DRAFT PAEDIATRIC STANDARD TREATMENT GUIDELINE 2017

CHHATTISGARH

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1. Initial Assessment and Triage in ER

Pediatric Triage

- Pediatric triage assessment is a rapid 3-5 min evaluation of a child that gathers pertinent subjective and objective data to determine the severity of illness.
- Pediatric patients who seek emergency care require timely assessment by experienced emergency care providers. Also it is particularly important to triage each child according to the age, symptomatology and acuity of illness.
- What is assigned a high level of acuity differs with age and associated symptoms and sign. e.g. abdominal pain or fever < 39^0C in older child may be non urgent but an emergency for a one – month – old infant.
- Once the patients are triaged, they are classified into various levels of illness acuity and prioritized accordingly.

Goals of Triage System

As the patients present to the ED, the rule of "Rights" have to be followed:

- **Get the right patient to the right provider**
- **In the right moment of time**
- **To receive the right care**
- **To achieve the right outcome.**

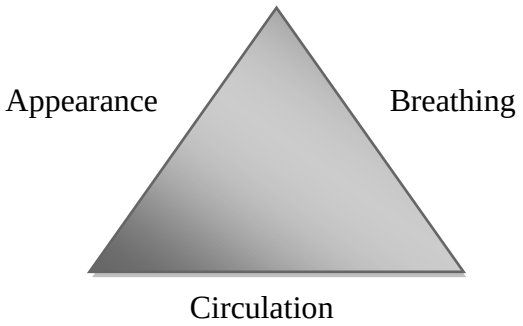
1. To rapidly assess and identify patients with life threatening illness. (This initial screening and classification of the patient frequently determines how quickly the child will receive medical and nursing interventions).
2. To determine appropriate cause and initiate first aid measures by experienced nurse or doctor and order immediate investigations and procedures as per the need.
3. Ongoing assessments are to be performed, as pediatric patients may deteriorate rapidly.
4. To provide safe and quality care to patients and to utilize the limited resources in an efficient manner.

Triage Assessment

- Triage evaluation can be completed in an organized and systematic manner using the general assessment i.e. Pediatric Assessment manner using the general assessment (ABCDE approach) (details are given in triage form).
- This assessment is different than diagnostic evaluation.
- The objective here is to identify anatomical or functional abnormality, its severity, to plan and guide initial emergency treatment as summarized in Fig. l.
- In the emergency room, triage assessment and management is done by a junior (trainee) resident, well trained in Pediatric Advanced Life Support (PALS), supported and supervised by the on duty senior resident (who is also trained in PALS). The assessment and treatment go hand in hand.

General Assessment

- PAT is the immediate visual and auditory assessment while the patient is brought in, based on the triad of appearance, breathing and circulation.
- This initial general impression of the patient is to be completed in initial 30 – 40 s. This helps in identifying the patients requiring rapid life saving decisions.



- Appearance can be assessed while the child is in mother's lap.
- Look for posture/positioning
    - Sniffing position, or leaning forward on outstretched arm
    - Muscle tone (active, moving or limp and listless),
    - Alertness and interaction
    - Consolability,
    - playful,
    - Agitated or crying,
    - Look/gaze or speech/cry (normal weak, muffed, hoarse).
- A grossly abnormal appearance suggests seriously ill child.
- It could be due to
    - underlying hypoxemia,
    - poor cerebral perfusion,
    - infection, poisoning,
    - brain injury,
    - hypoglycemia or any metabolic cause.
- **Such patients should be started measure to improve oxygenation and perfusion before continuing with further assessment.**
- Work of Breathing
    - Look for signs of increased work of breathing (nasal flaring, lower chest wall retractions),
    - Decreased or absent efforts,
    - Aabnormal breath sounds (wheeze, grunt, stridor).
- A normal appearance and increased work of breathing indicates a compensated state of respiratory distress, in which oxygenation and ventilation are reasonably well maintained.
- Abnormal appearance (agitation, restlessness, lethargy or diminished responsiveness) with increased work of breathing, on the other hand indicates a state of acute hypoxemia and hypercapnia (respiratory failure).
- Circulation Look for abnormal skin color (pale/mottled, cyanosed) or bleeding all over the body.
- When cardiac output is low there is constriction of blood vessels to the skin and blood flow to the skin is minimal.
- Pallor and/or mottling are usually the first signs of poor perfusion (shock).
- Cyanosis is a sign of respiratory failure or late shock. Abnormal circulation with normal appearance suggests early or compensated shock, while abnormal appearance and abnormal circulation indicate decompen-sated or late shock

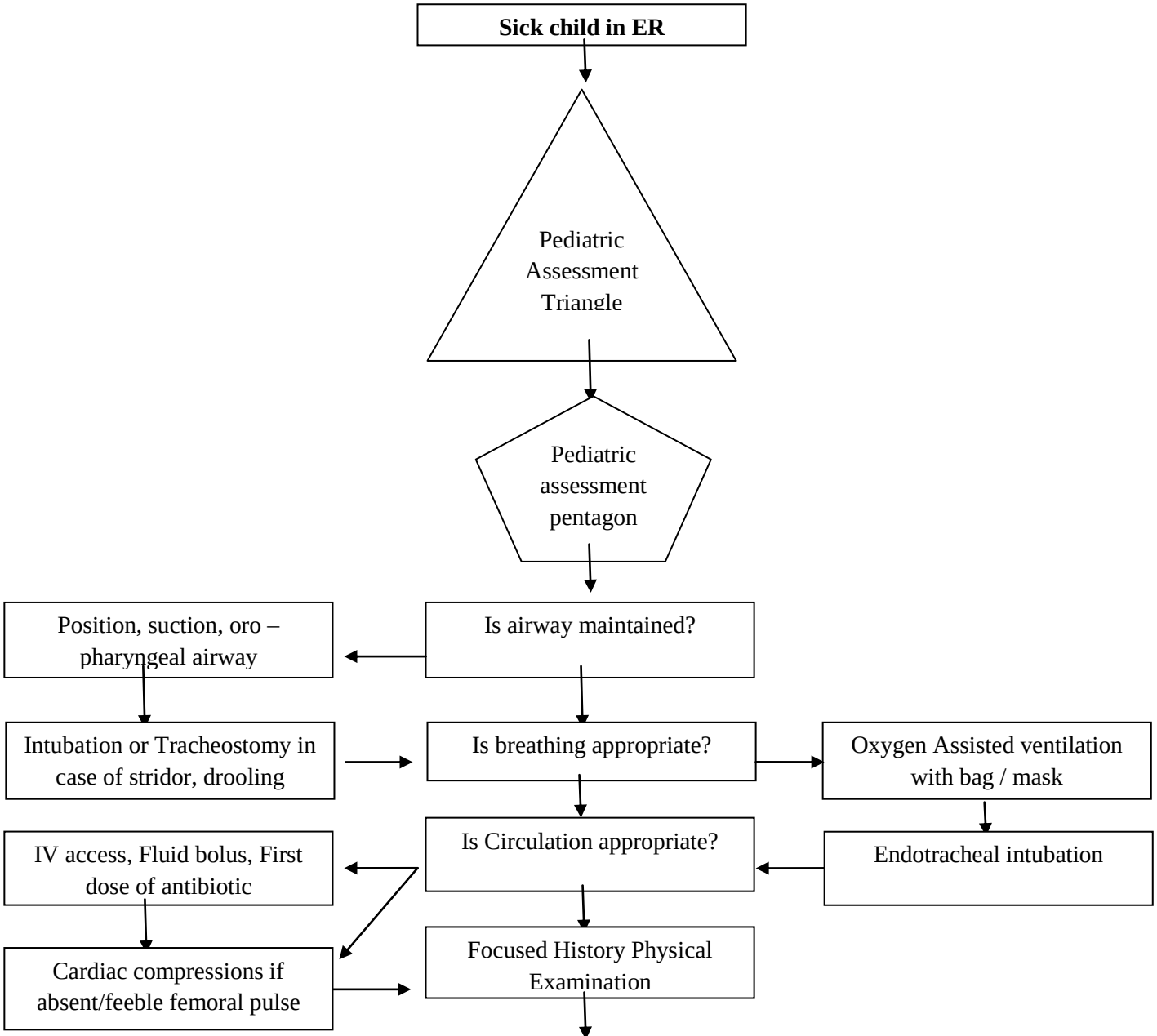
At the end of PAT patient's illness is categorized as either stable or unstable (Table 1).

- Unstable conditions are further classified into life threatening and non life threatening.
- Patients in the former category
    - e.g. cardiac arrest,
    - cordio-respiratory failure,
    - decompensated shock,
    - deep coma, severe stridor etc.

Need immediate treatment/resuscitation before going to primary assessment.

Primary Assessment

- Once a child is on the way to stabilization, the primary assessment (assessment pentagon) follows.
    - It involves the detailed physical examination/assessment of airway (**A**),
    - Breathing (**B**),
    - Circulation (**C**),
    - Neurologic abnormalities (**D**) and head to – toe examination (Exposure).
    - Primary assessment should be completed in 1 – 3 min.
    - This primary assessment also involves additional recording of parameters like SPO_2, EKG and blood glucose.



Five level Triage
Resuscitation, Emergent, Urgent, Less Urgent, Non Urgent

Scheme for initial assessment and resuscitation in Emergency room

Airway

- It is essential to determine patency of the airway.
- To assess upper airway.
    - Look for chest rise.
    - Listen – for breath sounds are air movement,
    - Audible abnormal airway sounds – gurgling, Stridor, and wheeze suggest airway obstruction.
    - Feel – the movement of air at the nose and mouth.

Clinical signs of an airway obstruction include

- Breathing difficulty,
- Inability to speak or breathe,
- A silent cough, or poor air exchange.
- It is crucial to determine whether the airway is maintainable by simple maneuvers, or not maintainable,

Table-1 Interpretation of findings on PAT and immediate intervention

Appearance	Work of breathing	Circulation	Interpreta-tion	Stablization
Normal	Normal	Normal	Stabel	-
Abnormal	Normal	Normal	Primary brain dysfunction or systemic disease	Start O_2, connect to pulse oximeter and cardiac monitor, obtain vascular access, check dextrostix, start saline infusion at minimal rate.
Normal	Abnormal	Normal	Respiratory distress	Oxygen using face mark/nasal prongs at maximal flow; if airway unstable insert oropharyngeal airway
Normal	Normal	Abnormal	Compensated shock	Start O_2, connect to pulse oximeter and cardiac monitor, obtain vascular access, start saline infusion 20 ml/kg, check dextrostix
Abnormal	Abnormal	Normal	Respiratory failure	If airway unstable, insert oropharynxial airway, start 100% oxygen and perform endotracheal intubation
Abnormal	Normal	Abnormal	Decompensated shock	O_2, Attach to a monitor – check for rhythm, obtain a vascular access IV or intraosseus
Abnormal	Abnormal	Abnormal	Cardiopulmonary failure/arrest	Start CPR if absent or poor femoral/ carotid/brachial pulse

Reference:

Adapted and improvised from APLS Pediatric Emergency Manual, 4th edition, American Academy of Pediatrics: 2008 : 34

- Necessitating advanced interventions.
- If head tilt-chin lift positioning and suctioning do not relieve the signs of airway obstruction,
- Child needs direct laryngoscopy and endotracheal intubation.

Breathing

- **The assessment of breathing includes**
    - an evaluation of the respiratory rate and effort,
    - lung sounds, and pulse oximetry.
- Normal respiratory rates depend on the age of the patient.
- However, there is some variation in normal rates defined by different expert groups (**Table**).
- Tachypnea is defined as a rate that is more rapid than normal for age,
- whereas bradypnea is a rate that is slower than normal for age.
- WHO has suggested age-specific threshold for tachypnea for children up to 5 years of age to diagnose pneumonia.
- Apnea is defined as a complete cessation of breathing for 20 s or more.
- Auscultate for adequacy of air-entry and abnormal lung sounds (crepitations, rhonchi, wheeze) over midaxillary line on both sides.
- **Increased respiratory effort can manifest**
    - as nasal flaring,
    - retractions,
    - accessory muscle use, or irregular respirations.
- Other points for assessment include adepuate and equal chest wall excursion, and auscultation of air movement. Abnormal lung

Table : Expected respiratory rate (breath/min), according to age

Age range, years	Neonate	0 – 1	1 – 2	2 – 3	3 – 4	4 – 5	5 – 6	6 – 12	12 – 13	13 - 18
APLS	30 – 40	30 –	25 -	25 –	25 –	25 –	20 –	20 –	15 – 20	15 – 20
PALS[a]	30 – 60	30 –	24 -	24 –	24 –	22 –	22 –	18 –	18 – 30	12 – 16
EPLS[b]	30 – 40	30 –	26 –	24 –	24 –	24 –	20 –	20 –	12 – 20	12 – 20
PHTLS	30 – 50	20 -	20 -	20 –	20 –	20 –	20 –	(12 –	(12 – 20)	12 – 20
ATLS		<60	<40	<40	<35	<35	<35	>30	>30	<30
WHO[c]	<60	<50[a]	<40	<40	<40	<40	-	-	-	-

[a]PALS and EPLS provide separate ranges for infants up to 3 months, and for those between 3 months and 2 years of age

[b]PALS and EPLS provide multiple ranges – ranges for awake children are tabulated

[c]WHO has suggested age-specific threshold for tachypnea for children up to 5 years of age to diagnose pneumonia

[d]PHTLS provides separate ranges for infants up to 6 weeks, and for those between and 1 years of age.

- PALS Pediatric Advanced Life Support ;
- EPLS European Pediatric Life Support;
- APLS Advanced Pediatric Life Support;
- PHTLS Pre Hospital Traumatic Life Support;
- ATLS Advanced Trauma Life Support; WHO World Health Organization.

Sounds include

- Stridor
- Grunting
- Gurgling
- Wheezing and crackles.

- Retractions + stridor = Upper airway obstruction
- Retractions + wheeze = Lower airway obstruction
- Retraction + Grunt/labored breathing = Parenchymal disease

- O_2 saturation $\geq$ 94% on pulse oximetry at room air suggests adequate oxygenation.
- However, it should be interpreted together with work of breathing.
- A child may be able to maintain oxygenation by increasing respiratory rate and work of breathing, but gets exhausted and deteriorates rapidly.
- Pulse oximetry may show abnormally low SpO_2 in presence of poor peripheral perfusion (shock) or abnormally high SpO_2 in a distressed child may be seen in methemoglobinemia and CO poisoning.
- Additional interventions are required if O_2 by non-rebreathing mask.

Circulation

- The assessment of cardiovascular function includes
  - Heart rate and rhythm,
  - Blood pressure,
  - Peripheral and central pulses,
  - Capillary refill time, skin color and temperature.
- Heart rate varies according to the child's age, and includes a wide range (Table 3).
- Typically, the rate will be much slower in a sleeping or athletic child.
- Tachycardia is a heart rate faster than expected for a child's age, whereas bradycardia is slower than normal.
- If heart rate is too fast or too slow
  - Immediately attach the child to a monitor or obtain a three-lead ECG, especially the one with signs of poor perfusion.
- Various rhythm disturbances, or arrhythmias, can be recognized to initiate appropriate interventions.
- The important dysrhythmias to recognize are ventricular fibrillation, ventricular tachycardia, pulseless electrical activity (PEA), asystole, and supraventricular tachycardia.

Disability Assessment

- In involves quick evaluation of neurological status: mainly cerebral cortex and the brain stem.
- Standard evaluation includes level of consciousness
  - using AVPU (awake, voice, pain, unresponsive) scale,
  - seizure,
  - Papillary response to light and posturing and motor activity (asymmetry/abnormal).
- Level of consciousness could also be assessed by applying modified Glasgow Coma Scale (GCS).
- A change of at least 2 points in the GCS score from one assessment to the next indicates a clinically important change in neurological status.

Exposure

- Examine whole body

- For evidence of trauma,
- Unusual markings of abuse,
- rashes,
- Bleeds and core temperature,
- By exposing entire body or one body area at a time.

- After the primary assessment, patient's physiological status is classified as; stable, respiratory distress or respiratory failure, shock compensated or decompensated, primary brain/systemic dysfunction, cardiorespiratory failure or cardiorespiratory arrest and further triaged into 5 levels (Table 5).

Triage Classification [3]

Patients' illness severity is triaged into 5 levels depending on the physiological abnormalities as given in the Table 5. A simple proforma used for triage in the authors' emergency department is shown in the Appendix.

Table : Expected heart rates, according to age (beats/minute)

Table : Expected respiratory rate (breath/min), according to age										
Age, years	Neonate	0 – 1	1 – 2	2 – 3	3 – 5	5 – 6	6 – 10	10 – 12	12 – 13	13 - 18
APLS	110 – 160	110 -	100 –	95 –	95 –	80 – 120	80 – 120	80 – 120	60 – 100	60 – 100
PALS[a]	85 – 205	100 -	100 –	60 –	60 –	60 - 140	60 – 140	60 – 140	60 – 100	60 – 100
EPLS	85 – 205	100 -	100 -	60 –	60 –	60 – 140	60 – 140	60 – 140	60 – 100	60 – 100
PHTLS[b]	120 –	80 - 140	80 - 130	80 -	80 -	80 - 120	(60 – 80)	(60 – 80)	(60 -80)	60 – 100[c]
							> 100	> 100	100	< 100
ATLS	< 160	< 160	< 150	< 150	< 140	< 140	< 120	< 120	< 100	

[a]PALS and EPLS provide separate ranges for infants up to 3 months, and for those between 3 months and 2 years of age

[b]PALS and EPLS provide multiple ranges – ranges for awake children are tabulated

[c]PHTLS does not provide ranges for adolescents over 16 years of age

PALS Pediatric Advanced Life Support; EPLS European Pediatric Life Support; APLS Advanced Pediatric Life Support; PHTLS PreHospital Traumatic Life Support; ATLS Advanced Trauma Life Support; WHO World Health Organization.

Expected systolic and diastolic blood pressures according to age

Age	Systolic BP (mmHg)	Diastolic BP (mmHg)
0 day	60 – 76	30 – 45
1 – 4 day	67 – 84	35 – 53
1 month	73 – 94	36 – 56
3 month	78 - 103	44 – 68
6 month	82 – 105	46 – 68
1 year	67 – 104	20 - 60
2 year	70 - 106	25 – 65
7 year	79 - 115	38 – 78
15 year	93 - 131	45 - 85

- Females have slightly lower systolic blood pressures, and higher diastolic blood pressures than males of the same age.
- **Adapted from Fourth Report on the diagnosis, evaluation and treatment of high blood pressure in children and adolescents: NHLBI; May 2004**

Key Points

- Triage refers to quick assessment of a patient in the Emergency Room with a view to define urgency of care and priorities in management.
- Triage evaluation can be completed in an organized and systematic manner using Pediatric Assessment Triangle (PAT), which refers to immediate visual and auditory assessment of appearance, breathing and circulation.
- At the end of PAT, patient's illness is categorized as either stable or unstable.
- Unstable conditions are further classified into life-threatening and non life threatening.
- Patients in cardiac arrest, cardio-respiratory failure, decompensate shock, deep coma, severe stridor etc. are assessed as having life-threatening illness. They are in need of immediate resuscitation.
- The primary assessment (assessment pentagon), which takes 1 – 3 min, follows once stabilization measures are in place. In involves the detailed physical assessment of airway (A), breathing (B), circulation (C), neurologic abnormalities (D) and head to-toe examination (Exposure).
- After the primary assessment, patient's illness severity is triaged into 5 levels of acuity based on the physiological abnormalities: those in need of Resuscitation, Emergent care, Urgent care, less urgent and non – urgent care.

Five levels of triage depending on the physiological abnormalities

Triage Level	Acuity	Description	Target time to treatment and reassessment	Examples	Remarks
Level 1	Resuscitation	Patient with life-threatening disease or injury requiring immediate treatment	Immediate and continuous (1–5 min)	Cardiac arrest, severe respiratory distress/failure, shock, seizure, unresponsive, airway obstruction, hypothermia, coma, GCS < 10, major burns, severe trauma,	Need continuous assessment and intervention to maintain physiological stability.
Level 2	Emergent	Patient with significant health problems that could become life threatening or disabling	15 min	Moderate respiratory distress, stridor, GCS < 13, Severe dehydration, fever : < 3 months age : and temp > 38^0C, inhalation or ingestion of toxic substance, acute bleeding, purpuric rash, burns > 10 %, abdominal pain with vomiting/diarrhea or abnormal vitals.	Any infant/child who requires multiple interventions to prevent further deterioration
Level 3	Urgent	Patient with significant health problems that could become life threatening or disabling	30 min	Alert, oriented, with minor alteration in vitals. Febrile child > 3 months old with temperature > 38.5^0C, minor head injury	Level 3 patients need carefully planned reassessments while awaiting care, since critical illness may present with common symptoms and may evolve rapidly
Level 4	Less urgent	Patient with stable conditions; to be evaluated in the ED	1 h	Diarrhea with no dehydration, lacerations, pain, sore throat	

Level 5	Non urgent	Patient with stable health conditions; to be evaluated in ED/OPD	2h	Afebrile, alert, well oriented, normal vitals.	These patients may be referred to other areas of hospital for management.

Adapted from Canadian pediatric triage and acuity scale

Appendix

Pediatric Emergency Triage Classification

Date: …… Time: …….. a.m. /p.m. CR. No. : ……

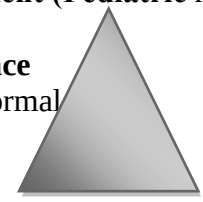
Name: …….. Age: ……, Gender : M/F ……..Weight: ……Kg

Chronic Complaints: 1 ……. 2 ……. 3 …….. 4 ……..

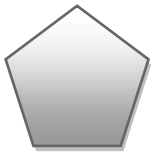
General Assessment (Pediatric Assessment Triangle) (√)

Appearance
Normal/Abnormal

Work of Breathing
Normal / Increased / Decreased/Gasping/ Apnea



Skin Circulation
Normal /Abnormal / Bleeding



Initial Physiological Categorization (√)

- Stable ……
- Unstable –
  - Not Life – threatening ……
  - Life – threatening ……

Primary Assessment (ABCDE) : Assessment Pentagon

*A*irway	*B*reathing	*C*irculation **HR:**
Open & Stable ……. Open but Unstable …… Obstructed ……...	**RR:** …….. /min. Efforts : Normal/Poor/Increased/Acidotic **Air Entry :** Normal/Poor/Differential **Auscultation :** None/Stridor/Wheeze/Crackles **SpO_2** (room air): ……. **SpO_2** (40% FiO_2) …….. **$EtCO_2$:** …….. mmHg	……/min. **CFT:** …… **BP :** ……mmHg **Central Pulse :** Good/Poor **Skin Temp :** Warm / Cool **ECG:** Rhythm: …… T-wave: ……. Others (specify): ……

*D*isability	*E*xposure
GCS: …… **Pupil Size:** …….. **Reaction:** …… **Motor Activity :** Normal & Symmetrical / Asymmetrical / Seizures / Posturing / Flaccidity / Extrapyramidal movements **Blood Sugar :** …… mg/dL	**Temp** ……^{0}C **Color :** Normal/Pallor/Cyanosis/Ashen Grey Skin **Surface Finding:** Rash / Abscess / Pustules / Cellulitis / Purpura / Patechie / Ecchymosis / Hemorrhagic nodules / Mucosal ulcers / Dermatosis / Desquamation / Edema / Trauma / Other (Specify) ……

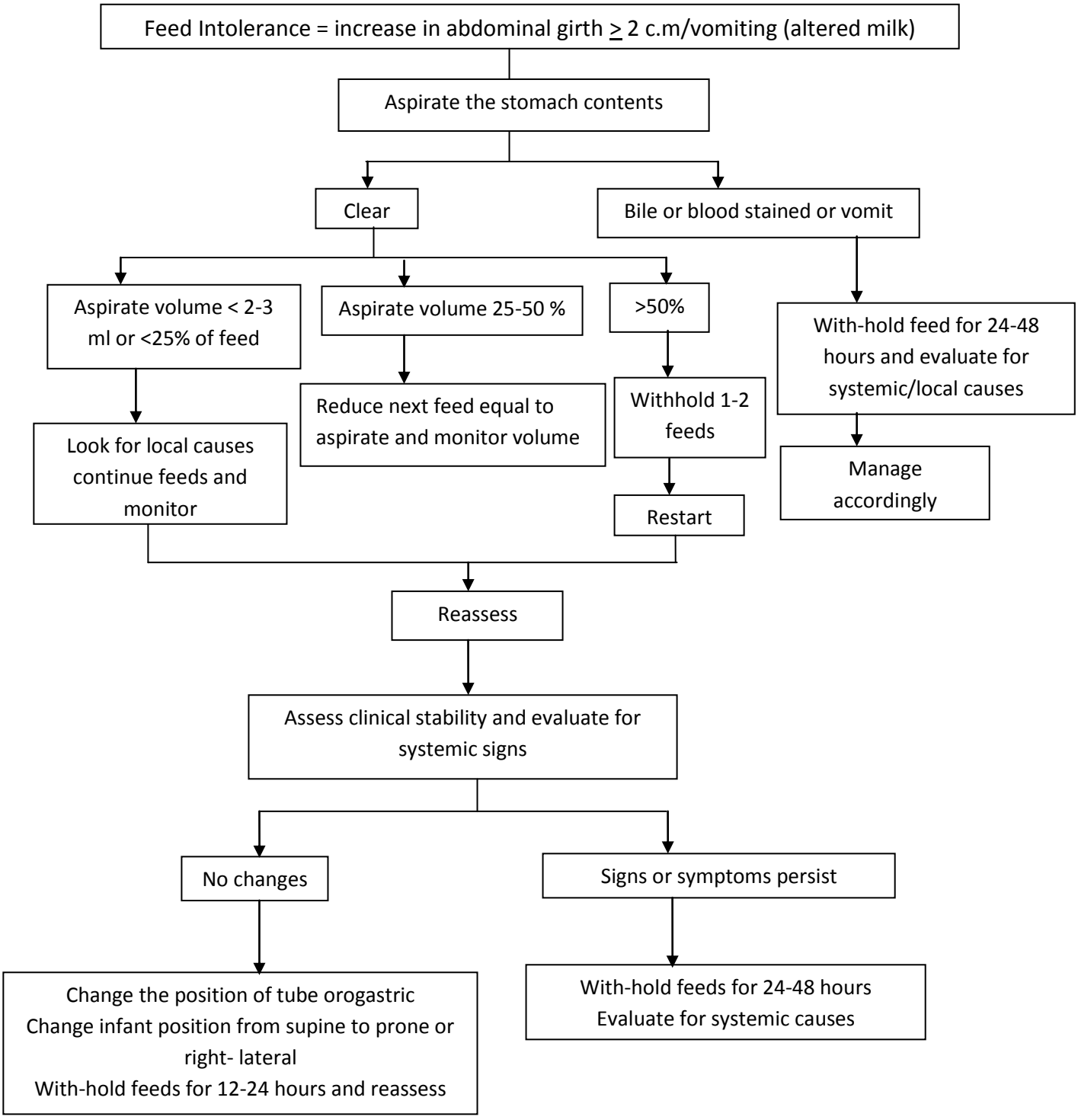
Any Other important Gross Clinical Finding : -

Final Physiological Categorization (√) :	**Triage Classification (√) :**
• Stable……..	
• Respiratory Distress ……..	• Level 1 (Resuscitation): ……
• Respiratory Failure ……	• Level 2 (Emergent): ……
• Compensated Shock ……	• Level 3 (Urgent): ……
• Hypotensive Shock ……	• Level 4 (Less Urgent): ……
• Primary Brain/Systemic Dysfunction ……	• Level 5 (Non-Urgent): ……
• Cardiorespiratory Failure ……	
• Cardiorespiratory Failure ……	
• Cardiorespiratory Arrest ……	

Staff Nurse **Doctor**

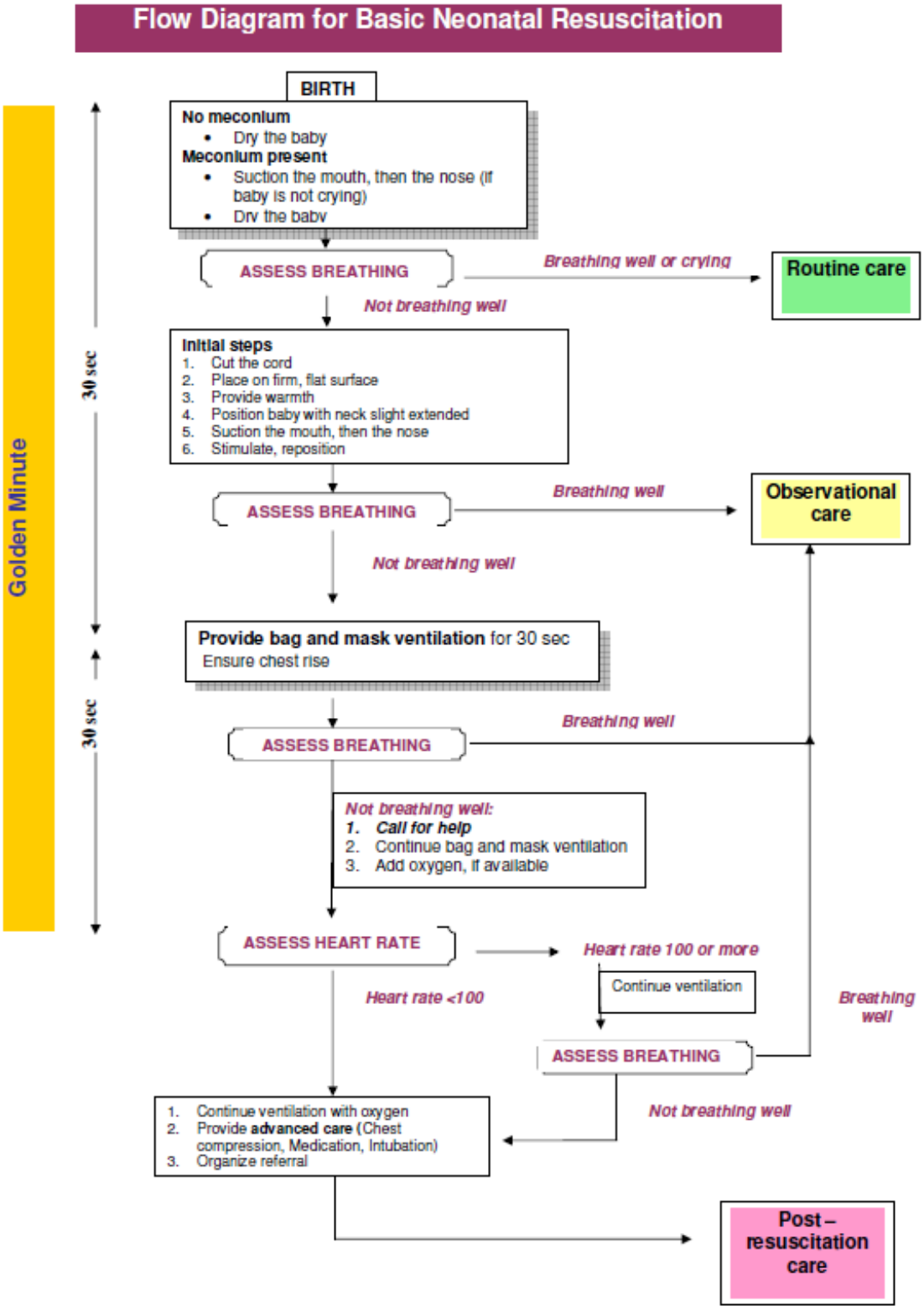
Emergency Room Outcome: Discharged / Transfer / Death / LAMA

2. ESSENTIAL NEWBORN CARE



NEONATAL RESUSCITATION

Neonatal resuscitation means to revive or restore life to a baby from the state of asphyxia. Approximately 10 % of newborn require some assistance to begin breathing at birth and only about 1% may need extensive resuscitative measures to survive.



Routine care

- **Provide warmth**
- **Suction mouth & nose (if necessary)**
- **Cut cord in 1-3 minutes**
- **Keep baby with mother**
- **Initiate breastfeeding**

Observational care

- **Provide warmth**
- **Observe breathing and temperature**
- **Watch for complications*; refer, if so**
- **Initiate breastfeeding, if well**

Post-resuscitation care

- **Provide warmth**
- **Observe breathing, temperature, color, CFT**
- **Monitor blood sugar**
- **Watch for complications *; refer, if soInitiate**

*** convulsion, coma, poor feeding, lethargy, respiratory distress**

Vitamin K Deficiency Bleeding (VKDB)

Vitamin K Deficiency Bleeding (VKDB) previously known as Hemorrhagic Disease of the Newborn (HDN), is a well-known clinical entity for over 100 years. Vitamin K is required for the synthesis of coagulation factors that prevent and control bleeding. All neonates have low levels of Vitamin K owing to poor transport of Vitamin K across placenta, low Vitamin K content in breast milk, and because gut colonization that is critical for its synthesis takes a few days to establish.

