to accommodate *rate decreases*
2. **Sinus bradycardia** (<60 bpm)
 - Normal in athletes and elderly
 - Secondary to hypothyroidism, hypothermia, cholestatic jaundice and ↑ ICP
 - Drugs: β -blocker, digoxin – Ischaemic heart disease affecting sinus node
 - Degenerative disease of the sinus node

R_x of cause: Acutely – IV Atropine, may need pacemaker
3. **Sinus tachycardia** (>100 bpm)
 - Physiological: Fever, exercise, emotion, pregnancy, anemia
 - Pathological: Hyperthyroidism, raised catecholamines

R_x of cause: β -blockers

- Pathological bradycardias

Physiologically, the pacemaker resides within SA node. Electrical impulses pass to the AV node, and then along the His-Purkinje system to the rest of the heart. The SA node and AV node are supplied about 90% and 60% respectively by the right coronary artery.

1. **Problems with the SA node (Sick Sinus Syndrome):**
 - Caused by ischaemic heart disease or, degenerative changes
 - PR interval is prolonged to 2 sec
 - May result in fast escape rhythms

R_x: Pacemaker, anticoagulation (thrombo-embolism is common in tachy-brady syndrome)
2. **Problems with the AV node:**
Please see the section of heart block syndrome (i.e. long PR interval)

Chapter 8

Others

8.1 Calorie value of diets

Table 8.1: Calorie value of different diets

	Diet	Calorie
1	Milk suji	67 Kcal/100 ml
2	Milk suji 100	100 Kcal/100 ml
3	Infant formula	68 Kcal/100 ml
4	3/4 rice suji	56.6 Kcal/100 ml
5	Full strength rice suji	70 Kcal/100 ml
6	Full strength biomil soya	68 Kcal/100 ml
7	3/4 strength biomil soya	51 Kcal/100 ml
8	Full strength comminuted chicken	60.6 Kcal/100 ml
9	3/4 strength comminuted chicken	46.3 Kcal/100 ml
10	Breast milk	65 Kcal/100 ml
11	Chicken corn soup	62 Kcal/100 ml
12	Khichuri	145 Kcal/100 gm
13	Halwa	240 Kcal/100 gm
14	Full strength pregistimil	67 Kcal/100 ml
15	3/4 strength pregistimil	50 Kcal/100 ml

8.2 Persistent Diarrhea

8.2.1 Definition

Persistent diarrhoea is diarrhoea, with or without blood, that begins acutely and lasts for ≥ 14 days. [10]

