सत्यमेव जयते

NATIONAL HEALTH MISSION
राष्ट्रीय स्वास्थ्य मिशन

Facility Based Integrated Management of Neonatal and Childhood Illness (F-IMNCI)




Child Health Division
Ministry of Health & Family Welfare
Government of India

2023

Participant Module

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PARTICIPANT MODULE

2023

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सदस्य
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13th November, 2023

MESSAGE

I am pleased to note that the Ministry of Health and Family Welfare has developed the revised version of Integrated Management of Neonatal and Childhood Illness (IMNCI) and developed Facility Based Care of Sick Children as an update of "Facility Based Integrated Management of Neonatal and Childhood Illness (F-IMNCI)" training package which are being released.

National Health Policy (NHP) 2017 provides a framework to strengthen healthcare system for attaining Universal Health Coverage (UHC) and work on Government's philosophy of 'Sabka Sath Sabka Vikas'. Our flagship programme 'Ayushman Bharat' is working towards attainment of UHC as one of the key targets under Sustainable Development Goals. Under this UHC, we are committed to provide appropriate healthcare to newborns and children across the country. Our progress has been steady, despite the COVID-19 pandemic and we are making all efforts to improve children's survival.

There's a continuous need for upskilling and revising training packages, based on recent challenges and new evidence. The training packages developed by the Ministry of Health and Family Welfare are a right step in this direction towards addressing comprehensive management of newborns and sick children in outpatient as well as in-patient settings. These will be helpful in setting up better standards of care in public health facilities for our newborns and children and will help us ensure that each child gets a better start to life and is provided an equal opportunity to survive and thrive.

I extend my best wishes to everyone.

(Vinod Paul)

सुधांश पंत
सचिव
Sudhansh Pant
Secretary

सत्यमेव जयते

आज़ादी का अमृत महोत्सव

भारत सरकार
स्वास्थ्य एवं परिवार कल्याण विभाग
स्वास्थ्य एवं परिवार कल्याण मंत्रालय
Government of India
Department of Health and Family Welfare
Ministry of Health and Family Welfare

MESSAGE

Health systems strengthening over the last decade brought a considerable improvement in the infrastructure, availability of human resources, drugs and equipment along with supportive services all across India. Effective sick newborn and child care is a crucial challenge that is faced by every health care system in low resource settings. While efforts are being made to improve the availability of specialists dealing with sick newborns and children, training of doctors, nurses and peripheral health workers remains key to equip the staff with appropriate knowledge and skills to provide evidence based healthcare to children.

With advances in critical care and based on evidence, the Integrated Management of Neonatal and Childhood Illness (IMNCI) training package has now been revised by the Child Health Division, with updated algorithm and improved training methodology. The revised training package also includes recommendations of the technical expert group on paediatric management of common illness. The package has been bifurcated and rebranded into OPD based Integrated Management of Neonatal and Childhood Illness Modules and Facility Based Care for Sick Children Package for inpatient management.

This revised package provides latest, evidence-based knowledge in improving newborn and child at facilities to provide required care for a newborn and child to identify and manage common conditions, complications, and emergency management of children, including pre-referral management, thereby saving many precious lives.

I hope that these training modules will be rolled out expeditiously across the States and UTs to ensure essential care to the children as a first step towards healthy childhood and adult life.

Date: 15.11.2023
Place: New Delhi

Sudhansh Pant
(Sudhansh Pant)

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FOREWORD

The Ministry of Health and Family Welfare, Government of India has implemented a number of policies and programmes aimed at ensuring universal access to health coverage and reducing child and neonatal mortality. Our country has made sizeable gains in last one decade in Child Mortality and reach to 32 per 1000 Live births in the year 2020. Under National Health Policy (NHP) 2017, the country has set-up ambitious targets of Under 5 Mortality i.e. 23 per 1000 Live births by 2025 and our team is closely working with States/ UTs to achieve these targets in given time frame.

To fulfill the role of providing quality healthcare services for newborns and children, Ministry of Health and Family Welfare, Government of India has developed training package for comprehensive management of illness in newborns and under-five children with distinct outpatient and inpatient components. These target the capacity building needs of pediatricians, medical officers, nurses and peripheral health workers and provide knowledge and skills of high order required for management of common conditions that lead to maximum morbidity and mortality among children in our country.

I would like to express my heartfelt appreciation to all those who contributed to the preparation of these documents. I am sure that these packages will help in equipping our healthcare providers with knowledge and skill to deliver newborn and child health services with quality, all across the country.

With best wishes!

(Ms. L S Changsan)

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राष्ट्रीय स्वास्थ्य मिशन

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GOVERNMENT OF INDIA
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Dr. P. Ashok Babu, IAS
Joint Secretary

PREFACE

The Government of India is committed to achieve goals under National Population Policy (2017) and bring down Neonatal Mortality Rate to 16 and Under Five Mortality Rate to 23 by 2025, which are well beyond the Sustainable Development Goals (SDGs) set for 2030. Newborn and Child health are the central pillars in the Reproductive, Maternal, Newborn, Child, Adolescent Health and Nutrition (RMNCAH+N) strategy. Inter-linkages between various RMNCAH+N life cycle stages have a significant impact on the mortality and morbidity of children.

The Child Health Division of the Ministry, with support from technical experts and development partners has revised Facility Based Integrated Neonatal and Childhood Illness (F-IMNCI) developed in the year 2009, with updated algorithms and improved training methodology and presented it in a pictorial format which also serves as a job-aid. The F-IMNCI training package has been divided into two packages of "Integrated Management of Newborn and Child Illnesses (IMNCI)" – for outpatient management of both young infants (0-2 months) and children up to five years of age and new package titled, "Facility Based Care of Sick Children" – focusing on appropriate inpatient management of major causes of childhood mortality beyond neonatal age from one month to 59 months old children with common illnesses, like pneumonia, diarrhoea, malaria, meningitis, and severe malnutrition. The training duration has been reduced to make it more practical.

The package emphasizes on the skill imparting techniques by the facilitators and ensures uniform messaging across all the levels. With this revised training package, we hope that the training will be more hands-on and the entire training experience will be enhanced, leading to better learning outcomes. I urge the States and UTs to take this package up to scale and universalize it by the end of 2024-25.

I am hopeful that by adopting this revised training package, the trainers along with service providers will feel more confident in carrying on with their roles and responsibilities. I would also like to place on record my appreciation for the hard work and untiring efforts put in by the Child Health Division in revising and developing the training package. I assure the States and UTs full support, of my team, in taking this important initiative forward.

(Dr. P. Ashok Babu)

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ACKNOWLEDGEMENT

India has witnessed a huge transformation in the scenario of children's health evident by faster reduction in child mortality over the last decade as compared to global rates. This has been made possible by India's continued investments in health systems which are being strengthened further in the wake of threats posed by COVID-19 pandemic through improvement of physical infrastructure and training of health care providers to equip them with suitable skill sets at different levels of care, to deliver quality newborn and child health services.

The Facility Based Integrated Neonatal and Childhood Illness (FIMNCI) package was first launched in India in the year 2009 guiding appropriate inpatient management of major causes of childhood mortality, which has now been bifurcated into two packages based on outpatient and inpatient management:

1. Integrated Management of Newborn and Child Illnesses (IMNCI)- for outpatient management of both young infants (0-2 months) and children up to five years of age with two separate chart booklets for healthcare workers (ANM) and Physicians to be covered over five days.

Cont'd on next page

2. New package titled, "Facility Based Care of Sick Children" - focuses on providing appropriate inpatient management of major causes of childhood mortality beyond neonatal age i.e. one month to 59 months old children with common illnesses, like- pneumonia, diarrhoea, malaria, meningitis, and severe malnutrition also taught over five days.

Other major differences are:

I. Facility based approach dissociated from IMNCI; management is now linked to Emergency signs
II. New chapters added on management of children with shock, management of children presenting with lethargy, unconsciousness or convulsions, supportive care
III. National Guidelines for pediatric management of COVID-19, Malaria, Dengue and Tuberculosis included
IV. Training videos developed by KSCH, Lady Hardinge Medical College

These training packages are a culmination of the work initiated by my previous colleagues Dr Ajay Khera, Ex-Commissioner (MCH); Dr P K Prabhakar, Ex Joint Commissioner (CH) and Dr. Sumita Ghosh, Ex- Additional Commissioner (Child Health), I convey my sincere gratitude for their vision. I would also like to thank Prof. (Dr) Praveen Kumar, Kalawati Saran Children's Hospital (KSCH), New Delhi and his team who worked very hard to develop and revise this package. I also want to acknowledge the contribution of Dr. Ashfaq Bhat (NIPI), Dr. Deepti Agarwal (WHO-India), Vishal Kataria (MoHFW) and Vaibhav Rastogi (MoHFW) who had worked together with KSCH to refine this package further with the support of Academicians, Experts, State Child Health Officers, Development Partners (NIPI, WHO, UNICEF, USAID, IPE Global, PATH) and also supported the pilot testing.

The Child Health Division will provide all the necessary support to the States and UTs to roll out these training packages at the earliest and contribute towards further improving children's health and survival. I wish you the very best for your efforts and look forward to your continued support as we move together on the mission to improve the quality of life of children and attain the national health goals.

(Dr. Shobhna Gupta)

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ABBREVIATIONS

ETAT	Emergency Triage Assessment and Treatment
PPE	Personal Protection Equipment
HCWs	Health Care Workers
RT-PCR	Reverse Transcriptase - Polymerase Chain Reaction
VTM	Viral Transport Media
BAL	Bronchoalveolar Lavage
RL	Ringer's Lactate
NS	Normal Saline
AED	Automated External Defibrillator
ERS	Emergency Response System
VF	Ventricular Fibrillation
VT	Ventricular Tachycardia
CPR	Cardio-Pulmonary Resuscitation
PEA	Pulseless Electric Activity
LTB	Laryngo Tracheo Bronchitis
URI	Upper Respiratory Infection
MDI	Metered Dose Inhaler
NTEP	National Tuberculosis Elimination Program
ASOM	Acute Suppurative Otitis Media
WALRI	Wheeze Associated Lower Respiratory Infection
CBNAAT	Cartridge Based Nucleic Acid Amplification Technique
PPD	Purified Protein Derivative
IGRA	Interferon Gamma Release Assay
MTB	Mycobacterium Tuberculosis
CSF	Cerebrospinal Fluid
MDR TB	Multidrug-Resistant Tuberculosis
ZN	Ziehl-Neelsen
PTB	Pulmonary Tuberculosis
EPTB	Extra Pulmonary Tuberculosis
MR	Mono-Resistant
PDR	Poly-Drug Resistant
MDR	Multi-Drug Resistant
RR-TB	Rifampicin Resistant TB
RR	Respiratory Rate
HR	Heart Rate
XDR	Extensively Drugs Resistant
DOT	Directly Observed Treatment
STCI	Standards for TV Care in India
FDCs	Fixed Dose Combinations
DSTB	Drug Sensitive TB
HRZE	Isoniazid (H), Rifampicin (R), Pyrazinamide (Z), Ethambutol (E)
HRE	Hormone Receptor Enzyme

CP	Continuation Phase
ADR	Adverse Drug Reaction
CRT	Capillary Refill Time
IVC	Inferior Vena Cava
ECG	Electrocardiogram
CRP	C-Reactive Protein
CHF	Congestive Heart Failure
AES	Acute Encephalitis Syndrome
JE	Japanese Encephalitis
HSV	Herpes Simplex Virus
PCR	Polymerase Chain Reaction
CECT	Contrast-Enhanced Computed Tomography
ICP	Intracranial Pressure
PS	Peripheral Smear
RDT	Rapid Diagnostic Test
SE	Status Epilepticus
AED	Anti-Epileptic Drugs
NPIC	National Poisons Information Centre
20WBCT	20-minute Whole Blood Clotting Test
ASV	Anti-Snake Venom
AVPU	Alert, Verbal, Pain, Unresponsive
FFP	Fresh Frozen Plasma
NG	Nasogastric
ORT	Oral Rehydration Therapy
UTI	Urinary Tract Infection
ACT	Artemisinin Based Combination Therapy
AL	Artemether-Lumefantrine
ACT-SP	Artesunate-Sulphadoxine-Pyrimethamine
ACT-AL	Artemisinin Based Combination Therapy - Artemether-Lumefantrine
CQ	Chloroquine
PQ	Primaquine
VCUG	Voiding Cystourethrography
DMSA	Dimercaptosuccinic Acid
DF	Dengue Fever
DHF	Dengue Haemorrhagic Fever
EDS	Expanded Dengue Syndrome
Hct	Haematocrit
ABCS	Acidosis, Bleeding, Blood Sugar, Calcium, Serum Sodium and Potassium
ARDS	Acute Respiratory Distress Syndrome
IDA	Iron Deficiency Anaemia
BMI	Body Mass Index
MUAC	Mid Upper Arm Circumference
SAM	Severe Acute Malnutrition
ATT	Anti-Tuberculosis Treatment
NSAID	Nonsteroidal Anti-Inflammatory Drugs

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Annexures

SECTION 1: GENERAL PRINCIPLES FOR THE MANAGEMENT OF SICK CHILDREN (1 MONTH - 5 YEARS)

Every year more than 5 million children die across the world before they reach their fifth birthday. The most common causes of infant and child mortality in India are perinatal conditions, acute respiratory infections, diarrhoea, malaria, measles and malnutrition *(Figure 1.1)*. Many of these deaths may be prevented by early referral of sick children to health facility and providing appropriate treatment. **This module describes assessment and management of sick children aged 1 month – 5 years.**

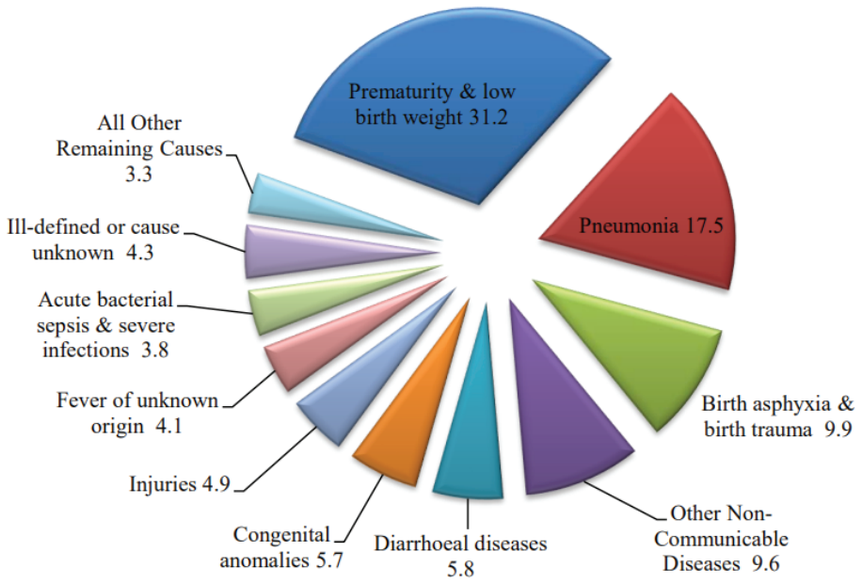


Figure 1.1: Causes of child death in India (Source: SRS 2017-19)

1.0: LEARNING OBJECTIVES

At the end of the session, participants should be able to:

- Describe the management process of sick children referred to a hospital

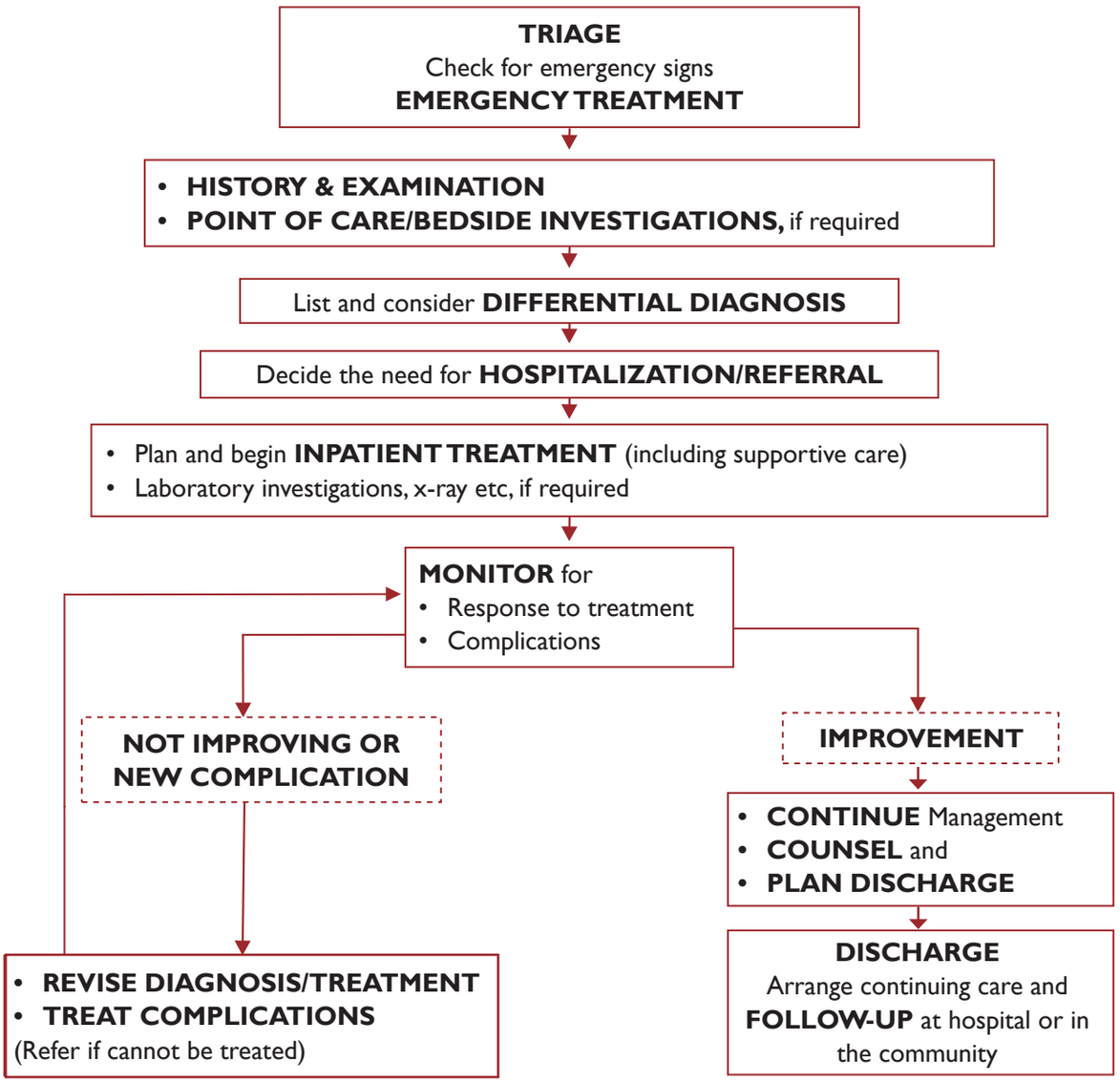
The stages of management for any child in a hospital are (Chart 1.1):

- Triage and Emergency treatment
- History & examination
- Point of care/bedside investigations
- Making a diagnosis or a differential diagnosis
- Decide need for hospitalization/referral
- Inpatient care
  - Specific treatment

- Laboratory investigations, x-ray etc. (if required)
- Supportive care
- Monitoring

- Discharge
- Follow-up

Chart 1.1: Steps in the management of children brought to hospital



1.1: TRIAGE AND EMERGENCY TREATMENT

First step is triage and providing treatment to children with emergency signs, which is described in section 2.