Clinical Forms of VKDB in Newborns

There are three forms of VKDB:

a. Early VKDB presents with bleeding within 24 hours and occurs in newborns of mothers taking drugs such as anticoagulants, anticonvulsants (phenytoin, phenobarbitone) or anti-tubercular drugs (Rifampicin). This condition can be prevented by administering Vitamin K to the mother receiving such drugs at least 24 hours before delivery, and/or replacing the offending drugs. Neonatal Vitamin K prophylaxis does not prevent this form of bleeding disorder.

b. Classical VKDB is the commonest variant and presents after 24 hours but within the first week of life. Incidence of classical VKDB varies from 0.01 to 1.5% depending upon the feeding pattern and Vitamin K prophylaxis status. Bleeding sites include the umbilical stump and GI tract, or the surgical wound Vitamin K Deficiency Bleeding (VKDB) previously known as Hemorrhagic Disease of the Newborn (HDN), is a well-known clinical entity for over 100 years. Vitamin K is required for the synthesis of coagulation factors that prevent and control bleeding. All neonates have low levels of Vitamin K owing to poor transport of Vitamin K across placenta, low Vitamin K content in breast milk, and because gut colonization that is critical for its synthesis takes a few days to establish. 2 (e.g. following circumcision). Intracranial hemorrhage (ICH) is rare. The incidence is higher in breastfed babies than in those who are formula-fed. Neonatal Vitamin K prophylaxis is effective in preventing classical VKDB.

c. Late VKDB is uncommon. The median incidence of late VKDB in infants who have not received any prophylaxis at birth is 30 per 100,000 births (range: 4.4 to 80). Less developed countries have almost 10-fold higher incidence than developed nations (median: 80 vs. 7.2 per 100,000 births) with an incidence of 4.2 to 7.4 per 100,000 births. It manifests between 2-12 weeks of age primarily among breastfed infants who have received no or inadequate Vitamin K prophylaxis. In addition, infants on antibiotics and those having intestinal malabsorption are at risk of this disorder. Intracranial hemorrhage is very common in this disorder and may be life threatening. Other sites of bleeding are skin, mucus membranes, and GI tract. Parenteral neonatal Vitamin K prevents late VKDB except in those with severe malabsorption syndromes.

Role of Vitamin K Prophylaxis in Preventing VKDB

A Cochrane review of 2000-2003 supports the use of Vitamin K for all newborns. Vitamin K administration to infants soon after birth is an effective, safe, and sustainable approach to preventing VKDB and is possible to upscale it. The risk of a baby developing VKDB can be reduced to 1/1 million by the administration of Vitamin K after birth.

Studies have shown a 27% relative risk reduction for classical Vitamin K deficiency bleeding with intramuscularly (IM) Vitamin K. The preferred method of Vitamin K prophylaxis is by intramuscular route. Oral Vitamin K prophylaxis requires repeat doses, hence not preferred. Intramuscular Vitamin K prophylaxis is a routine in neonatal practice in developed countries as well as in most tertiary care centres in our country.

Neonatal Vitamin K prophylaxis is supported by WHO and professional bodies such as the American Academy of Pediatrics and Canadian Pediatric Society. The concerns regarding Injection Vitamin K-enhancing cancer

have been reported to be unfounded. Likewise, there is no risk of hyper bilirubinemia in newborn if used in the recommended dose.

Facility based newborn care training manual of MoHFW recommends that all newborns weighing more than 1000 gm should be given 1 mg of Vitamin K intramuscularly after birth (i.e. the first hour by which infant should be in skin-to-skin contact with the mother and breast feeding is initiated). For babies weighing less than 1000 gm, a dose of 0.5 mg is recommended.

Purpose

The purpose of these guidelines is to:

- Provide the rationale and define the protocols for administration of Injectionv Vitamin K.
- Promote the use of Injection Vitamin K in all newborns delivered in both public andv private health facilities at all levels including medical colleges and tertiary care centres.

Recommendations:

1. All newborns delivered in health facilities at all levels including a sub-centre should receive Vitamin K prophylaxis.

2. Vitamin K prophylaxis is given as a single dose IM injection soon after birth. (Once the newborn is in skin-to-skin contact with the mother and breast feeding is initiated).

3. All newborns with birth weight of 1000 gm or more should be administered 1 mg of Vitamin K IM while those weighing less than 1000 gm should receive 0.5 mg dose.

4. Injection Vitamin K should be given IM on the antero-lateral aspect of the thigh using a 26 gauze needle and 1 ml syringe strictly following safe injection practices.

5. In cases that need urgent referral, Vitamin K prophylaxis may be given at the health facility where referral is made and should be documented accordingly.

6. It should be a routine practice to record the date and dose in the Labour Room/OT registers, neonatal case sheets, and referral/discharge slip.

7. Facility in-charge should ensure that medical and nursing staff will administer and document the use of prophylactic Vitamin K to all newborns.

Drug Preparation, Dosage and Administration

1. Vitamin K1: The recommended preparation for use is Vitamin K1 (Phytonadione injectable emulsion), which possesses the same degree of activity as the naturally occurring Vitamin K. The pharmacological action of Vitamin K is to promote the synthesis of Vitamin K-dependent clotting factors (factor II, VII, IX and X) in the liver.

2. Preparation: There are two commonly available preparations in the market:

a. 1 mg/1 ml

b. 1 mg/0.5 ml 3.

3. States may go for any of the two preparations depending on the availability. Under no circumstances should the state procure the preparation of Injection Vitamin K containing 10 mg/ml.

4. Storage: Injection Vitamin K does not require refrigeration and can be stored at room temperature. As it is thermo stable, no additional expenditure on cold chain maintenance is needed.

5. Dosage: Injection Vitamin K 1 mg per 1 ml or 0.5 ml aqueous preparation.

6. Site of injection: Antero-lateral aspect of the thigh. In case any vaccination being given at birth such as Hep-B then they should be given in separate thighs.

7. Logistics: Disposable Syringes (1 ml) and needles (26 G) for administering the injection

8. All facilities will ensure regular supplies of Vitamin K preparation, syringes, etc. 9. Records of Injection Vitamin K administration should be validated from delivery room registers, case sheets, discharge tickets, and referral registers during routine monitoring visits. This information will be finally transferred into MCTS.

Use of Gentamicin for management of sepsis in young infants under specific situations

Under IMNCI, Health personnel are well trained to recognize signs of suspected sepsis or PSBI in young infants and provide pre-referral treatment. Hence under the circumstances where referral is not possible or is refused, ANMs are best placed to be trained to administer appropriate antibiotic treatment to young infants with sepsis.

Health personnel should administer Injection Gentamicin along with oral Amoxicillin to young infants [0 – 2 months] suspected with sepsis under the following situations;

- **Pre-referral dose -** The Health personnel will give the first dose of each antibiotic before referral to a health facility.
- **Completion of antibiotic treatment -** If the infant has not completed a course of either of the antibiotic following discharge from a health facility, the Health personnel will complete the course of the treatment as prescribed by the Medical Officer
- **Referral not possible or refused -** Under this special situation where referral is not possible or is refused, the ANM will continue to give treatment for 7 days

Dosage & administration

Injection Gentamicin

- **Dosage:** 5 mg/kg body weight once a day.
- **Route of administration:** intramuscular
- **Site of Injection:** Antero-|atera| aspect of the thigh
- **Preparation:** Injection Gentamicin is available in two preparations – 20 mg/2 ml and 80 mg/2 ml. It is recommended that only 80 mg/2 ml preparation is used in young infants. This provides 40 mg Gentamicin per 1 ml. This preparation ensures that the volume of injection Gentamicin fluid for young infants does not exceed the safe limit of 1 ml.
- **Storage:** Gentamicin is a heat stable drug and can be maintained at room temperature. There is no need for refrigerator/cold chain maintenance for the storage of the drug.
- **Syringe and needle:** 1 ml disposable syringe with 23 Gauge needle should be used. Alternatively Insulin syringe could be used. Auto disposable syringes provided for immunization should not be used because of varying dosage marking.
- **Duration of treatment:** Total duration of treatment is 7 days. In cases of follow up treatment, the ANM may follow the advice as per the discharge ticket/ doctor’s prescription.

Syrup Amoxicillin

- **Dosage:** 15-25 mg/kg per dose given 12 hourly.
- **Route of administration:** Orally
- **Preparations:** Amoxici||in is avai|ab|e as Syrup [powder based/ ready to use] formulation and Dispersible tablets for pedeatric use. Syrup formulations are available as 125 mg/5 ml [1 ml contains 25 mg].
- **Duration of treatment:** The treatment is to be given for a period of 7 days.

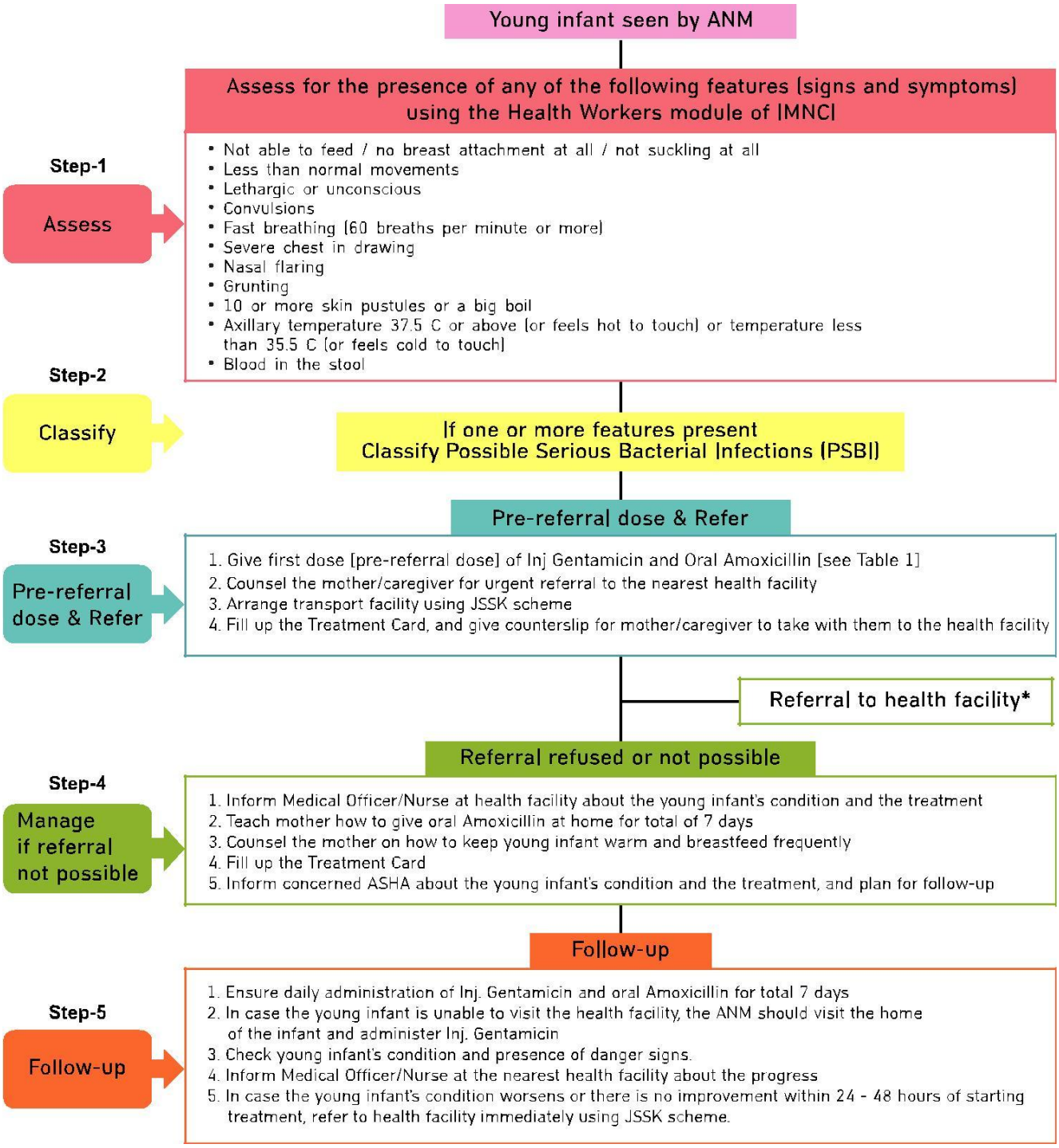
Table 1: Summary of antibiotic treatment for sepsis in a young infant

Young infant's weight	Amount of Gentamicin to be given intramuscularly as Injection (contains 80 mg in 2 ml vial)	Amount of Amoxicillin to be given per-orally as Syrup (contains 125mg / 5 ml)
Less than 1.5 Kg	To be referred to higher facility	
Above 1.5 kg - upto 2.0 Kg	0.2 ml	2 ml
Above 2.0 kg - upto 3.0 Kg	0.3 ml	2.5 ml
Above 3.0 kg - upto 4.0 Kg	0.4 ml	3 ml
Above 4.0 kg - upto 5.0 Kg	0.5 ml	4 ml
Route of administration	Intramuscular	Oral
Dosage	5 mg/kg/dose * Once a day	25 mg/kg/dose** Twice a day

*Precaution: If the treatment is to be continued same vial can be reused for the entire course of 7days, provided it is stored properly and its contents do not change colour or have turbidity. In case of any doubt it is better to use a new vial

**The ANM will instruct the mother how to reconstitute the syrup if it is in powder form

Flow Chart: Management of sepsis in young infants by the ANM



***Steps to be taken by the ANM before and during referral to health facility**

1. Warm the young infant by skin to skin contact with mother/care giver if temperature less than 35.5 (or feels cold to touch) while arranging referral and during transport.
2. Treat to prevent low blood sugar using Health Workers module of IMNCI

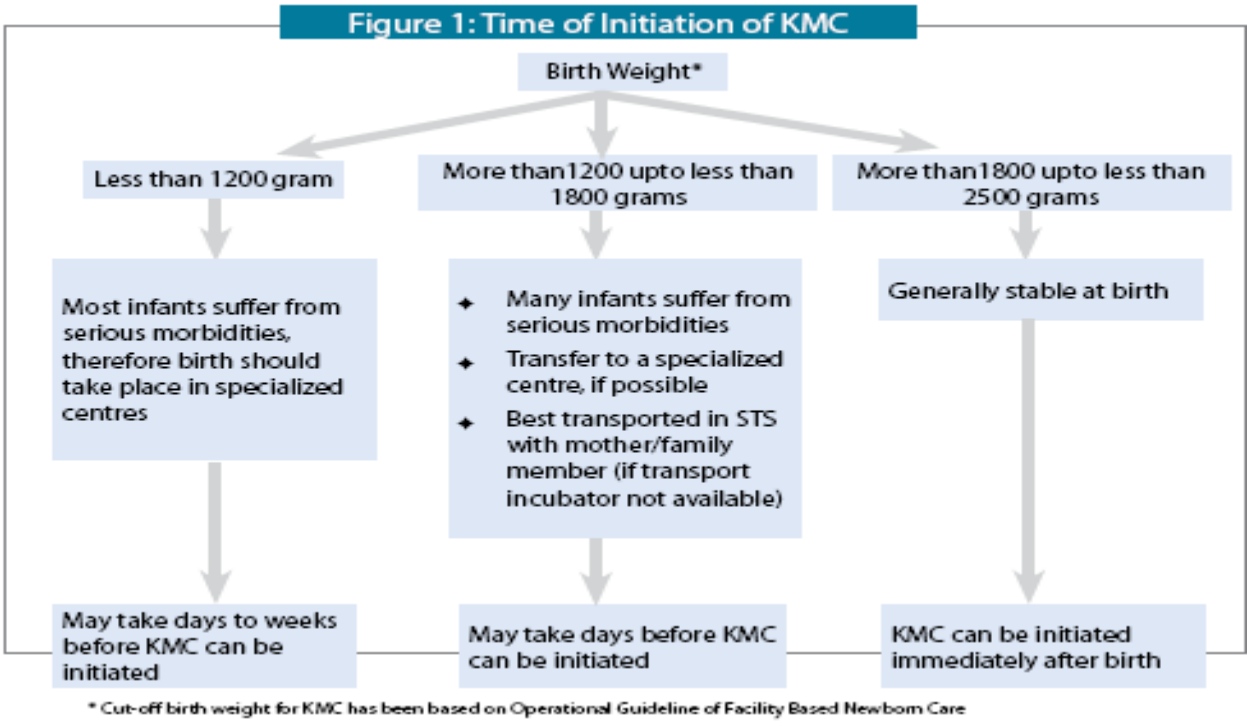
- **If the child is able to breastfeed:** Ask the mother to breastfeed the child.
- **If the child is not able to breastfeed but is able to swallow:** Give 20-50 ml (10 ml/kg) expressed

breastmilk or locally appropriate animal milk (with added sugar) before departure. If neither of these is available, give 20-50 ml (10 ml/kg) sugar water.

- **To make sugar water:** Dissolve 4 level teaspoons of sugar (20 grams) in a 200-ml cup of clean water.

Kangaroo Mother Care & optimal feeding of low birth weight infants

The timing of initiation of KMC depends on the birth weight and stability of the infant.



Duration of KMC

Minimum duration of a KMC session should be one hour because frequent handling may be stressful for the infant. The duration of each KMC session should be gradually increased for as long as the mother can comfortably provide KMC Duration of KMC.

The infants in KMC need to be removed from skin-to-skin contact only for changing diapers and clinical assessment according to hospital schedules.

Monitoring of the infant

Infants receiving KMC should be monitored carefully especially during the initial stages to ensure that the infant's airway is clear, breathing is regular, colour is pink and s/he is maintaining temperature. All the above clinical observations and duration of KMC should be duly recorded in the newborn case-sheet being used in the unit.

Mother should be trained to observe her infant for danger signs, like- hypothermia, respiratory problems, feeding difficulty change in colour during KMC so that she can continue monitoring at home.

Discharge from Hospital and Follow-up

Following criteria are accepted at most centres.

- The infant is Stable and not on parenteral medication
- Maintaining temperature in mother's bed for 3 consecutive days at room temperature
- Gaining 15-20 grams per day for at least 3 consecutive days
- Accepting feeds directly from breast (preferable) or by spoon, or (paal adai/ jhinuk) or cup
- Usually, the infant's weight is around 1,500 to 1,600 grams at the time of discharge. Infants who are above 1,800 grams birth weight, do not require admission into a nursery/SNCU, are given KMC soon after birth and can be sent home once adequacy of breastfeeding is established.
- At discharge, the mother and family members must be taught to ensure that the infant is nursed in a warm room and is breastfed (Given expressed milk using paal adai or cup). They should be adequately told about hygiene, danger signs, follow-up visits, immunization and prompt care seeking at a health facility.
- KMC should be continued as long as required and baby and mother should not be discharged in a hurry.

Newborn Feeding:

Defining Infant and Young Child Feeding Infant and Young Child Feeding (IYCF) is a set of well-known and common recommendations for appropriate feeding of new-born and children under two years of age. IYCF includes the following care practices:

Early Initiation of Breastfeeding means breastfeeding all normal newborns (including those born by caesarean section) as early as possible after birth, ideally within first hour. Colostrum ,the milk secreted in the first 2-3 days, must not be discarded but should be fed to newborn as it contains high concentration of protective immunoglobulins and cells. No pre-lacteal fluid should be given to the newborn.

Exclusive breastfeeding for the first 6 months means that an infant receives only breast milk from his or her mother or a wet nurse, or expressed breast milk, and no other liquids or

solids, not even water. The only exceptions include administration of oral rehydration solution, oral vaccines, vitamins, minerals supplements or medicines. .

Complementary feeding means complementing solid/semi-solid food with breast milk after child attains age of six months. After the age of 6 months, breast milk is no longer sufficient to meet the nutritional requirements of infants. However infants are vulnerable during the transition, from exclusive breast milk to the introduction of complementary feeding, over and above the breastmilk. For ensuring that thee nutritional needs of a young child are met breastfeeding must continue along with appropriate complementary feeding. The term "complementary feeding" and not "weaning" should be used. The complementary feeding must be:

Optimal IYCF practices

a. Early initiation of breastfeeding; immediately after birth, preferably within one hour.

b. Exclusive breastfeeding for the first six months of life i. e 180 days (no other foods or fluids, not even water; but allows infant to receive ORS, drops, syrups of vitamins, minerals and medicines when required)

c. Timely introduction of complementary foods (solid, semisolid or soft foods) after the age of six months i. e 180 days.

d. Continued breastfeeding for 2 years or beyond

e. Age appropriate complementary feeding for children 6-23 months, while continuing breastfeeding. Children should receive food from 4 or more food groups [(1) Grains, roots and tubers, legumes and nuts; (2) dairy products ; (3) flesh foods (meat fish, poultry); (4) eggs, (5) vitamin A rich fruits and vegetables; (6) other fruits and vegetables] and fed for a minimum number of times (2 times for breasted infants 6-8 months; 3 times for breastfed children 9-23 months; 4 times for non-breastfed children 6-23 months)

f. Active feeding for Children during and after illness.

Diarrhea Management

The normally frequent or loose stools of a breastfed baby are not diarrhoea. If the stools have changed from usual pattern and are many and watery, it is diarrhoea. Diarrhea is uncommon in breastfed babies and is seen in formula feed babies with poor hygiene.

Assess for:

- Signs of dehydration
- Duration of diarrhoea
- Blood in the stool

Dehydration assessment

Assess for signs of dehydration and choose the appropriate plan of management. Also assess for signs of possible sepsis and also determine if the young infant is low weight for age.

Severe dehydration	Two of the following signs: • Lethargic or unconscious • Sunken eyes • Skin pinch very slow	• Manage severe dehydration (Plan C) • Start antibiotics· • Admit or refer
Some dehydration	• Two of the following signs: • Restless, irritable • Sunken eyes • Skin pinch slow	• Manage dehydration (Plan B) • Start antibiotics if signs of sepsis or low weight • Admit or refer
No dehydration	Not enough signs to classify as severe or some dehydration	• Plan A (Home care) • Advise mother when to return immediately • Follow up in 5 days if not improving

Treatment of severe dehydration: A young infant with severe dehydration needs IV rehydration as described in PlanC. Start Inj Ampicillin and Gentamicin as for cases of sepsis, as diarrhoea is generally a manifestation of systemic infection.

How to treat severe dehydration in an emergency setting (Plan C)

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

Age	First give 30ml/kg in	Then give 70ml/kg in
Infants (under 12 months)	1 hour*	5 hours

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

• Reassess the infant every 15-30 minutes. If hydration status is not improving, give the IV drip more rapidly.

• Also give ORS (about 5ml/kg/hour) as soon as the child can drink: usually after 3-4 hours.

Weight	Volume of ORS solution per hour
<4kg	15ml
4 - <6kg	25ml
6 - <10kg	40ml
10 - <14kg	60ml
14 – 19kg	85ml

• If IV treatment not possible, give ORS 20ml/kg/hour for 6 hours(120ml/kg) by NG tube

• Reassess an infant after 6 hours. Classify dehydration. Then choose the appropriate plan (A, B, or C)

to continue treatment.

If possible, observe the infant for at least 6 hours after rehydration to be sure that the mother can maintain hydration by giving the child ORS solution by mouth.

Treatment of some dehydration: Manage dehydration as Plan B. In addition to ORS, encourage the mother
to breastfeed during first 4 hours of dehydration. If baby has low weight or signs of sepsis, give antibiotics as for cases of sepsis.

Diarrhoea Treatment Plan B: Treat Some Dehydration with ORS

GIVE RECOMMENDED AMOUNT OF ORS IN CLINIC OVER 4-HOUR PERIOD

• Determine amount of ORS to give during first 4 hours.

The approximate amount of ORS required (in ml) can also be calculated by multiplying the child's weight (inkg) by 75.
• If the child wants more ORS than shown, give more.

• **Show the mother how to give ORS solution :**
- Give frequent small sips from a cup.
- If the child vomits, wait 10 minutes. Then continue, but more slowly.
- Continue breastfeeding but stop other feeding.

• **After 4 hours:**
- Reassess the child and classify the child for dehydration.
- Select the appropriate plan to continue treatment.
- Begin feeding the child in clinic.

• **If the mother must leave before completing treatment:**
- Show her how to prepare ORS solution at home.
- Show her how much ORS to give to finish 4-hour treatment
- Give her enough ORS packets to complete rehydration. Also give 2 packets as recommended in Plan A.
- Explain the 3 Rules of Home Treatment:

1. Give extra fluid
2. Continue feeding Plan A
3. When to return

Treatment of no dehydration: Tell the mother to continue breastfeeding and teach the mother danger signs to return immediately.

Approach to a young infant with blood in stool
Blood in stool in a young infant may be because of dysentery but is often due to surgical cause, necrotizing enterocolitis (NEC) or a bleeding diathesis.

Assess	Signs	Treat
Loose stools with blood	• Active baby • Ist week of age • No signs of sepsis	• Manage as hemorrhagic disease of newborn. Give Inj. Vit K Img
	• Signs of possible sepsis	• Manage as sepsis / NEC
	• Abdominal mass • Attacks of crying with pallor	• Urgent surgical referral

Severe persistent diarrhoea

If the young infant has diarrhoea for 14 days or more, manage as case of severe persistent diarrhoea.

Treat severe persistent diarrhoea

• Admit the young infant.
• Manage dehydration if present.
• Investigate and treat for sepsis: Start Inj. ampicillin & gentamicin (Table 8).
• Encourage exclusive breastfeeding. Help mothers who are not breastfeeding to re-establish lactation. If only animal milk must be given, give a breast milk substitute that is low in lactose.
• Give supplement vitamins and minerals for at least 2 weeks.

Clinical pattern	Likely Diagnosis	Action Required
• Loose watery diarrhoea. • No blood or mucous. • No fever	• Acute gastroenteritis likely. • May be viral or bacterial	• In all these cases give fluids and ORS to correct dehydration. • If diarrhoea persists over two days one may add furazolidone 200 mg thrice daily for 3 days. • See the management of dehydration Page 181
• Same as above but watery diarrhoea • Rice water stool is profuse leading to early severe dehydration and shock	• Suspect cholera • Confirmation by "hanging drop" microscopic examination.	• Same as above • Doxycycline : Adult 300 mg single dose, Child over 8 year 100 mg single dose. • Ciprofloxacin : Adult 500 mg single dose
• With watery stools, and blood and mucous in stool and fever	• Suspect bacillary dysentery	• Give plenty of ORS and furazolidon or co-trimoxazole for 5 days or ciprofloxacin for 3 days.
• With foul smelling stools containing blood and sticky material. • Fever may or may not be present.	• Suspect amoebic dysentery • Confirmation by stool microscopy.	• Give ORS and metronidazole 400 mg thrice daily for 5-10 days.
• With abdominal pains but no fever. Stools have mucous, but no blood. Stools may be watery or more often semi-solid.	• Suspect giardiasis • Confirmation by stool microscopy.	• Give metronidazole 200 mg thrice daily for 5 days or one dose of four tablets of tinidazole 300mg.

Malaria Management

Malaria is a major health problem in India. Plasmodium vivax and P. falciparum are responsible for most cases. Use of appropriate anti-malarial drugs is very important to save lives in malaria cases. The National Malaria Policy 2008
recommends doing microscopy and Rapid Diagnostic Test (RDT) in all clinically suspected malaria cases in high risk areas and microscopy in low risk areas. The Policy also recommends using standardized full course of treatment to prevent emergence of resistant cases.

What is severe malaria?
Presence of any of the following features in a child with microscopy or RDT positive for malaria indicates severe malaria:
• Altered consciousness
• Severe anaemia (haematocrit < 15% or haemoglobin < 5g/dl)
• Hypoglycaemia
• Respiratory distress
• Jaundice

Severe malaria, which is most commonly due to P. falciparum is a life-threatening condition. The illness starts with high grade fever, headache, restlessness and often vomiting. Children can deteriorate rapidly over 1–2 days, going into coma (cerebral malaria) or shock, or manifesting convulsions, severe anaemia and acidosis.

It is observed that P. falciparum infection may lead to complications in 0.5% to 2% of cases. Mortality may result in about 30% of such cases if timely treatment is not given. Use of appropriate anti-malarial drugs is very important not only to save lives in such cases but also to contain the spread of this species.

Emergency measures: to be taken within the first hour
• Check and correct hypoglycaemia.
• Treat convulsions.
• Manage shock, if present.
• If the child is unconscious, minimize the risk of aspiration pneumonia (insert a nasogastric tube and remove the gastric contents).
• Treat severe anaemia, if present.
• Antimalarial treatment.
• Provide supportive care if child is unconscious.

Also give treatment for bacterial meningitis if it cannot be excluded.

Antimalarial treatment
Severe malaria is an emergency and treatment should be given as per severity and associated complications. Parenteral quinine or artemisinin derivatives should be used irrespective of Chloroquine resistance status of the area.

Quinine for severe malaria

Table 21: Quinine dose for severe malaria				
Age or Weight	Intravenous* or Intramuscular Quinine (2ml ampoules) 10mg/kg		Oral Quinine sulfate tablet	
	150mg/ml**	300mg/ml**	200mg **	300mg**
2 – <4 months (4 – <6kg)	0.4ml	0.2ml	¼	-
4 – <12 months (6 – <10kg)	0.6ml	0.3ml	½	-
1 – < 2 years (10 – < 12kg)	0.8ml	0.4ml	¾	½
2 – <3 years (10 – <14kg)	1.0ml	0.5ml	¾	½
3 – <5 years (14 – 19kg)	1.2ml	0.6ml	1	½

* Loading dose is double the maintenance dose given above
**Quinine salt

• **I/V Quinine**: Give a loading dose of 20mg/kg of quinine dihydrochloride in 10ml/kg of I/V fluid, 5% dextrose saline over 4 hrs followed by maintenance dose of 10mg/kg, 8 hrly; infusion rate should not exceed 5mg salt/kg of body weight per hour. It is essential that I/V quinine is given only if there is close nursing supervision of the infusion and control of the infusion rate. If this is not possible, it is safer to give I/M quinine.
• **I/M Quinine**: Give 10mg of quinine salt perkg I/M and repeat after 4 hrs. Then, give every 8 hrs until the malaria is no longer severe. The parenteral solution should be diluted before use because it is better absorbed and less painful.
• The parenteral treatment should be given for minimum of 48 hrs and once the child tolerates oral therapy, quinine 10mg/kg bw three times a day with clindamycin (20mg/kg/day in 2 divided doses for 7 days) should be given to complete seven days of treatment. Give single gametocidal dose of primaquine (0.75mg/kg) to prevent transmission in the community.

OR

IM Artemether: Give 3.2mg/kg on admission then 1.6mg/kg daily for a minimum of three days until the child can take oral treatment.
• **IV or IM Artesunate**: Give 2.4mg/kg on admission, followed by 2.4mg/kg after 12 hours and 24 hrs, then once a day for a minimum of 3 days or until the child can take oral treatment.
• Complete treatment following parenteral artemisin derivatives by giving a full course of artemisin based combination therapy (ACT). (*See Annexure* 8 for drug policy).
• **Arteether** is not recommended in children.

Provide supportive care of an unconscious child

• Care of an unconscious child: position the child and take care of airway, breathing, and circulation as you have learnt in the section ETAT.

• Take the following precautions in the delivery of fluids:
- Check for dehydration and treat appropriately.
- During rehydration, examine frequently for signs of fluid overload. The most reliable sign of overhydration is an enlarged liver. Additional signs are gallop rhythm, fine crackles at lung bases and/or fullness of neck veins when upright. Eyelid oedema is a useful sign in infants.
- In children with no dehydration, ensure that they receive their daily fluid requirements but take care not to exceed the recommended limits. Be particularly careful in monitoring I/V fluids.

Monitor the child

The child should be checked by nurses at least every 3 hrs and by a doctor at least twice a day. Monitor temperature, pulse rate, respiratory rate and blood pressure every 6 hrs, for at least the first 48 hrs:
• Check blood sugar every 3 hrly until the child is conscious.
• Monitor the rate of I/V infusions.
• Fluid intake and output.

Management of Pediatric Tuberculosis under the Revised National Tuberculosis Control Program (RNTCP)

1. Diagnosis

Suspect cases of Pul. TB: Children presenting with fever and / or cough for more than 2 weeks, with or without weight loss or no weight gain; and history with a suspected or diagnosed case of active TB disease within the last 2 years.