8.2.2 Dietary treatment algorithm

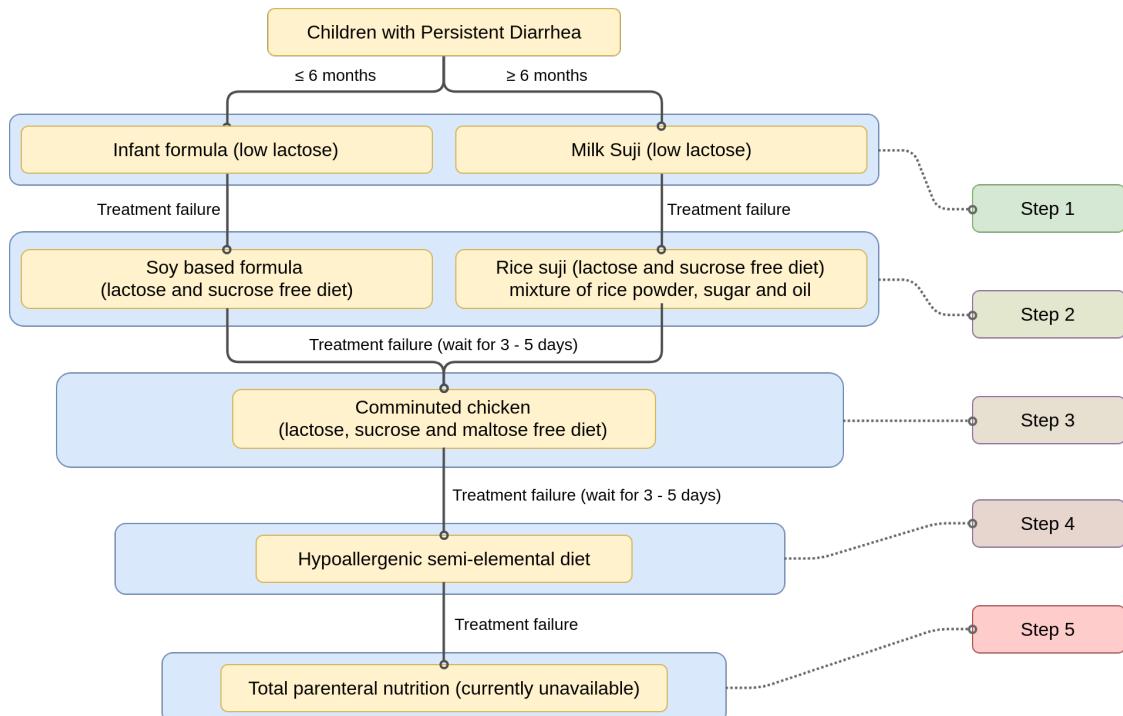


Figure 8.1: Treatment algorithm of icddr,b for children with persistent diarrhoea. [10]

★ Treatment failure:

- If deterioration of diarrhea, change to next diet after 3 days,
 - If remains static, change to next diet after 5–7 days.

★ In case of improvement, back to previous diet after 5–7 days.

8.2.3 Plan of investigations

1. 1st line: (Routine)

- (a) Complete Blood Count (CBC)
 - (b) Stool for Routine Microscopic Examination
 - (c) Stool for culture for *Salmonella*, *Shigella*, *Campylobacter jejuni*, *Vibrio cholerae*, *Aeromonas*

2. 2nd line: (if high probability)

- (a) *Cryptosporidium* by ELISA
 - (b) *Giardia* by ELISA

3. Associated investigations:

- (a) Urine R/M/E
- (b) Serum Electrolyte, Creatinine
- (c) Chest radiograph
- (d) Stool pH , electrolyte and Osmolality
- (e) Stool for Sudan III stain
- (f) Blood for C/S (if fever and sepsis is suspected)
- (g) Others investigations according to patient status

4. In case of Chronic diarrhea:

- (a) Investigations to be given for PD (persistent diarrhea)
+
(b) CBC (complete blood count) with PBF (peripheral blood film)

8.2.4 Management outline**1. Proper counseling and active participation of the parents or care giver****2. Rehydration**

- ORS in “some” or “no” dehydration
- IV fluid in “severe” dehydration or in “some” dehydration associated with frequent vomiting

3. Infection identification and early intervention

- Isolation of microorganism from stool examination
- Presence of any associated infection, e.g. UTI, pneumonia, CSOM etc.

4. Dietary treatment

- Reduce osmotic load
- Changing diet based on dietary (e.g. carbohydrate, fat etc.) malabsorption (Dietary Algorithm*)

5. Treatment of complication

- Electrolyte imbalance
- Hospital acquired infection
- Renal Failure

8.3 Simplified calculation of BSA

8.3.1 Height and weight known

$$BSA = \sqrt{\frac{ht(cm) \times wt(kg)}{3600}}$$

Therefore, if weight is 7 kg and height is 70 cm, then BSA will be,

$$\begin{aligned} &= \sqrt{(70 \times 7) / 3600} \text{ m}^2 \\ &= 0.36878177829 \text{ m}^2 \end{aligned}$$

8.3.2 Weight known, height unknown

$$BSA = \frac{(wt \times 4) + 7}{wt + 90} \text{ m}^2$$

So, if wt is weight is 7 kg, then BSA will be,

$$\begin{aligned} BSA &= (7 \times 4) + 7 / (7 + 90) \text{ m}^2 \\ &= (7 \times 4) + 7 / (7 + 90) \text{ m}^2 \\ &= 0.36082474226804123711 \text{ m}^2 \end{aligned}$$

8.4 Admission criteria

1. ICU:

- (a) Severe sepsis, septic shock
- (b) Requiring respiratory support,
 - o Invasive: mechanical ventilation in respiratory failure
 - o Non-invasive: bubble CPAP in hypoxemia and grunting respiration
- (c) Convulsion, disorientation, or coma
- (d) Hypothermia ($<35.5^{\circ}\text{C}$)
- (e) Hypoglycemia (≥ 2 times)
- (f) Gross abnormalities in laboratory findings