Several infections like COVID 19 are highly infectious. Use recommended infection prevention measures, like- Personal Protection Equipment (PPE), hand washing etc. when triaging, taking history, during clinical examination and managing sick children to protect yourself and preventing cross-transmission.

1.2: TAKING HISTORY IN CHILDREN

Taking a history generally starts with understanding the presenting complaint. Record what the mother/caregiver tells you about the child's problems. Use good communication skills when interacting with mother/caregiver.

- Greet the mother/caregiver appropriately and offer her a seat to sit with her child.
- Ask the mother/caregiver- what the child's problem is?
- Use words that mother/caregiver understands.
- Listen carefully to what s/he tells you.
- Give her/him time to answer the questions.
- Ask additional questions when s/he is not sure about the answer.

Take history of the present illness. You will learn more about the symptom-specific history in subsequent sections. The feeding history of infants and younger children is essential, as this is the age when malnutrition sets in. For children, information on immunization and development milestones is also important. Whereas the history is obtained from a parent or caretaker for younger children, older children can contribute important information related to their own health.

1.3: CLINICAL EXAMINATION

- All children must be examined fully, so that important signs are not missed.
- In contrast to the systematic approach for adults, examination of a child should be organized in a way that does not upset the child. The approach to examine children should be flexible. General principles of examination are:
  - Do not upset the child unnecessarily.
  - Let the child be with mother/care giver.
- Observe as many signs as possible before touching the child:
  - Does the child speak, cry or make any sound?
  - Is the child alert, interested and looking around?
  - Does the child appear irritable or drowsy?
  - Is the child vomiting?
  - Is the child able to feed?
  - Is the child cyanosed or pale?
  - Does the child show signs of respiratory distress?

These and other signs should be recorded before the child is disturbed. You might ask the mother/caregiver to cautiously reveal part of the chest to look for lower chest wall indrawing or to count the respiratory rate. If the child is distressed or crying, s/he might have to be left for a brief time with her/his mother/care giver to settle, or the mother could be asked to breastfeed, before key signs such as respiratory rate can be measured.

Then, proceed to signs that require touching the child but are minimally disturbing, such as feeling the pulse or listening to the chest. You obtain limited useful information if you listen to the chest of a crying child. Signs that involve interfering with the child, such as recording the temperature, testing for skin turgor, blood pressure or looking at the child's throat or ears should be done last.

1.4: POINT-OF-CARE/BEDSIDE INVESTIGATIONS

Perform investigations relevant to history and examination findings. Some of tests may be easily performed at the bedside, so called as point- of -care tests. Important investigations relevant to sick children include, complete blood count, blood sugar, routine urine examination, peripheral smear and rapid diagnostic tests for malaria. In addition, other investigations may be needed in hospitalized patients.

1.5: DIFFERENTIAL DIAGNOSIS

After the assessment, consider the various conditions that could be the cause of the child's illness and make a list of possible differential diagnosis. This helps to ensure that wrong assumptions are not made, a wrong diagnosis is not chosen, and rare problems are not missed. Remember that a sick child might have more than one clinical problem requiring treatment.

1.6: DECIDE NEED FOR ADMISSION (HOSPITALIZATION) OR REFERRAL

Children need hospitalization if they have emergency signs or priority signs for which they need investigations, or if they need work-up for underlying conditions.

Examples of common conditions for which children need investigations/work-up are:

- Fever lasting more than 7 days
- Generalized swelling
- Severe anaemia
- Poor growth/weight gain even after dietary counselling
- Persistent diarrhoea

If child needs some special treatment and referral, give pre-referral treatment before sending the child to another health facility.

1.7: INPATIENT AND SUPPORTIVE CARE

All admitted children should receive appropriate treatment for the most probable diagnosis, along with supportive therapy. Also, provide information to caregivers about the facilities and working of the hospital (e.g. diet, laboratories, toilets etc.). Supportive care is described in *Section 10*.

1.8: MONITOR A SICK CHILD FOR RESPONSE TO TREATMENT AND COMPLICATIONS

Monitoring is a critical component of management process, which is often neglected in inpatient care. Many conditions are dynamic and may become apparent on subsequent examinations.

Key aspects in monitoring the progress of sick children are:

- Making a plan to monitor the child regularly. Frequency of monitoring will depend on the nature and severity of the child's clinical condition.
- Using a standard chart for recording essential information to facilitate the prompt identification of any problems that require change in treatment.
- Bringing problems to the attention of the doctors who can take decision for change of management, if necessary.

1.9: DISCHARGE FROM THE HOSPITAL

Careful monitoring of the child's overall response to treatment and correct planning of discharge from the hospital are just as important as making the diagnosis and initiating the treatment. The discharge process for all sick children should include:

- Counselling the mother/caregiver on correct treatment and feeding of the child at home.
- Ensuring age appropriate immunization before discharge and remind the mother/caregiver about date and place of child's next immunization visit.
- Communicating with the health personnel who referred the child or who will be responsible for follow-up care. Provide discharge card or a referral note, as this will lead to more appropriate referrals to the hospital and better relationship between the hospital and community health workers.
- Instructing mother/caregiver on when to return for follow-up care and signs indicating the need to return immediately.
- Assisting the family with special support (e.g., providing equipment for a child with disability).

1.10: PROVIDING FOLLOW-UP CARE

- Children who are discharged from the hospital should return for follow-up care to the hospital or if this is not possible, then to a first-level referral facility for checking the child's condition in relation to the present problem. Services of community health workers should be utilized, wherever available.
- Advise mothers/caregivers to return immediately, if the child develops any of the danger signs *(Box 1.1)*.

Box 1.1: When to Return Immediately

- Not breastfeeding or drinking poorly
- Becomes sicker
- Develops fever or feels cold to touch
- Fast breathing
- Difficult breathing
- Diarrhoea with blood in stool

SECTION 2: EMERGENCY TRIAGE ASSESSMENT AND TREATMENT (ETAT)

Many deaths in hospital occur within 24 hours of admission. Some of these deaths can be prevented if very sick children are quickly identified on their arrival and treatment is started immediately. The functional survival of critically ill and injured children is influenced by the provision of timely and appropriate pediatric emergency care. Thus, it is very important to be trained to recognize life-threatening situations, if you are involved in the care of sick children.

Emergency management is by team, rather than by individual, so teamwork is necessary for providing quick and appropriate care. Nurses are the most important personnel in any emergency care department, since they are involved at all stages of patient care. Hence, it is equally important that they are well trained in important lifesaving procedures and their skills are renewed at frequent intervals. Besides the medical staff, other helping and non-clinical staffs may also be trained so that they can recognize some of these life-threatening situations and respond immediately. It is also advisable to have written policies and protocols for the care of children in the emergency department.

2.0: LEARNING OBJECTIVES

After completing this section, the participants will be able to:

- Triage all sick children when they arrive at hospital, into the following categories:
  - Those with emergency signs
  - Those with priority signs
  - Those that are non-urgent cases
- Assess airway and breathing and start emergency treatments if required.
- Assess the status of circulation and level of consciousness.
- Initiate management of shock, coma and convulsions.
- Assess and manage severe dehydration in a child with diarrhoea.
- Plan and implement ETAT in the hospital.

2.1: TRIAGE

The word "triage" means sorting.

Triage is the process of rapidly screening all sick children on their arrival in hospital to place them in one of the following categories:

E Emergency
P Priority
Q Queue (non-urgent)

Those with EMERGENCY SIGNS require **immediate emergency treatment** *(Chart 2.1)*.

The Triaging Process

Triaging should be quick and you must learn to assess several signs at the same time. Adherence to infection control measures (Use of N-95 mask, gloves, head shield, hand washing etc.) by all healthcare workers (HCW) involved in triaging is important to protect themselves and avoid cross transmission of infections like COVID 19.

Emergency signs can be identified on an average in twenty seconds.

- You can observe several signs just by looking at the child. A child who is smiling does not have severe respiratory distress, shock or coma.
- Look at the child, observe breathing and look for severe wasting, oedema.
- Listen for abnormal sounds, such as stridor or grunting.

When and Where Should Triaging take place?

Triage should be carried out as soon as a sick child arrives in the hospital, well before any administrative procedure such as registration. This may require reorganizing the flow of patients in hospital. Triage can be carried out at different locations – e.g. in the outpatient queue, in the emergency room, or in a ward if the child has been brought directly to the ward. If a child with emergency signs is identified in the outpatient queue, s/he must quickly be taken to a place where treatment can be provided immediately, e.g. the emergency room or ward.

Who Should Triage?

All medical and other health workers involved in the patient care can perform triage, if trained properly and they should also be able to give the initial emergency treatment.

2.2: ASSESSING EMERGENCY SIGNS: The ABCD concept

To quickly assess the patient for serious illness or injury, assess emergency signs, which relate to the Airway-Breathing-Circulation/Convulsions/Consciousness-Dehydration. You can easily remember them as **"ABCD"**.

A: Airway
B: Breathing
C: Circulation/Convulsions/Consciousness
D: Dehydration

First check for emergency signs in three steps *(Table 2.1)*:

Step-1: Check whether there is any airway or breathing problem. Manage the airway and give oxygen, if emergency signs related to airway and breathing are present.

Step-2: Quickly check circulation and decide whether the child is in shock or has impaired circulation. Then, quickly determine whether the child is **unconscious or convulsing**. If the **child is convulsing** when brought to hospital or during examination, this is an emergency and s/he will need emergency treatment.

Step-3: Ask whether the child is having diarrhoea. Assess for severe dehydration if history of diarrhoea is present.

Table 2.1: Triage steps

Triage Steps	Treat when any sign is positive
• Assess Airway	• If positive, treat. If negative, proceed to B
• Assess Breathing	• If positive, treat. If negative, proceed to C
• Assess Circulation/Consciousness/Convulsion	• If positive, treat. If negative, proceed to D
• Assess Dehydration	• If positive, treat. If negative, proceed to priority signs
If the child has any emergency sign of the ABCD, it means the child has an emergency "E" sign and emergency treatment should start immediately.	

General principles of management, if emergency signs are found:

- Call for help from an experienced health professional if available, but don't delay starting treatment. Stay calm and work with other health workers who may be required to give the treatment, because a very sick child may need several treatments at once.
- The most experienced health professional should continue assessing the child to identify all underlying problems and prepare a treatment plan.
- Carry out point of care emergency investigations (blood glucose, blood smear, hemoglobin etc.). Send blood for typing and cross-matching, if the child appears to be severely anemic or is bleeding significantly.
- After giving emergency treatment, proceed immediately to assess, diagnose and treat the underlying condition. All these children should be hospitalized and observed till stabilization.

The Need for Frequent Reassessment

During and after providing emergency treatment, the child should be re-assessed using the complete ABCD sequence. The disease course is dynamic and there could be new developments within a short time. Reassessment should begin with assessment of the airway and through the ABCD sequence.

2.3: ASSESSING PRIORITY SIGNS

Priority signs

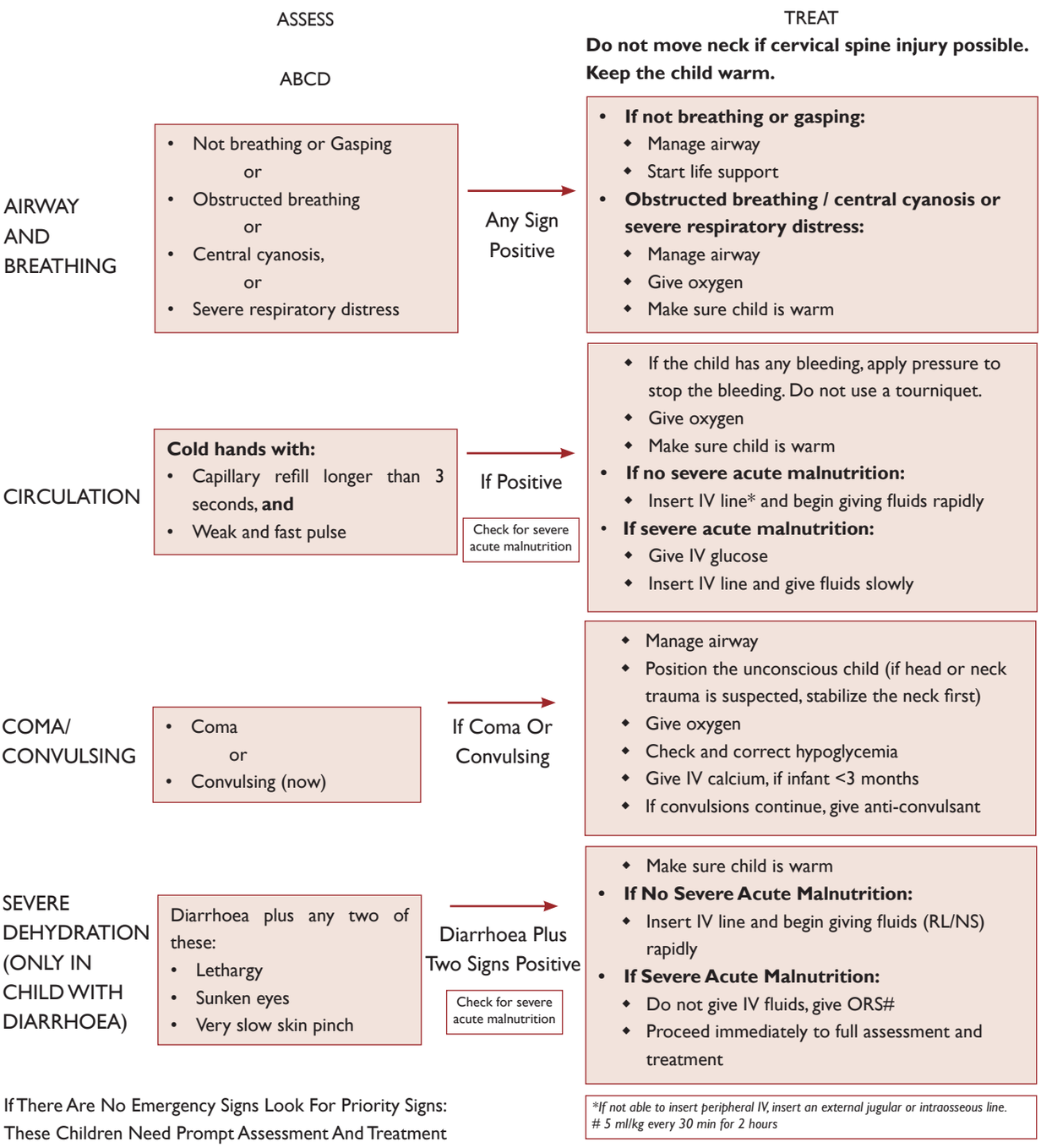
If no emergency signs are found, check for priority signs (Box 2.1). These children need prompt assessment (no waiting in the queue) to determine what further treatment is needed. Move a child with any priority sign to the front of the queue, to be assessed next. If a child has trauma or other surgical problems, get surgical help, wherever available.