Diagnosis to be based on a combination of:
• Clinical presentation
• Sputum examination wherever possible
• Chest X-ray (PA view)
• Mantoux test (Positive if induration >10 mm after 48-72 hours) and
• History of contact.

2. Treatment of Pediatric TB

DOTS is the recommended strategy for treatment of TB and all Pediatric TB patients should be registered under RNTCP.

Category of treatment	Type of patients	Intensive Phase	Continuation Phase
Category I	• New sputum smear positive Pul. TB • Seriously ill* sputum smear negative Pul TB • Seriously ill Extra-pul. TB	2 H3 R3 Z3 E3***	4H3R3
Category II	• Sputum smear positive relapse • Sputum smear positive treatment failure	2 S3 H3 R3 Z3 E3 / 1H3R3Z3E3	5H3R3 E3 4H3R3

* Seriously ill sputum smear negative Pul. TB includes all forms of Pul. TB other than primary complex, seriously ill Extra Pul. TB includes TBM, disseminated TB/military TB, TB pericarditis, TB peritonitis and intestinal TB, bilateral or extensive pleurisy, spinal TB with or without neurological complications, genitourinary tract TB, bone and joint TB.
** Not-seriously ill Extra Pul. TB includes lymph node TB and unilateral pleural effusion.
*** Prefix indicates month and subscript indicates thrice weekly.
• In patients with TBM on category 1 treatment, the 4 drugs used during intensive phase should be HRZS or HRZE.
Continuation phase in TBM or spinal TB with neurological complications should be given for 6-7 months, extending the total duration of treatment to 8-9 months.
• Steroids should be used initially in cases of TBM and TB pericarditis and reduced gradually over 6-8 weeks.
• Before starting category 11 treatment, patient should be examined by a pediatrician or a TB expert. Ethambutol is to be used for all age groups.

Chemoprophylaxis

Asymptomatic children under 6 years of age, exposed to an adult with infectious (smear positive) tuberculosis, from the same household, will be given 6 months of isoniazid (5 mg/kg daily) chemoprophylaxis.

Sickle cell anemia

Infants with sickle cell anaemia have abnormal immune function and may have functional asplenia at as early as 6 months of age. Bacterial sepsis is one of the greatest causes for morbidity and mortality in this patient population. By 5 yr of age, most children with sickle cell anaemia have functional asplenia.

Box 4: General Health Maintenance

1. *Environmental*	**4. *Education***
• Altitude: less than 1500 meters	• Health education for the patient and relatives
• Avoid cold exposure	• Information on symptoms requiring
• Avoid hot exposure	medical advice
	• Genetic counseling
	• Appropriate use of analgesia at home
2. *Way of Llife*	**5. *Psycho-Social Management***
• Regular hydration	• Implementation of care pathways
• Avoidance of alcoholic beverages	• Easy access to social workers
• Suppression of active (or passive) tobacco use	• Open access to psychologist
• No cannabis or other illegal drugs	• Avoidance of stress
• Avoidance of strenuous exercise	
• Adoption of a quiet way life	
3. *Nutrition*	**6. *Occupational Orientation***
• Folic acid supplementation 5 mg/day,	• Avoid physically tiring jobs

Prophylaxis to prevent Infections

- Penicillin V orally from 2 months to at least 5 years of age
- 125 mg twice a day up to age 3 yr, and then 250 mg twice a day
- An alternative for children who are allergic to penicillin is erythromycin ethyl succinate 10 mg/kg twice a day. In addition to penicillin prophylaxis, routine childhood immunizations as well as the annual administration of influenza vaccine are highly recommended.

Sickle Crisis

Treatment

1. Patient who has ~1 painful episode per year that requires medical attention.
2. Specific therapy for pain - the use of acetaminophen or a non-steroidal agent early in the course of pain, followed by escalation to acetaminophen with codeine or a short- or long-acting oral opioid.
3. Hospitalization for administration of IV morphine or derivatives of morphine.
4. Blood - reserve for patients with a decrease in Hb resulting in respiratory distress, or a falling Hb concentration, when the child has both a falling Hb level and reticulocytes count (with a parvovirus B19 infection).
5. IV hydration does not relieve or prevent pain. It is appropriate when the patient is unable to drink as a result of the severe pain or is dehydrated.

6. Opioid dependency in children with SCD is rare and should never be used as a reason to withhold pain medication.
7. Hydroxyurea, a myelosuppressive agent, is the only effective drug proved to reduce the frequency of painful episodes.

Aplastic Crisis Prevention, Diagnosis and Treatment

Prevention

Human parvovirus vaccine is under development but not yet available.

Diagnosis

Marked lowering of Hb – usually to 2-4 g/dl over a few days.

Reticulocytes 0% or if present, a daily marked increase consistent with the recovery phase.

Treatment

Blood Transfusion (BT) as emergency if reticulocytes 0% and Hb > 2g/dl below steady state level; transfusion may be performed in day care centre if uncomplicated aplasia (no features other than pallor).

Review after 3-4 days to ensure reticulocytosis of recovery phase has occurred.

Patients may be closely monitored **without transfusion** IF they are already in recovery phase

- daily marked increase in reticulocytes count and rising Hb.
- Monitor urine for proteinuria; watch for signs of stroke

Focal Neurologic Deficit

1. A prompt pediatric neurologic opinion.
2. Oxygen administration to keep SPO2 >96%.
3. Simple Blood Transfusion within 1 hr of presentation with goal of Hb maximum 10 g/dl. Excess Hb might limit O 2 delivery to Brain due to hyper-viscosity of blood can decrease O 2 delivery.

4. Prompt exchange transfusion to reduce the HbS % to at least <50% and ideally <30%.

When to Refer

average time for a positive blood culture with a bacterial pathogen is <20 hr in children with sickle cell anaemia, admission for 24 hr is probably the most prudent strategy for children and families without a telephone or transportation, or with a history of inadequate follow-up. Outpatient management should be considered only for those with the lowest risk for bacteremia, and treatment choice should be considered carefully.

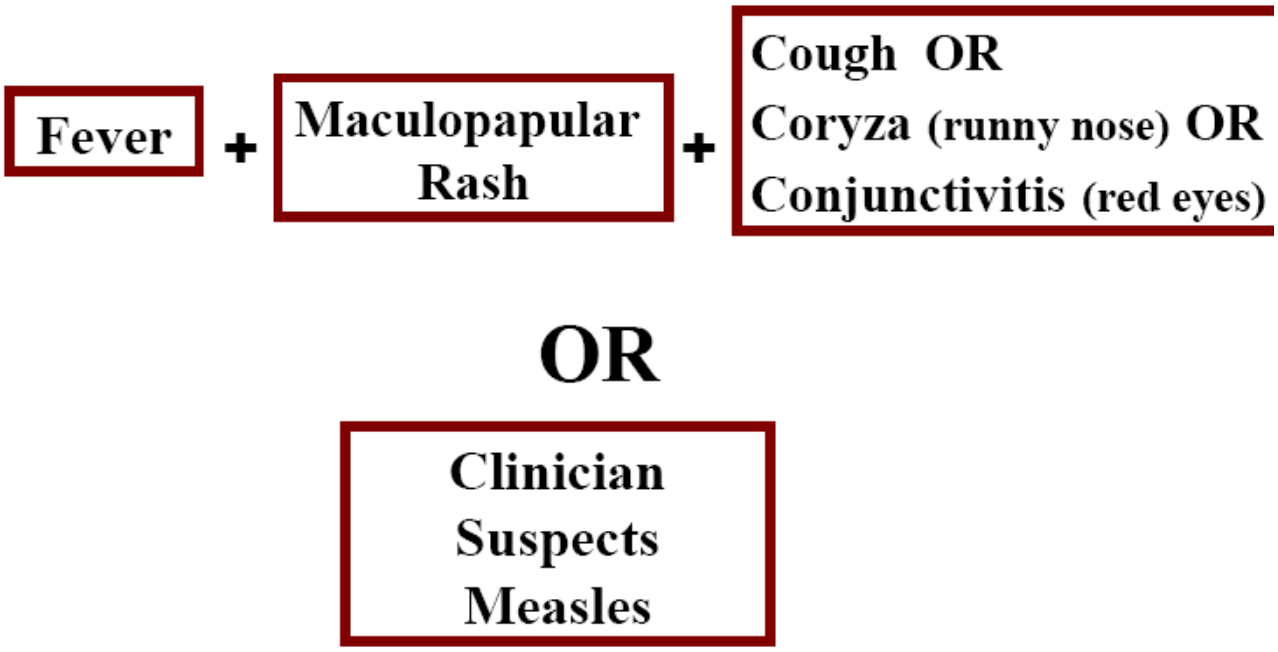
Children who have sickle cell disease and who are treated with ceftriaxone can develop severe, rapid, and life-threatening immune hemolysis; the established risks of outpatient management must be reasonable against

Increased Risk of Bacteremia Requiring Admission in Febrile Children with Sickle Cell Disease
Seriously ill appearance
Hypotension: systolic BP <70 mm Hg at 1 year of age or <70 mm Hg + (2 × tage in years) for older children
Poor perfusion: capillary-refill time >4 seconds
Temperature >40.0 ℃
A corrected white-cell count >30,000/cubic mm or <500/cubic mm
Platelet count <100,000/cubic mm
History of pneumococcal sepsis
Severe pain
Dehydration: poor skin turgor, dry mucous membranes, history of poor fluid intake, or decreased output of urine
Infiltration of a segment or a larger portion of the lung
Haemoglobin level <5.0 g/dl

Measles management

Suspected Measles

Clinical Case Definition



What should health care provider do when she/he suspects measles?

- Notify case
- Complete case investigation form
- Collect blood sample
- Manage case (Vitamin A, supportive tx, etc.)

Outbreak Response

1. Case notification
2. Case verification
3. Field investigation
4. Management
5. Post outbreak activities

Case Management

- Vitamin A supplementation
- Respiratory isolation of hospitalized cases
- Supportive treatment (antipyretics, antibiotics, fluids)
- Treatment of complications as needed

Measles Treatment with Vitamin A

AGE	Immediately on Diagnosis	Next Day
0-6 months	50,000 IU	50,000 IU
6-11 months	100,000 IU	100,000 IU
≥ 12 months	200,000 IU	200,000 IU

***For ocular manifestations, give a 3rd dose 2-4 weeks after the 2nd dose**

Measles vaccine

- Live virus vaccine
- Freeze dried (lyophilized) and used with diluent
- Store vaccine at 2°-8° C (but can be frozen)
- Protect from light at all times
- *Efficacy:*
    - 85% at 9m (EPI schedule)
    - 95% at 12-15m

Duration of immunity: life long

Hepatitis-B Management

Hepatitis B, This viral jaundice is transmitted by contaminated needles, contaminated blood, mother to child and by unsafe sex

Infant and neonatal hepatitis B vaccination

• All infants should receive their first dose of hepatitis B vaccine as soon as possible afterbirth, preferably within 24 hours, followed by two or three doses. (WHO. Hepatitis B vaccines. Wkly Epidemiol Rec. 2009;84:405–20.)
Indian UIP schedule is Birth Dose, 6 weeks, 10 weeks and 14 weeks (as part of Pentavalent vaccine)

WHO TO TREAT IN PERSONS WITH CHRONIC HEPATITIS B

• As a priority, all adults, adolescents and children with Chronic Hepatitis B and clinical evidence of compensated or decompensated cirrhosis (or cirrhosis based on APRI score >2 inadults) should be treated, regardless of ALT levels, HBeAg status or HBV DNA levels. (Strong recommendation, moderate quality of evidence)

Acute hepatitis B

Antiviral therapy is not necessary for uncomplicated symptomatic acute hepatitis B, as >95% of immunocompetent adults will spontaneously clear HBV infection Persons with fulminant or severe acute hepatitis may benefit from NA therapy with entecavir or tenofovir, to improve survival and reduce the risk of recurrent hepatitis B. The duration of treatment is not established, but continuationof antiviral therapy for at least 3 months after seroconversion to anti-HBs or at least 12 months after anti-HBe seroconversion without HBsAg loss is generally advised.

Children and adolescents

CHB is usually benign and asymptomatic in children, as they are generally in the immune-tolerant phase. In addition, there are low curative response rates with both NAs (necessitating long-term therapy) and IFN treatment, and concerns over long-term safety and risks of drug resistance.

For these reasons, a conservative approach to treatment is generally indicated, unless there are other criteria for treatment, such as cirrhosis or evidence of severe ongoing necroinflammatory disease on liver biopsy. Although the majority of children will not require antiviral therapy, early identification and monitoring of children at risk for progression of liver disease guided by liver histology and a family history of HCC remains important.

The use of NITs and identification of appropriate cut-offs have not yet been defined in children. Only conventional IFN, lamivudine and adefovir have been evaluated for safety and efficacy, but children generally have a similar response as adults.

IFN cannot be used in infants aged less than 1 year. The FDA has approved tenofovir for use in adolescents and children above the age of 12 years for HBV treatment (and 3 years or older for HIV treatment). In March 2014, the106 FDA approved entecavir for children with CHB above 2 years of age. Therefore, treatment options for children below 12 years, and especially below 2 years, remain limited.

3. National Immunization Schedule

Vaccines under UIP

- Under UIP,following vaccines are provided:
    1. BCG(Bacillus Calmette Guerin)
    2. DPT (Diphtheria,Pertussis and TetanusToxoid)
    3. OPV (Oral Polio Vaccine)
    4. Measles
    5. HepatitisB
    6. TT (Tetanus Toxoid)
    7. JEvaccination(in selected high disease burden districts)
    8. Hib containing Pentavalent vaccine(DPT+HepB+Hib)(In selected States)

I. Diseases Protected by Vaccination under UIP

1. Diphtheria
2. Pertussis.
3. Tetanus
4. Polio
5. Tuberculosis
6. Measles
7. HepatitisB
8. Japanese Encephalitis(commonly known asbrainfever)
9. Meningitis and Pneumonia caused by Haemophilus Influenzae typeb

II. UIP recommended vaccines for routine use

S No	Vaccine &its presentation	Protection	Route	Numberof doses	Vaccination Schedule
1	BCG (Bacillus Calmette Guerin)- Lyophilized vaccine	Tuberculosis	Intra - derma l	1	At birth(upto1year if not given earlier)
2	OPV (Oral Polio Vaccine)-Liquid vaccine	Poliomyelitis	Oral	5	Birth dose for institutional deliveries, Primary three doses at6,10& 14week and one booster dose at16-24month of age. Given orally
3	Hepatitis B– Liquid Vaccine	Hepatitis B	Intra - muscu lar	4	Birth dose (within 24hours)for institutional deliveries,Primary three doses at6,10& 14 week.
4	DPT(Diphtheria ,Pertussis and Tetanus Toxoid)– Liquidvaccine	Diphtheria, Pertussis and Tetanus	Intra - muscu lar	5	Three doses at 6,10 & 14 week and two booster dose at 16-24 Month and 5-6years of age
5	Measles- Lyophilized vaccine	Measles	Sub- cutane ous	2	9-12 months of age and 2nd dose at16-24 months.
6	TT(Tetanus Toxoid)–Liquid vaccine	Tetanus	Intra - muscu lar	2 2	10 years and 16 years of Age. For pregnant woman,two doses given(one dose if previously vaccinated within 3Year)

7	**JE vaccination (in selected high disease burden districts)Lyophilized vaccine**	**Japanese Encephalitis(Brainfever)**	**Sub-cutaneous**	**2**	**9-12 months of age and 2nd dose at16-24 months.**
8	**Hib(given as pentavalent containing Hib+DPT+HepB) (in selected states)–Liquid vaccine**	**Hib Pneumonia and Hib meningitis**	**Intra-muscular**	**3**	**6,10&14week of age**

* **High-risk category of children:**

- Congenital or acquired immunodeficiency (including HIV infection)
- Chronic cardiac, pulmonary (including asthma if treated with prolonged high-dose oral corticosteroids), hematologic, renal (including nephritic syndrome), liver disease and diabetes mellitus
- Children on long term steroids, salicylates, immunosuppressive or radiation therapy
- Diabetes mellitus, Cerebrospinal fluid leak, Cochlear implant, Malignancies,
- Children with functional/anatomic asplenia/hyposplenia
- During disease outbreaks
- Laboratory personnel and healthcare workers
- Travelers

I. General instructions :

- Vaccination at birth means as early as possible within 24 to 72 hours after birth as or at least not later than one week after birth.
- Whenever multiple vaccinations are to be given simultaneously, they should be given within 24 hours if simultaneous administration is not feasible due to some reasons.
- The recommended age in weeks/months/years mean completed weeks/months/years.
- Any dose not administered at the recommended age should be administered at a subsequent visit, when indicated and feasible.
- The use of a combination vaccine generally is preferred over separate injections of its equivalent component vaccines.
- When two or more live parenteral/intranasal vaccines are not administered on the same day, they should be given at least 28 days (4 weeks) apart; this rule does not apply to live oral vaccines.
- If given < 4 weeks apart, the vaccine given 2nd should be repeated.
- The minimum interval between 2 doses of inactivated vaccines is usually 4 weeks (exception rabies).

- Vaccine doses administered up to 4 days before the minimum interval or age can be counted as valid (exception rabies). If the vaccine is administered > 5 days before minimum period it is counted as invalid dose.
- Any number of antigens can be given on the same day.
- Changing needles between drawing vaccine into the syringe and injecting into the child is not necessary.
- Different vaccines should not be mixed in the same syringe unless specifically licensed and labeled for such use.
- Patients should be observed for an allergic reaction for 15 to 20 minutes after receiving immunization (s).
- When necessary, 2 vaccines can be given in the same limb at a single visit.
- The anterolateral aspect of the thigh is the preferred site for 2 simultaneous IM injections because of its greater muscle mass.
- The distance separating the 2 injections is arbitrary but should be at least 1 inch so that local reactions are unlikely to overlap.
- Although most experts recommend "aspiration" by gently pulling back on the syringe before the injection is given, there are no data to document the necessity for this procedure. If blood appears after negative pressure, the needle should be withdrawn and another site should be selected using a new needle.
- A previous immunization with a dose that was less than the standards dose or one administered by a nonstandard route should not be counted, and the person should be reimmunized as appropriate for age.

II. Specific instructions :

1. BCG Vaccine

Routine Vaccination:

- Should be given at birth or at first contact

Catch-up Vaccination:

- May be given up to 5 years

2. Hepatitis B (HepB) Vaccine

Routine Vaccination:

- Minimum age : birth
- Administer monovalent HepB vaccine to all newborns within 48 hours of birth.
- Monovalent HepB vaccine should be used for doses administered before age 6 weeks.
- Administration of a total of 4 doses of HepB vaccine is permissible when a combination vaccine containing HepB is administered after the birth dose.
- Infants who did not receive a birth dose should receive 3 doses of a HepB containing vaccine starting as soon as feasible.
- The ideal minimum interval between dose 1 and dose 2 is 4 weeks, and between dose 2 and 3 is 8 weeks. Ideally, the final (3" or 4") dose in the HepB vaccine series should be administered no earlier than age 24 weeks and at least 16 weeks after the first dose, whichever is later.

- Hep B vaccine may also be given in any of the following schedules : Birth, 1, & 6 mo, Birth, 6 and 14 weeks; 6, 10 and 14 weeks; Birth, 6, 10 and 14 weeks, etcl All schedules are protective.

Catch-up Vaccination:

- Administer the 3 dose series to those not previously vaccinated.
- In catch-up vaccination use 0, 1 and 6 months schedule.

3. Poliovirus Vaccines

Routine Vaccination:

- Birth dose of OPV usually does not lead to VAPP.
- OPV in place of IPV, if IPV is unfeasible, minimum 3 doses.
- Additional doses of OPV on all SIAs.
- IPV: Minimum age – 6 weeks.
- IPV : 2 instead of 3 doses can be also used if primary series started at 8 weeks and the interval between the doses is kept 8 weeks
- No child should leave your facility without polio immunization (IPV or OPV), if indicated by the schedule!!

Catch-up Vaccination:

- IPV catch-up schedule: 2 doses at 2 months apart followed by a booster after 6 months of previous dose.

4. Dephtheria and Tetanus Toxoids and Pertussis (DTP) Vaccine

Routine Vaccination:

- Minimum age : 6 weeks
- The first booster (4^{th} dose) may be administered as early as age 12 months, provided at least 6 months have elapsed since the third dose.
- DTaP vaccine / combinations should preferably be avoided for the primary series.
- DTaP may be preferred to DTwP in children with history of severe adverse effects after previous dose/s of DTwP or children with neurologic disorders.
- First and second boosters may also be of DTwP. However, considering a higher, reactogenicity, DTaP can be considered for the boosters.
- If any 'acellular pertussis' containing vaccine is used, if must at least have 3 or more conponents in the product.

Catch-up Vaccination:

- Catch-up schedule: The 2^{nd} childhood booster is not required if the last dose has been given beyond the age of 4 years.
- Catch up below 7 years : DTwP / DTaP at 0, 1 and 6 months;
- Catch up above 7 years: Tdap. Td and Td at 0, 1 and 6 months.

5. Tetanus and Diphtheria Toxoids and a Cellular Pertussis (Tdap) Vaccine

Routine Vaccination:

- Minimum age : 7 years (Adacel® is approved for 11-64 years by ACIP and 4 to 64 year olds by FDA, while Boostrix® for 10 years and older by ACIP and 4 years of age and older by FDA in US).
- Administer 1 dose of Tdap vaccine to all adolescents aged 11 through 12 years.

- Tdap during pregnancy: One dose of Tdap vaccine to pregnant mothers / adolescents during each pregnancy (preferred during 27 through 36 weeks gestation) regardless of number of years from prior Td or Tdap vaccination.

Catch-up Vaccination:

- Catch up above 7 years: Tdap, Td at 0, 1 and 6 months.
- Persons aged 7 through 10 years who are not fully immunized with the childhood DTwP / DTaP vaccine series, should receive Tdap vaccine as the first dose in the catch-up series; if additional doses are needed, use Td vaccine. For these children, an adolescent Tdap vaccine should not be given.
- Persons aged 11 through 18 years who have not received Tdap vaccine should receive should receive a dose followed by tetanus and diphtheria toxoids (Td) booster doses every 10 years thereafter.
- Tdap vaccine can be administered regardless of the interval since the last tetanus and diphtheria toxoid-containing vaccine.

6. Haemophilus linfluenzae Type b (Hib) Conjugate Vaccine

Routine Vaccination:

- Minimum age : 6 weeks
- Primary series includes Hib conjugate vaccine at ages 6, 10, 14 weeks with a booster at age 12 through 18 months.

Catch-up Vaccination:

- Catch-up is recommended till 5 years of age.
- 6-12 months; 2 primary doses 4 weeks apart and 1 booster;
- 12-15 months; 1 primary doses and 1 booster;
- Above 15 months: single dose.
- If the first dose was administered at age 7 through 11 months, administer the second dose at least 4 weeks later and a final dose at age 12-18 months at least 8 weeks after the second dose.

7. Measles

Routine Vaccination:

- Minimum age: 9 months or 270 completed days.

Catch-up Vaccination:

- Catch up vaccination beyond 12 months should be MMR
- Measles vaccine can be administered to infants aged 6 through 11 months during outbreaks. These children should be revaccinated with 2 doses of measles containing vaccines, the first at ages 12 through 15 months and at least 4 weeks after the previous dose, and the second at ages 4 through 6 years.

Cold Chain System, Vaccines and Logistics:

Cold Chain is a system of storing and transporting vaccine at the recommended temperature range from the point of manufacture to point of use. The vaccines are supplied by manufacturers directly to four Government Medical Store Depots (at Karnal, Mumbai, Chennai and Kolkata) and state and regional vaccine stores. The GMSDs supply to the states and regional vaccine stores; state and regional vaccine stores supply vaccines to Divisional

vaccine stores and district. The vaccines are further supplied to last cold chain points which are usually situated in Primary Health Centers (PHCs) and Community Health Centers. At the PHCs and CHCs, cold chain handlers, who are health personnel (pharmacists, male and female multi-purpose health workers, etc) have been tasked with proper storage and handling of vaccines and daily upkeep of Ice Lined Refrigerators (ILRs) and Deep Freezers (DFs) including temperature charting.

Vaccines are sensitive biological substances that can lose their potency and effectiveness if they are exposed to temperatures (heat and/or cold) outside the required temperature range of +2 °C to +8 °C or when exposed to light.

Failure to adhere to cold chain requirements may reduce vaccine potency, resulting in lack of protection against vaccine preventable diseases and/or increased local reactions after administration of vaccine.

The loss of vaccine effectiveness due to cold chain exposures to adverse conditions is cumulative, permanent and irreversible.

3. MANAGEMENT OF COMMON CLINICAL PROBLEMS IN NEWBORN

There are several phenomena after birth that are normal and mothers only need reassurance. These include:

Milia, Epstein pearls, Mongolian spots, capillary nevi, etc. These are a few developmental variants which may be present and be of concern to the mother. The mother needs to be reassured.

Red rashes on the skin may be seen on 2-3 days of life. These are normal.

Weight loss of 6-8% (10-12% in preterm infants) in the first few days of life is normal and most infants regain their birth weight by 10-14 days.

Regurgitation of feeds and vomiting. Unlike vomiting, non-projectile expulsion of stomach contents without force(regurgitation) is normal and simply needs advice regarding feeding technique.

Bowel disorders. No medication should be prescribed for passage of stools after each feed (exaggerated gastrocolic reflex) as this is normal in some babies. From 3rd to 14 days many exclusively breastfed babies pass loose stools (10-15 times/day) without illness/dehydration. These are transitional stools and require no medication.

Delayed passage of urine. Non-passage of urine by 48 hours after birth may suggest urinary tract anomalies. Such babies need to be investigated. Crying before passing urine in normal.

Jitteriness is abnormal only when it is excessive or persists even during feeding and then it may suggest hypoglycaemia or hypocalcaemia.

Dehydration fever. Transitory moderate fever (up to 38.5^{O}C) usually during the second or third day of life in summer months in an active baby, who sucks well, is normal and respond to lowering the environmental temperature.

Excessive crying. Most babies cry when either they are hungry or are having discomfort such as due to full bladder before passing urine, wet napkin, nose block, etc. Excessive inconsolable crying or high-pitched crying is indicative of meningitis or any other painful inflammatory condition.

Umbilical sepsis. If there is pus discharge not extending to periumbilical skin, apply 10% Gentain violet or Providone Iodine locally twice a day. However, if there is periumbilical erythema or induration administer syrup erythromycin 40 mg/kg/day in 3-4 divided doses. If the newborn has any other high-risk factor, refer to a higher centre.

Umbilical granuloma. A red flesh-like nodule at the base of umbilical cord can be managed by cautery with Silver Nitrate or application of common salt for 3 to 4 days.

Engorgement of breasts in both sexes and vaginal bleeding after 4 days of birth is normal
Tongue-tie. Rarely, require surgical intervention.

See Neonatal Seizures section for its management.

4. THE FEBRILE CHILD

Introduction

- Fever is defined as a core (rectal) temperature of 38^{0}C (100.4^{0}F).
- Oral temperature of 37.6^{0}C (99.7^{0}F) and axillary temperature of 37.3^{0}C (99^{0}F) are equivalent.
- However, axillary temperatures are less accurate and should not be used as far as possible.
- **Hyperpyrexia** is defined as a core temperature of 41^{o}C or more.
- Fever is one of the commonest symptoms in a sick child.
- It accounts for more than 50% of visits to our Pediatric emergency service.

Table: Historical and physical examination helpful in assessment of acutely febrile child

History:	Physical Examination: look for a focus
• Age: Infants < 3 months are more susceptible to severe infection and infections by unusual organizer because of immunologic immaturity. • Fever: onset, degree, site of recording, duration. Associated symptoms – localising, activity and responsiveness, abnormal cry and appetite, paradoxic irritability, playfulness, sleep. • Concurrent febrile illness among family members, day care centre: suggests viral illness • Local epidemiology and climate: useful in epidemic or endemic illness	• Meningeal signs (tense fontanelle) • Inspection of ear drum • Eye signs • Mouth, pharynx • Lymph nodes • All joints and limb movements • Auscultation of lungs, heart • Palpation of abdomen, examination of genitalia • Observation of the interaction of the child with parents, facial expression, alertness, activity, breathing, cry, abnormal posture/position. Presence of these signs may help in deciding if the infant is toxic or sick • If no signs re-examine after 24-48 hours.

Children requiring hospitalization/Referral

454 Synopsis of Pediatric Emergency Care

1. All toxic-sick children, irrespective of age.
2. All these patients should receive full sepsis work-up (culture of blood, urine and CSF).
3. All newborn (<28 days).
4. Infants: age 28-90-days if sepsis screen is +ve.
5. Children: age 3 months to 3 years if fever > $39^{O}C$ and sepsis screen +ve.

Approach to a previously healthy child with fever without focus and who is not toxic looking should be as follows:

Antibiotics in Undiagnosed Fever

- Do not give antibiotics for an undiagnosed fever' – Doctors have great difficulty in following this rule.
- Use antibiotics in patients who need hospitalization and are at high risk of bacterial infection after taking appropriate specimen for bacteriological studies.
- Discontinue if the results of sepsis – workup are negative.

Choice of Antibiotics:

Inj. Ceftrixone

Cefotaxime 50mg/kg in infants < 3 months.

Oral amoxicillin/Augmentin (40-50 mg/kg) or

Cloxacillin (100 mg/kg) with amoxicillin should be used in older children.

Fever > $38^{0}C$

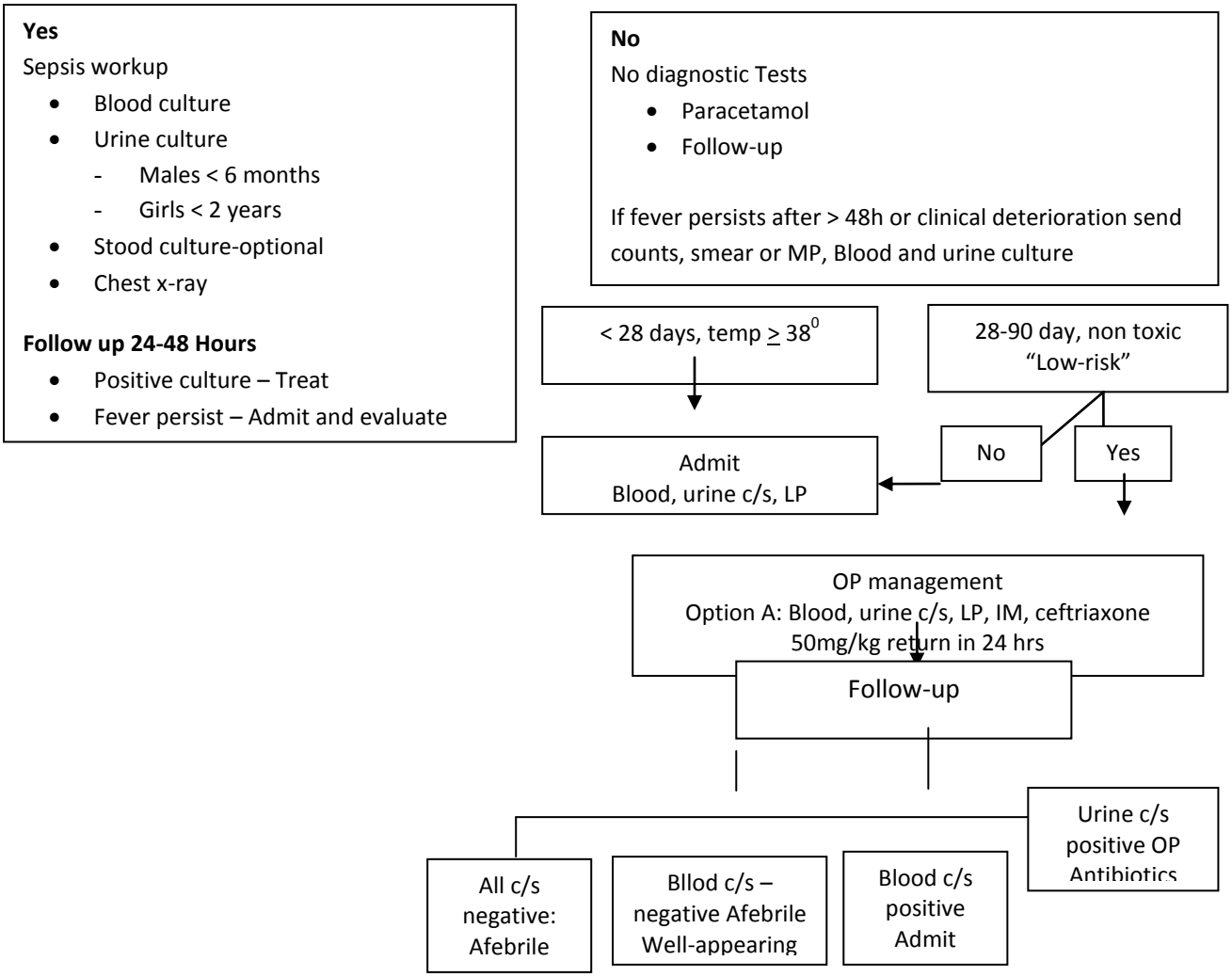


Fig. Algorithm for the management of a previously healthy infant < 90 days of age with a fever without localizing signs. This algorithm is a suggested, but not exhaustive approach to management.