2. LSU:

(a) General criteria:

- Patient with diarrhea (with or without co-morbidities) staying in SSU for >96 hours, with no improvement (after consultation with senior physician)
- Non-diarrheal patients under different studies with support (cost) from respective studies
- In the event with confusion please consult with senior physicians before admission

(b) Specific criteria:

- i. Weight for Length Z-score <-3 SD
- ii. Weight for Age Z-score <-4 SD
- iii. Bipedal edema
- iv. Premature, or, small for date neonate with diarrhea and signs of clinical sepsis
- v. Severe pneumonia
- vi. Evaluation of PTB
- vii. Persistent and/or chronic diarrhea
 - A. If diarrhea persists ≥ 14 days (after obtaining careful history) + signs of dehydration
(in case of any confusion, please consult with senior physician)
 - B. In case of PD (persistent diarrhea; duration ≥ 14 days), without any malnutrition or other illnesses, observe the patient for 2 days in SSU. If no improvement → admit in LSU
 - C. Chronic diarrhea (>4 weeks) with supporting documents
- viii. Clinical jaundice with co-morbidities and signs of dehydration
- ix. Suspected electrolytes imbalance, except tetany
- x. Urinary suppression ≥ 24 hours, without dehydration (please take history and check for retention of urine)
- xi. Moderate and severe acute asthma, acute exacerbation of COPD
- xii. Age ≥ 70 years, after consultation with senior physician
- xiii. NRU (Nutritional rehabilitation unit):
 - Resolution of acute phase +
 - Weight for Length Z-score <-3 SD
 - Weight for Age Z-score <-4 SD
 - Nutritional edema

8.5 Few physiological ranges

8.5.1 Normal respiratory rates in infants and children

Table 8.2: Ranges of RRs in children

Age	Breaths per minute
Newborn – 1 year	30 – 60 bpm
1 – 2 years	24 – 40 bpm
2 – 5 years	22 – 34 bpm
6 – 11 years	18 – 30 bpm
≥12 years	12 – 20 bpm

Taken from Childhood TB Portal, where normal temperature was regarded as $\leq 38^{\circ}\text{C}$ [11].

8.5.2 Normal BP ranges in infants and children

Table 8.3: Ranges of BPs in children

Age	Systolic BP (mmHg)
premature	55 - 65
0 - 3 m	65 - 85
3 - 6 m	70 - 90
6 - 12 m	80 - 100
1 - 3 y	90 - 105
3 - 6 y	95 - 110

8.5.3 Pulse rate and BP ranges in children

Table 8.4: Ranges of Pulse rate and BPs in children

Age (years)	Pulse rate (range)	Systolic BP (mmHg)
0 - 1	100 - 160	>60
1 - 3	90 - 150	>70
3 - 6	80 - 140	>75

8.6 TB in children

8.6.1 Diagnostic clinical criteria

The presence of ≥ 3 of the following features, suggests a diagnosis of TB.

1. Symptoms suggestive of TB
2. A history of recent close contact (≤ 12 months)
3. Physical signs highly suggestive of TB
4. A positive Montoux test
5. Chest X-ray suggestive of TB
6. Special laboratory tests, e.g. CSF examinations, histopathology

NB: If a child has only 2 features and other criteria are no helpful in diagnosis, expert opinion should be sought before proceeding further.

8.6.2 Key risk factors for TB in children

1. Household or close contact with a smear positive or culture positive pulmonary TB (e.g. parents, siblings, close relatives, neighbors, teachers).
2. Age <5 years: As the risk of developing TB is highest in very young children, who is immune immature.
3. Severe malnutrition or other immunosuppressive conditions,
 - Measles in past 3 months
 - Whooping cough
 - HIV infection
 - Being on drugs like steroids, or other immunosuppressive agents
4. The time since exposure or infection: The vast majority of children who develop TB, do so **within the first year** after *M. tuberculosis* exposure or infection

NB: Other risk factors are HIV/ AIDS, diabetes, end-stage renal failure, cancer, connective tissue disease, silicosis, gastrectomy, solid organ transplantation and patients on prolong steroids. Both type I and type II diabetic patients have the increased risk of having TB.

Chapter 9

Further Reading

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