Box 2.1: Priority signs

• Young infant (any sick child aged <2 months)
• Temperature (very high)
• Trauma or other urgent surgical condition
• Pallor (severe)
• Poisoning (history of swallowing drug/poisonous substance or stings/bites)
• Pain (severe)
• Respiratory distress
• Restless, continuously irritable, or lethargic
• Referral (urgent)
• Malnutrition: visible severe wasting
• Oedema of both feet
• Burns (major)

The above can be remembered from the mnemonic 3TPR MOB.

Chart 2.1: Triage of all sick children



NON-URGENT: Proceed with assessment and further treatment according to the child's priority.

2.4: AIRWAY AND BREATHING

The letters **A** and **B** in "ABCD" represent **"airway and breathing"**. Respiratory problems are common in infants and children and are the predominant cause of death in them. Assessment and treatment decisions must be made quickly to prevent respiratory failure and cardiopulmonary arrest *(Table 2.2)*.

Table 2.2: Assessment and treatment of airway and breathing

ASSESS AIRWAY AND BREATHING	• Not breathing / gasping, or • Obstructed breathing, or • Central cyanosis, or • Severe respiratory distress	→ ANY SIGN POSITIVE	• **If not breathing or gasping:** ◆ Manage airway ◆ Provide life support • **Obstructed Breathing / Central Cyanosis/ Severe Respiratory Distress** ◆ Manage airway ◆ Give oxygen ◆ Make sure child is warm

Assessment of breathing

Is the Child Breathing?

To assess whether the child is breathing there are three things you must do:

- Look: If active, talking, or crying, the child is obviously breathing. If not;
- Listen: Listen for any breath sounds. Are they normal?
- Feel: Can you feel the breath at the nose or mouth of the child?

Is the Airway Obstructed?

If the child is not breathing, or if the child has severe respiratory distress, is there an obstruction to the flow of air?

Does the child show Central Cyanosis?

Cyanosis occurs when there is an abnormally low level of oxygen in the blood. To assess for central cyanosis, look at the mouth and tongue. A bluish or purplish discoloration of the tongue and the inside of the mouth indicates central cyanosis. This sign may be absent in a child, who has severe anaemia.

Does the child have Severe Respiratory Distress?

If the child is talking, drinking or feeding comfortably, or appears to be happy, there is no severe respiratory distress (or obstructed breathing). Observe whether the child has significant discomfort from not getting enough air into the lungs.

- Is the child's breathing laboured – i.e. needing much more effort to breathe than normal? Is the child exhausted (tired)?
- Is there difficulty in breathing while talking, eating or breastfeeding?

- Is the child breathing very fast, has severe lower chest wall in-drawing, or using the auxiliary muscles for breathing which cause the head to nod or bob with every inspiration? The latter is particularly seen in young infants.
- Is oxygen saturation (SpO_2) less than 90%?

Abnormal respiratory noises

Are there any noises heard when breathing in? A harsh noise on breathing in (inspiration) is called **stridor**, a short noise when breathing out (expiration) in young infants is called grunting. Both noises are signs of severe respiratory problems *(Box 2.2)*.

Box 2.2: Signs of Severe Respiratory Distress

- Laboured or very fast breathing (RR >70/min)
- Severe lower chest wall indrawing
- Use of auxiliary muscles
- Head nodding
- Inability to feed because of respiratory problems
- Abnormal respiratory noises (stridor, grunting)
- SpO_2 (oxygen saturation) <90%

If the child is breathing adequately (no sign of severe respiratory distress), go to the next section and assess other emergency signs. If the child has an airway or breathing problem, you should initiate appropriate treatment and then quickly resume the assessment.

Provide life support

Remember that the administration of life support (cardiorespiratory resuscitation) involves performing numerous aerosol generating procedures. Hence all emergency response team members should be ready with full PPE when working in the emergency area. Restrictive Team Composition is advised to limit risk of exposure. Three-member Emergency Response System (ERS) team making the triangle of resuscitators with add on responsibilities can provide life support as described below:

Role 1: Airway (act as leader also)

Role 2: Compressor to alternate with member 3

Role 3: Automated External Defibrillator (AED) or defibrillator/administer medication/assists

Other team member(s) responsible for recording events or counseling should stay outside the resuscitation room or at safe distance from the site. Family members also should be advised to wait outside resuscitation room or at a safe distance from the site.

When a sick child reaches emergency, assess responsiveness and risk of COVID. If the child is unresponsive or has gasping breathing or not breathing, you need to provide life support *(Chart 2.2)*. SHOUT FOR HELP & activate emergency response system. Activation of ERS means immediate mobilization of resuscitation equipment (including defibrillator, wherever available) and skilled staffs at the site. Assess for breathing by looking for chest movements and pulse within 5-10 seconds.

How to check pulse

Check the child's pulse (take at least 5 seconds but no more than 10 seconds). You may try to feel the child's carotid or femoral pulse (brachial pulse in infants).

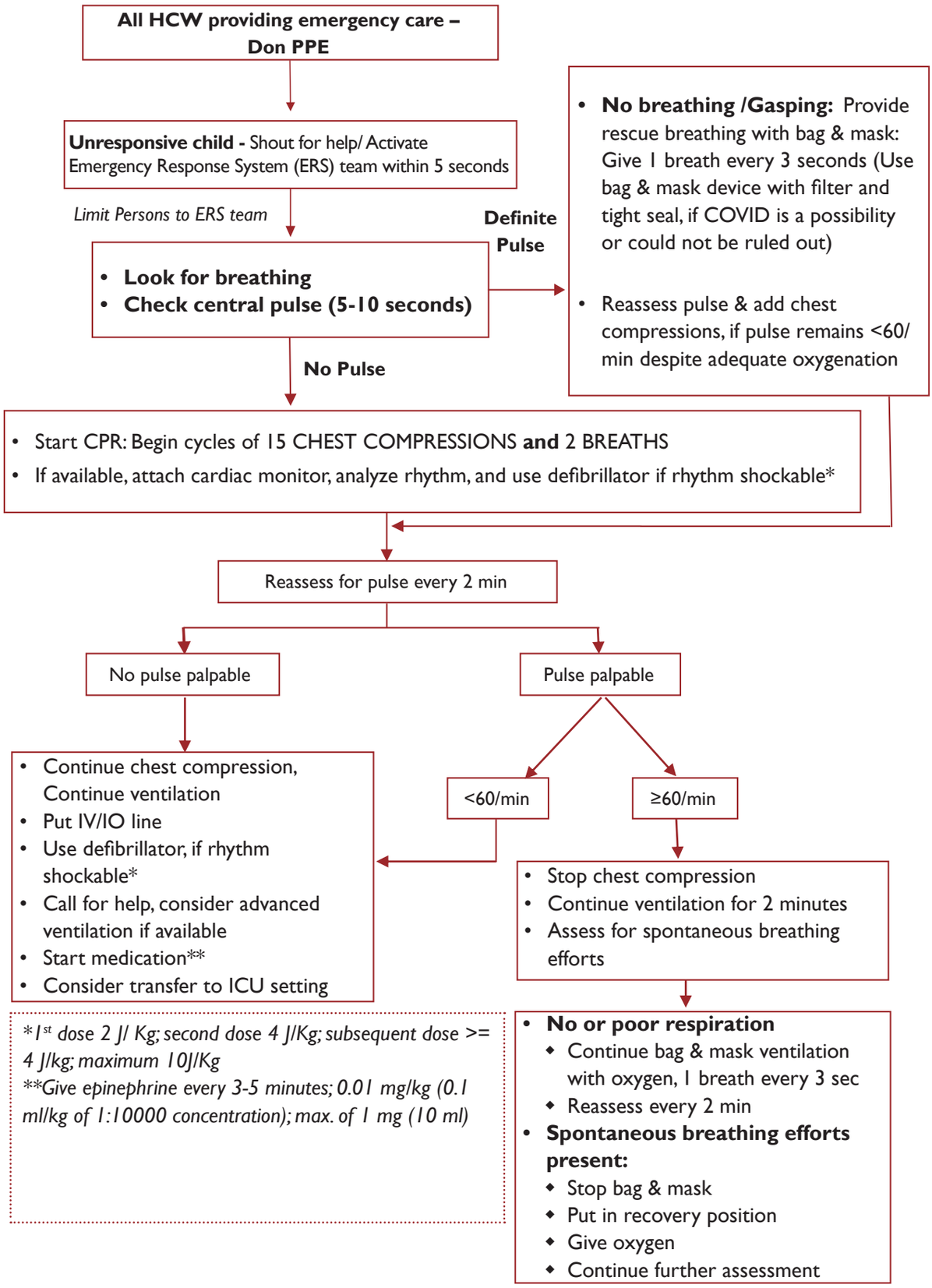
Locating the Carotid or Femoral Artery Pulse

To perform a pulse check in the child, palpate a carotid or femoral pulse.

- For palpating a carotid pulse, locate the trachea, using 2 or 3 fingers; slide these 2-3 fingers in to the groove between the trachea and the muscles at the slide of the neck.
- For palpating a femoral pulse, place 2 fingers in the inner thigh, midway between the hipbone and the pubic bone, just below the crease, where the thigh meets the abdomen.

If you do not definitely feel a pulse within 10 seconds, start chest compressions.

Chart 2.2: Providing Life Support



FURTHER READING: Management of Pulseless Cardiac Arrest

The etiology of pulseless arrest differs in children as compared to adults. Pulseless arrest in children does not usually result from a primary cardiac cause. More often it is the terminal result of progressive respiratory failure (hypoxia) or shock and is often called hypoxemic –ischemic arrest. Cardiac arrest may also occur due to Ventricular Fibrillation (VF) or Pulseless Ventricular Tachycardia (VT) in approximately 5% to 15 % of paediatric patients. The incidence of VF and pulseless VT cardiac arrest rises with age.

Simultaneous actions in a child found in pulseless cardiac arrest:

- As soon as the child is found to be unresponsive with no breathing, shout for help, ask for a defibrillator. Chest compressions should be immediately started by one rescuer, while second rescuer prepares to initiate ventilation with a bag and mask. Ventilation is extremely important in paediatric patients because large percentage of pulseless arrests occurs due to asphyxia.
- While two rescuers perform chest compressions and ventilations, third rescuer should arrange a monitor/ defibrillator, establish vascular access, and calculate and prepare the anticipated medications. Attach cardiac monitor, as soon as available.
- Emphasis should be placed on provision of high quality CPR providing chest compressions of adequate rate and depth, allowing for complete chest recoil after each compression.
- After attaching the monitor /defibrillator leads, temporarily interrupt chest compressions to determine the child's rhythm. Asystole and bradycardia with a wide QRS are most common in asphyxial arrest. VF and Pulseless Electric Activity (PEA) are less common, but VF is more likely to be present in older children. Rhythms are divided in two types –shockable and non-shockable rhythms.

Shockable rhythm: VF/VT

If the rhythm is shockable, deliver one unsynchronized shock. You can use either self- adhesive electrode pads or paddles to deliver shocks with a manual defibrillator. Self- adhesive pads are preferred because they are easy to apply and reduce the risk of current arcing. If you are using paddles, apply a conducting gel, cream, paste or an electrode pad between the paddle and the child's chest to reduce transthoracic impedance. Do not use saline-soaked gauze pads, sonographic gels, or alcohol pads. Alcohol pads may pose a fire hazard and cause chest burns.

Paddles/Pads

Use the largest paddles or self- adhering electrode pads, that will fit on the chest wall, without contact between the pads. Recommended paddle sizes are based on the child's weight/age.

Weight/ Age	Paddle size
>10 kg (approx. 1 year or older)	Large "adult" paddles (8 to 13 cm)
<10 kg (<1 year)	Small "infant" paddles (4.5 cm)

Steps for using manual defibrillation (for VF or pulseless VT)

- Turn on defibrillator
- Set lead switch to paddles (or lead I, II or III, if monitor leads are used)
- Select adhesive pads or paddles. Use the largest pads or paddles that can fit on the patient's chest without touching each other
- If using paddles, apply conductive gel or paste. Be sure cables are attached to defibrillator
- Position adhesive pads on patient's chest: right anterior chest wall and left axillary positions. If using paddles, apply firm pressure. If patient has an implanted pacemaker, do not position pads /paddles directly over the device. Be sure that oxygen is not directed over patient's chest
- Select energy dose
  - Initial dose: 2 J/kg
  - Subsequent doses: 4 J/kg or higher (not to exceed 10 J/kg or standard adult dose)
- Announce "charging defibrillator," and press charge on defibrillator controls or apex paddle
- When defibrillator is fully charged, state firm chant, such as: "I am going to shock on three." Then count. "All clear!" (chest compressions should continue until this announcement)
- After confirming all personnel are clear of the patient, press the shock button on the defibrillator or press the 2 paddle discharge buttons simultaneously
- Immediately after shock delivery, resume CPR beginning with compressions for 5 cycles (about 2 minutes), and then recheck rhythm. Interruption of CPR should be brief

Remember, rhythm and pulse checks should be brief (<10 seconds)

Non-shockable Rhythm

- If the rhythm is non-shockable, asystole or PEA may be present. Twenty-five percent (25 %) of children with non-shockable rhythm may convert to shockable rhythm at some point during resuscitation.
- For treatment of asystole or PEA, provide high quality CPR. During this time establish vascular (IO or IV) access and consider endotracheal intubation. Deliver epinephrine as appropriate, and try to identify and treat potentially reversible causes of the arrest.

Dose of epinephrine is as follows:

Epinephrine	
Route	**Dose**
IO/IV	0.01 mg/kg (0.1 mL/kg) bolus 1:10 000
ET	0.1 mg/kg (0.1 mL/kg) bolus 1:1000
Repeat epinephrine administration about every 3 to 5 minutes if cardiac arrest persists. This generally results in the administration of epinephrine after every second (i.e., every other) rhythm check.	

After about 2 minutes of CPR, check the rhythm

If rhythm is	Then
Shockable	Give shock as described earlier
Non-shockable	Continue CPR and drugs

2.5: MANAGEMENT OF AIRWAY AND BREATHING IN A UNRESPONSIVE/ GASPING CHILD WITH PALPABLE PULSE

Respiratory Arrest

When a child or infant has a palpable pulse, but is not breathing effectively, rescuers should give breaths without chest compressions. Respiratory arrest is the absence of respirations (apnoea). During initial phase of respiratory arrest and inadequate ventilation, the victim has cardiac output (blood flow to the body) detectable as a palpable central pulse. The heart rate may be slow, and cardiac arrest may develop if rescue breathing is not provided. When respirations are absent or inadequate, the healthcare provider must immediately open the airway and give breaths to prevent cardiac arrest and hypoxic injury to the brain and other organs. Reassess pulse after 15-20 breaths (1 min) and if despite adequate oxygenation and ventilation, the pulse is <60/min, start Cardio-Pulmonary Resuscitation (CPR), starting with chest compression (C-A-B sequence).

Cardiac arrest in infants and children does not usually result from a primary cardiac cause. More often it is the terminal result of progressive respiratory failure or shock, also called an asphyxia arrest. Asphyxia begins with a variable period of systemic hypoxemia, hypercapnia and acidosis, progresses to bradycardia and hypotension and culminates with cardiac arrest.

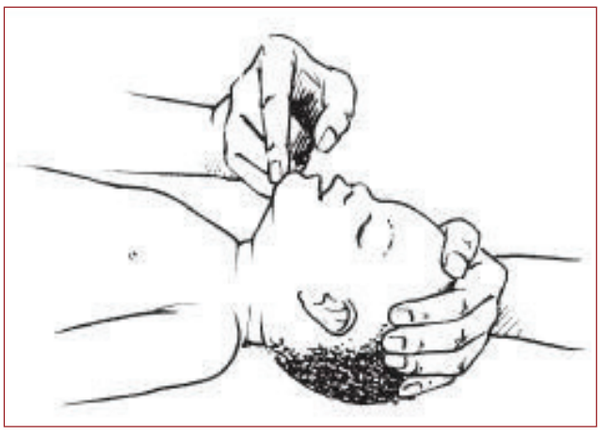


Figure 2.1: Neutral Position in an Infant

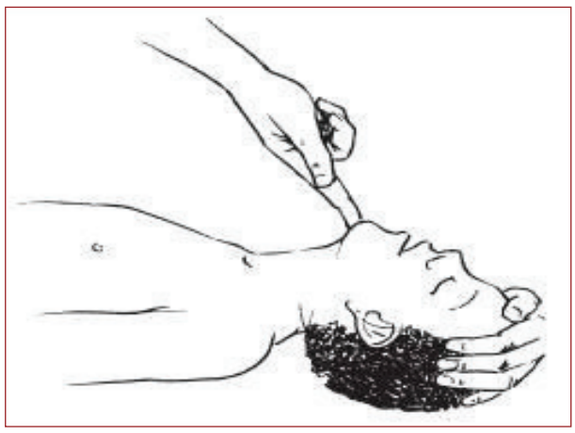


Figure 2.2: Sniffing Position to Open up Airway in a Child (Chin Up)

Positioning to improve the airway

Children are at higher risk of having respiratory obstruction and failure due to small size of upper airway, large size of tongue, smaller and compliant subglottic area, relatively compliant chest wall and limited oxygen reserve. To treat an airway or breathing problem, you should first open the airway and then begin giving oxygen. The drawings above show the chin lift *(Figure 2.1 & 2.2)*. This is a way of opening the airway in children who have not been subjected to trauma. The drawings illustrate two different positions. **To do this safely, you must know if the child has been subjected to any trauma**. In such a case, it is important not to tilt the head or move the neck. It is also important to know the child's age because you will position an infant differently from a child.