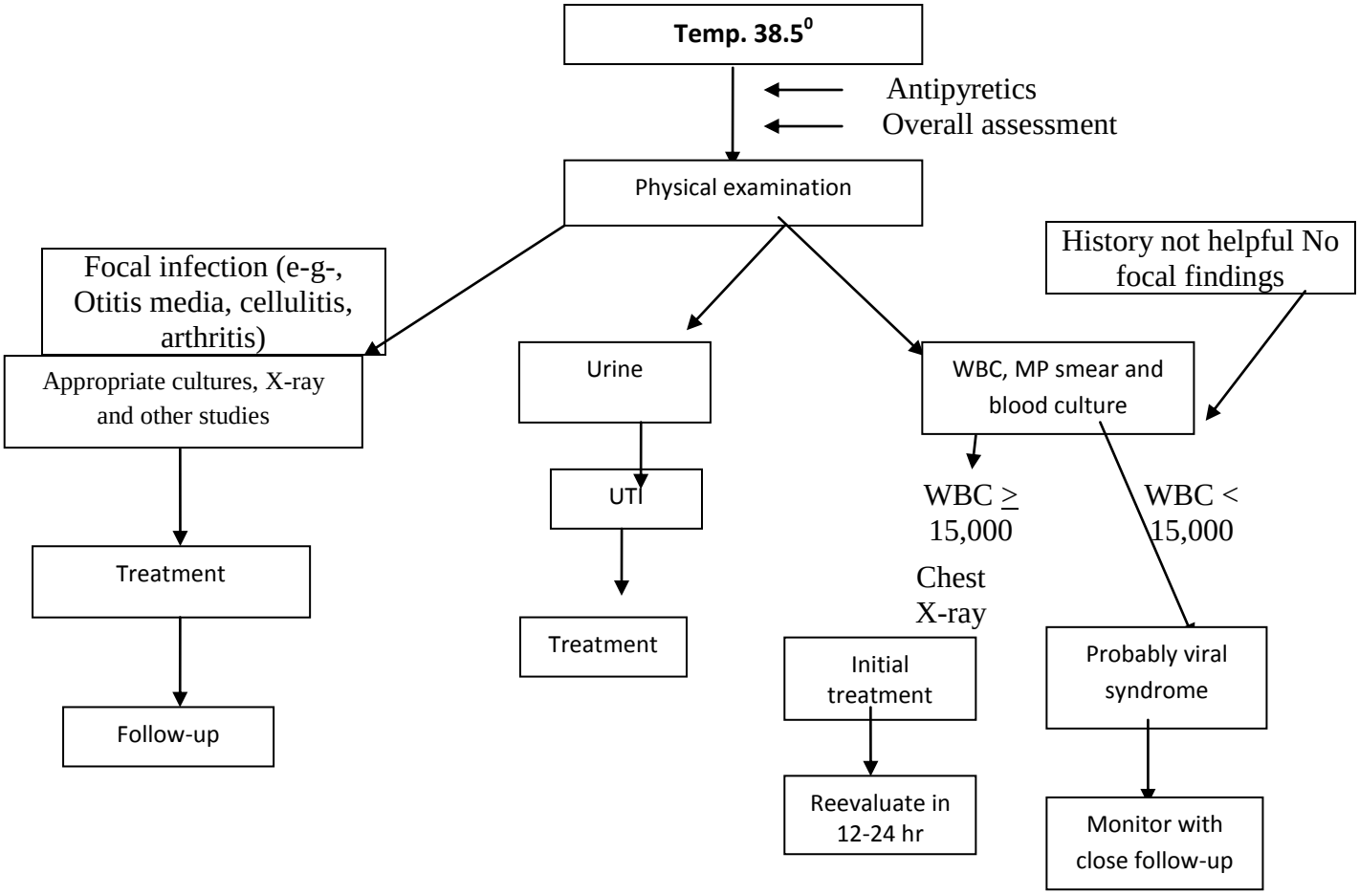


Fig. Evaluation of the febrile child 3 months to 3 years of age. *Adapted from Barkin RM, Rosen P: Emergency pediatrics, ed 5, St Louis, 1999, Mosby*.

Antipyretic Therapy

- Acetaminophen (15 mg/kg/dose per os [PO] or per rectum [PR]) should be administered to all children with temperatures higher than 38.5^{O}C (101.3^{O}F) on arrival in the clinic or
- Emergency department to ensure optimal observation by reducing temperature and permitting a more accurate assessment of the child.
- Children with temperature higher than 39.5^{O}C (103^{O}F) should also be sponged with tapid water.
- The response to antipyretics does not predict the prevalence of bacteremia.

Antipyretics are Indicated in Following Group of Febrile Children

(i) If temperature > 39^0C
(ii) If child is uncomfortable
(iii) If there is a known risk of febrile seizure

Choice of antipyretics: following drugs may be used

1. Paracetamol 10-15 mg/kg/6 hours
2. Ibuprofen 5 mg/kg/6 hours

- Cold sponging is necessary only if temperature is 40^0 or higher.
- The limit needs be lowered in children who have experienced a febrile seizure in past.
- It must cover whole body and use plain tap water.
- Antipyretic should be used an hour before cold sponging for maximum effect.

What Supportive Therapy

1. **Sedation**: Febrile children are very restless and may require sedation with Promethazine 1.0 mg/kg dose or Trichloryl 50 mg/kg dose.
2. **Hydration** – Febrile children have increased fluid requirement. Though there is no constant relationship between degree of fever and water loss, parents must be advised to give fluids liberally. There is no need, however to force fluids.
3. **Diet** – Anorexia is common. The best solution is to give food of child's liking and sweetened beverages. There is no need to force feed.

PARENTAL EDUCATION: POINTS

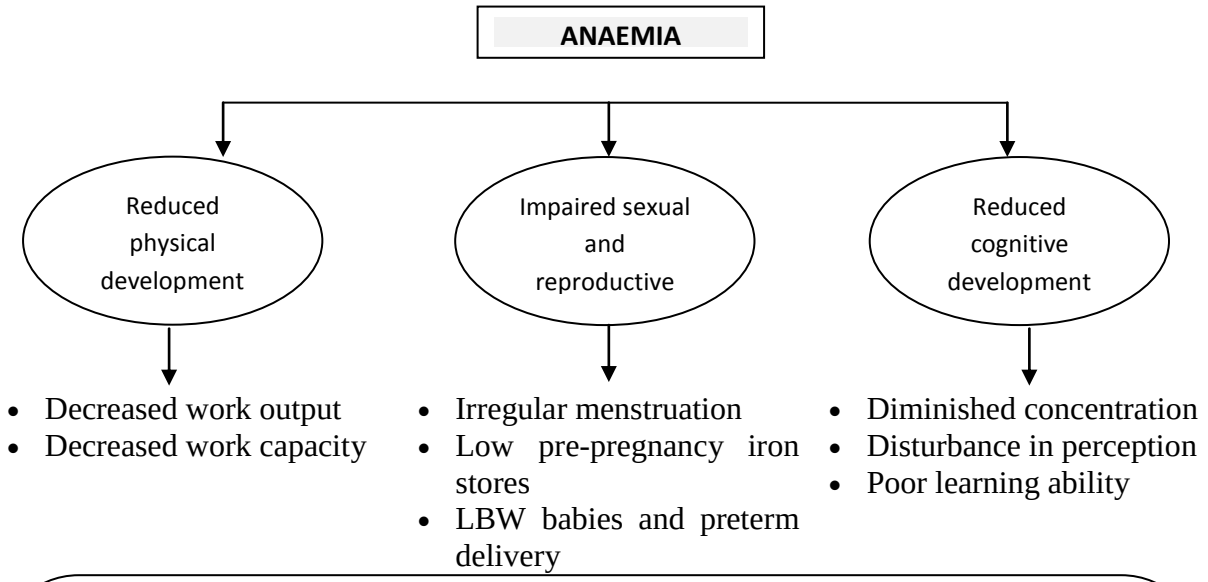
The following should be highlighted while counseling the parents about fever :

1. Fever is body temperature above 37.8^0C (100^0C) measured orally or 38^0C when measured rectally.
2. Fever is not a disease by itself; it is due to some underlying illness.
3. Fever per se does not cause any harm unless the body temperature is 41^0C. Generally the body keeps a check on the temperature and it seldom goes beyond 41^0C.
4. Antipyretics are required only if the temperature exceeds 39^0C (102^0F) and/or if the child is uncomfortable. If the child is comfortable and sleeping he need not be awakened for antipyretic medication.
5. Cold sponging is necessary only if the temperature is 40^0C or higher. It must cover the whole body. Ordinary tap water at a temperature between 30^0C – 37^0C is good enough for the purpose, antipyretic one hour before cold sponging to derive the best effect from the sponging.
6. The limits for antipyretics and cold sponging need to be lowered for those children who have experienced a febrile seizure in the past.
7. A doctor must be consulted for fever if
   (i) The child is younger than 3 months;
   (ii) It persists for more than 2 days;
   (iii) The child appears sick or stop feeding;
   (iv) The temperature is > 39^0C; and
   (v) The child has other symptoms.

6. ANAEMIA

- Anaemia is a condition in which the number of red blood cells (RBCs), and consequently their oxygen-carrying capacity, is insufficient to meet the body's physiological needs.
- **The function of the RBCs is to deliver oxygen from the lungs to the tissues and carbon dioxide from the tissues to the lungs. This is accomplished by using haemoglobin (Hb), a tetramer protein composed of haem and globin. Anaemia impairs the body's ability for gas exchange by decreasing the number of RBCs transporting oxygen and corbon dioxide.**
- Anaemia results from one or more of the following process: defective red cell production, increased red cell destruction or blood loss.
- Iron is necessary for synthesis of haemoglobin. Iron deficiencies (including folate, vitamin B12 and vitamin A), acute Hb synthesis, red blood cell production or red blood cell survival can all cause anaemia.

Fig. Adverse effects of anaemia



Children: Causes of Nutritional Anaemia

- Lower on stores at birth due to anaemia in mother
- Now-exclusive breastfeeding
- Too early introduction of inappropriate complementary food (resulting in diminished breast milk intake, insufficient iron intake, and heightened risk of intestinal infections)
- Late introduction of appropriate (iron-rich) complementary foods
- Insufficient quantity of iron and iron enhancers in diet, and low bioavailability of dietary iron (e.g. non-haem iron)
- Increased iron requirement related to rapid growth and development during infancy and childhood
- Iron loss due to parasite load (e.g. malaria, intestinal worms)
- Poor environmental sanitation, unsafe drinking water and inadequate personal hygiene

Source: Haemoglobin concentration for the diagnosis of anaemia and assessment of severity. WHO

Diagnosis of Anaemia

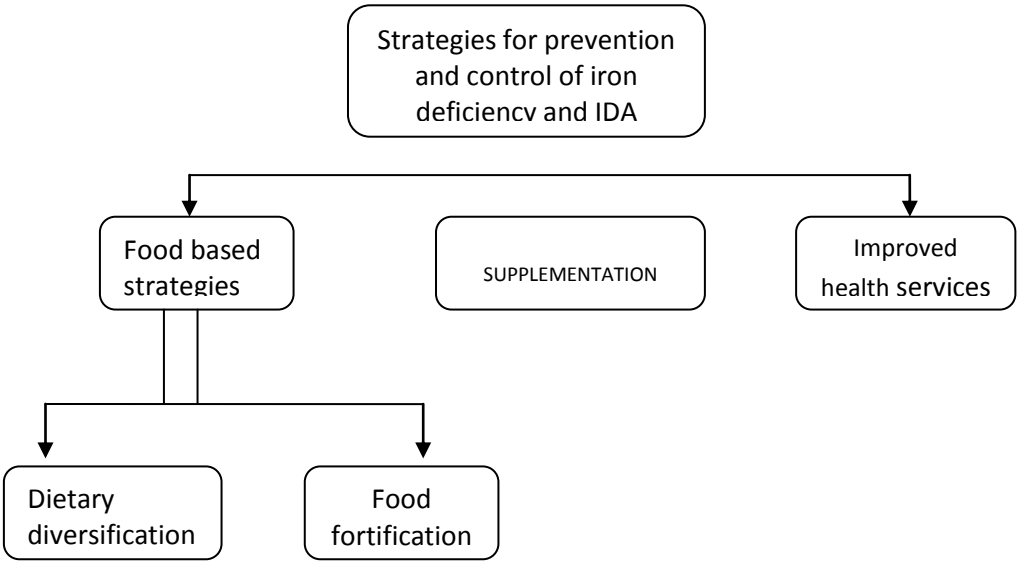
Table Haemoglogin levels to diagnose anaemia (g/dl)

Age groups	No Anaemia	Mild	Moderate	Severe
Children 6-59 months of age	≥ 11	10-10.9	7-9.9	<7
Children 5-11 years of age	≥ 11.5	11-11.4	8-10.9	<8
Children 12-14 years of age	≥ 12	11-11.9	8-10.9	<8
Non-pregnant women (15 years of age and above)	≥ 12	11-11.9	8-10.9	<8
Pregnant women	≥ 11	10-10.9	7-9.9	<7
Men	≥ 13	11-12.9	8-10.9	<8

Approach to Anaemia

- Anaemia is a multi-factorial disorder that requires a multi-pronged approach for its prevention and treatment.
- Prevention of both iron deficiency and anaemia require approaches that address all the potential causative factors.

Interventions to prevent and correct iron deficiency and IDA



***Source: Iron deficiency anaemia** : assessment, prevention and control. A guide for programme Managers; WHO/NHD/o1.3*

1. Therapeutic Approach

5.1. Six Months – 60 Months

Screening through assessment of palmar pallor *(as per IMNCI guidelines)*

- If the skin of child's palm is paler than that of others, the child will be referred to the appropriate health facility (PHC)/Mobile Medical Teams for Hb estimation and treatment of anaemia.

Facility level management

- Any child reporting to any facility (PHC level and above) with any illness will be assessed clinically by the attending Medical Officer for anaemia routinely and should undergo Hb estimation if found to be anaemic clinically/\.
- All children referred from field (community, outreach, sub-centre) to PHC due to palmar pallor will undergo Hb level estimation before initating treatment.
- Iron therapy should be started after deworming

Table Dosage of Albendazole tablets for biannual de-worming

Age	**Dose** (Albendazole 400 mg tablet)	Appropriate administration of tablets to children between the ages of 1 and 3 years is important. The tablet should be broken and crushed between two spoons, the safe water added to help administer the drug
1-2 years	Half tablet	
2 years upwards	One tablet	

Note:

1. **Prophylaxis with iron should be withheld in case of acute illness (fever, acute diarrhoea, pneumonia etc.),**
2. **Severe Acute Malnutrition (SAM) and in a known case of haemoglobinopathy/history of repeated blood transfusion.**
3. **Iron therapy to be started after deworminng.**

- Children will be categorized as having mild, moderate and severe anaemia on the basis of Hb levels and will be managed as per **Table**

Table : Management of anaemia on the basis of haemoglobin levels in children 6 months – 5 years

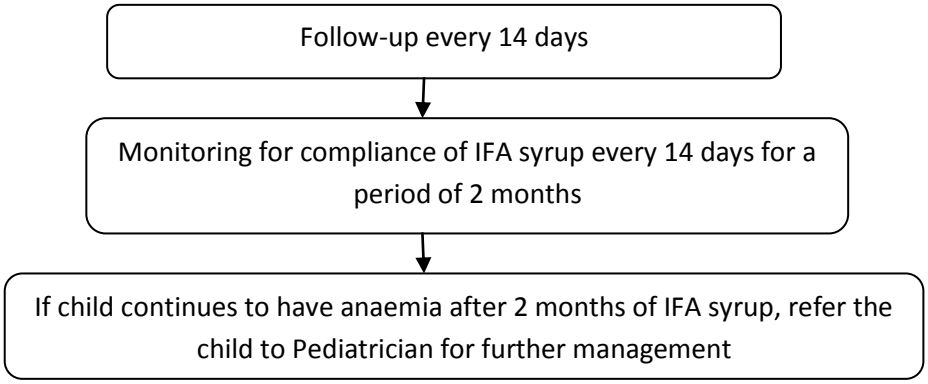
Level of Hb	Treatment	Follow-up	Referral
No Anaemia (>11 gm/dl)	20 mg of elemental iron and 100 mcg of folic acid in biweekly regimen		
Mild Anaemia (10-10.9 gm/dl)	3 mg of iron/Kg/day for 2 months	Follow-up every 14 Hb estimation after completing 2 months of treatment of document Hb>11 gm/dl	In case the child has not responded to the treatment of anaemia with daily dose of iron for 2 months, refer the child to the FRU/DH with F-IMNCI trained MO/ Paediatrician/ Physician for further investigation
Moderate Anaemia (7-	3 mg of	Follow-up every 14	In case the child has not responded

9.9 gm/dl)	iron/Kg/day for 2 months	Hb estimation after completing 2 months of treatment of document Hb>11 gm/dl	to the treatment of anaemia with daily dose of iron for 2 months, refer the child to the FRU/DH with F-IMNCI trained MO/ Paediatrician/ Physician for further investigation
Severe Anaemia (<7 gm/dl)	Refer urgently to DH/FRU		

Table Dose of IFA syrup for anaemic children 6 months – 5 years [1ml = 20 mg of iron 100mg of Folic Acid]

Age of child	Dose	Frequency
6 months – 12 months (6-10 kg)	1 ml of IFA syrup	Once a day
1 year – 3 years (10-14 kg)	1.5 ml of IFA syrup	Once a day
3 year – 5 years (14-19 kg)	2 ml of IFA syrup	Once a day

Follow-up of children undergoing treatment of anaemia



- After completion of treatment of anaemia and documenting Hb level >11 gm/dl, the IFA supplementation to be resumed.
- Treatment of anaemia with iron should be withheld, in case of acute illness, Severe Acute mainutrition and in a known case of haemoglobinopathy. Anaemia in these cases should be treated as per the standard treatment guidelines, by the attending physician, as per the merit of the individual case.

Indications for further investigations and referral for management:

- Cases of anaemia and Hepato-splenomegaly/Splenomegaly, if malaria has been excluded or not strongly suspected.
- Children with similar history in the family (siblings).
- Cases of anaemia with significant lymphadenopathy, bleeding manifestations.
- Cases of anaemia with abnormal/immature cells or marked leucocytosis or bicytopenia or pancytopenia on smear examination.
- Children who are not responding to adequate dose of iron/folate given for 2 weeks.

Table Management of anaemia on the basis of haemoglobin levels in children, Adolescent 5-10 years

Level of Hb	Treatment	Follow-up	Referral
Mild Anaemia (11-11.4 gm/dl)	3 mg of iron/ kg/day for 2 months	Follow-up every 14 days Hb estimation after completing 2 months of treatment to assess if Hb estimates are >11.5 gm/dl	In case the child has not responded to the treatment of anaemia with daily dose of iron for 2 months, refer the child to the FRU/DH with F-IMNCI trained MO/Paediatrician/Physician for further investigation
Moderate Anaemia (8-10.9 gm/dl)	3 mg of iron/ kg/day for 2 months	Follow-up every 14 days Hb estimation after completing 2 months of treatment to assess if Hb estimates are >11.5 gm/dl	In case the child has not responded to the treatment of anaemia with daily dose of iron for 2 months, refer the child to the FRU/DH with F-IMNCI trained MO/Paediatrician/Physician for further investigation
Severe Anaemia (<8 gm/dl)	Refer urgently to DH/FRU		

Note:

- After completion of treatment of anaemia and attaining Hb level >11.5 gm/dl, the IFA supplementation to be resumed.
- Treatment of anaemia with iron should be withheld in case of acute illness, severe acute malnutrition and in a known case of haemoglobinopathy and anaemia in these cases should be treated as per the standard treatment guidelines, by the attending physician, as per the merit of the individual case.

Facility level management of anaemia in adolescents

- All adolescents referred to PHC with pallor will undergo Hb level estimation before initiation of treatment.
- Adolescents will be categorized as having mild, moderate and severe anaemia on the basis of Hb levels and further management of anaemia will be as per **Table**

Table Management of anaemia on the basis of haemoglobin levels among adolescents 10-19 years

Level of Hb	Treatment	Follow-up	Indication for referral
Mild Anaemia (11-11.9 gm/dl)	60 mg of elemental iron daily for 3 months	Follow-up every month Hb estimation after completing 3 months of treatment to assess if Hb estimates are >12 gm/dl.	In case of no improvement in Hb levels after 3 months of treatment, adolescent will be referred to DH/FRU for further investigation
Moderate Anaemia (8-10.9 gm/dl)	60 mg of elemental iron daily for 3 months	Investigate Follow-up every 14 days Hb estimation after completing 3 months of treatment to assess if Hb estimates are >12 gm/dl.	In case of no improvement in Hb levels after 3 months of treatment, adolescent will be referred to DH/FRU for further investigation
Severe Anaemia (<8 gm/dl)	Refer urgently to DH/FRU	Severely anaemic adolescents would be line listed by ANM	

The moderately anaemic cases/adolescents with non-response to 3 months of iron will need the following investigation to determine the cause of anaemia :

- Complete blood counts
- Examination of peripheral blood smear
- Blood films to be examined for malaria parasites (particularly in high malaria risk areas)
- Stool examination for ova, cyst and occult blood

Precautions for oral therapy

- Intake of doses as per regime, should be taken regularly and must complete the treatment
- Ideally, tablets should be taken on empty stomach for better absorption. In case of gastritis, nausea vomiting etc., advise to take one hour after meal or at night
- If constipation occurs, advise to drink more water and add roughage to diet
- IFA tablets should not be consumed with tea, coffee, milk or calcium tablets
- IFA treatment should always supplemented with diet rich in iron, vitamins (particularly Vitamin C), protein, minerals and other nutrients e.g. green leafy vegetables, whole pulses, jiggery, meat, poultry and fish, fruits and black gram, groundnuts, ragi, whole grains, milk, eggs, meat and nuts, etc.

Management of severe anaemia at FRU/DH (as per F-IMNCI) in children, adolescent 6 months – 5 years

<table>
<tr><th colspan="2">History to be taken for</th><th colspan="2">Examination for</th></tr>
<tr><td colspan="2">• Duration of symptoms
• Usual diet (before the current illness)
• Family circumstances (to understand the child's social background)
• Prolonged fever
• Worm infestation
• Bleeding from any site
• Any lumps in the body
• Previous blood transfusions
• Similar illness in the family (siblings)</td><td colspan="2">• Severe plamar pallor
• Skin bleeds (petechial and/or purpuric spots)
• Lymphadenopathy
• Hepato-splenomegaly
• Signs of heart failure (gallop rhythm, raised JVP, respiratory distress, basal crepitations)</td></tr>
<tr><th>Investigations</th><th>Indication for blood transfusion</th><th colspan="2">Blood transfusion</th></tr>
<tr><td>• Full blood count and examination of a thin film for cell morphology
• Blood films for malaria parasites
• Stool examination for ova, cyst and occult blood</td><td>• All children with Hb ≤4 gm/dl
• Children with Hb 4-6 gm/dl with any of the following :
- Dehydration
- Shock
- Impaired consciousness
- Heart failure
- Deep and labored breathing
- Very high parasitaemia (>10% of RBC)</td><td colspan="2">• If packed cells are available, give 10 ml/kg over 3-4 hours preferably. If not, give whole blood 20 ml/kg over 3-4 hours.</td></tr>
</table>

7. MALNUTRITION

- Undernutrition is one of the most concerning health and development issues as in other parts of the world. Undernutrition encompasses stuntrition encompasses stunting (choronic malnutrition), wasting (acute malnutrition) and deficiencies of micronutrients (essential vitamins and minerals).
- Undernutrition is associated with high rates of mortality and morbidity and is an underlying factor in almost one third to half of all children under five years who die each year of preventable causes.

Malnutrition

- Malnutrition is a general term.
- It most often refers to undernutrition resulting from inadequate consumption, poor absorption or excessive loss of nutrients, but the term can also encompasses over-nutrition, resulting from excessive intake of specific nutrients.
- An individual will experience malnutrition if the appropriate amount of, or quality of nutrients comprising for a healthy diet are not consumed for an extended period of time. Programmatically, it is helpful to categories children with SAM into 'complicated and uncomplicated' cases based on clinical criteria as.

1. **Facility/hospital-based care for children with SAM and medical complications.**
2. **Home/community-based care for children with SAM but without medical complications.**

- Anthropometry is a widely used, inexpensive and non-invasive measure of the general nutritional status of an individual or a population group.
- **The three commonly used anthropometric indices are:**

♦ Weight – For – Age (WFA).
♦ Length – For – Age or Height – For – Age (HFA).
♦ Weight – For – Length or Weight – For – Height (WFH).

Types of under nutrition

- The three indices–weight–for–age, height/length–for–age, weight–for–height /length are used to identify three nutrition conditions: underweight, stunting and wasting, respectively.
- Each of the three nutrition indicators is expressed in standard deviation units (Z-scores) from the median of the reference population based on which under nutrition may be further classified as moderate or severe.

Underweight

- An underweight child has a weight-for-age Z-score that is at least two standard deviations (-2SD) below the median in the World Health Organization (WHO) Child Growth Standards.

Stunting

- A stunted child has a height-for-age Z-score that is at least two standard deviations (-2SD) below the median for the WHO Child Growth Standards.

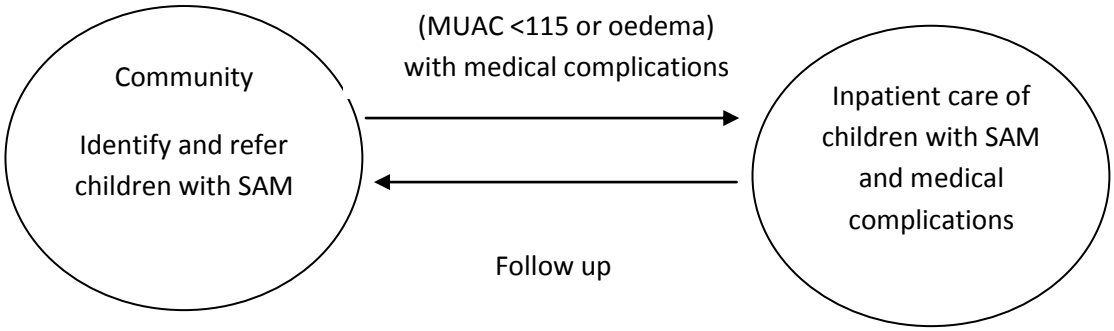
Wasting

- A wasted child has a weight-for-height Z-score that is at least two standard deviations (-2SD) below the median for the WHO Child Growth Standards.

Severe Acute Malnutrition (SAM)

- Severe acute malnutrition is defined by very low weight-for-height/length (Z-score below – 3SD of the median WHO child growth standards), a mid-upper arm circumference <115 mm, or by the presence of nutritional oedema.
- SAM increases significantly the risk of death in children under five years of age. It can be an indirect cause of child death by increasing the case fatality rate in children suffering from common illnesses such as diarrhea and pneumonia.
- Children who are severely wasted are 9 times more likely to die than well-nourished children.

Diagnostic criteria for SAM in children aged 6-60 months		
Indicator	**Measure**	**Cut-off**
Severe wasting	Weight-for-height	<-3SD
Severe wasting	MUAC[2]	< 115mm
Bilateral oedema	Clinical sign	
Reference : Who/UNICEF Joint Statement		



Case identification

- Active screening at village lived by AWW/ASHA through house to house visit with MUAC tape for all children (6 – 59 months) and looking for presence/absence of bilateral pitting edema.
- Passive screening during Growth Monitoring/Village Health and Nutrition Days (VHND) using MUAC for all children (6 – 59 months) and looking for presence/absence of bilateral pitting edema.
- Screening of children coming to OPDs/inpatient wards in health facilities using weight for height and/or MUAC

SAM: WFH < -3SD/and/or severe visible wasting and or bitaleral pedal oedema and/or MUAC < 115mm

No SAM: MUAC > 115; or WFH > -3SD; and no bilateral pedal oedema

Nutrition counseling to mother/caregiver

Medical complications (any one)

- Poor appetite
- Visible severe wasting
- Oedema of both feet
- Severe palmar pallor
- Any sick young infant (<2 months old)
- Lethargy, drowsiness, unconsciousness
- Continually irritable and restless
- Any respiratory distress
- Signs suggesting severe dehydration in a child with diarhoea

No medical complications

Refer to Sub Centre for further assessment and counselling

Transfer to community based program for SAM management

Hospitalisation and management

After discharge

Admission criteria

Criteria for admission for inpatient treatment
Children 6 – 59 months
Any of the following : ♦ MUAC < 115mm with or without any grade of oedema ♦ WFH < - 3 SD with or without any grade of oedema ♦ Bilateral pitting oedema +/++ (children with oedema +++ always need inpatient care) **WITH** Any of the following complications : 1. Anorexia (Loss of appetite) 2. Fever (39 degree C) or Hypothermia (< 35 C) 3. Persistent vomiting 4. Severe dehydration based on history and clinical examination 5. Not alert, very weak, apathetic, unconscious, convulsions 6. Hypoglycemia 7. Severe Anemia (severe palmar pallor) 8. Severe pneumonia 9. Extensive superficial infection requiring IM medications 10. Any other general sign that a clinician thinks requires admission for further assessment or care In addition to above criteria if the caregiver is unable to take care of the child at home, the child should be admitted.
Infants < 6 months
Infant is too weak or feeble to suckle effectively (independently of his/her weight-for-length). **or** WfL (weight-for-length) < - 3SD (in infants > 45 cm) **or** Visible severe wasting in infants < 45 cm **or** Presence of oedema both feet
Other reasons for inpatient enrolment
Readmission: Child previously discharged from in-patient care but meets admission criteria again.
Return after default: Child who returns after default (away from in-patient care for 2 consecutive days) and meets the admission criteria.

Triage

- **Triage is the process of rapidly screening sick children.**
- Triage must be done for all paediatric patients coming to the health facility.
- The first step is to check every child for emergency signs and provide emergency treatment as necessary keeping in mind the **ABCD steps: Airway, Breathing, Circulation, Coma, Convulsion, and Dehydration.**

The chart next page gives the steps of triage:

Assessment at admission

Take a history concerning	**On examination, look for**
♦ Recent intake of food and fluids ♦ Usual diet (before the current illness) ♦ Breastfeeding ♦ Duration and frequency of diarrhea and vomiting ♦ Type of diarrhea (watery/bloody) ♦ Chronic cough ♦ Loss of appetite ♦ Family circumstances (to understand the child's social background) ♦ Contact with tuberculosis ♦ Recent contact with measles ♦ Known or suspected HIV infection. ♦ Immunizations	♦ Anthropometry- weight, height/length, mid arm circumference ♦ Oedema ♦ Pulse, heart rate, respiratory rate ♦ Signs of dehydration ♦ Shock (cold hands, slow capillary refill, weak and rapid pulse) ♦ Palmar pallor ♦ Eye signs of vitamin A deficiency : • Dry conjunctiva or cornea, • Bitot"s spots • Corneal ulceration • Keratomalacia ♦ Localizing signs of infection, including ear and throat infections, skin infection or pneumonia ♦ Mouth ulcers ♦ Skin changes of kwashiorkor : • Hypo or hyperpigmentation • Desquamation • Ulceration (spreading over limbs, thighs, genitalia, groin, and behind the ears) • Exudative lesions (resembling severe burns) often with secondary infection (including Candiada).

Triage

<table>
<tr><td colspan="2">ASSESS FOR EMERGENCY SIGNS
(In all Cases)</td><td>TREAT :
♦ Check for head/neck trauma before treating child
♦ Do not move neck if cervical spine injury possible
♦ Give appropriate treatment for +ve emergency signs
♦ Call for help
♦ Draw blood for glucose/malaria Hb</td></tr>
<tr><td>AIRWAY AND BREATHING
♦ Not Breathing or Gasping or
♦ Central cyanosis or
♦ Severe respiratory distress</td><td>Any sign Positivbe</td><td>Manage airway
Provide basic life support (Not breathing/gasping)
Give Oxygen
Make sure child is warm*</td></tr>
<tr><td rowspan="2">CIRCULATION
Cold hands with :
♦ Capillary refill longer than 3 secs, and
♦ Weak and fast pulse</td><td rowspan="2">If Positive
Check for Severe Acute Malnutition</td><td>♦ If the child has any bleeding, apply pressure to stop the bleeding. Do not use a tourniquet.
♦ Give oxygen
♦ Make sure child is warm*
♦ Insert IV and begin giving fluids rapidly
If not able to insert peripheral IV, insert an umbilical or intraosseous line</td></tr>
<tr><td>IF SEVERE ACUTE MALNUTRITION
(Age ≥ 2 months)
If lethargic or unconscious :
♦ Insert IV line and give IV glucose and fluids
If not lethargic or unconscious :
♦ Give glucose orally or by NG tube.
♦ Proceed immediately to full assessment and treatment.</td></tr>
<tr><td>COMA CONVULSING
♦ Coma or
♦ Convulsing (Now)</td><td>If Coma or Convulsing</td><td>Manage airway
♦ Position the child
♦ Check and correct hypoglycaemia
♦ If convulsions continue give IV calcium in young infants
♦ If convulsions continue anticonvulsants</td></tr>
<tr><td rowspan="2">SEVERE DEHYDRATION (ONLY WITH DIARRHOEA)
Diarrhoea plus any two of these :
♦ Lethargy
♦ Sunken eyes
♦ Very slow skin pinch</td><td rowspan="2">Diarrhoea Plus Two Signs Positive
Check for Severe Acute</td><td>♦ Make sure child is warm*
♦ Insert IV line and begin giving fluids rapidly following PLAN C</td></tr>
<tr><td>IF SEVERE ACUTE MALNUTRITION
(Age ≥ 2 Months)
♦ Do not start IV immediately
♦ Proceed immediately to full assessment and treatment.</td></tr>
<tr><td colspan="2">*Check temperature; if baby is cold to touch, rewarm</td><td></td></tr>
<tr><td colspan="3">IF THERE ARE NO EMERGENCY SIGNS LOOK FOR PRIORITY SIGNS :
These children need prompt assessment and treatment</td></tr>
<tr><td>♦ Tiny baby (< 2 months)
♦ Bleeding
♦ Pallor (Severe)
♦ Malnutrition: Visible severe wasting</td><td>♦ Trauma or other urgent surgical condition
♦ Referral (urgent)
♦ Oedema of both feet
♦ Temperature < 36.5^{0}C or > Respiratory distress 39.5^{0}C</td><td>♦ Restless, continuously irritable or lethargy
♦ Poisoning
♦ Burns (major)</td></tr>
<tr><td colspan="3">NON-URGENT : Proceed with assessment and further treatment according to Child's priority</td></tr>
<tr><td colspan="3">Note : If a child has trauma or other surgical problems, get surgical help or follow surgical guidelines</td></tr>
</table>

Laboratory tests

Following laboratory tests should be done for the children admitted to a health facility for management of SAM.

Laboratory Tests
♦ Blood glucose ♦ Haemoglobin or packed cell volume in children with severe palmar pallor ♦ Serum electrolytes eg; (sodium, potassium, and calcium whenever possible) ♦ Screening for infections : ▪ Total and differential leukocyte count, blood culture ▪ Urine routine examination ▪ Urine culture ▪ Chest x-ray ▪ Mantoux test ▪ Screening for HIV after counseling (only when suspected, based on history and clinical signs and symptoms) ▪ Any other specific test required based on geographical location or clinical presentation e.g. Celiac Disease, malaria etc.

Principles of hospital-based management

The principles of management of SAM are based on 3 phases:

1. **Stabilization Phase,**
2. **Transition Phase and**
3. **Rehabilitative Phase.**

1. Stabilisation Phase:

- Children with SAM without an adequate and/or a major medical complication are stabilized in an in-patient facility.
- This phase usually lasts for 1-2 days.
- The feeding formula used during this phase is Starter diet which promotes recovery of normal metabolic function and nutrition-electrolytic balance.
- All children must be carefully monitored for signs of overfeeding or over hydration in this phase.

2. **Transition Phase :**

- This phase is the subsequent part of the stabilization phase and usually lasts for 2-3 days.
- The transition phase is intended to ensure that the child is clinically stable and can tolerate an inceased energy and protein intake.

The child moves to the Transition Phase from Stabilization Phase when there is :

- At least the beginning of loss of oedema
  AND
- Return of appetite
  AND
- No nasogastric tube, infusions, no severe medical problems
  AND
- **Is alert and active**
  - The ONLY difference in management of the child in transition phase is the change in type of diet.
  - There is gradual transition from Starter diet to Catch up diet (F 100).
  - The quantity of Catch up diet (F100) given is equal to the quantity of Starter diet given in stabilization Phase.

3. **Rehabilitation Phase:**

   - Once children with SAM have recovered their appetite and received treatment for medical complications they enter Rehabilitation Phase.
   - The aim is to promote rapid weight gain, stimulate emotional and physical development and prepare the child for normal feeding at home.
   - The child progresses from Transition Phase to Rehabilitation Phase when :

- S/he has reasonable appetite; finishes > 90% of the feed that is given, without a significant pause
- Major reduction or loss of oedema
- No other medical problem

Ten steps for management of SAM

Management steps	Stabilisation		Rehabilitation	
	Day 1-2	Day 3-7	Day 7-14	Week 2-6
1. Treat/prevent hypoglycaemia				
2. Treat/prevent hypodration				
3. Treat/prevent dehydration				
4. Correct imbalance of electrolytes				
5. Treat infections				
6. Correct deficiencies of micronutrients	No iron		With iron	
7. Start cautious feeding				
8. Rebuild wasted tissues (catch-up growth)				
9. Provide loving care and play				
10. Prepare for follow-up				

Treatment of hypoglycaemia

- Estimate Blood Glucose levels by using glucometer or drawing blood sample for lab test .
- If blood glucose is low (<53 mg/dl) or hypoglycaemia is suspected, immediately give the child a 50 ml bolus of 10% glucose or 10% sucrose (1 rounded teaspoon of sugar in $3^1/_2$ tablespoons of water). Glucose is preferable because the body can use it more easily.
- If the child can drink, give the 50 ml bolus orally.
- If the child is alert but not drinking, give the 50 ml by NG tube.
- If the child is lethargic, unconscious, or convulsing, give 5 ml/kg body weight of sterile 10% glucose by IV, followed by 50 ml of 10 % glucose or sucrose by NG tube.
- I the IV dose cannot be given immediately, give the NG dose first. (*If the child will be given IV fluids for shock, there is no need to follow the 10% IV glucose with an NG bolus, as the child will continue to receive glucose in the IV fluids.)

- Start feeding with 'Starter diet' half an hour after giving glucose and give it every half-hour during the first 2 hours. For a hypoglycaemic child, the amount to give every half-hour is ¼ of the 2 hourly amount (refer to Annexure T9 & 10% for calculation of the amount of feed).
- Keep child warm (described in step-2) as hypoglycemia and hypothermia coexist.
- Administer antibiotics as hypoglycaemia may be a feature of underlying infection (as described in step-5).

If blood glucose is normal (>54mg/dl), start giving 'Starter Diet', 2 hourly. (Refer to Annexure 13 and 14 for calculation of the amount of feed).

Treatment of hypothermia

Take temperature

↓

(Preferably using a low-reading thermometer; range 29^0C – 42^0C)

↓

If axillary temperature is below 35^0C

Or

Rectal temperature is below 35.5^0C

↓

- Start feeding immediately (or start rehydration if needed).
- Re-warm, Put the child on the mother's bare chest (skin to skin contact: kangaroo technique) and cover them, OR clothe the child including the head, cover with a warmed blanket and place a heater or lamp nearby.
- Remove wet clothing/bedding
- Feed 2 – hourly (12feeds in 24 hours).
- Take hypoglycaemia,
- Give 1st dose of antibiotics.

Monitor during re-warming

- Take temperature every two hours; stop re-warming when it rises above 36.50 C
- Take temperature every 30 minutes if heater is used

If rectal temperature < 32^0C

↓

Treat for Severe Hypothemia

- Give warm humidified oxygen.
- Give 5 ml/kg of 10% dextrose IV immediately or
- 50 ml of 10% dextrose by nasogastric route (if intravenous access is difficult).
- Provide heat using radiation (overhead warmer), or
- Conduction (skin contact) or
- Convection (heat convector).
- Avoid rapid rewarming, monitor temperature every 30 minutes.
- Give warm feeds immediately, if clinical condition allows the child to take orally, else administer the feeds through a nasogastric tube. Start maintenance IV fluids (prewarmed), if there is feed intolerance/contraindication for nasogastric feeding.
- Rehydrate using warm fluids immediately, when there is a history of diarrhea or there is evidence of dehydration.
- Start intravenous anitibiotics.

Do not use hot water bottles due to danger of burning fragile skin.

Treatment of dehydration in the children with SAM, without shock.
Give oral rehydration solution as follows, in amounts based on the child's weight :

How often to give ORS*	Amount to give
Every 30 minutes for first 2 hours	5 ml/kg weight
Alternate hours for up to 10 hours	5-10 ml/kg**

** Reduced osmolarity ORS is used ; add 15 ml of potassium chloride to one litre ORS (15 ml contains 20 mmol/L of potassium)*

*** The amount offered should be based on child's willingness to drink and amount of ongoing losses in stool.*

- Starter diet is given in alternate hours (eg. 2, 4, 6) with reduced osmolarity ORS (eg. 3, 5, 7) until the child is rehydrated.

Signs to check every half hour for the first two hours, then hourly :

- Respiratory rate
- Pulse rate
- Urine frequency
- Stool or vomit frequency
- Stool of hydration

Signs of over hydration :

- Increased respiratory rate and pulse. (Both must increase to consider it a problem – increase of pulse by 15 & respiratory rate by 5)
- Jugular veins engorged
- Puffiness of eye

Stop ORS if any of the above mentioned signs appear.

Signs of improved hydration status (any 3 of following) :

- Child is no longer thirsty
- Child is less lethargic
- Slowing of respiratory and pulse rates from previous high rate
- Skin pinch is less slow
- Child has tears

If diarrhoea continues after rehydration, give ORS after each loose stool to replace ongoing losses :

- For children less than 2 years, give approximately 50 ml after each loose stool
- For children 2 years and older, give 100ml after each loose stool

Breast feeding is continued with increased frequency if the child is breastfed.

Management of severely acute malnourished child, with shock

A severely malnourished child is considered in shock if s/he is:

- Lathargic or unconscious and
- Has cold hands

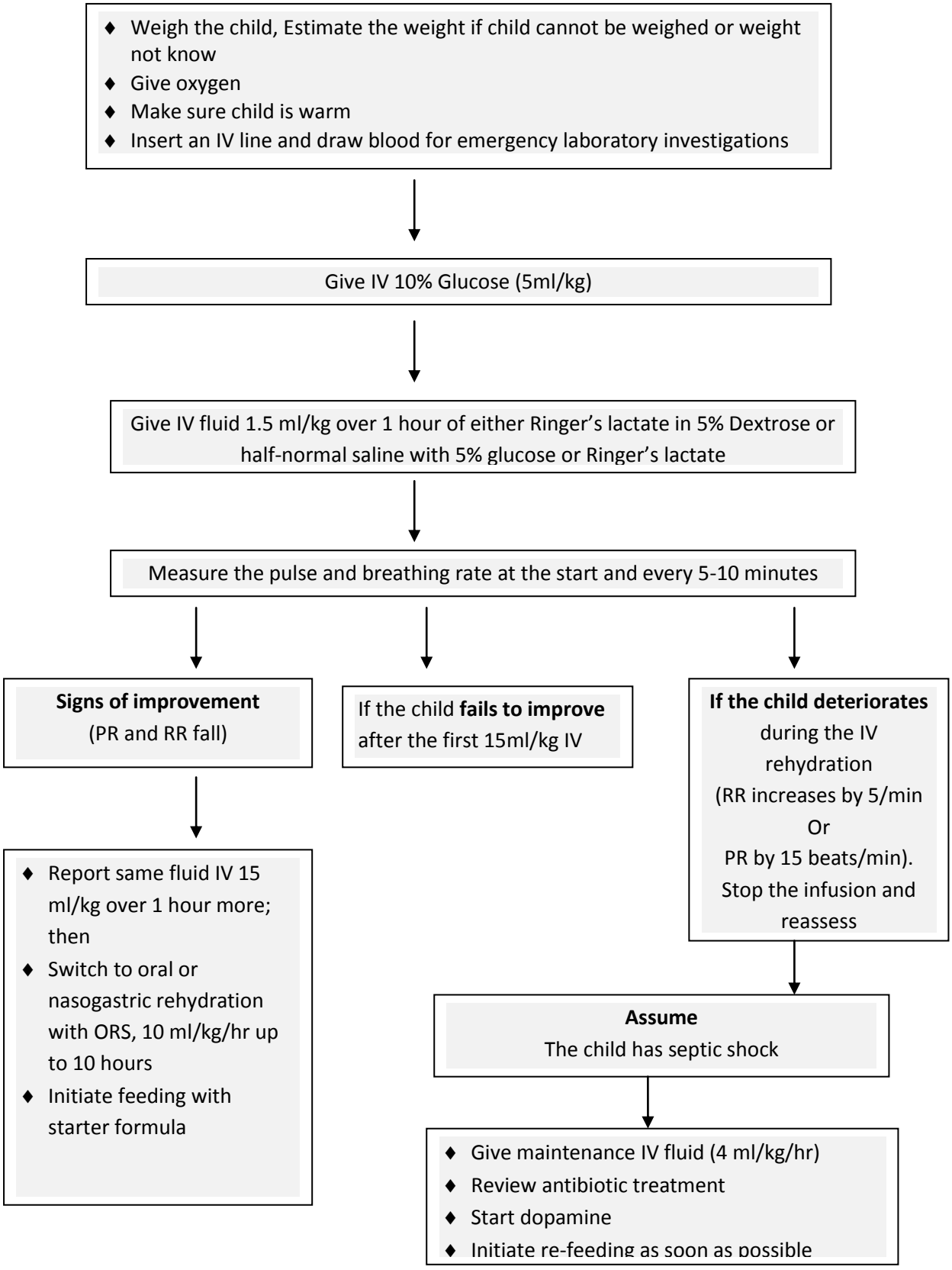
Plus either:

- Show capillary refill (more than 3 seconds)

  Or

- Weak or fast pulse

Give this treatment only if the child has signs of shock and is lethargic or has lost consciousness



Correction of electrolyte imbalance

- Normally the body uses energy to maintain appropriate balance of potassium inside the cells and sodium outside the cells.
- In severely malnourished children the level of sodium in the cells rises and potassium leaks out due to reductive adaptation.
- Therefore all severely malnourished children should be given potassium to make up for what is lost.
- Magnesium is essential for potassium to enter the cells and be retained. Malnourished children already have excess sodium in their cells, so sodium intake should be restricted.

In order to correct electrolyte imbalance:

- Give supplemental potassium at 3-4 meq/kg/day for at least 2 weeks. Potassium can be given as syrup potassium chloride; the most common preparation available has 20meq/15ml. It should be diluted with water.
- One day 1, give 50% magnesium sulphate IM once (0.3 ml/kg) up to a maximum of 2 ml. Thereafter, give extra magnesium (0.4 – 0.6 mmol/kg/daily) orally. If oral commercial preparation is not available you can give injection magnesium sulphate (50%); 0.2-03 ml/kg orally as magnesium supplements mixed with feeds. Give magnesium supplements for 2 weeks.
- Give food without added salt to avoid sodium overload.

Do not treat oedema with diuretics

Treatment of infections

If the child appears to have no complication give :

- Oral amoxicillin 15mg/kg 8-hourly for 5 days

If child has complications (eg; septic shock, hypoglycaemia, hypothermia, skin infections or dermatosis, respiratory or urinary tract infections, or lethargic/sickly appearance), select antibiotic as shown in the table below :

Status	Antibiotics
All admitted cases with any complication other than shock, meningitis or dysenterly	♦ Inj. Ampicillin 50 mg/kg/dose 6 hrly and Inj. Gentamicin 7.5 mg/kg once a day for 7 days ♦ Add Inj. Cloxacillin 100 mg/kg day 6 hrly if staphylococcal infection is suspected ♦ Revise therapy based on sensitivity report
For septic shock or worsening/no improvement in initial hours	♦ Give third generation cephalosporins like Inj. Cefotaxime 150 mg/kg/day in 3 divided doses or Ceftriaxone 100 mg/kg/day in 2 divided doses along with Inj. Gentamicin 7.5 mg/kg in single dose. ♦ Do not give second dose until child is passing urine.
Meningitis	♦ IV Cefetaxime 50mg/kg/dose 6hrly or Inj. Ceftriaxone 50 mg/kg 12 hrly plus Inj. Amikacin 15 mg/kg/day divided in 8 hrly doses.
Dysentery	♦ Give Ciprofloxacin 15mg/kg in two divided doses per day for 3 days. If child is sick or has already received ciprofloxacin, give Inj. Ceftriaxone 100 mg/kg once a day or divided in 2 doses for 5 days.

Duration of antibiotic therapy depends on the diagnosis i.e.

- Suspicion of clinical sepsis : at least 7 days
- Urinary tract infection : 7-10 days
- Culture positive sepsis : 10-14 days
- Meningitis : at least 14-21 days

Deep seated infections like arthritis and osteomyelitis : at least 4 weeks.

- If clinical condition does not improve after 5 days of antibiotics treatment, reassess the child (check for sites of infection and potentially resistant organisms) and take appropriate measures. If there is partial improvement after 5 days, complete a full 10 day course.

Micronutrient supplementation

- Vitamin A : Give Vitamin A in a single dose to all SAM children unless there is evidence that child has received vitamin A dose in last 1 month.

Recommended oral dose of Vitamin A according to child's age

Age	Vit. A dose
< 6 months	50 000 IU
6-12 months or if weight < 8 Kg	100 000 IU
> 12 months	200 000 IU

- Give same dose on Day 1, 2 and 14 if there is clinical evidence of vitamin A deficiency.
- Children more than twelve months but having weight less than 8 kg should be given 100,000 IU orally irrespective of age.
- Oral treatment with vitamin A is preferred, except for initial treatment of. For oral administration, an oil-based formulation is preferred.
- IM treatment should be used in children with severe anorexia, oedematous malnutrition, or septic shock. Only water-based formulations and half of oral dose should be used.

Other micronutrients should be given daily for at least 2 weeks :

- **Multivitamin supplement** (should contain vitamin A, C, D, E and B 12 and not just vitamin B-complex): Twice Recommended Daily Allowance.
- **Folic acid :** 5 mg on day 1, then 1 mg/day
- **Copper:** 0.3 mg/kg/day (if separate preparation not available use commercial preparation containing copper).

Iron: Start daily iron supplementation after two days of the child being on Catch up diet. Give elemental iron in the dose of 3 mg/kg/day in two divided doses, preferably between meals. (Do not give iron in stabilization phase).

Feeding child with SAM

Cautious feeding in stabilization phase

- Feeding should begin as soon as possible after admission with 'Starter diet' until the child is stabilized.
- This is a phase when the child recovers normal metabolic function and nutrition-electrolytic balance and but there is NO weight gain. Severely malnourished children cannot tolerate usual amounts of protein and sodium at this stage, or high amounts of fat. Starter diet is low in protein and sodium and high in carbohydrate, which is more easily handled by the child and provides much-needed glucose. Contains 75 kcal and 0.9 g protein per 100ml.
- Give starter formula, calculating the required daily amount for each child using Starter diet.
- Give 8-12 feeds over 24 hours.
- If the child has gross oedema, reduce the volume to 100 ml/kg/day
- If the child has poor appetite, coax and encourage the child to finish the feed. If eating 80% or less of the amount offered use a nasogastric tube. If in doubt, see feed chart for intakes below which tube feeding is needed.
- Keep a 24 hour intake chart. Measure feeds carefully. Record leftovers.
- If the child is breastfed, ecourage continued breastfeeding but also give starter formula.
- Transfer to starter formula as soon as appetite has returned (usually within one week) and oedema has been lost or is reduced.

Weight daily and plot weight.

Catch up growth in rehabilitation phase

Feeding for catch up growth

Catch-up diet is started to rebuild wasted tissues once the child is stabilized. Catch-up diet contains more calories and protein: 100 kcal and 2.9 g protein per 100 ml. During this phase there is rapid weight gain.

- Change to catch-up diet: For 2 days, replace starter formula with the same amount of catch-up diet; on the next day increase each feed by 10ml until some feed remains uneaten.
- Give 8 feeds over 24 hours. These can be 5 feeds of catch-up diet and 3 specially modified family meals, high in energy and protein.
- Encourage the child to eat as much as possible, so the child can gain weight rapidly. If the child is finishing everything, offer more and increase subsequent feeds. Make sure that the child is actively fed.
- Weigh daily and plot weight.

Note: Children with SAM require Starter diet (also called F-75 diet) followed by catch-up diet (also called F-100) for promotion of weight gain as well as functional and immunological recovery. F-75 and F-100 refers to the specific combination of calories proteins, electrolytes and minerals that should be delivered to children with SAM as per WHO guidelines made available for this purpose. These diets can be prepared using locally available products.

Prepare for discharge and follow up

The average stay in a hospital setting varies between 10 to 15 days (but can be longer), depending on each child's medical recovery. However the child requires follow up for another 4 – 6 months for full recovery, depending upon the child's progress at home. Therefore parent/caregivers must be prepared for discharge and follow up.

- Before being discharged from the facility, child must become accustomed to eating family meals. While the child is in the ward, gradually reduce and eventually stop the feeds of Catch-up diet, while adding or increasing the mixed diet of home foods, until the child is eating as s/he will eat at home.
- Ensure that parent/caregiver understands the causes of malnutrition and how to prevent its recurrence by following correct breastfeeding and feeding practices (frequent feeding with energy and nutrient dense foods).
- Treatment for helminthic infections should be given to all children before discharge. Give a single dose of any one of the following antihelminthics orally :

  200 mg. albendazole for children aged 12-23 months, 400 mg albendazole for children aged 24 months or more.

  100 mg mebendazole twice daily for 3 days for children aged 24 months or more.
- Before discharge inform the ANM posted at the nearest PHC or sub-centre in order to ensure follow up. All SAM children should be followed up by health providers in the program till s/he reaches weight-for-height of -1 SD.
- Make a plan with the parent for follow-up visits. Regular check-ups should be made at 2 weeks in first month and then monthly thereafter until weight for height reaches – 1 SD or above. If a problem is detected or suspected, visit/s can be made earlier or more frequently until the problem is resolved.

Management of SAM children less than 6 months of age

- Initial steps of management i.e. hypoglycemia, hypothermia, dehydration, infection septic shock are same as for older children.
- Feed the infant with appropriate milk feeds for initial recovery and metabolic stabilization. Wherever possible breastfeeding or expressed milk is preferred in place of Starter diet. If the production of breast milk is insufficient initially, combine expressed breast milk and non-cereal Starter diet initially. For non-breastfed babies, give Starter diet feed prepared without cereals.
- Provide support to re-establish breastfeeding as soon as possible. Support and help to express breast milk if the infant is too weak to suckle.
- Give supplementary milk feeds if breast milk is not enough or if breastfeeding is not possible or mother is HIV+ve and has opted for replacement feeds.
- Give good diet and micronutrient supplements to the mother.
- In the rehabilitation phase, provide support to mother to give frequent feeds and try to establish exclusive breast feeding. In artificially fed without any prospects of breastfeeds, the infant should be given diluted Catch-up diet. [Catch-up diet diluted by one third extra water to make volume 135 ml in place of 100 ml].
- On discharge the non-breastfed infants should be given locally available animal milk with cup and spoon. The infant formulas are very expensive and should only be advised if the parents can afford this.
- Discharge the infant from the facility when gaining weight for 5 days and has no medical complications.

Relactation through Supplementary Suckling Technique – Supplementary Suckling Technique (SST) is a technique which can be used as strategy to initiate relactation in mothers who have developed lactation failure.

Management of SAM in HIV exposed/HIV infected and TB infacted children

- SAM may occur in children who are HIV exposed/HIV infected. Basic principles & step of management is same as described earlier.
- Treatment of malnutrition should be started at a minimum two weeks before the introduction of anti-retroviral drugs and other long term treatment to diminish the risk of serious side effects. Preferably anti-retroviral treatment should be delayed until the recovery phase is well established.
- Children with HIV should be given co-trimoxazole prophylaxis against pneumocystis pneumonia. This is inadequate antibiotic cover for the severely malnourished patient; amoxicillin should be given in addition to prophylactic doses of co-trimoxazole.
- Once SAM is being treated satisfactorily, treatment for HIV and/or TB (as indicated) should be started; national guidelines are to be followed.
- Cotrimoxazole prophylaxis is to be continued as per NACO guidelines.
    - For severe pneumonia in HIV infected children give adequate anti-staphylococcal and gram-negative antibiotic coverage (e.g. ampicillin and gentamicin).
    - For pneumonia with severe hypoxia, consider Pneumocystis pneumonia. Add high-dose cotrimoxazole (trimethoprim 5 mg/kg/dose, sulfamethoxazole 25 mg/kg/dose) 6-hrly for 3 weeks.

Feeding recommendations as per IMNCI

Guidelines			
Up to 6 months	**6 to 12 months**	**12 months – 2 years**	**2 years and older**
♦ Breast feed as often as the child wants, day and night, at least 8 times in 24 hours. ♦ Do not give any other foods or fluids not even water.	Breast feed as often as the child wants. ♦ Give at least one katori serving* at a time : - Mashed roti/ rice/bread/biscuit mixed in sweetened undiluted milk **OR** - Mashed roti/rice/ bread mixed in thick dal with added ghee/oil or khichri with added oil/ghee. Add cooked vege-tables also in the servings. **OR** - Sevian/dalia/halwa/kheer prepared in milk or any cereal porridge cooked in milk **OR** - Mashed boiled/fried potatoes ♦ Also give nutritious food between meals, such as; banana/biscuit/cheeko/mango/papaya as snacks *3 times per day if breast feed; 5 times per day if not breast feed.	♦ Breast feed as often as the child wants ♦ Offer food from the family pot ♦ Give at least $1^{1}/_{2}$ katori serving* at a time of : - Mashed roti/rice/bread mixed in thick dal with added ghee/oil or khichri with added oil/ghee. Add cooked vegetables also in the servings **OR** - Mashed roti/rice/ bread/biscuit mixed in sweetened undiluted milk **OR** - Sevian/dalia/halwa/ kheer prepared in milk or any cereal porridge cooked in milk **OR** - Mashed boiled/fried potatoes ♦ Also give nutritious food between meals, such as: banana/biscuit/ cheeko/mango/papaya as snacks *5 times per day	♦ Give family foods at 3 meals each day. ♦ Also twice daily, give nutritious food between meals, such as: banana/biscuit/ cheeko/mango/papaya as snacks.
Remember ♦ Continue breastfeeding if the child is sick	**Remember** ♦ Keep the child in your lap and feed with your own hands ♦ Wash your own and child's hands with soap and water every time before feeding	**Remember** ♦ Ensure that the child finishes the serving ♦ Wash your child's hands with soap and water every time before feeding	**Remember** ♦ Ensure that the child finished the serving ♦ Teach your child to wash hands with soap and water every time before feeding

8. ACUTE BRONCHIAL ASTHMA

- Acute exacerbation of asthma can be defined as episodes of coughing (particularly at night/early morning), wheezing, breathlessness or chest tightness associated with widespread, but variable, airflow obstruction within the lung than is often reversible either spontaneously or with treatment.

Table : Differential diagnosis of wheezing in childhood

1. Infection
   - A. Viral
     - Respiratory syncytial virus/bronchiolitis
     - Parainfluenza, Influenza, Adenovirus, Rhinovirus, Human metapneumovirus
   - B. Bacterial pneumonia
   - C. Chlamydia
2. Asthma
3. Aspiration syndromes[#]
   - Gastro-esophageal reflux disease (GERD)
4. Heart disease[#]
5. Anatomic abnormalities[#]
   - A. Extrinsic airway anomalies
     - Vascular ring/sling
   - B. Intrinsic airway anomalies
     - Airway hemangioma
     - Cystic adenomatoid malformation
     - Bronchial lung cyst
     - Congenital lobar emphysema
     - Sequestration of lung
     - Mediastinal lymph node/tumor/TB lymphadenitis
   - C. Malacia of larynx, trachea, or bronchi
6. Foreign body
7. Anaphylaxis
8. Inhalational injuries (burns)
9. Mucociliary clearance disorder[#]
   - Cystic fibrosis
   - Primary ciliary dyskinesia
   - Bronchiectasis

Entities marked # are causes of recurrent wheeze

Table Clinical asthma severity score[#]

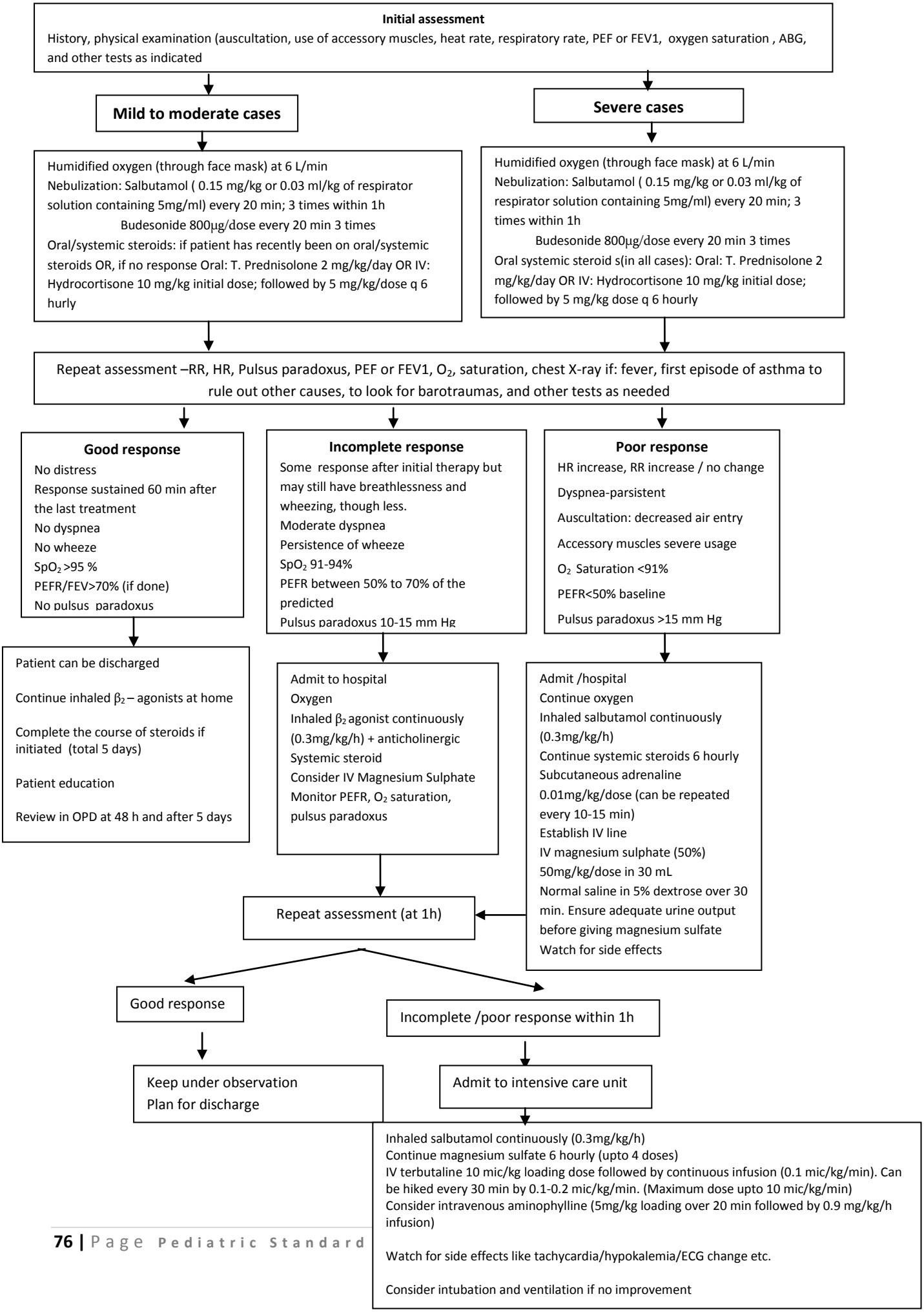
Score	RR	Room air saturation[b]	Auscultation (wheeze	Retractions[c]	Dyspnea
0	<30	97-100	None	None	None
1	31-45	94-96	End expiration	+/-	Full sentences
2	46-60	91-93	All expiration	++	Partial sentences
3	>60	<91	Inspiration and Expiration without stethoscope	+++	Single word/grunt

a. Maximum score is 15. This score should be used for initial assessment and to monitor the response to therapy. Generally the severe cases will have a high score (i.e. >7).
b. Off oxygen for 5 min or until saturation drops less than 91%.
c. Subjective assessment

Table Assessment severity

Parameter[a]	Mild	Moderate	Severe	Imminent respiratory arrest
Breathless	Walking	Talking(infant-shorter cry/difficult feeding);	At rest (infant will stop feeding)	
	Can lie down	Prefers sitting	Hunched forward	
Talks in	Sentences	Phrases	Words	
Alertness	May be agitated	Usually agitated	Usually agitated	Drowsy/confused
Respiratory rate	Increased	Increased	Increased	
Accessory musclesand Suprasternal retractions	Usually not	Usually	Usually	Paradoxical movement
Wheeze	Moderate (end expiration)	Loud	Usually loud	Absence of wheeze
Pulse/min	<100	100-120	>120	Bradycardia
Pulsus paradoxus (mm Hg)	Absent (<10)	10-25	>25	Absence suggests respiratory muscle fatigue
PEER (after bro-Nchodilator)	>80%	60-80%	<60%	
PaO_2 on room air and/or	Normal	>60	<60	
$PaCO_2$ (mm Hg)	(need not be tested)	<45	>45	
Saturation	>95%	91-95%	90% or less	

Other presence of several parameters, but necessarily all, indicate the severity of attack.