Head tilt-chin lift manoeuver

The neck is slightly extended and the head is tilted by placing one hand on to the child's forehead. Lift the mandible up and outward by placing the fingertips of other hand under the chin. In an infant, a neutral position (nose up) *(Figure 2.1)* and in a child a sniffing position (chin up) is maintained *(Figure 2.2)*.

Is Trauma of the Neck a Possibility?

Always ask and check for head or neck trauma before treating, as this will determine how much the child can be moved. If the child has trauma, you must avoid further injury during assessment or treatment. If you suspect trauma, open airway with jaw thrust to limit the risk of aggravating a potential cervical spine injury while you immobilize the cervical spine. Jaw thrust is safe to use in cases of trauma for children of all ages. The jaw thrust is achieved by placing two or three fingers under the angle of the jaw on both sides, and lifting the jaw upwards and outward *(Figure 2.3)*. The jaw thrust manoeuver is also used to open the airway when bag-mask ventilation is performed.

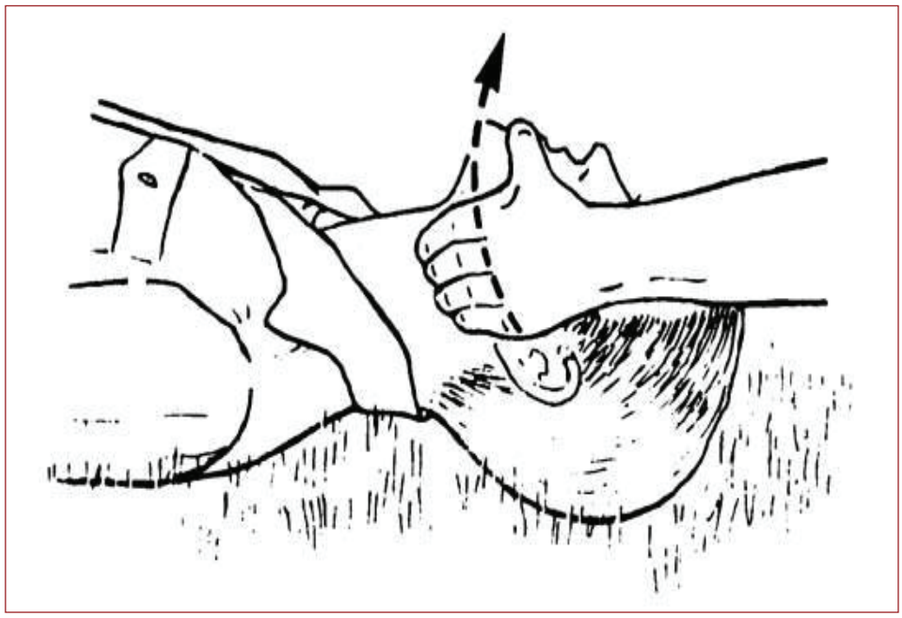


Figure 2.3: Jaw Thrust without Head Tilt

- Kneel behind the patient's head.
- Rest your elbows on the surface on which the patient is lying.
- Place one hand on each side of the patient's head.
- Place the tips of your index and middle fingers under the angles of the patient's jaw. (This is done on both sides)
- Place your thumbs on the patient's jaw just below the level of the teeth. The thumbs will keep the patient's head from turning or tilting during the lift.
- Lift the jaw upward with your fingertips. The mouth should not be closed as this could prevent air from entering the patient's airway. Use your thumb to retract the patient's lower lip if needed.
- If the lift does not open the airway (tongue is still blocking the airway), lift the jaw up a little further. If you are unable to obtain an airway with the jaw-thrust method, the head-tilt/chin-lift method should be used. The importance of maintaining a patent airway outweighs the risk of spinal damage.

Ventilate with Bag and Mask

If the child is not breathing or breathing is inadequate (as judged by insufficient chest movements and inadequate breath sounds) even after management of the airway, ventilate with a self-inflating bag and mask. **Wherever there is risk of COVID, use bag-mask device with filter and tight seal.**

Before use, check the bag and valve by closing the patient's side of connection with your thumb and attempt to expel air from the bag. If the bag and valve are in order, this will not be possible until you release your thumb. If either the bag or valve is faulty, the bag will empty easily. The essence of the technique is to roll the mask on to the face from the chin while avoiding the eyes with a finger and thumb and apply a strong even downward pressure to the top of the mask.

It is important for the mask to be the correct size for the child; it must completely cover the mouth and nose without covering the eyes or overlapping the chin. The correct size and position are shown in the *Figure 2.4*.

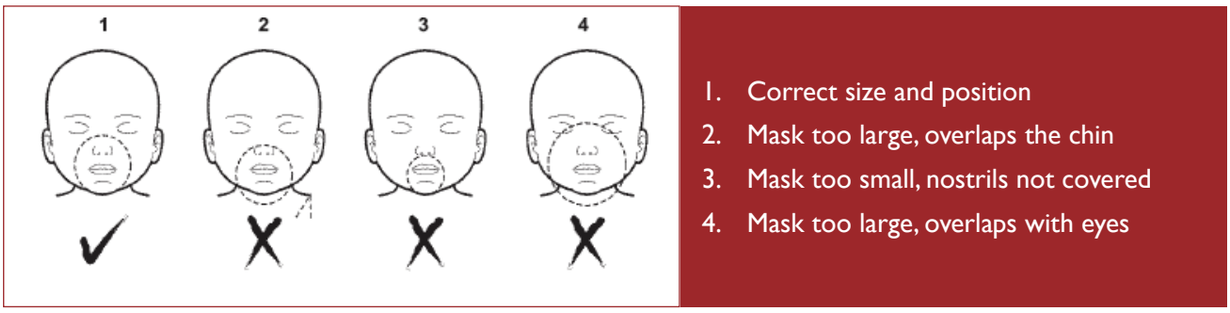


Figure 2.4: Choosing the correct mask size

There are several sizes of mask, and a selection of these should be available. Self-inflating bags of minimum volume 450-500 ml should be used. Use only the force and tidal volume necessary to cause the chest to rise visibly. Reservoir and oxygen (5-6 L/min) should be connected to the self-inflating bag during resuscitation *(Figure 2.5)*. If oxygen is not available, use room air for resuscitation. With room air 21% oxygen is delivered, but by using oxygen source with reservoir 60% to 90% oxygen can be delivered.

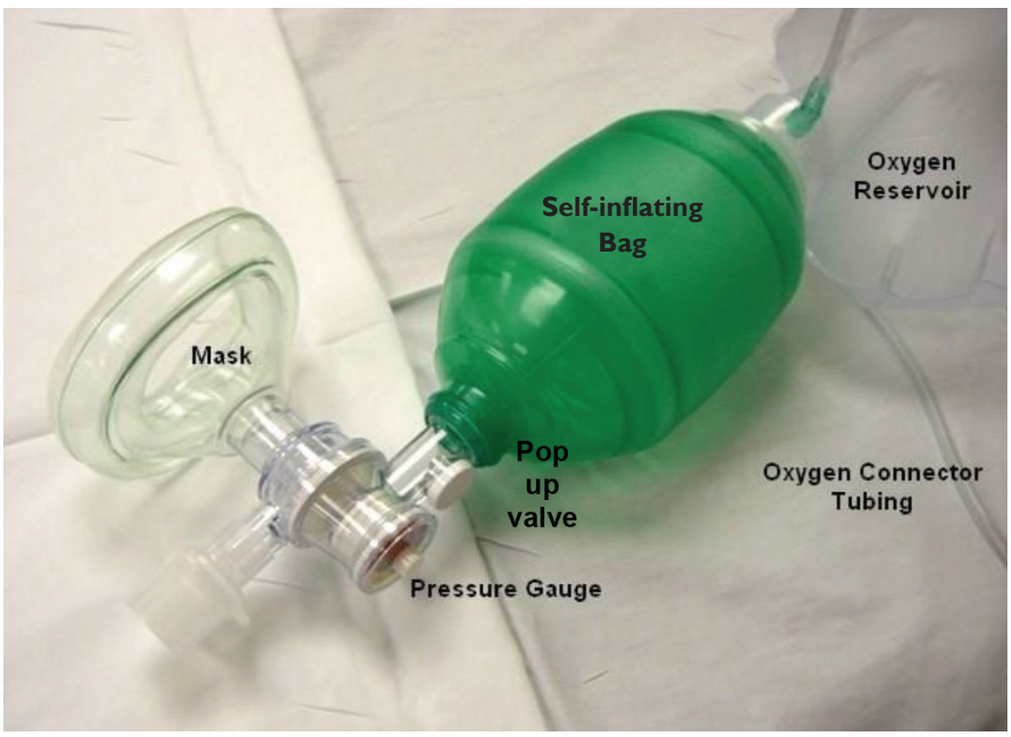


Figure 2.5: Self Inflating Bag

Perform the bag and mask ventilation with E-C clamp technique *(Figure 2.6)*. Position the thumb and index finger in a C shape over the mask and exert downward pressure on the mask to ensure proper air seal. Position the last 3 fingers under the angle of mandible to lift the jaw. If you are alone, maintain the E-C clamp with one hand and compress the bag with the other hand. More effective ventilation can be achieved when performed by 2 persons.

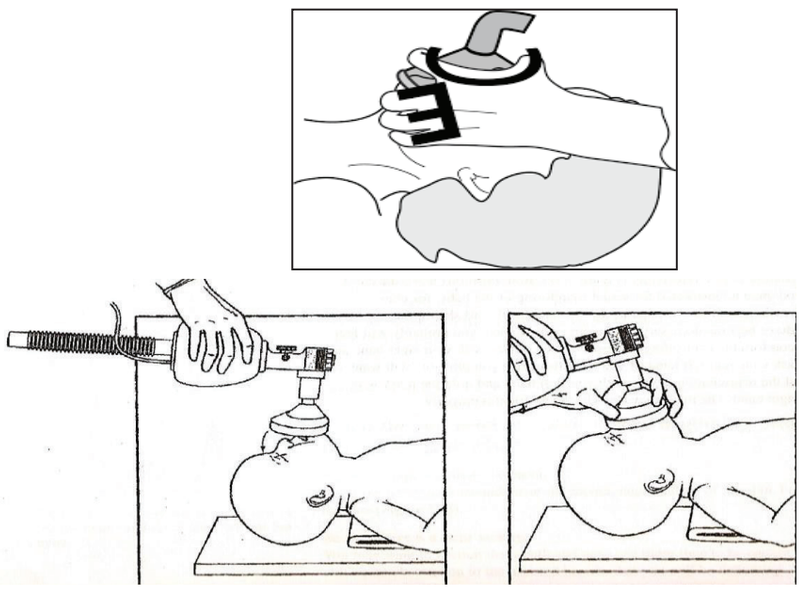
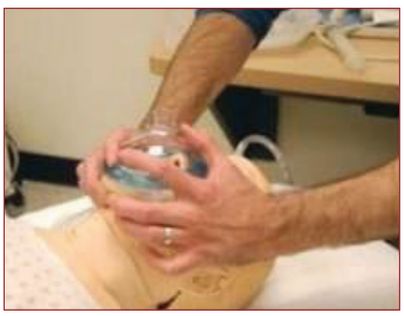


Figure 2.6: Bag and Mask Ventilation E-C clamp technique

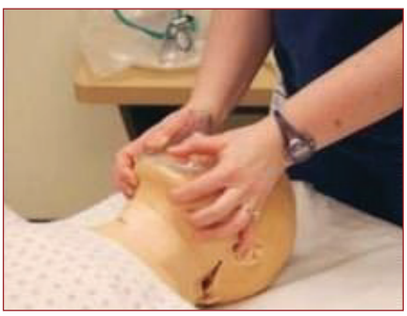
If effective ventilation is not achieved (i.e., the chest does not rise), perform the actions listed in *Box 2.3*. If signs of circulation are present, but spontaneous breathing is absent, continue bag and mask ventilation at a rate of 20 breaths/ minute for a few minutes and see if child revives and starts to breathe spontaneously. If bag and mask ventilation is prolonged, it can cause gastric inflation, which can be relieved by nasogastric tube.

Box 2.3: Actions to be taken, if effective ventilation is not achieved

- Reapply mask & reposition the head
- Suction the throat and keep mouth slightly open
- Increase the pressure
- Use endotracheal intubation, if skill available



With the two-provider technique, one person should hold the mask with both hands, while the other person bags the patient



An alternative method is for the mask holder to apply pressure to the mask while using four finger to apply jaw lift

Figure 2.7: Two-person Bag and Mask Ventilation

When two persons are available and only ventilation is required, use above mentioned method as shown in (Figure 2.7).

In spontaneous breathing patients, gentle positive-pressure breaths administered with bag and mask should be carefully timed to augment the child's effort (Box 2.4). If not breathing adequately- intubate/call help for intubation and provide tracheal tube ventilation to the child as it is the most effective and reliable method of assisted ventilation. Some of these children may additionally need chest compression.

Box 2.4: Rescue breathing for infants and children

- Give 1 breath every 3 to 5 second (about 12 to 20 breaths /min)
- Give each breath in 1 second.
- Each breath should result in visible chest rise.
- Check the pulse about every 2 minutes

2.6: MANAGEMENT OF AIRWAY IN A CHOKING CHILD (FOREIGN BODY ASPIRATION WITH INCREASING RESPIRATORY DISTRESS)

A child with a history of aspiration of a foreign body, who shows increasing respiratory distress is in immediate danger of choking. Attempts to remove the foreign body should be made instantly. Do not hesitate. Foreign body (such as a piece of fruit) can lodge in the upper airway. Coins and peanuts are notorious causes of aspiration and subsequent choking. Ask the child's caretaker explicitly for a history of choking. Foreign body should be suspected in cases of sudden respiratory distress associated with coughing, gagging, stridor, cyanosis, or wheezing. **Do not try to remove the foreign bodies in the upper airway by blind finger sweep, as it may result in pushing back of foreign body into the airway or may cause serious bleeding.**

The treatment differs depending on whether there is a foreign body causing respiratory obstruction or some other cause for the obstruction or respiratory distress. If child is able to cough or cry it indicates partial obstruction. Encourage the child to cough, **consider immediate referral where bronchoscopy facility is available**. If a foreign body is causing the complete obstruction, it is life threatening and needs immediate interventions. Different methods are used for clearing up the foreign body in infants and children.

Management of conscious infant *(Figure 2.8)*

- Lay the infant on your arm or thigh in a head down position and support the head by firmly holding the jaw.
- Give 5 blows to the infant's back with heel of hand between the shoulder blades.
- If obstruction persists, turn infant over and give 5 chest thrusts with 2 fingers, one finger breadth below nipple level in midline.
- If obstruction persists, check infant's mouth for any foreign body which can be removed.
- If necessary, repeat sequence until the foreign body is expelled or the patient becomes unconscious. If he becomes unconscious start CPR.

Figure 2.8: Slapping the back to clear airway obstruction in a choking child

Management of conscious child: Abdominal thrusts (Heimlich maneuver) ≥ One year as shown in Figure 2.9.

- The child may be sitting or standing.
- Stand or kneel behind the child and encircle his torso by putting both arms directly under axillae.
- Place the thumb side of one fist against the victim's abdomen in the midline slightly above the navel and well below the tip of the xiphoid process.
- Place the other hand over the fist and pull upwards into the abdomen, repeat this Heimlich maneuvers 5 times.
- If the obstruction persists, check the child's mouth for any foreign body which can be removed.
- If necessary, repeat this sequence until the foreign body is expelled or the patient becomes unconscious. After you have performed this procedure you should check inside the mouth for any foreign body. Obvious foreign bodies should be removed. Secretions should be cleared from the throat. The breathing should be checked again.

Figure 2.9: Heimlich maneuver in a choking older child

2.7: MANAGEMENT OF UNREPONSIVE CHILD WITH NO PALPABLE PULSE

If you do not definitely feel a pulse, begin CPR starting with chest compressions (C-A-B sequence).

Chest Compressions

If you do not confidently detect a pulse or other signs of circulation or if heart rate is less than 60/min in an infant or child, with signs of poor perfusion even after adequate oxygenation and ventilation, provide chest compressions coordinated with ventilations. Recheck pulse after 2 minutes. The child should be supine on a hard-flat surface.

Chest compression in the infant

- **Thumb technique**, where the 2 thumbs are used to depress the sternum, while the hands encircle the torso and the fingers support the spine *(Figure 2.10)*.
  - This is preferred method when 2 or more health workers are available
  - Stand at the infant's feet or side
  - Place your thumbs side by side over lower half of sternum, encircle the infant's chest and support the infants back with the fingers of both hands.
  - Use both thumbs to depress the sternum.