Initial assessment
History, physical examination (auscultation, use of accessory muscles, heat rate, respiratory rate, PEF or FEV1, oxygen saturation , ABG, and other tests as indicated
Mild to moderate cases
Severe cases
Humidified oxygen (through face mask) at 6 L/min
Nebulization: Salbutamol (0.15 mg/kg or 0.03 ml/kg of respirator solution containing 5mg/ml) every 20 min; 3 times within 1h
Budesonide 800µg/dose every 20 min 3 times
Oral/systemic steroids: if patient has recently been on oral/systemic steroids OR, if no response Oral: T. Prednisolone 2 mg/kg/day OR IV: Hydrocortisone 10 mg/kg initial dose; followed by 5 mg/kg/dose q 6 hurly
Humidified oxygen (through face mask) at 6 L/min
Nebulization: Salbutamol (0.15 mg/kg or 0.03 ml/kg of respirator solution containing 5mg/ml) every 20 min; 3 times within 1h
Budesonide 800µg/dose every 20 min 3 times
Oral systemic steroid s(in all cases): Oral: T. Prednisolone 2 mg/kg/day OR IV: Hydrocortisone 10 mg/kg initial dose; followed by 5 mg/kg dose q 6 hourly
Repeat assessment –RR, HR, Pulsus paradoxus, PEF or FEV1, O2, saturation, chest X-ray if: fever, first episode of asthma to rule out other causes, to look for barotraumas, and other tests as needed
Good response
No distress
Response sustained 60 min after the last treatment
No dyspnea
No wheeze
SpO2 >95 %
PEFR/FEV>70% (if done)
No pulsus paradoxus
Incomplete response
Some response after initial therapy but may still have breathlessness and wheezing, though less.
Moderate dyspnea
Persistence of wheeze
SpO2 91-94%
PEFR between 50% to 70% of the predicted
Pulsus paradoxus 10-15 mm Hg
Poor response
HR increase, RR increase / no change
Dyspnea-parsistent
Auscultation: decreased air entry
Accessory muscles severe usage
O2 Saturation <91%
PEFR<50% baseline
Pulsus paradoxus >15 mm Hg
Patient can be discharged
Continue inhaled β2 – agonists at home
Complete the course of steroids if initiated (total 5 days)
Patient education
Review in OPD at 48 h and after 5 days
Admit to hospital
Oxygen
Inhaled β2 agonist continuously (0.3mg/kg/h) + anticholinergic
Systemic steroid
Consider IV Magnesium Sulphate
Monitor PEFR, O2 saturation, pulsus paradoxus
Admit /hospital
Continue oxygen
Inhaled salbutamol continuously (0.3mg/kg/h)
Continue systemic steroids 6 hourly
Subcutaneous adrenaline 0.01mg/kg/dose (can be repeated every 10-15 min)
Establish IV line
IV magnesium sulphate (50%) 50mg/kg/dose in 30 mL
Normal saline in 5% dextrose over 30 min. Ensure adequate urine output before giving magnesium sulfate
Watch for side effects
Repeat assessment (at 1h)
Good response
Incomplete /poor response within 1h
Keep under observation
Plan for discharge
Admit to intensive care unit
Inhaled salbutamol continuously (0.3mg/kg/h)
Continue magnesium sulfate 6 hourly (upto 4 doses)
IV terbutaline 10 mic/kg loading dose followed by continuous infusion (0.1 mic/kg/min). Can be hiked every 30 min by 0.1-0.2 mic/kg/min. (Maximum dose upto 10 mic/kg/min)
Consider intravenous aminophylline (5mg/kg loading over 20 min followed by 0.9 mg/kg/h infusion)
Watch for side effects like tachycardia/hypokalemia/ECG change etc.
Consider intubation and ventilation if no improvement

Indication for Transfer to tertiary care centre

1. Any child with signs of life-threatening attack
2. If the child has been receiving therapy in emergency department for a few hours and has shown poor response.
3. Development of clinical signs of respiratory failure such as persisting hypoxemia, exhaustion or change in the level of consciousness.

Treatment that are not Recommended in the Emergency Care

- Antibiotics (except as needed for co-morbid conditions)
- Aggressive hydration
- Chest physical therapy
- Mucolytics
- Sedation

Discharge Advice

- MDI with spacer (ensure proper technique)
- A course of oral steroids (1-2 mg/kg) if steroids have been used during the treatment of acute episode (total duration 5 days).
- Health education/counseling.

9. Pneumonia

- Pneumonia is an inflammation of the parenchyma of the lungs. Although most cases of pneumonia are caused by micro-organisms, noninfections causes include aspiration of food or gastric acid, foreign bodies, hydrocarbons, and lipoid substances, hypersensitivity reactions, and drug or radiation-induced pneumonitis.
- The World Health Organization (WHO) has defined pneumonia solely on the basis of clinical findings obtained by visual inspection and counting the respiratory rate, for developing countries.
- **Table** show the age-specific criteria used to define pneumonia. The clinical features of pneumonia include cough. Increased respiratory rate, chest indrawing, stridor and altered sensorium.

Table WHO age specific criteria for tachypnea

Age	Approximate normal respiratory rate (breaths/min)	Tachypnea threshold (breaths/min)
2-12 months	25-40	50
1-5 years	20-30	40
>5 years	15-25	30

Table Etiology of pneumonia in children in various age groups

Age group	Frequent pathogens (in order of frequency)
Neonates (<1 month)	*Group B streptococcus, Escherichia coli,* other gram-negative bacilli cytomegalo virus *Streptococcus pneumonia, Haemophilus influenzae (type b) are uncommon*
1-3 months febrile pneumonia	Respiratory syncytial virus, other respiratory viruses (parainfluenza virus, influenza viruses, adenoviruses), *S pneumoniae , H. influenzae (type b)*
Afebrile *pneumonia*	*Chlamydia trachomatis, Mycoplasma hominis,* Ureaplasma *urealyticum,* cytomegalovirus
3-12 months	Respiratory syncytial virus, other respiratory viruses (parainfluenza viruses, Influenza viruses, adenoviruses), *S pneumoniae , H. influenzae (type b) , C. trachomatis, Mycoplasma pneumoniae ,* Group A streptococcus, *Staph. aureus*
2-5 years	Respiratory viruses (parainfluenza viruses, influenza viruses, adenovirus), *S Pneumonia, H. influenzae (type b), Staph. aureus, M. pneumonia,* C. pneumoniae, Group A streptococcus
5-18 years	*M. pneumoniae, S. pneumoniae, C. pneumoniae,* H. influenza viruses (type b), adenoviruses, other respiratory viruses

Table WHO criteria for severity assessment child age 2 months to 5 years

Severity classification	Clinical features
Very severe pneumonia	Not able to drink Convulsion Abnormally sleepy or difficult to awake Severe malnutrition Central cyanosis
Sever pneumonia	Lower chest indrawing Grunting Cyanosis
Pneumonia (not severe)	Fast breathing (>age specific threshold) No chest in-drawing
Cough and cold (no pneumonia)	No fast breathing No chest in-drawing

Investigations

i . Chest radiography (CXR): Chest radiographs are not needed routinely in all children with suspected pneumonia. Specific indications include:

1 . When the diagnosis is in doubt (bronchiolitis, asthma, development malformation, foreign body inhalation, aspiration pneumonia etc.)
2 . Asymmetrical findings on chest examination
3 . Suspected complications of pneumonia (pleural effusion, empyema, lung abscess etc.)
4 . Known case of recurrent chest infection (asthma, cystic, fibrosis, immunodeficiency etc.)
5 . Severe and very severe pneumonia.

Findings to be looked for in chest radiograph include:

- Parenchymal infiltrates (evidence of consolidation)
- Features of atypical pneumonia (bilateral streaky infiltrate)
- Presence of pneumonia
- Any evidence of foreign body inhalation

ii. Arterial blood gas (ABG). The indications are:

1. Severe and very severe pneumonia.
2. Hypoxemia on pulse oxymetry (Spo_2 <94% on 40% oxygen)
3. shock

Baseline Stabilization

- A-Airway assessment
- B-Breathing
- C-Circulation
- Resuscitation if required as per the Pediatric Assessment Triangle and Primary Assessment
- O_2 inhalation by nasal prongs, at flow rate 1-5 1/min (depending on age) if child has lower chest wall indrawing or SpO_2 $\leq$92% Oxygen can be effectively delivered by any

low-flow delivery method; therefore the specific delivery device (nasal prongs, face mask, nasal catheters etc.) are more a matter of personal/institutional choice.

- First dose of antibiotic as early as possible; preferably after obtaining a sample for blood culture. However, administration of the first dose should not be delayed for this.
- Hydration (intravenous or nasogastric tube feed)
  i. If child is accepting orally well-allow orally (adlibitum)
  ii. If not accepting well orally (but feeding not contraindicated)-Nasogastric or orogastric feed can be started
  iii. Start 0.45 Saline in 5% dextrose as 2/3rd to 3/4th maintenance if there is respiratory distress (where feed cannot be started) or underlying dehydration or ongoing losses through vomiting etc.
- Treatment of other emergent co-morbidities
  i. Hypoglycemia
  ii. Electrolyte imbalance

Hospitalization

The indications for hospitalization are:

- Age <2 months
- Severe and very severe pneumonia (as per WHO definition)
- Signs of shock
- Hypoxemia (requirement for supplemental oxygen)
- Moderate to severe malnutrition because it increases the risk of mortality
- Recurrent chest infection (cardiopulmonary disease, anatomical defects in airway, neurological disease)
- Immunocompromised state
- Not accepting orally, dehydration, vomiting
- No response or increased severity (treatment failure) on appropriate oral antibiotic therapy
- Family unable to provide appropriate care at home.

Other Investigations in Hospitalized Patients

- Hemogram with total and differential leukocyte count
- Serum electrolytes and renal function test
- Blood culture: These are positive in 10%-20% of children with pneumonia
- Other diagnosis investigations:
  In atypical pneumonia: Serology- RSV, Mycoplasma, Chlamydia CMV serology (if suspected like immune-compromised and TORCH group of infection)
- Atypical H1N1 (swine flu) testing during epidemics
- CSF (if feasible) in case of
  i. Newborns
  ii. Infants presenting with altered sensorium

iii. Seizures

Antibiotic Treatment

Choice of Antibiotics

The choice of first-line antibiotics therapy is guided by:

- Age of the child
- Severity of pneumonia
- Associated clinical features suggesting specific etiology e.g. pustules suggesting Staphylococcal infection
- Immune-suppressed or immunocompromised state (such as post-measles state)
- Underlying chronic lung disease e.g. cystic fibrosis
- Radiographic pointers towards a specific etiology (necrotizing pneumonia, pneumatoceles suggest Staphylococcal infection; parahilar streaky infiltrates are more common in atypical pneumonia.)
- Presence of complication such as pneumothorax/empyema.

Treatment of Non-severe Pneumonia (at home)

- Non-severe pneumonia can be treated at home with oral antibiotics in most cases.
- Amoxicillin (50 mg/Kg/day) in 2 divided doses for 3-5 days
- Advise to return immediately if the child develops lower chest indrawing, is unable to drink/feed, is excessively sleepy or sick looking.
- Follow-up after 2 days
    - Check the child for general danger signs such as inability to suck/drink, impaired sensorium, convulsions, grunting, cyanosis.
    - Assess the child for cough and difficult breathing
    - Ask: Is the child breathing slower? Is there less fever? Is the child eating better?
    - If the answer to above questions is **Yes,** complete 3-5 days of amoxicillin
    - If the child has persistent raised respiratory rate but no indication for admission, change to Amoxicillin-clavulanic acid (80-90 mg/kg of amoxicillin) in 2 divided doses for 5 days or add Azithromycin 5 mg/kg for 5 days if clinical and radiological features suggest atypical pneumonia. Cloramphenicol is a less desirable second line agent for non severe pneumonia because of its potential for bone marrow toxicity.
    - If lower chest indrawing or a general danger sign appears, **hospitalize urgently** for treatment as severe/very severe pneumonia

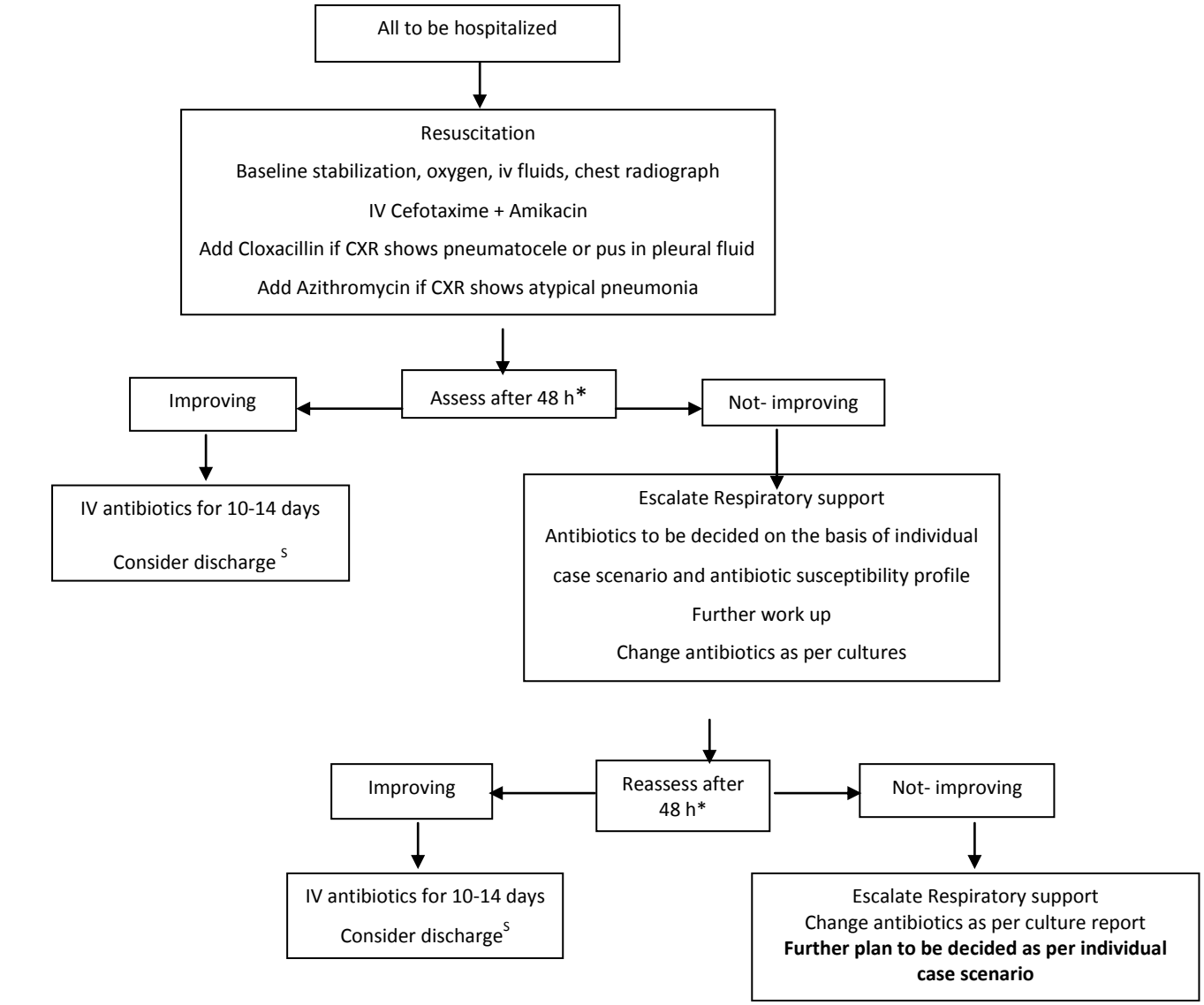
Treatment Failure in Non-severe Pneumonia ***Table***

A systemic assessment should be done for children who have failed therapy for non-severe pneumonia. Treatment failure is defined as follows.

- Persistently raised respiratory rate at 72 h
- Danger sign at any time during the illness, such as inability to suck/drink, impaired sensorium, convulsions, grunting, cyanosis.
- Development of lower chest-wall indrawing
- Central cyanosis

Table Potential reasons for treatment failure for WHO defined non-severe pneumonia and possible solutions

Reasons for treatment failure	Possible intervention
Common	
Reactive airway disease/asthma	Admission and brounchodilator therapy
Viral infection	Observation in hospital
Malnutrition	Hospitalization and nutritional rehabilitation
Malaria (in endemic region)	Hospitalization, blood smear exam and antimalarials
Uncommon	
Anemia	Hospital assessment
Cardiac disease	Hospital assessment
Tuberculosis	Hospital assessment and anti tuberculous durgs
Foreign body	Hospital assessment, bronchoscopy
Empyema, abscess	Hospital assessment, radiography and drainage
Pulmonary maldevelopment	Hospital assessment
Non- susceptible organism	Appropriate antibiotics
HIV/AIDS	Hospital assessment, HIV testing and anti-retrovial therapy



* Assessment involves

RR
Retraction
Saturation
General well being
Oral acceptance

\# Improvement involves [3,4]

1. Afebrile
2. ↓ RR≥ 10/min within 48 hours
3. ↓ Retraction within 72 hours
4. Saturation >92%
5. Improved general well being
6. Improved oral acceptance

S Discharge criteria

Accepting orally & normal sensorium

Afebrile for at least 48 hours

No oxygen requirement for at least 48 hours

Completely IV antibiotics

£ Alternate antibiotic options

Cloxacillin

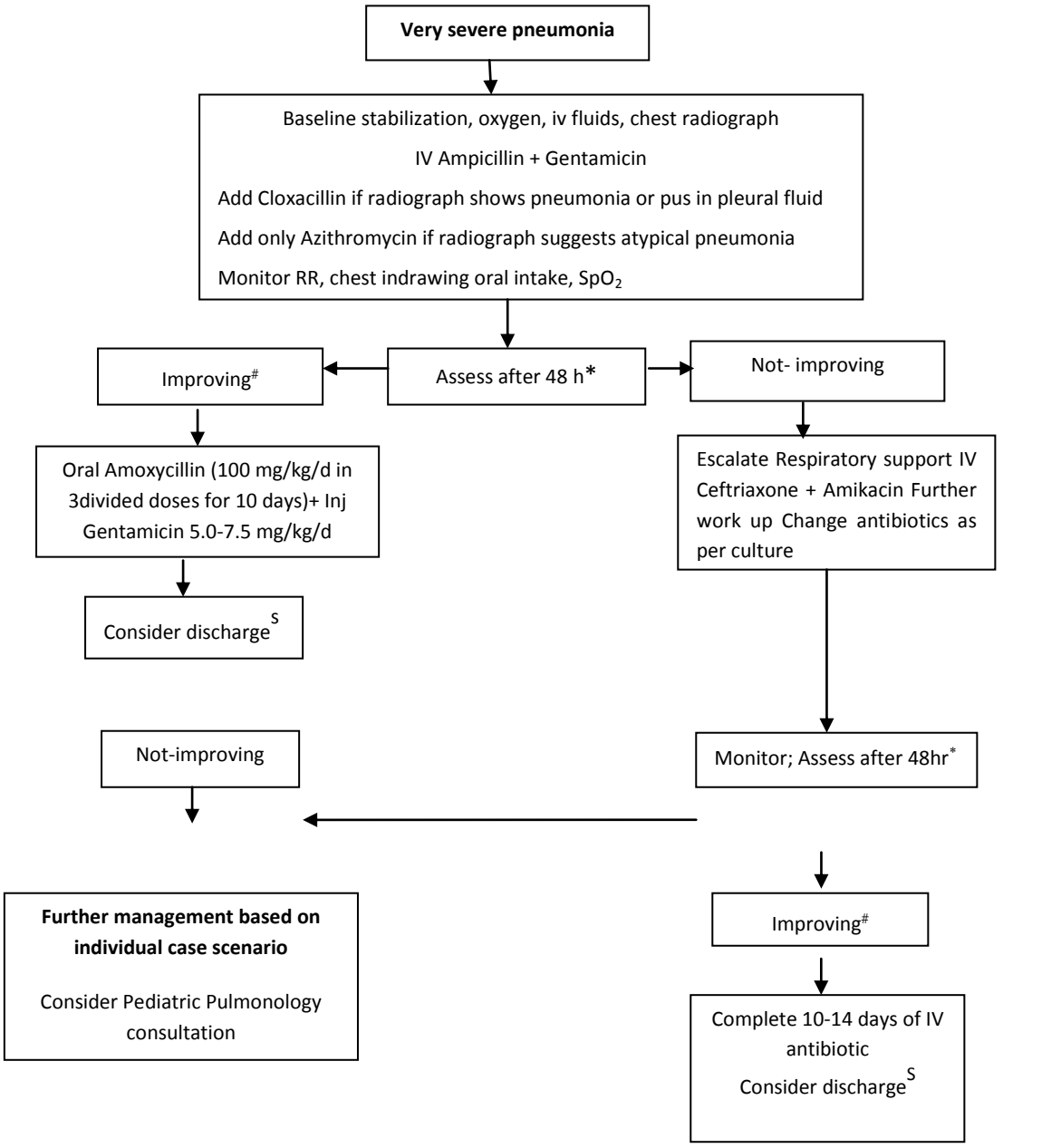
Vancomycin

± Meropenem

Cefoperazone + sulbactum

Piperacillin + tazobactum

Metronidazole



* Assessment involves

- RR
- Retraction
- Saturation
- General wall being
- Oral acceptance

Improvement involves [3, 4]

1. Afebrile
2. ↓ RR≥ 10/min within 48 hours
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4. Saturation >92%
5. Improved general well being
6. Improved oral acceptance

S Discharge criteria

Accepting orally & normal sensorium

Afebrile for at least 48 hours

No oxygen requirement for at least 48 hours

Completely IV antibiotics

Severe Pneumonia:

- Hospitalize, continue oxygen.
- Injectable ampicillin (50 mg/kg dose) iv 6 hourly.
- Ad cloxacillin (100-200 mg/kg/day) in 4 divided doses) if clinical features (presence of pustules, post meashes state, severe malnutrition, empyema) and
- Radiographic features (pneumotoceles, nectotizing pneumonia) suggest staphylococcal injection.
- Assess and monitor for oral intake/feeding, respiratory rate, chest indrawing, and oxygenation (by pulse oximetry)
- It at any time danger signs of very severe pneumonia develop treat as very severe pneumonia.
- After 48 hour-if improved continue or oral amoxicillin for 5 more days, it not improved in 48 h deteriorated: treat as very severe pneumonia

Very severe Pneumonia:

- Children with very severe pneumonia require immediate hospitalization, oxygen, injectable ampicillin plus gentamicin, and chest radiograph.
- The protocols for treatment of very severe pneumonia and pneumonia in infants are shown in Fig 1 or 2 respectively.

Special situation

- Cystic fibrosis
  - Start Anti-staphylococcal and Anti pseudomonal antibiotics in combination.
- Aspiration Pneumonia
  - Start crystalline penicillin or metronidazole

10.Diabetes Mellitus

- The usual presenting symptoms of diabetes in children are
    - Polyuria, polydipsia, blurring of vision,
    - Weight loss, in association with glycosuria and ketonuria.
- A marked elevation of the blood glucose level confirms the diagnosis,
    - if ketones are present in blood or urine
- Treatment is urgent and
- The child should be referred the same day to avoid the development of ketoacidosis .
    - The diagnosis of diabetes should not be based on a single plasma glucose concentration.
    - Diagnosis may require continued observation with fasting and/or 2 hour post-prandial blood glucose levels and/or an OGTT.

Tablet Criteria for the diagnosis of diabetes mellitus*

1. Symptoms of diabetes plus casual plasma glucose concentration $\geq$ 11.1 mmol/l (200 mg/dl)* Causal is defined by any time of day without regard to time since last meal.
   Or
2. Fasting plasma glucose $\geq$ 7.0 mmol/l ($\geq$ 126 mg/dl)+.
   Fasting is defined as no caloric intake for at least 8 hours.
   Or
3. 2 hour postload glucose $\geq$ 11.1 mmol/l ($\geq$ 200 mg/dl) during an OGTT.
   The test should be performed as described by WHO, using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water or 1.75 g/kg of body weight to a maximum of 75 g.

4. HbA_{1c} $\geq$ 6.5.
   However, there are difficulties with assay standardization and individual variation in the relationship between blood glucose and $HbA_{1c,}$ which may outweigh the convenience of this test.

- Corresponding value are
- $\geq$ 10.0 mmol/l for venous whole blood and
- $\geq$ 11.1 mmol/l for capillary whole blood and
- + $\geq$6.3 mmol/l for both venous and capillary whole blood

Prediabetes includes Impaired Glucose Tolerance (IGT) and Impaired Fasting Glyaemia (IFG)

- IGT:2 hour postload plasma glucose 7.8-11.1 mmol/l (140-199 mg/dl)
- IFG: plasma glucose 5.6-6.9 mmol/l (100-125 mg/dl)

Table Target indicators of glycemic control

Level of control	Ideal (non-diabetic)	Optimal	Suboptimal (action suggested)	High risk (action required)
Clinical assessment				
Raised BG	Not raised	No symptoms	Polyuria,polydipsia, and enuresis	Blurred vision,poor weight gain, poor growth, delayed puberty, poor school attendance, skin or genital infections, and signs of vascular complications
Low BG	Not low	Few mild an no severe hypoglycaemias	Episodes of severed hypoglycaemias (unconscious and/or convulsions)	
Biochemical assessment				
SMBG Values in mmol/l (mg/dl)				
AM fasting or Preprandial PG	**3**3.6-5.6 (65-100)	5-8 (90-145)	>8(>145)	> 9 (>162)
Postprandial PG+	4.5-7.0 (80-126)	5-10 (90-180)	10-14 (180-250)	>14 (>250)
Bedtime PG+	4.0-5.6 (80-100)	6.7-10 (120-180)	<6.7 or 10-11 (< 120-200)	< 4.4 or > 11 (<80 or >200)
Nocturnal PG+	3.6-5.6 (65-100)	4.5-9 (80-162)	<4.2 or > 9 (<75 or >162)	<4.0 or >11 (<70 or >200)
HBA_{1c} DCCT (%)				
(DCCT standardized)	< 6.05	< 7.5+	7.5-9.0+	>9.0+
IFCC (mmol/mol)	< 43	< 58	58-75	>75

BG, bloog glucose; DCCT, Diabetes Control and Complications Trial; HbA_{1c} hemoglobin A1c; PG, plasma glucose.

These targets are intended as guidelines, and each child should have their targets individually determined with the goal of achieving a value as close to normal as possible while avoiding severe hypoglycaemia as well as frequent midl to moderate hypoglycaemia.

* These populations – based target indicators must be adjusted according to individual circumstances. Different target will be appropriate for various individual such as those who have experienced severe hypoglycaemia or those with hypoglycemic unawareness.
+ These figures are based on clinical studies and expert opinion, but no strict evidence – based recommendations are available. PG levels are given because BG meters are internally calibrated to reflect the plasma glucose level.
‡ DCCT conventional adult cohort had a mean HbA_{1c} value of 8.9%, and both DCCT and EDIC have shown poor outcomes with this level; therefore, it seems prudent to recommend levels below this value.

5. Insulin storage

- Insulin must never be frozen.
- Direct sunlight or warming (in hot climates) damages insulin.

- Patients should not use insulins that have changed in appearance (clumping, frosting, precipitation, or discolouration).
- Unused insulin should be stored in a refrigerator (4-8 oC).
- After first usage, an insulin vial should be discarded after 3 months if kept at 2-8oC or 4 weeks if kept at room temperature.
- However, for some insulin preparations, manufactures recommend only 10-14 days of use in room temperature.

Guideline on insulin dosage

Insulin requirements

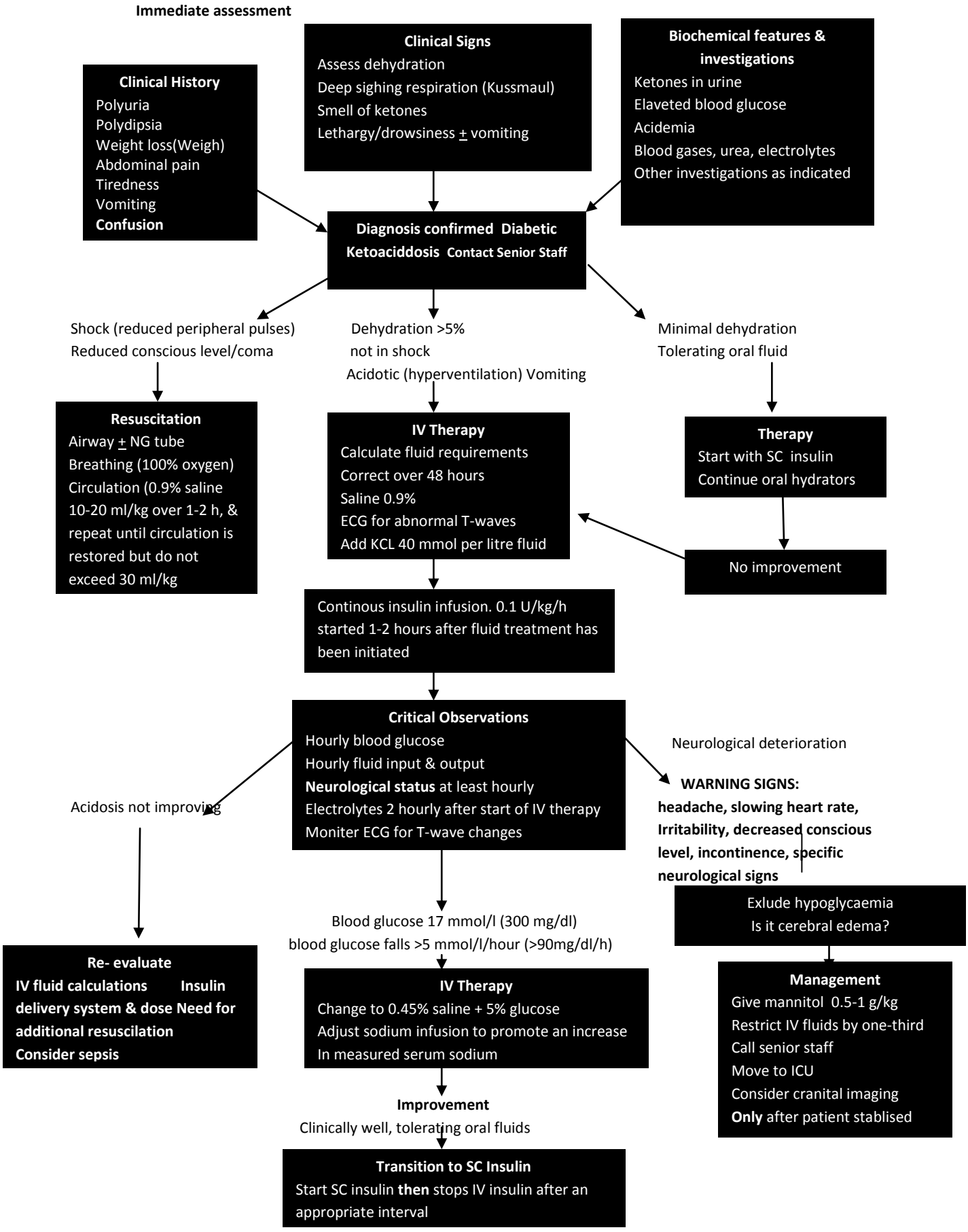
- During the partial remission phase, the total daily insulin dose is often < 0.5 U/kg/day.
- Prepubertal children (outside the partial remission phase) usually require 0.7–1.0 IU/kg/day.
- During puberty, requirements may rise substantially above 1 and even up to 2 U/kg/day.
- The "correct" dose of insulin is that which achieves the best attainable glycaemic control for an individual child or adolescent without causing abvious hypoglycaemia problems, and resulting in a harmonious growth according to children's weight and height charts.

Distribution of insulin dose

- Children on twice daily regiments often require more (around two-thirds) of their total daily insulin in the morning and less (around one-third) in the evening.
- On this regimen approximately one-third of the insulin dose may be short-acting insuliln and approximately two thirds may be intermediate-acting insulin, although these rations change with greater age and maturity of the young person.
- On basal-bolus regiments the night- time intermediateacting insulin may represent between 30 (typical for Regular insulin) and 50% (typical for rapid-acting insulin) of the total daily insulin dose. Approximately 50% as rapid-acting or 70% as Regular insulin is divided up between three to four premeal boluses. When using rapid-acting insulin for premeal boluses, the proportion of basal insulin is usually higher, as Regular insulin also provides some basal effect.
- Glargine is often given once a day, but many children may need to be injected twice a day or combined with NPH to provide daytime basal insulin coverage
- Glargine can be given before breakfast, before dinner or at bedtime with equal effect, but nocturnal hypoglycaemia occurs significantly less often after breakfast injection.
- When transferring to glargine as basal insulin, the total dose of basal insulin needs to be reduced by approximately 20% to avoid hypoglycaemia. After that, the dose should be individually tailored.

- **Detemir is most commonly given twice daily in children**.
  - When transferring to detemir from NPH, the same doses can be used to start with.

Figure immediate assessment of recommended care



11. Diabetic Ketoacidosis

Definition and Classification

- Diabetic ketoacidosis (DKA) in children is defined as hyperglycemia (serum glucose concentration >200-300 mg/dL) in the presence of metabolic acidosis (blood pH<7.3 with serum bicarbonate level <15 mEq/L) and ketonemia (presence of ketones in blood). As measurement of ketones in blood is not readily available, ketonuria is used as a marker of ketonemia.
- When measured, serum ketones (B hydroxybutyrate plus acetoacetate) exceed 31 mg/dL with or without ketonuria >80 mg/dL .
- Euglycemic ketoacidosis is observed rarely, occurring in patients with prolonged vomiting, very poor oral intake, known type 1 deabetes mellitus (TIDM) with insulin administered prior to emergency visit, and during pregnancy.
- Infrequently, adolescents with type 2 diabetes mellitus (T2DM) may present with hyperglycemic hyperosmolar state (HHS), defined by blood sugar >600 mg/dL and increased serum osmolality >320 mOsm/kg in the absence of significant acidosis or ketonuria.

The severity of DKA is defined by the degree of acidosis. *Mild DKA* is defined by venous pH between 7.2 and 7.3 or bicarbonate between 10-15 mEq/L; *moderate* by pH between 7.1 and 7.2 or bicarbonate between 5 and 10 mEq/L; and *severe* by venous pH below 7.1 or bicarbonate below 5 mEq/L.

Management of DKA

Most children with DKA require admission. Initial resuscitation should be followed by frequent clinical and biochemical monitoring.

The goal of therapy in DKA include

1. Correction of dehydration
2. Correction of acidosis and reversal of ketosis
3. Restoration of blood glucose to near normal
4. Avoiding complications of therapy, particularly cerebral edema
5. Identification and treatment of the precipitating event
6. Prevention of recurrent episodes

Table Clinical features in evaluation of a child with diabetic ketoacidosis (DKA)

History

- Polyuria, polydipsia
- Weight loss
- Nausea, vomiting, abdominal pain
- Headache
- edema

} Indicate cerebral

- Restlessness, irritability
- Lethargy, altered sensorium, loss of consciousness
- Fever (indicates consomitant infection)

Past history

- Known case of diabetes mellitus
- Recent changes in insulin dosage or regimen
- Poor compliance to insulin therapy
- Past history of DKA
- Inadequate blood sugar control in past
- Insulin discontinuation

Comorbidity

- Recent sugar, psychosocial stress
- Concomitant infection
- Eating disorder

Examination

- Fruity odor in breath (ketosis)
- Tachycardia
- Low volume pulses
- Hypotension
- Impaired skin turgor
- dehydration
- Sunken eyes

} Indicate or hypovolemia

- Delayed capillary refill time
- Absence of tears
- Weight loss (if premorbid weight known)
- Rapid deep sighing breathing, Kussmaul respiration (metabolic acidosis)
- Changes in sensorium, coma
- Bradycardia , hypertension
- Papilledema
- cerebral edema

} Indicate

- Abnormal papillary reflexes, cranial nerve palsies
- posturing: decerebrate, decorticate

Management

- *Rate of fluid administration* the total deficit should be corrected evenly over 48 h at an infusion rate not exceeding 1.5-2 times the maintenance requirements.
- One must be mindful to subtract any fluid already administered as boluses (except for resuscitation) or just prior to emergency visit.

Example We shall calculate the fluid requirement for a boy weighing 10 kg with severe DKA (assuming 10% dehydration), who received one bolus of 20 mL/kg 0.9% saline within one hour:

- Maintenance fluid requirement for 48 h = 2000 mL
- Fluid deficit (10% dehydration) =1000mL
- Subtract fluid bolus given one hr= 200 mL
- Total fluid to be administered in 47 h =2800 mL
- Therefore, fluid administration rate = 59.5 mL/h

Insulin therapy

Insulin therapy is essential to reverse the metabolic derangements like lipolysis and ketogenesis, and to normalize the blood glucose.

Timing Therapy with insulin is started after the initial volume expansion, i.e., 1-2 h after starting fluid replacement.

Type Although rapid acting subcutaneously administered insulins such as lispro and aspart are demonstrated to be effective, only intravenous regular insulin is used for management of DKA in children.

Bolus *Dose* Administration of insulin boluses is not justified. Satisfactory decrease in serum glucose is achieved with rehydration alone, and use of boluses is associated with occurrence of edema.

Dose Low dose intravenous insulin therapy at 0.1 Unit per kg per hour is the standard of care. Higher doses are associated with increased risk of hypokalemia, hypoglycemia and too rapid a decline in serum osmolality, while lower rates may be inadequate to suppress ketogenesis.

Preparation To minimize the risk of computational errors, 50 units of regular insulin is diluted in a volume of 50 mL NS to arrive at a standard insulin concentration of 1 U/mL.

Priming of Tubing Priming of tubing must be performed by flushing insulin solution through the tubing prior to infusing into the patient because insulin binds to glass bottles, plastic IV bags, syringes and tubing.

Duration of Therapy Regular insulin is administered at the same rate (0.1 U/kg/h) until the resolution of ketoacidosis, i.e., venous pH> 7.3, HCO_3 >15 mmol/L and closure of the anion gap.

Transition of Subcutaneous Insulin Therapy

- Oral fluids should be introduced only when substantial clinical improvement has occurred, metabolic acidosis has been corrected (though ketosis may persist) and the patient indicates a desire to cat.
- As oral feeds are advanced, intravenous fluids are reduced and a change to subcutaneous insulin is planned.

Timing of Switch To Subcutaneous Route

- The ideal time of begin administration of subcutaneous insulin just before a meal.
- In order to avoid rebound hyperglycemia, rapid acting insulins (lispro or aspart) are administered subcutaneously 15-30 min prior and regular insulin 1-2 h prior, to stopping insulin infusion.
- **With intermediate**- or long-acting insulin, the overlap should be longer and the IV insulin gradually lowered.
- For example for patients on a basal-bolus insulin regimen, the first dose are basal insulin may be administered in the evening and the insulin infusion is stopped the next morning.

Dose of Subcutaneous Insulin

- In patients with known insulin dependent diabetes, their usual insulin regimen may be restarted.
- For patients with DKA at disease onset, the recommended total daily dose (TDD) for pre-pubertal age is 0.75-1 units/kg and for pubertal children is 1-1.2 units/kg.
- This is conveniently administered as:

- Before breakfast: 2/3 of TDD (1/3 as rapid acting and 2/3 as intermediate acting insulin)
- Before dinner: 1/3 of TDD (1/3 as rapid acting and 2/3 as intermediate acting insulin).
    - Frequent monitoring of blood glucose is indicated (before breakfast, before lunch, before dinner and at 2 am) to prevent hypo and hyperglycemia and to adjust the insulin requirement in newly diagnosed patients.

Table Complications of DKA

- Hypoglycemia
- Hypokalemia
- Hyperchloremic acidosis
- Cerebral edema
- Inadequate venous thrombosis
- Arrhythmia
    - Secondary to dyselectrolytemia
    - Prolonged QT interval corrected for heart rate (QTc)
- Pancreatitis
- Renal failure
- Rare complications
    - Deep vein thrombosis
    - Intestinal necrosis
    - Rhabdomyolysis
    - Pulmonary edema
- Infections:
    - Mucormycosis (rhinocerebral and pulmonary)

Management of Acute Seizure, Febrile Seizure and Status Epilepticus

***Epileptic Seizure**:*

- It is a transient occurrence of signs and / or symptoms due to abnormal or excessive synchronous neuronal activity in the brain

Epilepsy:

- It is a disorder of brain characterized by an enduring predisposition to generate epileptic seizures and by the neurobiologic, cognitive, psychological and social consequence of the condition.
- The definition of epilepsy requires occurrence of atleast one epileptic seizures; generally it include two or more unprovoked seizures.

***Convulsion**:*

- Attack of involuntary muscle contractions, which may be sustained (tonic) or interrupted (clonic).

***Status epilepticus**:*

- It is a condition or prolonged seizures activity (more than 5 min) or persistent, repetitive seizures activity without recovery of consciousness in between episodes.
- Any child who is brought seizing to the emergency room should be treated as status epilepticus.

***Postictal period**:*

- It usually follows the seizures. During this time, the patient may be confused, lethargic, fatigued, or irritable; also, headache, vomiting, and muscle soreness may occur.
- In general, the length of the postictal period is proportional to the length of the seizures.

Table 1 Cause of refractory status epilepticus

Causes
• Bacterial/purulent meningitis • Encephalitis • Idiopathic epilepsy • Post-hypoxic encephalopathy • Reye's encephalopathy • Shigella encephalopathy • Intracranial bleed • Neuro metabolic disorders • Other

Febrile Seizures

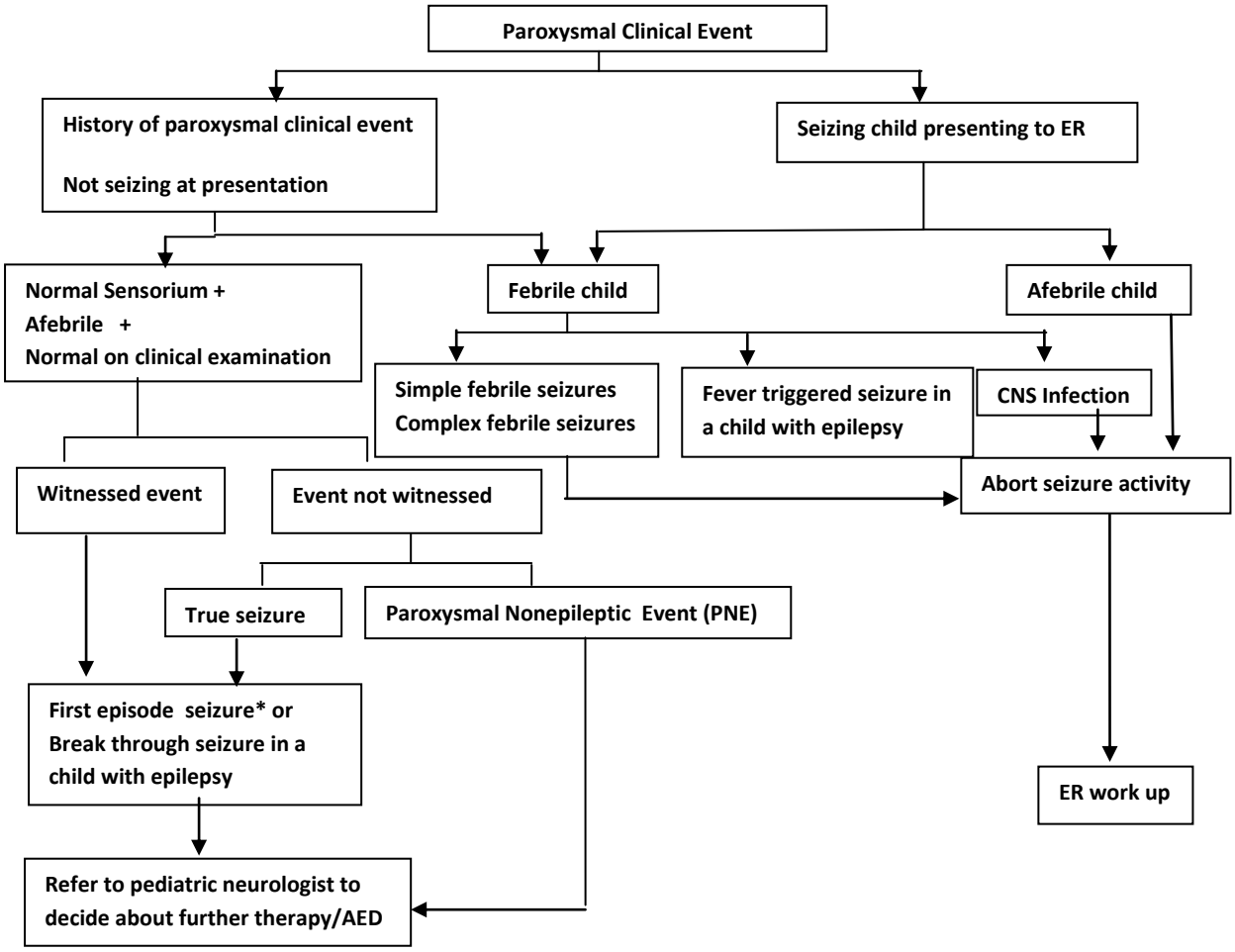
Acute seizures in a febrile child need to be differentiated from simple febrile seizures. Simple febrile seizure would fulfill all of the following characteristics:

- Patient age between 6 mo and 5 y
- Generalized tonic clonic convulsion
- Spontaneous cessation of convulsion within 15 min
- Return to alert mental status after convulsion
- Documentation of fever > $38^{O}C$
- One convulsion within 24 hour period
- Absence of pre-existing neurological abnormality

Fig. 1 Steps for Confirming the diagnosis and type of Seizures.

∗ First episode seizure requiring antiepileptic therapy.

Symptoms seizures due to underlying etiology (inflammatory granuloma, infarct, migration defect) Partial seizures (greater relapse



*** first episode seizure requiring antiepileptic therapy**

* First episode seizure requiring antiepileptic therapy.

Symptoms seizures due to underlying etiology

- Inflammatory granuloma, infarct, migration defect
- Partial seizures (greater relapse risk than generalised tonic clonic events)
- Positive family history of epilepsy seizures associated with head injury Seizures in a predisposed child & development delay,
- Myoclonic seizures. Absence seizures, seizures during sleep.

Fig 2 The team approach to a seizing child presenting to the pediatric emergency

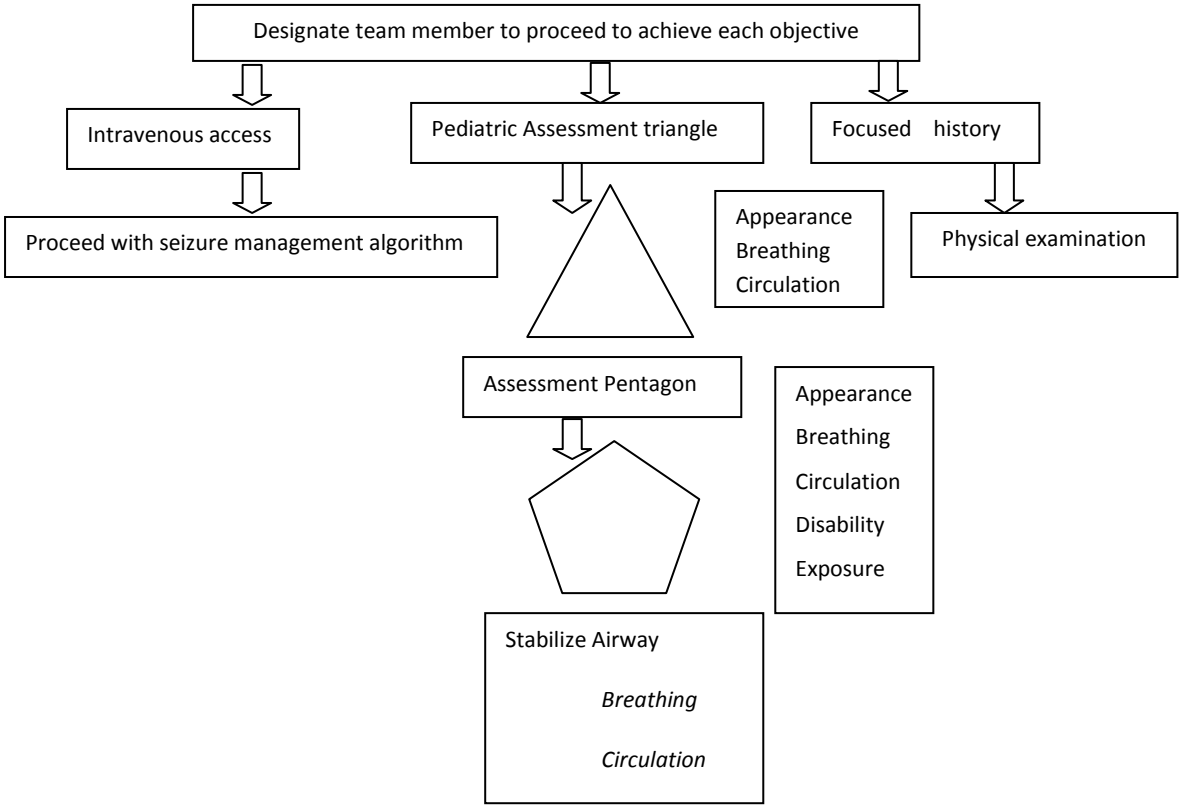


Table 2 Stepwise antiepileptic drug escalation protocol aiming at terminating the seizures activity

	Drug	**Supportive treatment**
0-3 min	Initial stabilization and supporting vital function as mentioned above	
3-5 min	Benzodiazepine first line therapy Lorazepam[a] 0.1mg/kg over 2 min (max 4 mg) OR Diazepam 0.3 mg/kg over 2 min (max 10 mg)	Start second IV line for simultaneous administration of second medication and IV fluids
7-8 min	Phenytoin[b] 20 mg/kg dilute in saline and infuse at a rate of not more than 1 mg/kg min	Thiamine 100 mg iv push; pyridoxine 100 mg iv push in children <3 y of age
10 min	Repeat Diazepam 0.3 mg/kg OR Lorazepam 0.1 mg/kg	
15 min	Repeat Diazepam (same dose) OR Lorazepam 0.1 mg/kg	
25 min	Phenytoin 10 mg/kg dilutes in saline and infuses at a rate not more than 1 mg/kg/min	
35 min	IV Valproate 30 mg/kg dilute 1:1 in normal saline over 2-5 min. if the status in not controlled within 10 min of bolus, repeat 10mg/kg bolus dose, follow by continuous infusion at the rate of 5mg/kg/h[18][c]	Transfer to PICU,prepare for intubation, ventilation, get EEG
	OR Midazolam OR Diazepam infusion [19][d] Diazepam: 0.01 mg/kg/min, max 0.1 mg/kg/min Midazolam: 2 mcg/kg/min upto 12 mcg/kg/min in increments of 2mcg/kg/min every 5 min Levetiracetam 40 mg/kg at 5 mg/kg/min can be infused after valproate before initiating thiopental coma	Cardiorespitatory monitoring
45-50 min	Thiopental[e] 3-4 mg/kg iv over 2 min followed by an infusion at 2 mg/kg/h	Mechanical ventilation

Table 3 Suggested diagnostic workup in a child in status epilepticus

Blood	Hemogram, glucose, calcium, magnesium, urea, electrolytes, blood-gases anti-epileptic drug levels, toxicology screen, culture if febrile
Urine	Rautine analysis, myoglobinuria, toxicology
CSF	In suspected meningitis
Continuous EEG monitoring	In refractory SE and SE in neonates
Neuroimaging (CT scan, MRI)	In case of focal findings, raised ICP, suspected head injury, coma

Table 4 Complications of status epilepticus

Cardiovascular	Bradycardia, arrhythmia, cardiac failure or arrest, hypertension, hypotension, shock
Respiratory	Hyperpnea, apnea, irregular or cheyne stokes breathing, respiratory acidosis, aspiration pneumonia, pulmonary edema
Renal	Oliguria, acute renal failure, acute tubular necrosis, myoglobinuria (form rhabdomyolysis)
Autonomic	Hyperpyrexia, excessive sweating, excessive secretions with airway obstruction
Metabolic	Hyperglycemia, hypoglycemia, hyperkalemia, hyponatremia, metabolic and lactic acidosis

12. ANIMAL BITES

Key facts

- Animal bites are a significant cause of morbidity and mortality worldwide.
- Worldwide, up to five million people are bitten by snakes every year; the majority in Africa and South-East Asia.
- Prompt medical treatment with appropriate antivenom is required for poisonous snake bites.
- Dog bites account for tens of millions of injuries annually; the highest risk is among children.
- Rabies is a significant health concern following dog bites, cat bites and monkey bites.
- Circumstances of the injury (provoked or unprovoked)

General principles on animal bite management

HELICOPTER: An Acronym for Management of Animal Bite Wounds

H	History
E	Examination
L	Liberal cleansing and
I	Irrigation
C	Closure, culture consideration
O	Operative cleansing and closure
P	Prophylactic or therapeutic antimicrobial agent use
T	Tetanus immunization status
E	Elevation
R	Rabies risk

General Management of Animal Bite

History taking

- Circumstances of the injury (provoked or unprovoked)
- Type of animal involved (Dog bites become infected 2-20% of the time, one of the lowest rates for mammalian bites).
- Current location of the animals/ownership/vaccination status.
- Patient's underlying medical conditions.
- Drug allergy.
- Tetanus immunization status.

Physical examination

- Location/type/depth of wound
- Range of motion, neurovascular function
- Signs of infection
- LYMPHNODE
- X-rav if wound near ioint or bone

Wound management

- Clean with 25% soap solution or dilute povidon-iodine solution, followed by irrigation with copious normal saline with syringe
- Take culture after topical decontamination (if infection suspected)
- Remove foreign bodies and necrotic tissue. Delayed suturing is advised for contaminated, large or deep wounds and hand wounds
- Ortho/surgical consultation as appropriate
- Elevation and immobilization of wound

Prophylactic Antibiotics Regimens for animal bite wounds

- Empirical Rx :
  - Oral amoxicillin-clavulanic acid – Duration 5 -7 Days
- For patient with allergy to penicillin :
  - Oral Azithromycin
- For rat bite injuries
  - Tetracycline

Dog Bite –

Management –

- Meticulous & prompt local care with 1% Povidon lodine & irrigate with NS

⇩

- Open lacerations can be sutured if local care is effected in several hour. (Facial wounds often mandate primary closure for cosmetic reasons)

⇩

- Extremities with extensive wounds should be immobilized in a position of function and kept elevated.

⇩

- **Suggested Indication of antibiotics.**
  - Human and cat bites through dermis.
  - Bites closed prematurely.
  - Bites more than 8hrs old with significant crush injury or edema.
  - Potential damage to bones, joints or tendons.
  - Bites to hands and feet.
  - Patients with increase risk of infection.
  - Signs of infection with in 24 hrs.

⇩

- **Tetanus prophylaxis.**

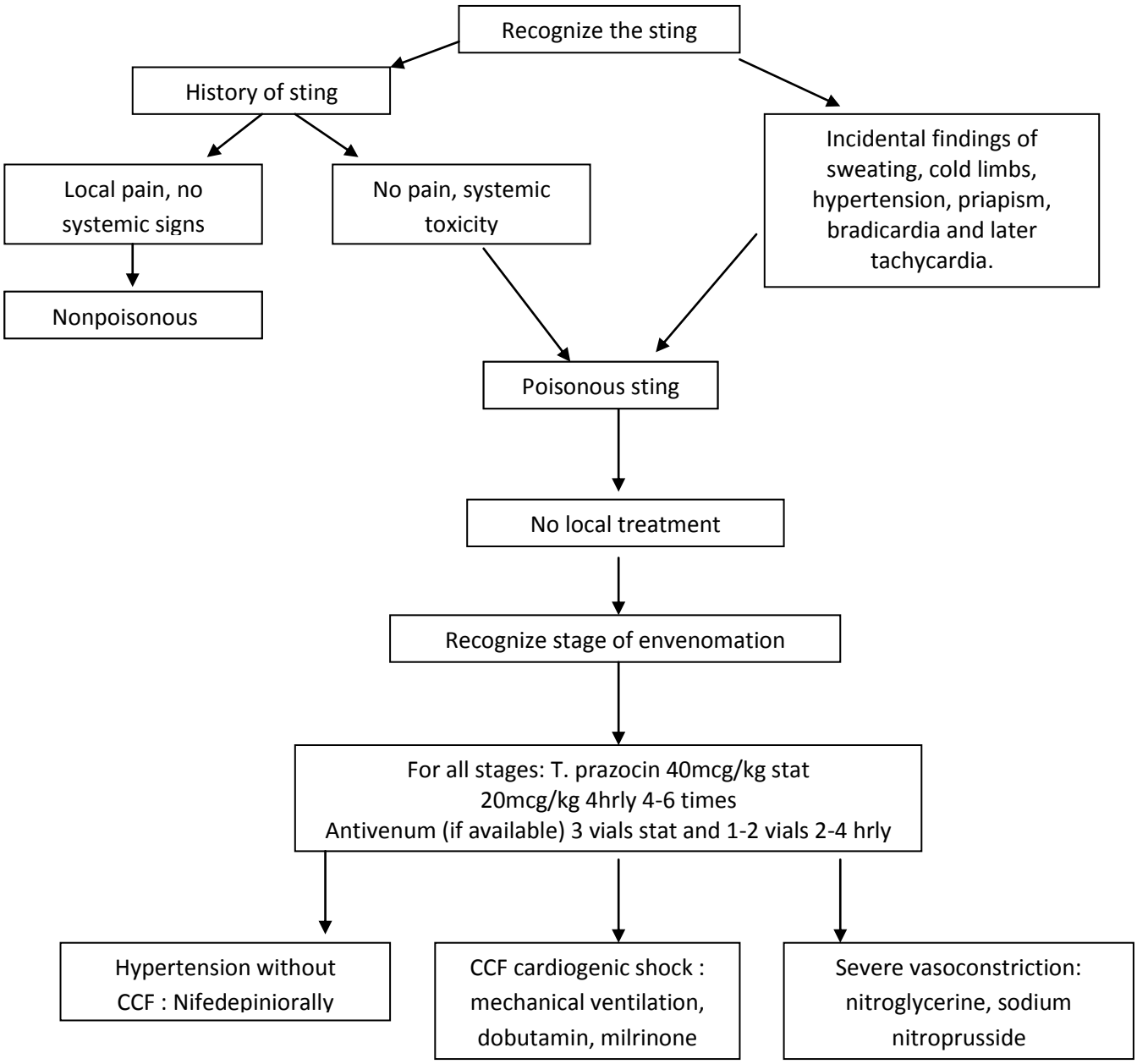
⇩

- **Rabies prophylaxis**.
- **Indicated for bites – Dogs, cat monkey, skunks, foxs, bat, raccons, mongoose, jackels, hyena, cattle.**
  - Immunoglobulin – (RIG) – 20IU/kg once half locally infiltrate and half IM.
  - Rabies HDCV immunization 0, 3, 7, 14, 28 & 90 for 6 doses of 1.0 ml each IM.

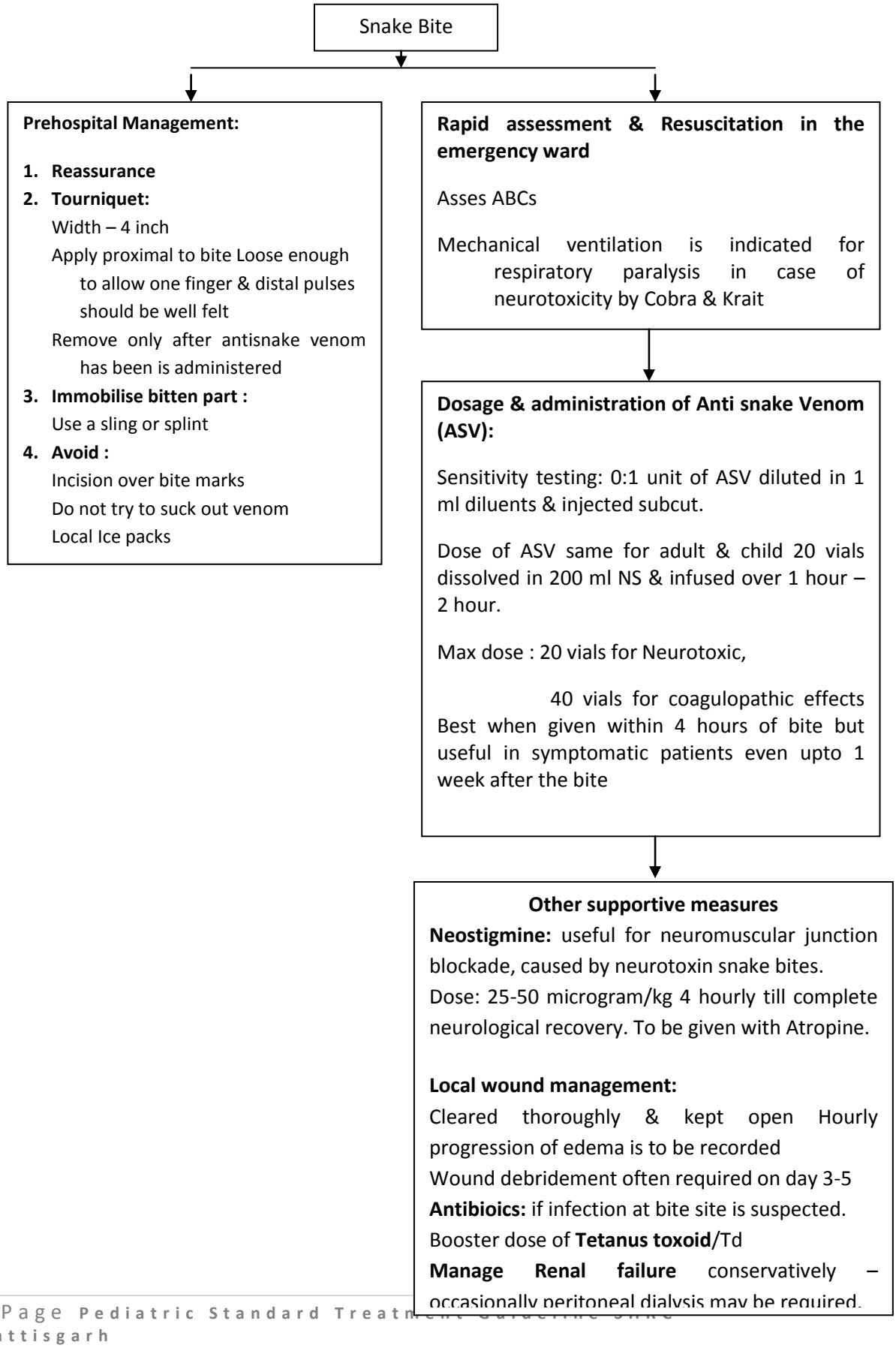
Animal highly suspicious of being rabid :

- The biting incident was unprovoked and the animal has bitten more than one person or other animal
- The animal shows clinical signs and symptoms of rabies, e.g. increase salivation, shivering, change in behavior, paralysis or restlessness
- Wild mammals : raccoons, skunks, foxes, coyotes, cats

Scorpion Sting



Snake Bite Management Algorithm



SNAKE BITE

- Antivenom is indicated if evidence is observed of systemic Envenomation or progressive limb swelling or necrosis.
- Investigation CBC, coagulation studies, platelet count, urinalysis 1 blood cross match, RBC, myoglobin, Sr. Electrolytes, BUN, creatinine, Fibrinogen, Fibrinogen, ABG, CK, PT or INR.