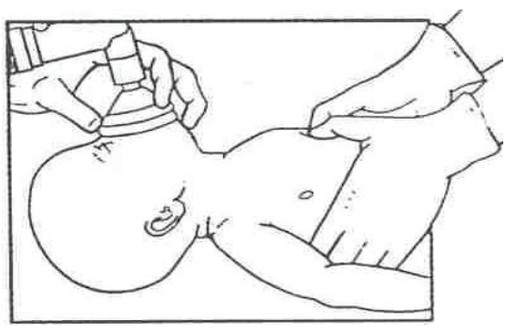


Figure 2.10: Chest Compression-Thumb Technique

- **High quality CPR**
  - Using either method to give chest compressions, **compress the lower half of the sternum but do not compress over the xiphoid**. After each compression, allow the chest to recoil fully, because complete chest re-expansion improves blood flow into the heart.
  - **"Push hard":** push with sufficient force to depress the chest approximately one third to one half the antero-posterior diameter of the chest.
  - **"Push fast":** push at the rate of 100-120 compressions per minute.
  - **Release completely** to allow complete recoil of the chest by completely releasing the pressure but maintaining contact with the compression site.
  - **Minimize interruptions** in chest compressions.
  - **Change compressor** every 2 minutes, or sooner if fatigued.
  - The ratio of chest compressions and ventilation should be **15:2.** Two effective breaths should be given after every 15 chest compressions. *(Box 2.5)*.

- Rate 100-120/min
- Compression depth to at least 1/3 AP diameter of the chest, about 1.5 inches (4 cm) in infants and 2 inches (5 cm) in children
- Allow complete chest recoil after each compression
- Minimize interruptions in chest compressions
- Avoid excessive breaths
- Change compressor every 2 minutes, or sooner if fatigued

Box 2.5: High quality CPR

Chest compressions for the child (1 year or above)

- Place the heel of one hand over the lower half of the sternum. Lift your fingers to avoid pressing on the ribs (Figure 2.11).
- Depress the sternum 1/3 to 1/2 of the depth of the chest. This corresponds to approximately 4 -5 cm.
- Compress at the rate of approximately 100 times per minute.
- The compression to ventilation ratio remains same as described for infants.

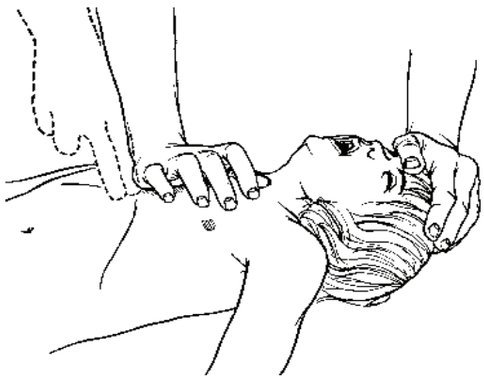


Figure 2.11: Chest Compression for the Child (1 year or above)

2.8: GIVE OXYGEN

For all children who have any problem with their airway or breathing, always give oxygen first, while you continue to assess for other problems. Oxygen therapy should be guided by pulse oximetry, wherever possible. **When the child has only respiratory distress, oxygen supplementation is recommended at SpO_2 <90%. Children presenting with other emergency signs with or without respiratory distress should receive oxygen therapy if their SpO_2 is <94%.** When a pulse oximeter is not available or pulse oximeter does not pick saturation (shock, hypothermia) the necessity for oxygen therapy should be guided by clinical signs and should be continued till emergency signs persists.

Oxygen therapy can be stopped when a child no longer has emergency signs and maintains a peripheral capillary oxygen saturation ≥90% in room air.

2.9: CIRCULATION

The letter C in "ABCD" stands for

- Circulation (shock)
- Coma
- Convulsions

Assess the Circulation

After the airway, has been opened, to assess if a child has a circulation problem you need to know:

- Does the child have warm hands?
- Is the capillary refill time (CRT) longer than 3 seconds?
- Is the pulse weak and fast?

Are the child's hands warm?

To assess the circulation, take the child's hand in your own. If it feels warm, the child has no circulation problem and you do not need to assess capillary refill or pulse. If the child's hands feel cold, you need to assess the capillary refill.

Is the CRT> 3 seconds?

Capillary refill is a simple test that assesses how quickly blood returns to the skin after pressure is applied. It is carried out by applying pressure to the pink part of the nail bed of the thumb or big toe in a child and over the sternum or forehead in an infant for 3 seconds *(Figure 2.12)*. CRT is the time from release of pressure to complete return of the pink color. **Normally, it is less than 3 seconds**. If it is >3 seconds, then this is prolonged. While checking the CRT in a limb, lift it slightly above heart level. Lifting of the limb helps in assessing arteriolar capillary refill and not venous stasis. Lifting is not required when tested on forehead or sternum.

Capillary refill is prolonged in shock because the body tries to maintain blood flow to vital organs and reduces the blood supply to less important parts of the body like the skin (peripheral vasoconstriction). This sign is reliable except when the room temperature is low, as cold environment can cause a delayed capillary refill *(Box 2.6)*.

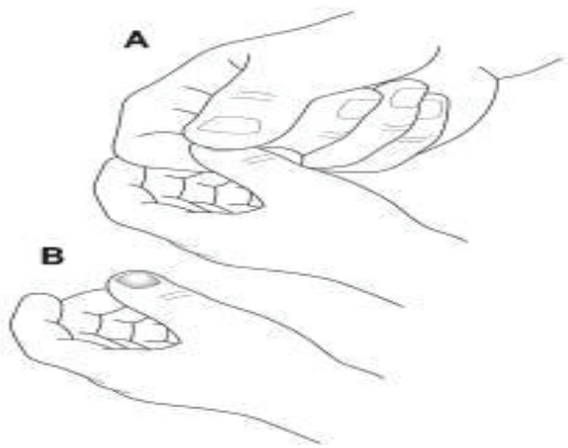


Figure 2.12: Checking Capillary Refill

A. Applying pressure to the nail bed for 3 seconds

B. Check the time to the return of the pink color after releasing the pressure

Is the pulse weak and fast?

The central pulse (a pulse nearer to the heart) should be felt. *If this is strong and not obviously fast, then the pulse is adequate* and no further assessment is needed. In an infant, the best place to feel pulse is at the middle of the upper arm medially (brachial pulse) as shown in *Figure 2.13*. If the child is lying down, feel for the femoral pulse in the groin. Locate the superior border of the pubic symphysis in the mid line of the body. Feel the bony prominence in the anterior limit of the iliac crest. The femoral pulse can be found midway between these two bony points (the mid-inguinal point). In an older child, feel for the carotid pulse in the neck. Pulse is fast if rate is >160/min in an infant and >140/min in children above 1 year.

Figure 2.13: Palpating the brachial artery

Box 2.6: Blood pressure & Shock

It is not recommended to check blood pressure to assess for shock during the ETAT because of two reasons:

- Low blood pressure is a late sign in children and may not help to identify early (compensated) shock cases.
- Normal BP readings will not exclude compensated type of shock.

2.10: SHOCK

If the child has **cold hands and a CRT >3 seconds, and a fast & weak pulse**, then he or she is in shock. The commonest cause of shock in children is due to loss of fluid from circulation, either through loss from the body as in severe diarrhoea or when the child is bleeding, or through capillary leak in a disease such as severe dengue fever. In all cases, it is important to replace this fluid quickly. An intravenous line must be inserted and fluids given rapidly in children with shock unless the child has severe acute malnutrition.

Treatment of Shock:

Treatment of shock requires teamwork and following actions need to be started simultaneously:

- If the child has any bleeding, apply pressure to stop the bleeding (do not use tourniquet).
- Give oxygen to keep SpO_2 ≥94%.
- Make sure the child is warm, lying supine, head not elevated.
- Establish IV access at an appropriate site or intraosseous access.
- Take blood samples for emergency laboratory tests (blood sugar, blood urea, serum creatinine, sodium and potassium etc.).
- Start IV fluids

2.11: ADMINISTERING IV FLUIDS RAPIDLY FOR SHOCK IN A CHILD WITHOUT SEVERE ACUTE MALNUTRITION *(Chart 2.3, Box 2.7)*

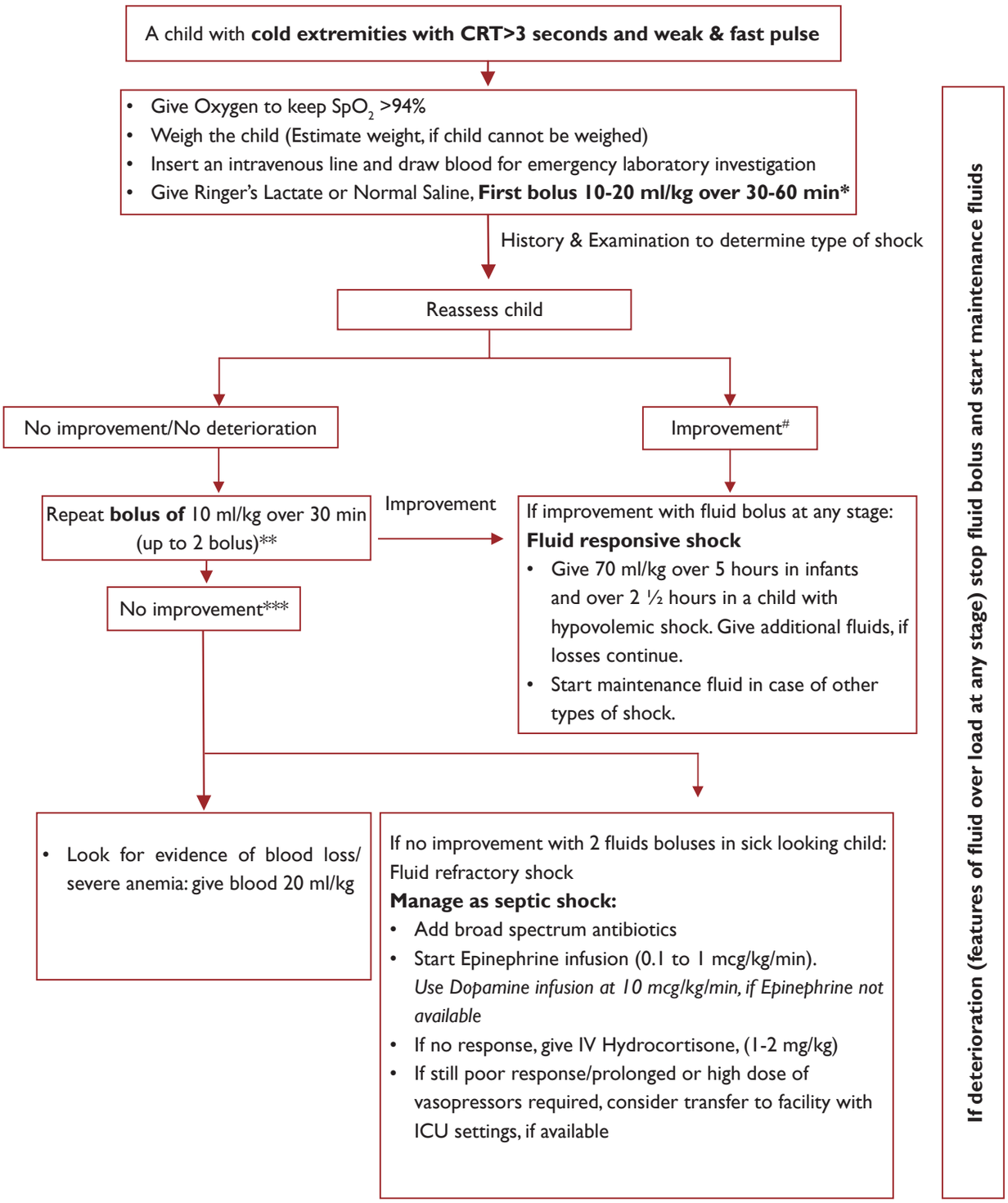
When shock is characterized by aetiology, the terms hypovolemic, cardiogenic, distributive and obstructive shock are used. Hypovolemia is the leading cause of shock in children worldwide. Expansion of circulatory blood volume by early volume replacement is important to prevent progression to refractory shock and to reduce the risk of multiple organ dysfunctions.

Therefore, quickly establish vascular access in all patients with shock. Administer intravenous fluids during initial resuscitation of all forms of shock, although cardiogenic shock may require alternative therapies. Volume expansion is best achieved with isotonic crystalloid solutions such as Ringer's lactate (RL) or normal saline (NS) as they are easily available and effectively expand the intravascular volume. As only approximately one fourth of administered solution remains in the intravascular compartment, adequate quantity of crystalloid solution must be administered in hypovolemic children. Large rapid bolus may cause problem in febrile children, children who are malnourished and children with cardiogenic shock where slow and careful monitoring is critical. Colloid solutions (e.g. hemoccel, 5% albumin, blood, and fresh frozen plasma) also are also efficient volume expanders but are not easily available and may cause sensitivity reactions and other complications.

Box 2.7: Initial fluid therapy in a child with shock

- When signs of shock are detected, rapidly administer a fluid bolus of 10-20 ml/kg of isotonic crystalloid solution (RL/NS over 30-60 minutes).
- Fluid administration rate should be individualized for each patient based on frequent clinical assessment (pulse rate, capillary refill, breathing rate) before, during and after fluid therapy is given.
- Placement of a 3-way stopcock in the IV tubing system can facilitate rapid fluid delivery as fluids can be pushed by syringe.
- Slower rate (over 60 min) is recommended for children who have febrile illnesses, are malnourished and children with moderate to severe anaemia.
- Once you have started fluid, assess for type of shock (hypovolemic, distributive, cardiogenic and obstructive) which is critical to decide further management.

Chart 2.3: How to Give IV Fluids for Shock in a Child without Severe Acute Malnutrition



**Give 20 ml/kg IV fluids fast over 15-30 minutes in hypovolemic shock, slow over 60 min if the child has moderate malnutrition or severe pallor or fever*

***Give 20 ml /kg IV fluid bolus in case of hypovolemic shock*

#Signs of improvement: Good volume and slowing pulse rate and faster capillary refill.

****If deterioration (increase in RR > 5 and HR > 15) stop fluid, consider cardiogenic or septic shock.*

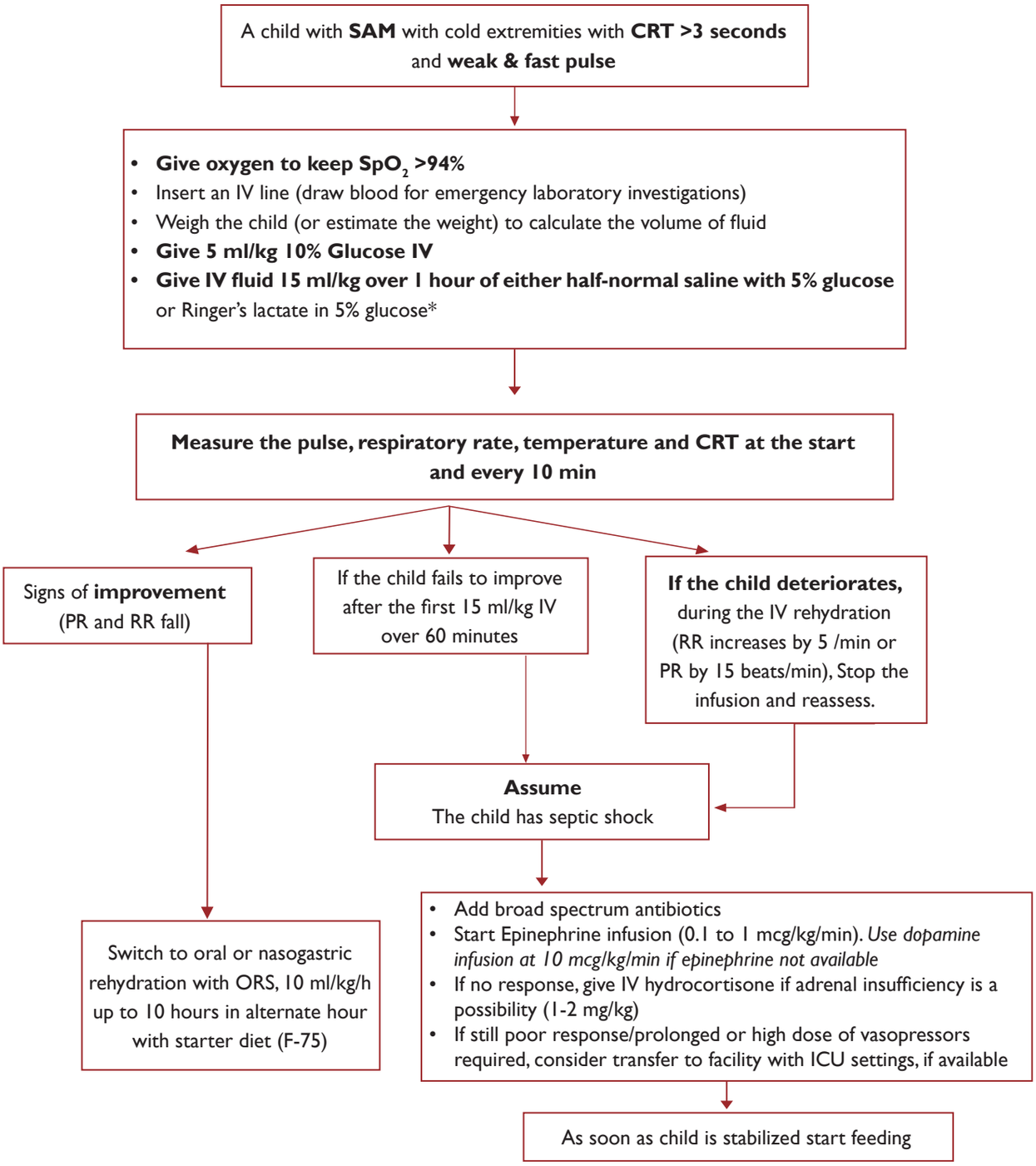
2.12: ADMINISTERING IV FLUIDS FOR SHOCK IN A CHILD WITH SEVERE MALNUTRITION *(Chart 2.4)*

Shock in children with severe acute malnutrition is difficult to assess and manage. Malnutrition not only affects the muscles but also other internal organs. The heart become very weak and may fail if it has to pump large volumes of fluid. Fluid accumulates in the lungs (pulmonary oedema) and makes breathing difficult with the child getting worse or even critical. Therefore, a child who is severely malnourished should not be treated by rapid IV infusion of fluid.

Children with severe acute malnutrition should be managed with different type of fluid and a different rate of administration and need close monitoring. Give IV fluids ½-strength Normal Saline (N/2) with 5% glucose or Ringer's Lactate in 5% glucose at 15 ml/kg in 1 hr. Give Ringer's Lactate if both the fluids are not available.

Sometimes children with severe acute malnutrition have circulatory signs suggesting shock, but have septic shock rather than hypovolemia. Monitoring child closely by checking the pulse, respiratory rate, temperature and CRT every 10 minutes helps in identifying septic shock. Discontinue the intravenous infusion if either of these increase (pulse by 15/minute, respiratory rate by 5/minute). If the child fails to improve after the first 15 ml/Kg IV, assume the child has septic shock and manage as per management guidelines for children with severe acute malnutrition. More details are available in Section 9. Repeat 15 ml/kg of fluid if child has some improvement and there is history of profuse diarrhoea or is a suspected case of cholera. If the child shows signs of improvement, then switch to oral or nasogastric rehydration.

Chart 2.4: How to Give IV Fluids for Shock in a Child with Severe Acute Malnutrition (SAM)



** If profuse diarrhoea (more than 10 loose watery stools in last 24 hours), repeat 15 ml/kg of fluid over 1 hour*

The presence of one or two of three signs i.e. cold extremities, CRT >3 seconds and a weak and fast pulse indicates nonspecific circulatory impairment that could be due to conditions other than circulatory shock. For example, cold extremities and prolonged capillary refill may be due to exposure to cold and a fast pulse may be due to pain or distress.

These children should not be given rapid infusions of fluids but should receive maintenance fluids, appropriate for their age and weight. In the absence of shock, rapid intravenous infusions of fluids may be particularly harmful in children with severe febrile illness, severe pneumonia, severe malaria, meningitis, severe acute malnutrition, severe anaemia, congestive heart failure with pulmonary oedema, congenital heart disease, renal failure and diabetic ketoacidosis.

Children with any sign of impaired circulation, i.e. cold extremities, or prolonged capillary refill or a weak and fast pulse, should be prioritized for full assessment and treatment and reassessed within 1 hour.

2.13: COMA AND CONVULSION

Now we shall look at the second and third components in which C represents "**coma and convulsion**".

Coma, lethargy, and convulsions indicate impaired neurological state.

Assess the child for coma and convulsion

To assess the child's neurological status, you need to know:

- Is the child in coma?
- Is the child convulsing?

Is the Child in Coma?

A child who is awake is obviously conscious and you can move to the next component of the assessment. If the child is asleep, ask the mother/caregiver if the child is just sleeping. If there is any doubt, you need to assess the level of consciousness.

Try to wake the child by talking to him/her, e.g. call his/her name loudly. A child who does not respond to this should be gently shaken. A little shake to the arm or leg should be enough to wake a sleeping child. Do not move the child's neck. If this is unsuccessful, apply a firm squeeze to the nail bed, enough to cause some pain. A child who does not wake up to voice or being shaken or to pain is unconscious.

To assess level of consciousness of a child, a simple scale (AVPU) is used:
A Is the child **A**lert? If not,
V Is the child responding to **V**oice? If not,
P Is the child responding to **P**ain?
U The child who is **U**nresponsive to voice (or being shaken) AND to pain is considered **U**nconscious

A child who is not alert, but responds to voice, is lethargic. An unconscious child may or may not respond to pain. **A child with a coma scale of "P" or "U" will receive emergency treatment for coma as described below.**

Is the Child Convulsing Now?

This assessment depends on your observation of the child and not on the history from the parent. Children who have a history of convulsion, but are alert during triage, need a complete clinical history and investigation, but no emergency treatment for convulsions. Convulsion can be recognized by the sudden loss of consciousness associated with uncontrolled jerky movements of the limbs and/or the face. There is stiffening of the child's arms and legs and uncontrolled movements of the limbs. The child may lose control of the bladder, and is unconscious during and after the convulsion. Sometimes, in infants, the jerky movements may be absent, but there may be twitching (abnormal facial movements) and abnormal movements of the eyes, hands or feet. Therefore, observe the infant carefully for convulsion.

Treatment of coma and convulsion *(Table 2.3)*

Treatment of coma and convulsions are similar and will be described together. Airway is managed in a manner similar to treating any child with an airway or breathing problem. This has been discussed earlier. Give oxygen to all children with SpO2 <94%. If blood sugar is less than 45 mg/dl in normal nutritional status child or less than 54 mg/dl in severely malnourished child, he/she has hypoglycaemia. Treat him with 5 ml/kg of 10% Dextrose IV.

Table 2.3: Assessment and treatment of coma and convulsion

COMA/ CONVULSING	• Coma **or** • Convulsing (now)	→ IF COMA OR CONVULSING	• Manage airway • Position the unconscious child (if head or neck trauma is suspected, stabilize the neck first) • Give oxygen • Check and correct hypoglycemia* • Give IV calcium if infant <3 months • If convulsion continue, give anti-convulsant

**Give treatment for hypoglycemia if a facility to check blood sugar is not available.*

Coma

Any unconscious child who is breathing and keeping the airway open should be placed in the recovery position *(Figure 2.14)*. This position helps to reduce the risk of vomitus entering the child's lungs. It should only be used in children without any trauma.

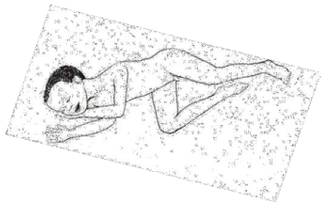


Figure 2.14: Recovery Position of Unconscious Child

If neck trauma is not suspected

- Turn the child on the side to reduce risk of aspiration
- Keep the neck slightly extended and stabilize by placing the cheek on one hand
- Bend one leg to stabilize the body position

If trauma is suspected:

- Stabilize the child while lying on the back
- Use the "log roll" technique as shown in Figure 2.15 to turn the child on the side if the child is vomiting

Log roll

Move a patient with a suspected cervical spine injury carefully. Avoid rotation and extremes of flexion and extension. One person, usually the most senior attendant, should assume responsibility for the neck. S/He should stand at the top end of the patient, hold the patient's head, and place the fingers under the angle of the mandible with the palm over the ears and parietal region and maintain gentle traction to keep the neck straight and in line with the body. Patient then can be rolled to one side with the help of two more persons simultaneously moving the torso and lower limbs on instructions from the senior attendant as shown in *Figure 2.15*.When the patient is not being moved, a sandbag placed on each side or a cervical collar can splint the neck. Use bottles or rolled towels in case sandbags are not available.

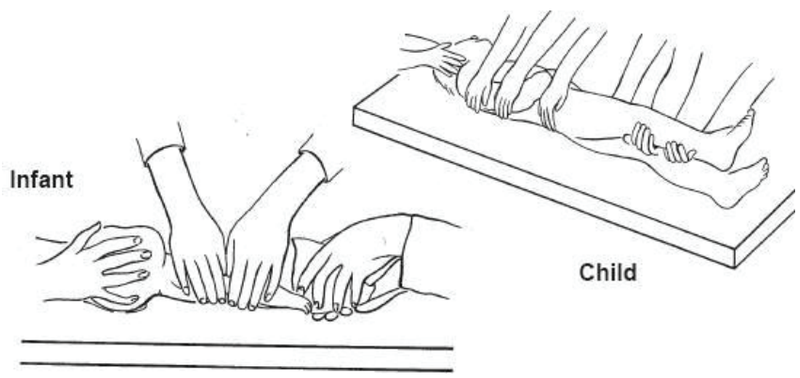


Figure 2.15: Log Roll-Stabilizing the Neck of the Patient while Moving the Body

Cervical spine immobilisation:

Cervical immobilisation is needed to protect extension of an existing spinal cord injury following head and neck trauma. In a child with history of neck trauma, the neck is immobilized with a cervical collar, and the body is placed on a spine board and secured with straps. Cervical collar should be rigid, appropriate sized and should not interfere with management of airway. The child should be adequately secured to a backboard in order to fully immobilize the cervical spine and body. Care must be taken to avoid flexion or extension of the neck when the patient is placed on the backboard. Patient should be kept in neutral position to maximize cervical spine protection.

The neutral position is defined as "the normal anatomic position of the head and body that one assumes when standing and looking straight ahead". Neutral positioning in children requires special precautions because of their relatively large head size and prominent occiput. The prominent occiput in children and infants forces the cervical spine into flexion when the child is supine. To prevent flexion, the back can be elevated by the

placement of padding under the shoulders. The approach to cervical spine stabilization depends upon the position in which the patient is found. Patients who are found in the prone position must be first log-rolled to the supine position for further evaluation and management. A rigid cervical collar should be applied before rolling the patient.

Convulsion

If the child is having a convulsion, do not attempt to hold him/her down or put anything in the child's mouth. If the child vomits turn the child on his/her side to avoid aspiration. If the convulsion has stopped and the airway is clear, the child can be placed in the recovery position.

Insertion of an Oropharyngeal (Guedel) Airway

The oropharyngeal or Guedel airway can be used in an unconscious patient to improve airway opening. It may not be tolerated in a patient who is awake and may induce choking or vomiting. Guedel airways come in different sizes (Guedel size 000 to 5). An appropriate sized airway goes from the angle of mouth to the angle of the jaw when laid on the face with the raised curved side (convex) up ("the right side up").

Infant

- Select an appropriate sized airway
- Position the child to open the airway, taking care not to move the neck, if trauma suspected
- Using a tongue depressor, insert the oropharyngeal airway the convex side up
- Re-check airway opening
- Use a different sized airway or reposition, if necessary
- Give oxygen

Child

- Select an appropriate sized oropharyngeal airway *(Figure 2.16 & 2.17)*
- Open the child's airway, taking care not to move the neck if trauma suspected *(Figure 2.18)*
- Using a tongue depressor, insert the airway "upside down" (concave side up) until the tip reaches the soft palate *(Figure 2.19)*
- Rotate through 180° and slide back over the tongue
- Re-check airway opening
- Use a different sized airway or reposition, if necessary
- Give oxygen

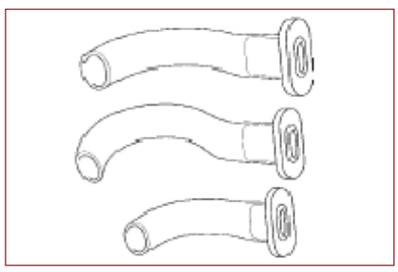


Figure 2.16: Guedel Airway of Different Sizes

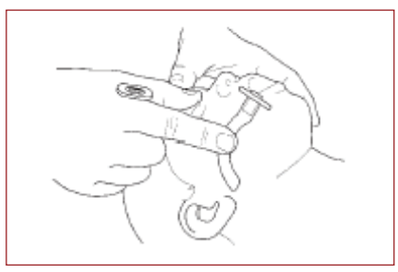


Figure 2.17: Selecting Right Size of an Airway

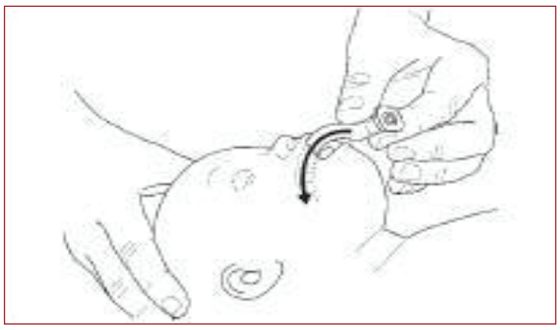


Figure 2.18: Inserting an Oropharyngeal Airway in an Infant: Convex Side Up

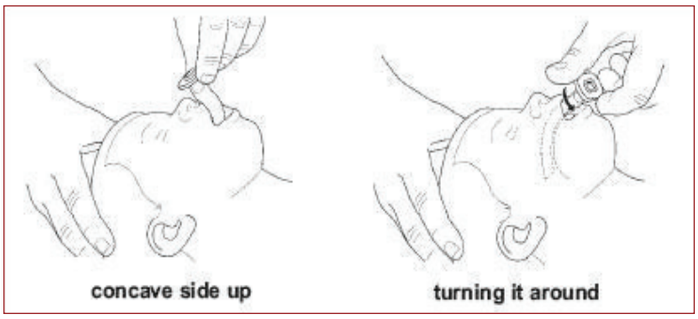


Figure 2.19: Inserting an Oropharyngeal Airway in an Older Child

Suctioning of secretions, blood, and vomitus may be necessary to maintain a patent airway. The source of suction can be foot operated or electric suction machine or mucous extractor. Suction pressure should not be set at more than 100 cm of water. There should be no negative pressure during insertion of suction catheter. Apply pressure only when catheter is in place.

2.14: ADMINISTERING DIAZEPAM FOR CONVULSIONS

A child presenting with acute seizures or status epilepticus, who has normal blood sugar or seizures persisting even after treatment of hypoglycaemia needs anti-convulsion drug to terminate the seizure. Where intravenous administration is available, either intravenous diazepam or intravenous lorazepam (0.1mg/kg) should be used to terminate the seizure. Diazepam can be given by the intravenous or rectal route. If you already have intravenous access, you can give the correct volume of drug directly, but slowly, in at least one full minute. Reassess the child after 10 minutes. Base the dose on the weight of the child, if available. The dose of Diazepam is 0.5 mg/kg (0.1 ml/kg) rectally or 0.25 mg/kg (0.05 ml/kg) intravenously (Max. total dose: <5 years: 5 mg, ≥5 year: 10 mg). This is a useful guideline in an emergency situation when you may not have a chance to weigh the child. Display the guideline on wall of your department (Table 2.4).

Table 2.4: Dosages of diazepam

	Rectal diazepam 10 mg/2 ml	Intravenous diazepam 10 mg/2 ml
Age / weight	**0.1 ml/kg**	**0.05 ml/kg**
2 weeks to 2 months (<4 kg)	0.3 ml	0.15 ml
2 - <4 months (4 - <6 kg)	0.5 ml	0.25 ml
4 - <12 months (6 - <10 kg)	1.0 ml	0.5 ml
1 - <3 years (10 - <14 kg)	1.25 ml	0.60 ml
3 - <5 years (14 – 19 kg)	1.5 ml	0.75 ml

Administer Diazepam injection solution per rectum by a tuberculin syringe preferably with a catheter. Hold the buttocks together for a few minutes. Flush the catheter with 2 ml of normal saline after administering Diazepam.

If convulsions continue after 10 min, give a second dose of diazepam (or give diazepam IV at 0.05 ml/kg = 0.25 mg/kg if IV access achieved; Max 10 mg). Diazepam can affect the child's breathing, so it is important to reassess the airway and breathing regularly. **Do not** give more than two doses of Diazepam. Midazolam (Intravenous/ intramuscular 0.1-0.2 mg/kg or intranasal 0.2 mg/kg; Max 5 mg) / Lorazepam (0.1 mg/kg IV; Max 4 mg) may be used in place of Diazepam.

In children with established status epilepticus, i.e. seizures persisting after two doses of benzodiazepines, other agents like intravenous Valproate, intravenous Phenobarbital or intravenous Phenytoin can be used, with appropriate monitoring. The choice of these drugs depends on local resources, including availability and facilities for monitoring. If available, intravenous valproate 20 mg/kg via infusion over 10 minutes is preferred to intravenous Phenobarbital or intravenous Phenytoin because of its superior benefit-risk profile. Inj. Phenytoin can be given intravenously if access has been achieved, **15-20 mg/kg phenytoin is diluted in about 20 ml of saline (not a solution containing Dextrose) and given slowly (not more than 1 mg/kg Phenytoin per minute)**. Alternatively, Phenobarbitone can be used in a dose of 15-20 mg/kg IV (in 20 ml 5% Dextrose or saline) over 20 minutes.