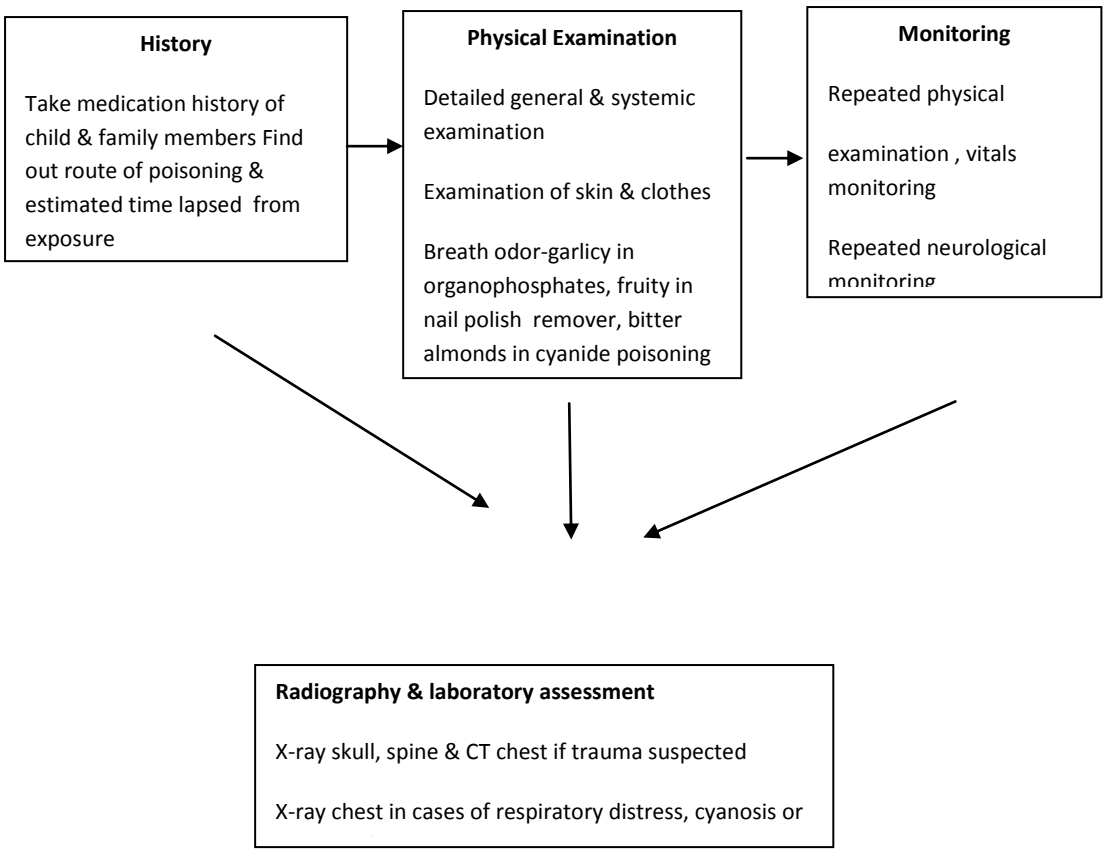
Indication for Snake Antivenom Administration

Evidence of systemic toxicity	
Haemodynamic or Respiratory instability	Hypotension, respiratory distress
Haemotoxicity	Clinically significant bleeding or abnormal coagulation studies
Neurotoxicity	Any evidence of toxicity usually beginning with cranial nerve abnormalities progressing to descending paralysis including the diaphragm
Evidence of local toxicity	Progressive soft tissue swelling.

ANTIVENIN

1. Each vial to be reconstituted with 10 ml of diluents (distill water or isotonic saline), DO NOT SHAKE, roll between palms until it dissolves.
2. Antivenin to be given in NS or RL (volume 20 ml/kg) as a slow infusion, at a rate 1 ml/min increasing rate as per tolerance & infuse over 1hr.
3. Antivenin should be given in first 4 hrs but may be efficacious even till 48 hrs & reports suggest its effectiveness even after 6-7 days.
4. Skin test with 0.1 ml intradermal of 1:10 diluted antivenin in forearm & control with NS on other hand.
5. A wheal or erythema > 10mm in 30 minutes indicates hypersensitivity.
6. Negative results does not rule our possibility of anaphylaxis and positive result is not absolute CI to antivenin.

Approach to A Child with Poisoning/Algorithm



Management of Poisoned Patient

1. Decontamination

- Ocular :- flush with water or normal saline
- Dermal :- Removal of clothing and particulate matter followed by flushing
- Gastrointestinal :- MOST EFFECTIVE IN 1ST HOUR

  Emesis, Gastric Lavage — C/I in caustics (acids & bases) hydrocarbons, agents causing rapid onset CNS / cardiovascular symptoms

  Single dose Charcoal : - Dose 1 g/kg in children 50-100 gm in adolescent & adult
  - Ensure patients airway in intact and protective and benign
  - Abdominal examination.

Whole body irrigation:

- 35 ml/kg/hr in children 1-2L/hr in adolescent of polyethylene glycol electrolyte solution
- Used in slowly adsorbed substance. Substance not adsorbed by charcoal i.e. lithium, iron, transdermal patches drug packets.

2. ELIMINATION

* **Multiple Dose Activaled Charcoal**
  Dose 0.5 g/kg every 4-6 hour continued till significant clinical improvement used in , Carbamazepine, dapsone, phenobarbitol, Quinine, theothylline
* Urinary Alkalanization :- By infusion of sodabicarbonate containing fluid .(good use pH -7.5-8)
* Used in salicylate & methotrexate

C/I → in CCF, kidney failure, pulmonary & cerebral edema.

* Dialysis → Toxins :- low volume of distribution (<1L/kg)

Characteristics

- Low Molecular weight
- Low degree of protein binding
- High degree of water solubility
- Used in methanol, ethylene glycol, lithium salicylates

3. Stabilization and supportive care

– A B C
– Cardio respiratory Monitoring
– Inotropes
– Anti epileptics → Benzodiazepine are drug of choice. Avoid phenytoin/phenobarbitone
– Blood / Blood Products
Transfusion

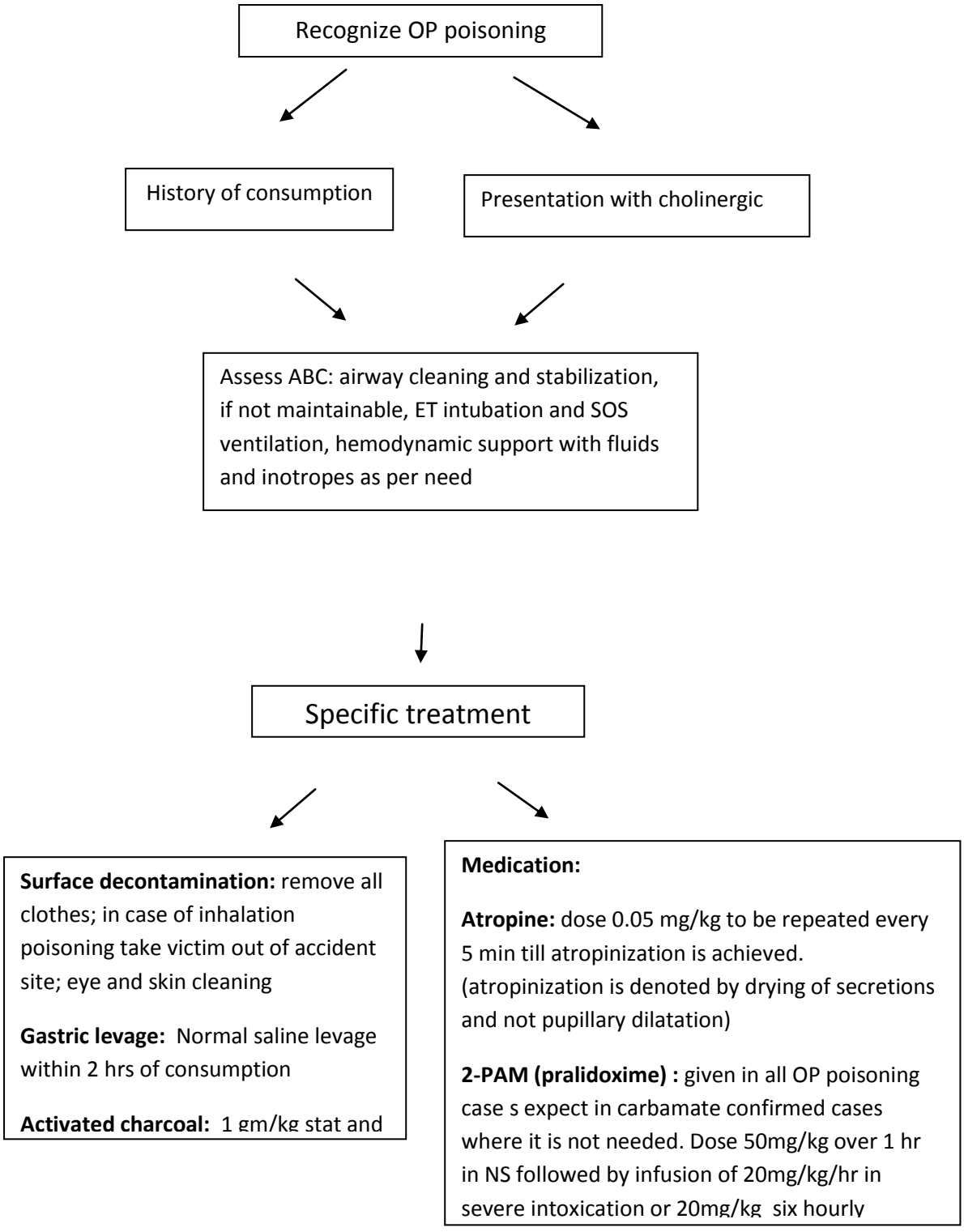
4. Specific Anti dote Therapy

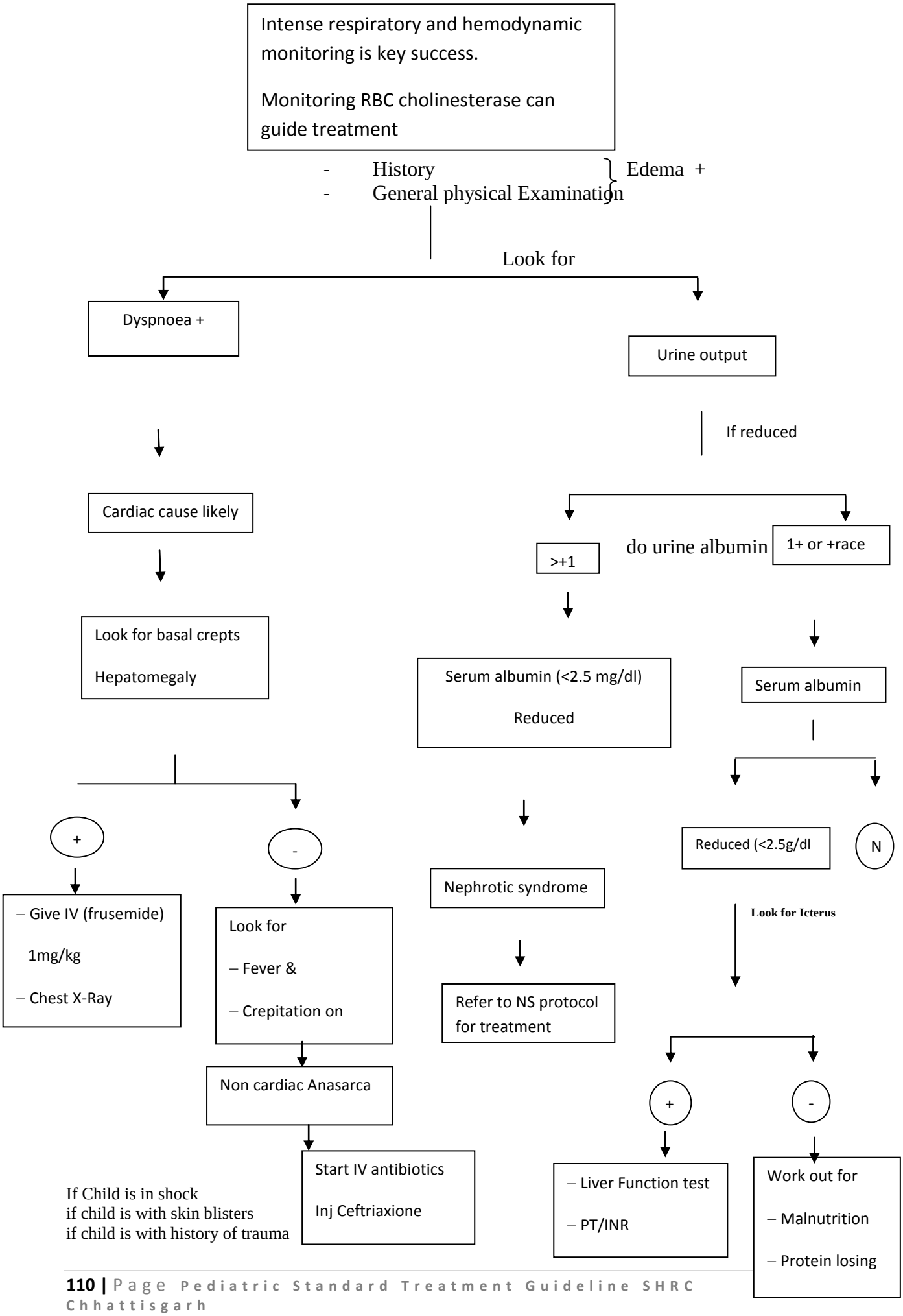
Acetaminophen	–	N acetyl cysteine
Anti cholinergic	–	Physostigmine
Benzodiazepine	–	flumazenil
Beta Blocker	–	Glucagon
Calcium channel Blocker	–	insulin , calcium salt
Carbon diaoxide	–	Oxygen
Iron	–	Deferoxamine
Lead and other heavy metals	–	Bal

Toxic Syndromes (Toxidromes)

Syndrome	Symptoms	Common Causes
Anticholinergic	Tachycardia, hyperthermia, mydriasis, warm and dry skin, urinary retention, ileus, delirium ("mad as a hatter, blind as a bat, red as a beet, hot as a hare, and dry as a bone")	Antihistamines, Atropine Belladonna alkaloids Mushrooms (some) Psychoactive drugs (many) Scopolamine Tricyclic antidepressants
Cholinergic, muscarinic	*S*alivation, *l*acrimation, *u*rination, *d*efection, *G*I cramps, *e*mesis (mnemonic device: SLUDGE) *Or* *D*iarrhea: *u*rination: *m*iosis; *b*ronchorrhea, *b*radycardia, and *b*ronchoconstriction; *e*mesis; *l*acrimation; and *s*alviation (mnemonic device: DUMBLES) Wheezing	Carbamates Mushrooms (some) Organophosphates Physostigmine Pilocarpine Pyridostigmine
Cholinergic, Nicotinic	*M*ydriasis, *t*achycardia, *w*eakness, *h*ypertension and *h*yperglycemia, *f*asciculations, *s*weating (mnemonic device: MTWH[h]FS) Abdominal pain, paresis	Black widow spider bites Carbamates Nicotine Organophosphates(some)
Opioid	Hypoventilation, hypotension, miosis, sedation, possibly hypothermia	Opioids (eg, diphenoxylate, fentany, heroin, methadone, morphine, pentazocine, propoxyphene)
Sympathomimetic	Tachycardia, hypertension, mydriasis, agitation, seizures, diaphoresis, hyperthermia, psychosis (after chronic use)	Amphetamines Caffeine Cocaine Ephedrine Herbal and synthetic marijuana and common substitutes MDMA(Ecstasy) Phenylpropanolamine Theophylline

Organophosphate (OP) Poisoning




Intense respiratory and hemodynamic monitoring is key success.
Monitoring RBC cholinesterase can guide treatment
- History
- General physical Examination
Edema +
Look for
Dyspnoea +
Urine output
If reduced
Cardiac cause likely
Look for basal crepts
Hepatomegaly
do urine albumin
>+1
1+ or +race
Serum albumin (<2.5 mg/dl)
Reduced
Serum albumin
+
-
Nephrotic syndrome
Reduced (<2.5g/dl
N
Look for Icterus
– Give IV (frusemide)
1mg/kg
– Chest X-Ray
Look for
– Fever &
– Crepitation on
Refer to NS protocol for treatment
Non cardiac Anasarca
+
-
Start IV antibiotics
Inj Ceftriaxione
– Liver Function test
– PT/INR
Work out for
– Malnutrition
– Protein losing
If Child is in shock
if child is with skin blisters
if child is with history of trauma

13. OEDEMA

Oedema → anasarca is the term to denote generalized oedema.

- Oedema is looked by pressing just above malleous & lower tibia. In bed ridden patients presacral area may show oedema.
- The common cause of oedema is

1 . **Cardiac** – Cardiac failure produces dependent oedema. May have other CVS symptoms like dyspnoea, cyanosis.

2 . **Renal** – usually oedema first appears on the face also renal oedema worse in the morning eg. Nephrotic syndrome & nephritis look for scrotal oedema especially in nephrotic syndrome

3 . **Hepatic** – eg. Liver cirrhosis

- Ascites is common in cirrhosis
- In cirrhosis, Ascites precedes oedema of other parts whereas in nephrotic syndrome ascities follows oedema of other parts.

4. **Nutritional** – e.g. Kwashiorkor or Anemia

- Nutritional history may give clue of malnutrition.
- As per present WHO SAM guidelines oedema of malnutrition is looked by pressing the dorsum of foot (Ref to treatment of Malnutrition)

5. **Allergic** – eg. Urticaria
   angioedema

- may be associated with pruritus
- history of previous allergy
- sudden onset of oedema may point towards allergic etiology

6. **Endocrinal** – eg. Myxoedema , Cushing's syndrome

Salient Features

	History	**Examination**
Cardiac	- Dyspnoea on Exertion - tachypnoea - palpitation - oedema - orthopnoea - Paroxysmal nocturnal dyspnoea	- hepatomegaly - basal crepts on chest - auscultation - Raised J VP - gallop rhythm - dependent edema - peripheral cyanosis cool extremities
Renal	chronic	
Nephrotic	- early morning edema - first periorbital edema,Reduce appetite - altered mettalic test - altered sleep pattern	- hypertension may be
Nutritional	- dietary history	- Anthropometry - Signs of nutribut def - pallor
Hepatic	- anorexia - vomiting (hametemisis)	- Icterus - hepatomegaly - spider angioma - splenomegaly - Ascites

Ref. edema, Harrisonas, Principle of Medicine 17th edition 36 p.

14. COMATOSE CHILD

- Coma is a medical emergency which present diagnosis as well as therapeutic challenges
- The potential cause of coma is numerous, and the critical window for diagnosis and effective intervention (not only to ensure survival but also to prevent long-term sequelae) is short.
- Pediatricians in the emergency services and intensive care units (ICU) have to frequently manage comatose patients.
- The incidence of non-traumatic coma is 30/100,000 children per yr, and that of traumatic brain injury is 670/100,000 [1,2].
- Central nervous system (CNS) infections are the most common cause of non-traumatic coma in children. This article provides a practical approach to evaluate a child with non-traumatic coma.

Table Causes of coma in children

1. Coma with focal signs
   - i Intracranial hemorrhage
   - ii Stroke : arterial ischemic or sinovenous thrombosis
   - iii Tumors
   - iv Focal infections-brain abscess
   - v Post seizure state: Todd's paralysis
   - vi Acute disseminated encephalomyelitis
2. Coma without focal signs and without meningeal irritation
   - i ***Hypoxia-Ischemia****: Cardiac or pulmonary* failure, Cardiac arrest, Shock, Near drowning
   - ii ***Metabolic disorders****:* Hypoglycemia Acidosis (e.g. Organic acidemias, diabetic keto-acidosis) Hyperammonemia (e.g. hepatic encephalopathy, urea cycle disorders, valproic acid encephalopathy, disorders of fatty acid metabolism, Reye syndrome) Uremia, Fluid and Eletrolyte disturbances (dehydration, hyponatremia, hypernatremia).
   - iii ***Systemic Infections****:* Bacterial: gram-negative sepsis, meningitis, toxic shock syndrome, cat-scratch disease, Shigella encephalopathy, Enteric encephalopathy
   - iv ***Post infection disorders****:* Acute necrotizing encephalopathy, ADEM, Hemorrhagic shock and encephalopathy syndrome

v ***Post immunization encephalopathy:*** Whole cell pertussis vaccine, Semple Rabies vaccine

vi Drugs and toxins

vii Cerebral malaria

viii **Rickettsia**l: Lyme disease, Rocky mountain spotted fever

ix Hypertensive encephalopathy

x Post seizure states

xi Non-convulsive status epilepticus

xii Post migraine

3. Coma without focal signs and with meningeal irritation

i Meningitis

ii Encephalitis

iii Subarachnoid hemorrhage

Rapid assessment and stabilization

Evaluate	• **Establish and maintain Airway :** Intubate if GCS≤8, impaired airway Reflexes, abnormal respiratory pattern, signs of raised ICP, oxygen saturation <92% despite high flow oxygen, fluid refractory shock • **Ventilation, Oxygenation** as indicated • **Circulation:** Establish IV access, take samples*(S. Electrolytes, Arterial Blood gas, lactate, CBC with platelets, MP slide/RDT, LFT, KFT, Blood culture, urine sugar and ketones). • Fluid bolus if in circulatory failure (20 ml/kg NS), inotropes if required • ***Blood Glucose:** Perform reagent strip testing and give dextrose <50mg/dL. • **Identify signs of cerebral herniation or raised ICP;** If any following present, Give 20% mannitol or 3% NS (if patient in shock), intubate & short term hyperventilation ($PaCO_2$:30-35 mmhg): GCS<8, abnormal pupil size and reaction, absent doll's eye movements, abnormal tone /Posturing, hypertension with bradycardia, abnormal respiratory pattern. • **Temperature:** treat fever & hypothermia

History

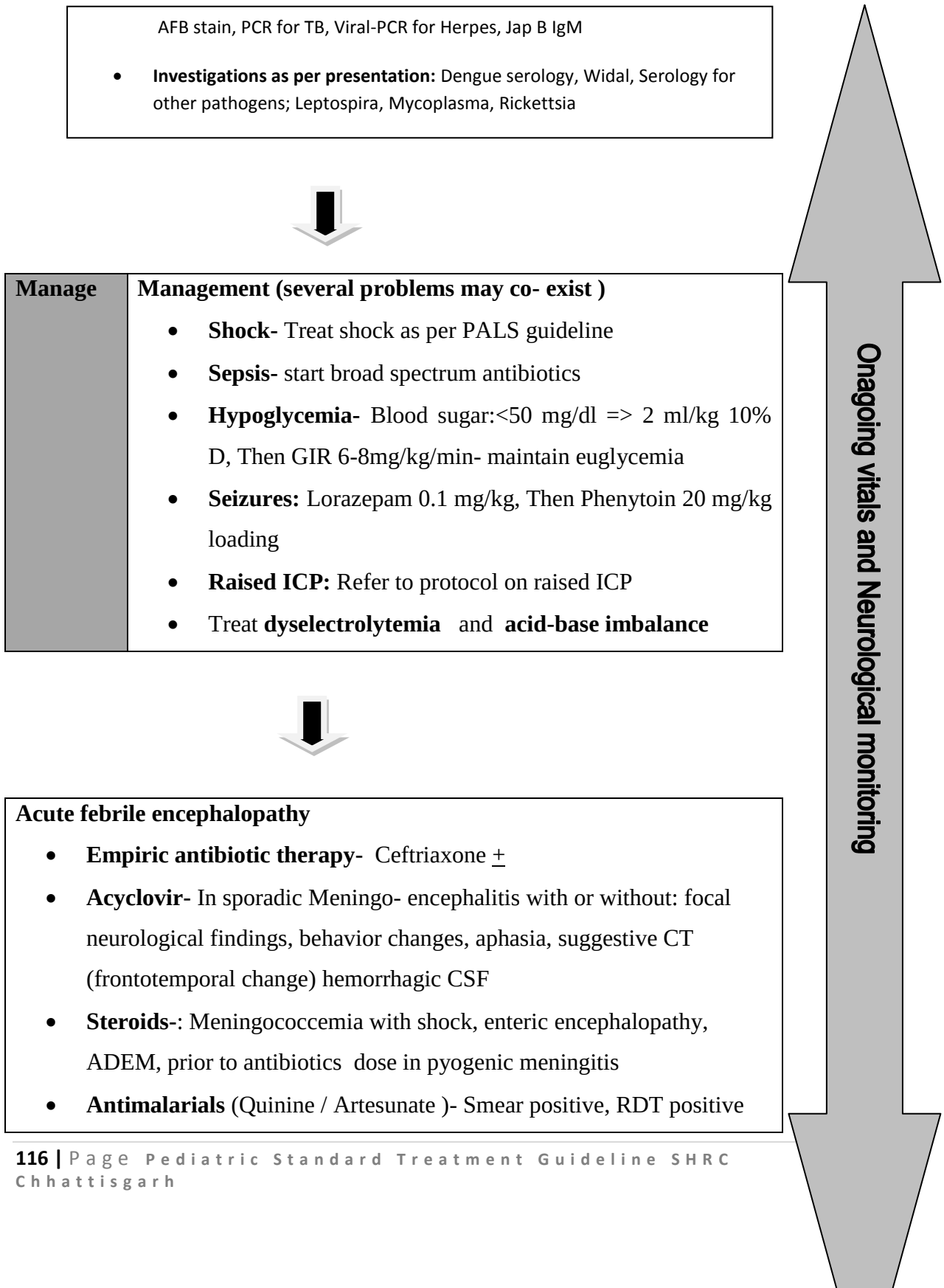
Examination- see Table

Neurological assessment

Investigate

- **CT:** in patient with: features of raised ICP, focal neurological deficits, Unexplained altered sensorium, features of herniation
- **CSF in suspected meningitis/ encephalitis :** (if CSF is delayed/contraindicated, start i/v antibiotics and acyclovir), Cytology, biochemistry, culture, Latex Agglutination, Duration of illness > 1wk:

Fig Step wise approach to child with non-traumatic impairment of consciousness



cases, Empiric treatment if resident of P. falciparum endemic area[#], short history (<48hrs), absent meningeal signs, anemia, hypoglycemia, retinal hemorrhages

Treatment as per identified cause

- Diabetic ketoacidosis: Fluids, insulin and other measure
- Hypertensive encephalopathy: antihypertensives
- Toxidrome: Opiate overdose-Naloxone, Benzodiazepine overdose Flumanezil, Organophosphate poisoning-Atropine, Pralidoxime
- Envenomation: Antivenom

" Be alert to possibility of Child abuse in an infant/toddler with sudden unexplained altered consciousness"

Further evaluation	If first investigation non-contributory and patient not improving despite empirical therapy, consider **second-line investigations:** • **MRI-** to identify stroke, ADEM, Herpes Simplex Encephalitis (frontotemporal lesions), Japanese B (thalamic involvement), viral associated encephalopathy, Inborn of error Metabolism • **EEG-** Periodic lateralized epileptic form discharges in HSE, Non convulsive status epilepticus as cause of unexplained altered sensorium • **Drug levels** (suspected anti-epileptic toxicity) • **Metabolic work-up-** NH_3, acylcarnitine profile (TMS), urine organic acids (GCMS) • **Urine toxicology screen** • **ESR and autommune screen** (cerebral vasculitis) • **Thyroid function and thyroid autoantibodies** (Hashimoto's encephalopathy)

Table Clues to etiology of coma in general physical examination

Look For	If present, think of
Pallor	Cerebral malaria, Intracranial bleed , Hemolytic uremic syndrome
Icterus	Hepatic encephalopathy, leptospirosis, complicated malaria
Rashes	Meningococcemia, Dengue, Measles, Rickettsial disease, Arboviral diseases
Petechiae	Dengue, Meningococcemia, Hemorrhagic fevers
Head and scalp hematomas	Traumatic/non-accidental injury
Dysmorphism, Neurocutaneous markers	Possibility of seizures
Abnormal Odour of exhaled breath	Diabetic ketoacidosis, hepatic coma

Treatment

Management of a child with coma usually proceeds simultaneously with the clinical evaluation (Fig 1). The goals of treatment are:

- Stabilization of vitals: airway, breathing and circulation
- Identification and treatment of brain herniation and raised intracranial pressure: hyperventilation, mannitol 3% saline etc.
- Mannitol is administered as an initial bolus of 0.25-1 g/kg (the higher dose for more urgent reduction of ICP) followed by 0.25-0.5 g/kg boluses repeated every 2-6 h as per requirement. Hypertonic saline is administered as a continuous infusion at 0.1 to 1.0 mL/kg/h, to target a serum sodium level of 145-155 meq/L.
- Identify and treat hypoglycemia with intravenous dextrose (2 ml/kg 10% D, Then glucose infusion rate of 6-8 mg/kg/min.
- Identification and treatment of seizures. If the child is having tonic-clonic movements, tonic deviation of eyes or nystagmus, or there is history of a seizure preceding the encephalopathy, anticonvulsant should be administered.
- Lorazepam should be given (0.1mg/kg), followed by phenytoin loading (20 mg/kg).Non convulsive status epilepticus (NCSE) may be seen in comatose children, and should be locked for in all children with unexplained encephalopathy.
- Maintenance of normothermia.
- Acid base and electrolyte abnormalities should be corrected.
- Treatment of infections. In case of suspected sepsis/meningitis, broad spectrum antibiotics(ceftriaxone, vancomycin) should be instituted immediately.

- If viral encephalitis is likely, then samples for PCR for herpes simplex virus should be sent and acyclovir should be started (dose). Antimalarials (quinine/artesunate) should be started if there is a clinical suspicion of cerebral malaria.
- Steroids are of benefit in acute disseminated encephalomyelitis, meningococcemia with shock, enteric encephalopathy, tubercular meningitis, and pyogenic meningitis.
- If metabolic causes have been identified, e.g. diabetic ketoacidosis, hepatic encephalopathy, uremia or hyperammonemia, these should treat appropriately.

- In sick children with acute febrile encephalopathy, empirical therapy with antibiotics, acyclovir and anti-malarial agents should be considered while the results of investigations are awaited.

- The clinical signs should be documented on a daily basis Particular attention should be paid to changing level of
    - consciousness, fever, seizures,
    - autonomic nervous system dysfunction,
    - increased intracranial pressure, and
    - speech and motor disturbances.
    - Nosocomial infections are important complications during hospitalization, and must be prevented and treated promptly.

HYPOXIC SPELL

- Hypoxic spell (also called cyanotic spell, hypercyanotic spell, "tet" spell) of TOF requires immediate recognition and appropriate treatment because it can lead to serious complications of the CNS.
- Hypoxic spells are characterized by a paroxysm of hyperpnea (i.e., *rapid* and *deep* respiration), irritability and prolonged crying, increasing cyanosis, and decreasing intensity of the heart murmur.
- Hypoxic spells occur in infants, with a peak incidence between 2 and 4 months of age. These spells usually occur in the morning after crying, feeding, or defecation.
- A severe spell may lead to limpness, convulsion, cerebrovascular accident, or even death.

Physicians may use one or more of the following to treat the spell.

1. The infant should be picked up and held in a knee-chest position.
2. Morphine sulfate, 0.2 mg/kg administered subcutaneously or intramuscularly, suppresses the respiratory center and abolishes hyperpnea (and thus breaks the vicious circle).
3. Oxygen is usually administered, but it has little demonstrable effect on arterial oxygen saturation.
4. Acidosis should be treated with sodium bicarbonate (NaHCO3), 1 mEq/kg administered intravenously. The same dose can be repeated in 10 to 15 minutes. NaHCO3 reduces the respiratory center-stimulating effect of acidosis.
5. Fluid bolus 10-20 ml/kg may be required if child is dehydrated.
    - With the preceding treatment, the infant usually becomes less cyanotic, and the heart murmur becomes louder, which indicates an increased amount of blood flowing through the stenotic RVOT.
    - If the hypoxic spells do not fully respond to these measures, the following medications can be tried:

1. Propranolol, 0.01 to 0.25 mg/kg (average 0.05 mg/kg) administered by slow intravenous push, reduces the heart rate and may reverse the spell.
2. Vasoconstrictors such as phenylephrine (Neo-Synephrine), 0.02 mg/kg administered intravenously, may be effective (by raising systemic arterial pressure).
3. Ketamine, 1 to 3 mg/kg (average of 2 mg/kg) administered intravenously over 60 seconds, works well. It increases the systemic vascular resistance and sedates the infant.
4. Correction of precipitating factors such as polycythemia, anemia, dehydration or infection should be under taken.
5. Precipitating factors dehydration, fever, infection.