Intramuscular phenobarbital remains an option in settings where intravenous infusion or monitoring is not feasible. **Phenytoin and Valproate should not be given intramuscularly**. Seek help of a senior or more experienced person, for identifying cause as early as possible.

Follow management guidelines for status epilepticus if seizure persists (Section 5).

If seizure is associated with high fever:

- Sponge the child with room-temperature water to reduce the fever.
- Give antipyretic only when convulsion has controlled (danger of aspiration).

2.15: DEHYDRATION

The letter D in the ABCD mnemonic stands for Dehydration. In emergency settings, you will assess severe dehydration by looking on general conditions, sunken eyes and skin turgor. You will classify severe dehydration if child has two or more out of three clinical signs- lethargy, sunken eyes and very slow skin pinch.

You will learn management of severe dehydration in *Section 6.*

REMEMBER: All children with emergency signs should be hospitalized and kept under close supervision (high dependency unit or intensive care units where available).

2.16: PRIORITY SIGNS

Tiny baby (young infant)

If the patient appears very young (less than 60 days), confirm the age from the mother/caregiver and assess them as a priority as they are more likely to deteriorate further, if sick.

Severe Trauma (or other urgent surgical condition)

Usually this is an obvious case, but one needs to think of acute abdomen, fractures and head injuries in this category.

Temperature (fever - high temperature)

A child who feels very hot has high fever and needs immediate care like antipyretics and investigations for the cause of fever. Treatment with oral paracetamol should be given, if the baby has a fever of ≥38.5^{0}C.

Severe Pallor

It can be detected by comparing the child's palms with your own. If the palms are very pale (creases are also pale), the child is severely anaemic. This child needs admission and may need blood transfusion *(Section 8)*.

Poisoning

A child with a history of swallowing drugs or other dangerous substances, stings/bites needs to be assessed immediately, as he can deteriorate rapidly and might need specific treatments depending on the substance taken. The mother/caregiver will tell you if she has brought the child because of possible intoxication *(Section 5)*.

Severe Pain

If a child has severe pain and is in agony, s/he should be prioritized to receive early full assessment and pain relief. Severe pain may be due to severe conditions such as acute abdomen, meningitis, etc.

Respiratory distress

The child having severe respiratory distress needs emergency care but if there is mild respiratory distress like fast breathing or mild chest in-drawing, this child needs urgent assessment.

Restless, continuously irritable, or lethargic

The child who cries constantly and will not settle is irritable or restless. A lethargic child is drowsy and uninterested.

Referral (Urgent)

Any patient referred urgently from another hospital needs urgent assessment.

Malnutrition: Visible severe wasting

A severely wasted child has very little muscle and fat. Examine the child from the back and you see the buttocks are flat and there are loose folds of skin (baggy pant sign). The arms and legs are thin and you can see the outline of ribs. This is a form of severe acute malnutrition. These children should be examined on priority.

Oedema of both feet

If you press the dorsum of foot gently with your thumb for atleast 3 seconds and a definite pit is formed, the child has oedema. Oedema of both feet is an important diagnostic feature of another form of severe malnutrition. These children should be examined on priority.

Major Burn

Any child with a major burn, trauma or other surgical condition needs to be seen quickly. Get surgical help or follow surgical guidelines.

EXERCISE-2.1

1. Meera, 3-year-old is brought to hospital with complaints of loose motion for four days. She is breathing normally, hands are cold and capillary refill is 2 seconds. She is alert and there is no convulsion. The eyes are normal and skin pinch goes back immediately.
   How do you triage Meera? - **Emergency / Priority /Non-urgent Case**

2. Mayank, 13 months old child is brought to hospital with the complaints of cough and fever. His respiration is very fast and there is severe chest in drawing.
   How will you triage Mayank? - **Emergency / Priority /Non-urgent case**

3. Sonu, four-year old male child has been brought with high grade fever (39^0C) for last 2 days. Sonu is breathing normally, has warm hands and feet. He is conscious, no h/o convulsion and diarrhoea.
   How do you triage Sonu? - **Emergency/Priority/Non-urgent case**

4. A 10-week old baby was brought in hospital with complaints of not feeding well and excessive crying. Airway, breathing, sensorium and circulation are normal. There is no history of diarrhoea. He feels very hot on touch. He weighs 3.5 kg.
   How do you triage the baby?

5. Suman, 18 months old child is brought to hospital with the complaints of cough & fever. Her respiration is very fast, there is severe chest in drawing and SpO_2 is 88% on room air. Write emergency treatment to be given to Suman.

6. A 9-month old baby has been brought to hospital with gasping respiration. His lips are blue and heart rate is 56/minute. Write emergency treatment for this baby.

EXERCISE-2.2

1. A 4-year-old boy is brought to emergency. He is breathing normally, his hands are cold and the capillary refill time is longer than three seconds and pulse is rapid and weak. There is no visible severe wasting or no bilateral pitting oedema .What do you do next?

2. Sunita 4-month old baby is brought to hospital with fever and refusal of breastfeed. She also had 2 episodes of vomiting and watery diarrhoea. Her respiratory rate 60/min, no chest indrawing and there are no abnormal respiratory noises. Her hands are cold and capillary refill is more than 3 seconds. The femoral pulse is palpable but fast and weak. There is no severe visible wasting. Her weight is 5 kg.
   - How do you triage the baby?
   - How do you manage Sunita?

3. Vijay 12-months-old is brought to you with loose stools and vomiting. He weighs 5.0 kg and has visible severe wasting. He is breathing normally. The child is very lethargic and extremities are cold with capillary refill of more than 3 seconds. The pulses are weak and fast. How do you manage this child?

EXERCISE 2.3

1. Sunil two-year-old boy is brought by his grandmother with convulsions. The child is breathing normally. Extremities are warm. He is unconscious and hot to touch. How would you manage the child if weight is 12 kg?

2. Anil is an 18-month-old boy who has fever for two days. His mother has noticed that he has fast breathing. His airway is clear, and he has no chest indrawing. His extremities are warm and there is no history of diarrhoea. However, the boy started to convulse while being examined. He weighs 11 kg. How will you manage him?

3. Five weeks old infant weighing 4 kg is brought to the emergency with generalized tonic seizures. The child is breathing normally and has warm extremities. Baby's blood sugar is 60 mg/dl. How will you manage this case?

SECTION 3: APPROACH TO A CHILD WITH COUGH OR DIFFICULTY IN BREATHING

Cough and difficulty in breathing are common problems in young children. The causes range from a mild, self-limited illness to severe, life-threatening disease like pneumonia. Pneumonia is the single largest infectious cause of death in children under five years of age. Infective causes of pneumonia can be viruses, bacteria or fungi. Cough, difficulty in breathing and fever are also most common presentation for COVID 19.

3.0: LEARNING OBJECTIVES

After completion of this section, participants should be able to:

- Outline steps of management of children admitted with pneumonia
- Describe management of children with wheeze
- Outline steps of management of a child with acute attack of bronchial asthma
- Describe investigations and management of children with tuberculosis

Pneumonia is usually identified on the basis of fever, cough, fast breathing and signs of respiratory distress. This chapter provides guidelines for managing the under-five-children with cough and/or difficult breathing. All children with cough and fever should be screened in the designated COVID screening /Flu OPD and all HCW should follow recommended infection control measures like use of PPE, hand washing, adequate distance between patients.

Before proceeding with further detailed History and Examination, you must ensure that emergency treatment has been provided for the emergency signs detected.

Following history & examination will help you in reaching a diagnosis in children presenting with cough /difficult breathing:

History

- Cough
  - duration in days
  - paroxysms with whoop or vomiting or central cyanosis
  - wet cough more often seen with infective conditions
- Fever: the absence of fever makes pneumonia less likely, except in immunocompromised, severely malnourished or atypical cases. Whenever present, record duration of fever.
- Noisy breathing: grunt is more often associated with severe parenchymal involvement while, audible wheeze is often a feature of airway narrowing

- Difficulty in breathing- duration
- Chest Pain
- Choking or sudden onset of symptoms
- History suggestive of measles - now or in recent past
- Similar episodes in past
- Known or possible HIV infection (e.g. thrush, chronic diarrhoea, parotid swelling etc)
- Immunization: BCG, DPT, Haemophilus influenza type b or Pentavalent Vaccine; Measles
- Family history of asthma

Examination

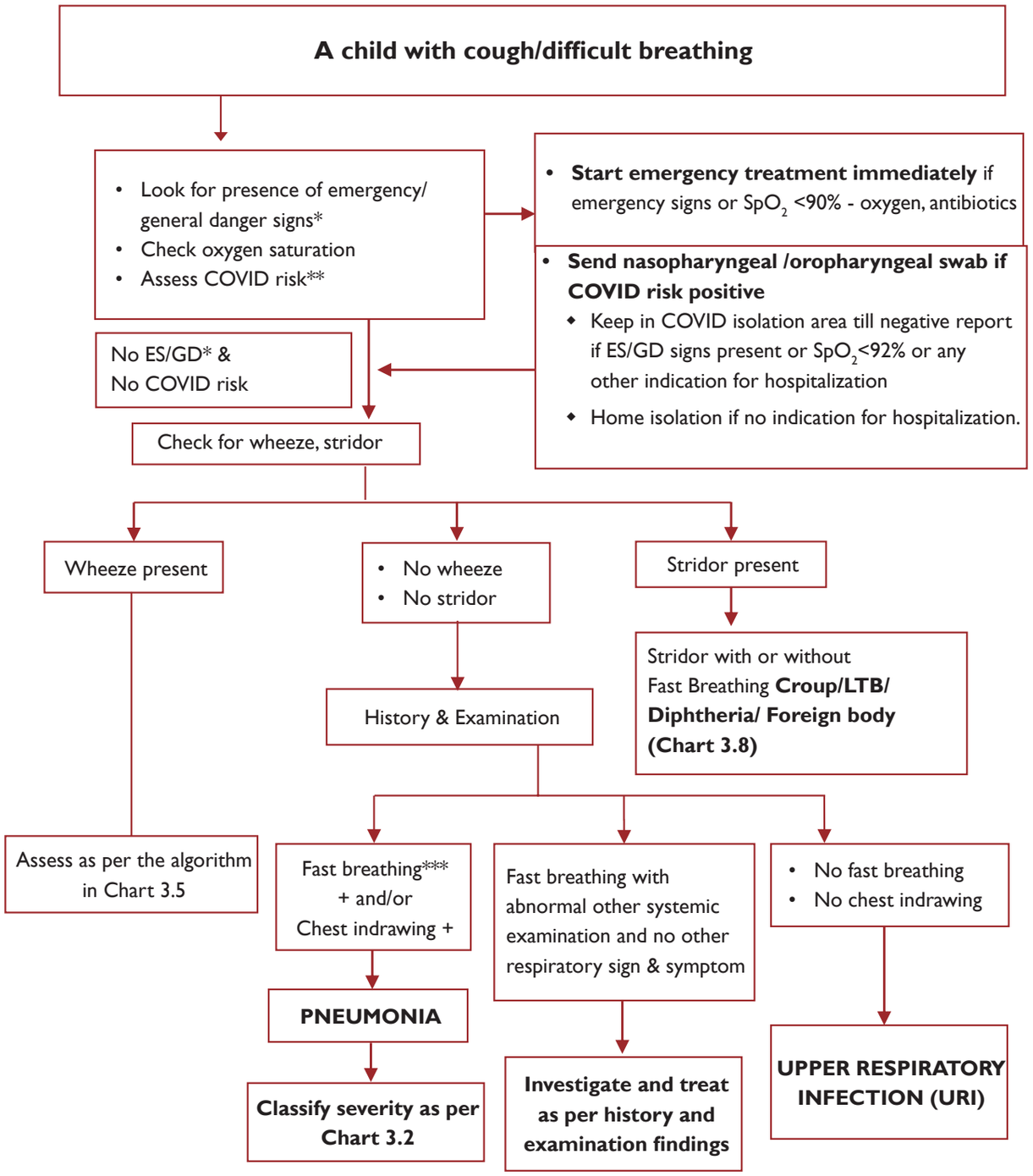
The signs listed below are a guide to reach a diagnosis. Not all children will show every sign.

- Excessive irritability
- Suprasternal recession, nasal flaring,
- Grunting, audible wheeze, stridor
- Head nodding (a movement of the head synchronous with inspiration indicating severe respiratory distress)
- **Respiratory rate:** count respiratory rate for full one minute when the baby is calm and not feeding.
- **Lower chest wall indrawing:** It is said to be present when lower chest wall goes in when the child breathes in (if only the soft tissue between the ribs goes in when the child breathes, this is not lower chest wall in drawing). It suggests lower respiratory tract involvement.
- Throat – Congestion, enlarged & inflamed tonsils, membrane etc.
- Increased heart rate(tachycardia)
- Severe palmar pallor
- Lymphadenopathy
- Large skin boils; or abscess; or infected scabies
- Cardiac apex beat may be displaced or trachea shifted from midline in case of large collection of air or fluid in the pleura; or, any other mass (contralateral shift); or, collapse (ipsilateral shift).
- Chest auscultation may show unequal air entry, no air entry (in pleural effusion, empyema, pneumothorax), crackles or bronchial breath sounds in pneumonia; or wheeze (indicating airway narrowing).
- Percussion signs of pleural effusion (stony dullness) or pneumothorax (hyper-resonance).
- On CVS auscultation- murmur, soft heart sounds, abnormal heart rhythm.
- Enlarged liver and spleen

3.1: CLASSIFICATION OF CHILDREN WITH COUGH AND DIFFICULTY IN BREATHING

Children with cough and/or difficult breathing may be classified as severe pneumonia, pneumonia and no pneumonia, cough and cold, based on examination findings (Chart 3.1). Out of all causes which present with cough and difficult breathing, severe pneumonia is most common cause of mortality in under five children. As young children can also have rapid breathing and wheeze with respiratory infections, it is important to differentiate cases with rapid breathing due to pneumonia from those with asthma or wheeze due to lower respiratory infections *(Chart 3.1)*.

Chart 3.1: Assessment of a child with Cough/Difficult Breathing



**Emergency/General Danger Signs (ES/GD): Not breathing at all or gasping, Obstructed breathing, Central cyanosis, Oxygen saturation <90%, Severe respiratory distress, Shock, Coma, Convulsions, Inability to breastfeed or drink or persistent vomiting (Initial management of children with emergency signs have already been covered in ETAT Section 2).*

*** Fever with cough or loss of smell/taste or difficult breathing of less than 10 days or H/o contact with COVID case in last 2 weeks*

****Fast breathing: ≥ 60 breaths/min in a child aged <2 months; ≥50 breaths/min in a child aged from 2 months up to 12 months; ≥ 40 breaths/min in a child aged from 1year up to 5 years.*

The severity of pneumonia is detailed below in Chart 3.2:

Chart 3.2: Classification of the severity of pneumonia

Sign or symptom	Classification	Treatment
Cough or difficulty in breathing with any of the following signs: • Central cyanosis • Oxygen saturation < 90% • Severe respiratory distress (Laboured or very fast breathing {RR >70} or severe lower chest indrawing or head nodding or stridor or grunting) • Any other general danger/Emergency signs*	Severe pneumonia	• Admit • Manage airway • Give oxygen if saturation < 90% (<94%, if other emergency signs) • Give injectable antibiotics
• Fast breathing: ◆ ≥ 60 breaths/min in a child aged <2 months ◆ ≥ 50 breaths/min in a child aged 2 months upto 12 months ◆ ≥ 40 breaths/min in a child aged 1–5 years • Chest indrawing	Pneumonia	• Give oral Amoxicillin for 5 days • If wheezing (or disappeared after rapidly acting bronchodilator) give bronchodilator for 5 days • Soothe the throat and relieve the cough with a safe remedy • If coughing for more than 14 days or recurrent wheeze, refer for possible TB or asthma assessment • Advise mother when to return immediately • Follow-up in 2 days
• No signs of pneumonia or severe pneumonia	No pneumonia: cough or cold	• Home care • Soothe throat and relieve cough with a safe remedy • Advise the mother when to return immediately • Follow up after 5 days, if not improving

**inability to breastfeed or drink, shock or lethargy/ reduced level of consciousness or convulsions*

3.2: SEVERE PNEUMONIA (Pneumonia which needs hospitalization)

Severe pneumonia is defined as cough or difficult breathing in a child with at least one of the following conditions:

- Central cyanosis
- Oxygen saturation < 90%.
- Severe respiratory distress (Laboured or; very fast breathing {RR >70}; or severe lower chest indrawing; or head nodding; or stridor; or grunting).
- Presence of emergency /general danger sign (inability to breastfeed or drink, persistent vomiting, shock, lethargy / reduced level of consciousness or convulsions).

In addition to above mentioned signs, on auscultation, you may get following signs in severe pneumonia:

- Bronchial breath sounds
- Crackles
- Decreased breath sounds
- Abnormal vocal resonance (decreased over a pleural effusion or empyema and increased over lobar consolidation).

Investigations

- Obtain a chest X-ray in all children with severe pneumonia to identify complications.
- Haemogram (Hb, TLC, DLC).
- Blood culture may be sent, where possible, in severely ill septicemic infants or with severe complicated pneumonia.

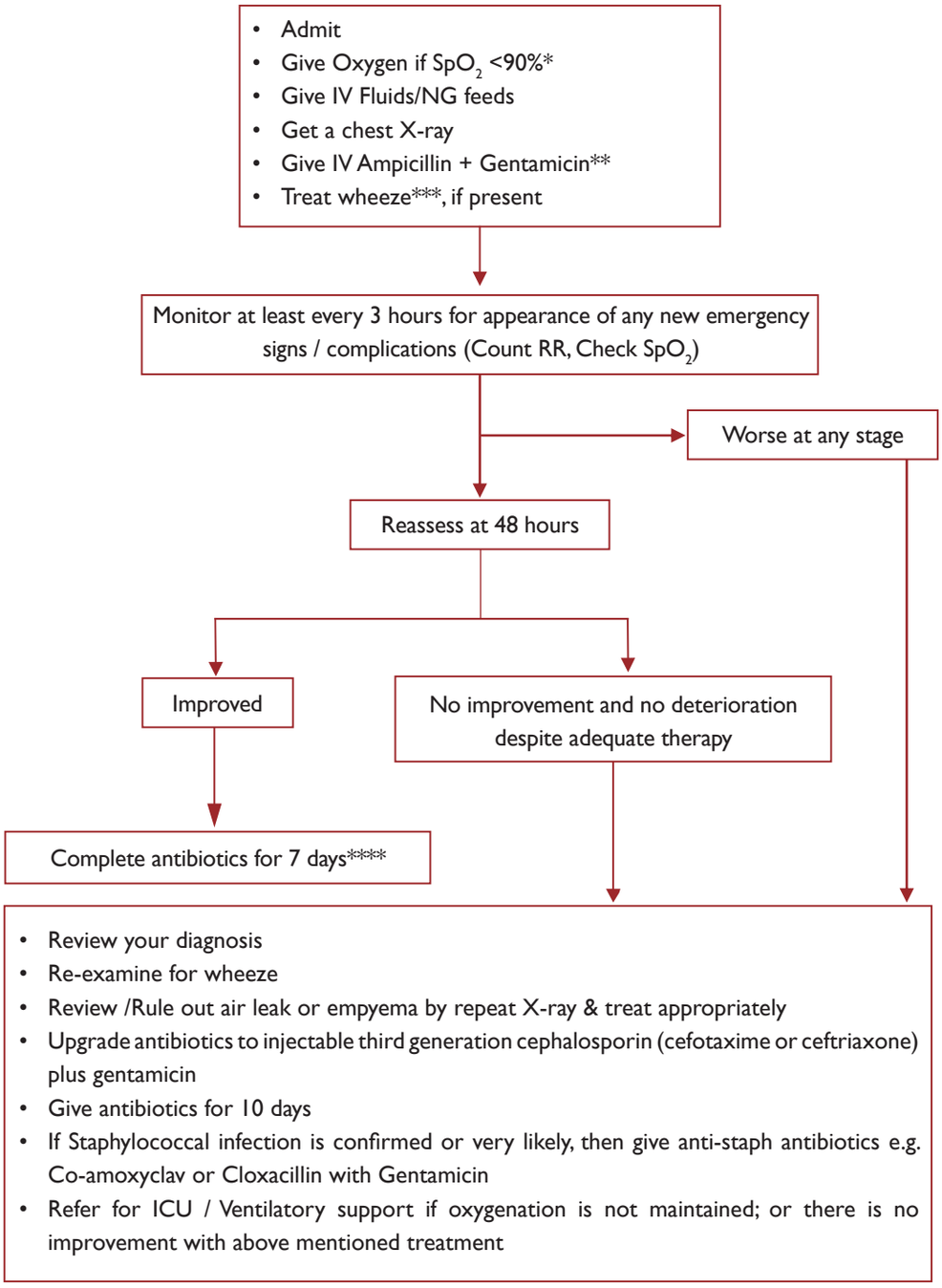
Management:

Such children need urgent treatment. They are often very hypoxic and need oxygen therapy. They also cannot take orally and therefore need to be given intravenous fluids and parenteral antibiotics. These children need very close monitoring for respiratory distress and oxygen saturation as they are at higher risk of complications *(Chart 3.3)*.

Note:

- *If the child also has wheezing, a trial of rapidly acting inhaled bronchodilator should be given in addition, and if there is improvement it should be continued under monitoring. In severe pneumonia DO NOT DELAY ANTIBIOTICS administration, pending evaluation of response to bronchodilators, unlike cases with simple pneumonia.*

Chart 3.3: Algorithm for management of children with severe pneumonia



** < 94 % in presence of other emergency signs*

*** If staphylococcal infection is suspected, give anti-staph antibiotic like Co-amoxyclav or Cloxacillin and Gentamicin; in case of severe pneumonia with septic shock consider Ceftriaxone and Vancomycin (Box 3.2)*

****In case the child improves significantly with bronchodilator therapy, review the diagnosis*

*****Shift to oral drugs as soon as the child is able to take orally*

Box 3.1: Trial of bronchodilator

Wheeze present:

- Give 3 doses of nebulized salbutamol every 20 min.

  OR

- 2-4 puffs of salbutamol MDI (at a gap of 2-3 min between each puff) with spacer repeated every 20 min.

Assess the response after 1 hour:

Look for following signs of improvement:

- less respiratory distress (easier breathing)
- lower chest wall indrawing, less than before
- improved air entry

- After initial trial of bronchodilator as mentioned in *Box 3.1*, re-examine to see whether child would still be classified as severe pneumonia.
- In case the respiratory rate and distress improves significantly with bronchodilator AND there are no clinical signs of lobar pneumonia or complicated pneumonia, one may reconsider the diagnosis of severe pneumonia and use the algorithm in *chart 3.4* for further management.
- In all other situations, continue to manage as severe pneumonia.
- In addition, follow national guideline to cover other infections like seasonal influenza/ novel influenza, if clinically and epidemiologically suspected.

Treatment

Oxygen therapy

- Give oxygen to all children with oxygen saturation <90% (<94% if they also have other emergency signs like shock etc.).
- Use nasal prongs as the preferred method of oxygen delivery to young infants; if not available, a nasal or nasopharyngeal catheter may be used.
- Use a pulse oximetry to guide oxygen therapy (keep oxygen saturation > 90%). If a pulse oximeter is not available, continue oxygen until the clinical signs of hypoxia (such as inability to breastfeed or breathing rate ≥ 70/min) are no longer present.

Antibiotic therapy

- Give antibiotics:
  - Ampicillin 50 mg/kg or benzylpenicillin 50 000 U/kg IM or IV every 6 hours.
  - Gentamicin 7.5 mg/kg IM or IV once a day
- If staphylococcal infection (Box 3.2) is suspected, give Co –amoxyclav or Cloxacillin with Gentamicin.
- In case of septic shock, give Ceftriaxone with Vancomycin.
- If the child does not show signs of improvement within 48 hours, switch to Gentamicin 7.5 mg/kg IV once a day combined with Ceftriaxone 100 mg/kg IV in two divided doses or Cloxacillin 50 mg/kg IV, eight hourly.
- Shift to oral drugs as soon as the child is able to take orally, except those with shock or complicated pneumonia, where longer parenteral therapy is advised. Injection Ampicillin can be modified to oral Amoxicillin

- Injection Gentamicin can be shifted from intravenous to intramuscular injection once a day to complete duration of antibiotics
- Total duration of antibiotics in severe pneumonia:
  - Clinical response within 48 hours: 7 days
  - Clinical response after 48 hours: 10 days

Box 3.2: When to suspect Staphylococcus aureus pneumonia

It is important to have high index of suspicion for staphylococcal infection as the initial choice of antibiotic does not cover this less common, but a more severe infection adequately. Staphylococcal pneumonia is suspected if any child with pneumonia has:

- Rapid progression of the disease, **or**
- Pneumatocele, or Pneumothorax, or Effusion on chest radiograph, **or**
- Large skin boils, or abscess, or infected scabies, **or**
- Post-measles pneumonia, which is not responding within 48 hours to the initial therapy

Supportive care

- Remove any thick secretions at the entrance to the nasal passages or throat by gentle suction, which the child cannot clear.
- If the child has fever (≥ 38.5^0 centigrade), give paracetamol.
- Provide maintenance IV fluid, if child cannot accept oral feeds. Stop IV fluids gradually, when the child is accepting orally satisfactorily.
- If wheeze is present, give a rapid-acting bronchodilator.
- Encourage the child to feed as soon as child is able to take feeds.
- Do not give cough syrup (may be harmful).
- Ensure vaccination/ nutritional advice.

Monitoring: child should be checked by a nurse at least every 3-hours and by a doctor at least twice a day. In the absence of complications, there should be signs of improvement like breathing slower, less indrawing of the lower chest wall, less fever, improved ability to eat and drink and better oxygen saturation in next 48 hours.

Other alternative diagnosis and treatment

If the child has not improved after 48 hours or if the child's condition has worsened, look for complications or alternative diagnosis. Repeat the Chest x-ray.

- *Staphylococcal Pneumonia:* This is suggested if there is rapid clinical deterioration despite treatment, by presence of pneumatocele, or pneumothorax, or effusion on chest X-ray, or isolation of Staph. aureus in blood culture or pleural fluid.
- *Tuberculosis:* A child with persistent cough and fever for more than 2 weeks and signs of pneumonia after adequate antibiotic treatment should be evaluated for TB. Follow national guidelines (NTEP) for investigation and treatment. **Do not start empirical antitubercular therapy**.

Discharge

Children with severe pneumonia can be discharged when:

- Respiratory distress has resolved.
- There is no hypoxemia (oxygen saturation ≥90% on room air).
- They are feeding well.
- They are able to take oral medication or have completed a course of parenteral antibiotics.
- The family is counselled when to return.

Follow up

Since children with severe pneumonia have been very sick, follow up is important to check if medication has been completed and if any new complications have developed. Also their nutrition is often poor. Give the feeding advice, vaccinations that are due, and arrange follow– up 2 weeks after discharge, if possible, to check the child's nutrition. Also address risk factors such as malnutrition, indoor air pollution and parental smoking.

3.3: PNEUMONIA

A child is suspected to have pneumonia if he/she has cough or difficult breathing, plus at least one of the following signs:

- Fast breathing
- Lower chest wall indrawing

AND, there are no signs of severe pneumonia.

On auscultation, crackles or bronchial breathing may be present. Some patients also have wheeze. As wheezy disorders are important pneumonia mimickers, efforts should be made to find clues to proper diagnosis. A **trial of rapidly acting inhaled bronchodilators should be given to those also having wheeze and should be re-examined before final diagnosis of pneumonia *(Box 3.3)*. Antibiotics should not be used if there is significant improvement with bronchodilator AND there are no clinical signs of consolidation *(See Chart 3.4)*.**

Sometimes pneumonia can also have some element of wheezing and in such cases there is usually persistence of tachypnoea and/or respiratory distress even after bronchodilator doses. They also may look sick or toxic. In such overlapping situations antibiotics may be continued along with bronchodilators.

Treatment

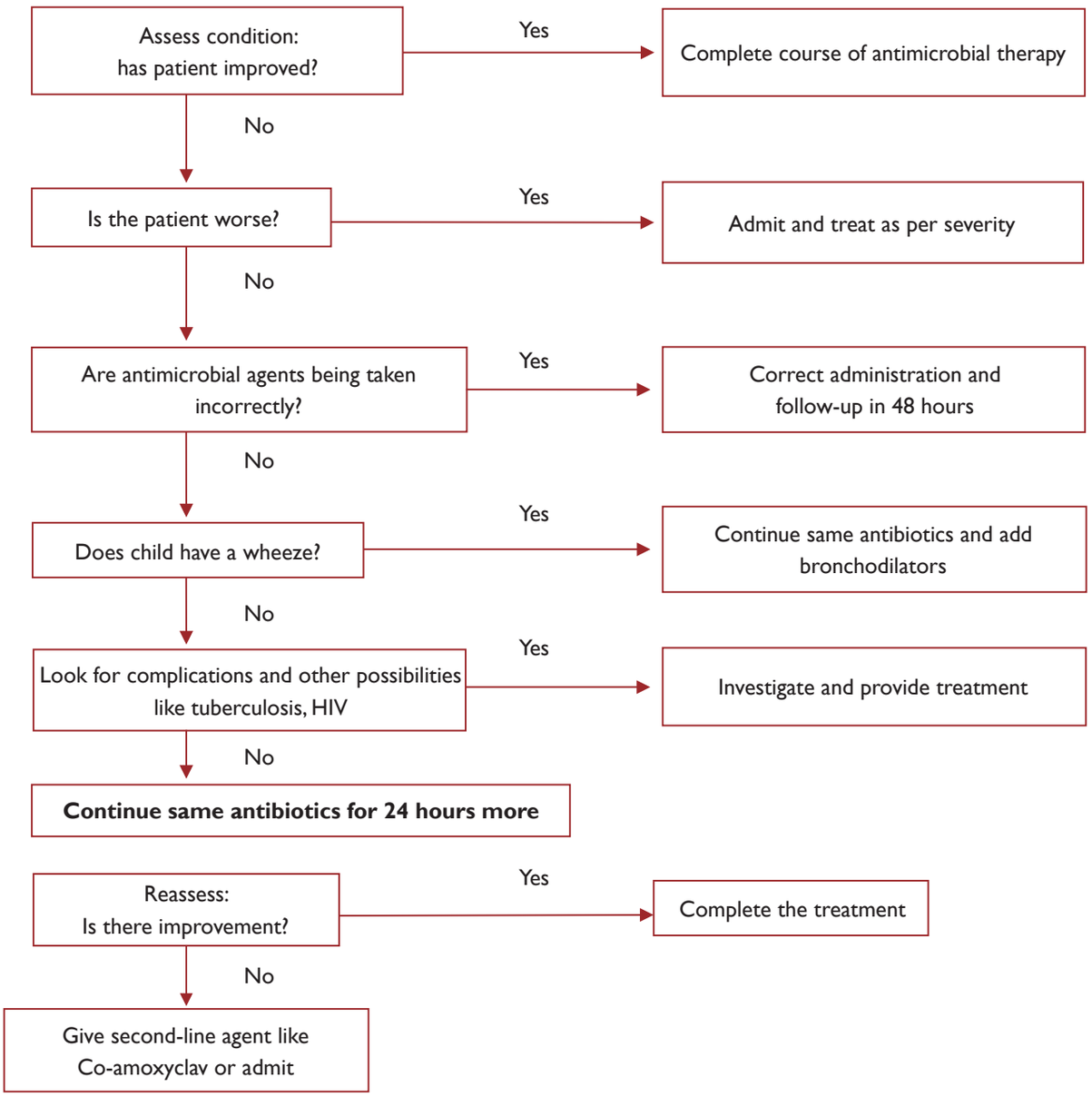
- Treat child as outpatient, unless the child has additional risk factors, like-severe acute malnutrition or age is less than two months.
- Treat wheeze if present, with oral bronchodilators.
- Antibiotic therapy: Give oral Amoxicillin, 45-60 mg/kg/day in two to three divided doses for 5 days. Give the first dose at the clinic and teach the mother/caregiver how to give the other doses at home.
- Avoid unnecessary harmful medications such as cough syrups, medicated nose drops, local menthol application, steam/menthol inhalation.
- Advise to continue feeding.

Follow up: Tell the mother/caregiver to come back for follow up after 3 days.

A lack of response on follow up needs a systematic evaluation as issues range from incorrect prescription or administration or adherence, untreated wheeze where present, alternative diagnosis, complicated or non-responsive pneumonia. Chart 3.4 details the systematic evaluation of the non-response on follow up in such a case.

When to return: Advise her to bring the child back after 3 days, or earlier if the child becomes sicker or is unable to drink or breastfeed. *See Section 10* for feeding advice.

Chart 3.4: Systematic assessment of Children with non-severe pneumonia at follow-up



3.4 : COMPLICATIONS OF PNEUMONIA

Septicaemia is the most common pneumonia complication and occurs when the bacteria causing pneumonia spreads into the bloodstream. The spread of bacteria can lead to septic shock or metastatic secondary infections, like-meningitis, septic arthritis, especially in infants and severely malnourished children.

3.4a: Pleural Effusion and Empyema

A child with pneumonia should be suspected to have pleural effusion or empyema if any one of the following is present:

- Pain in chest during breathing.
- The chest is dull to percussion.
- Breath sounds are reduced or absent over the affected area.
- A pleural rub may be heard at an early stage before the effusion is fully developed.
- Fever persists, despite adequate antibiotic therapy.

A chest X-ray shows fluid on one or both sides of the chest. Diagnostic pleural tap is a must to make a diagnosis. Frank pus (thick or thin) is aspirated in cases of empyema. The aspirate should always be sent for Gram's staining, cytology, biochemical analysis (sugar and protein levels) and culture.

Treating Empyema

- **Chest drainage:** Management of fluid in the pleural cavity depends on the character of the fluid obtained. If there is pus in the pleural cavity, then an intercostal drain is must, unless the collection is very small. In case the disease is bilateral and significant, both sides may need intercostal drainage.
- **Antibiotic therapy:** Initial intravenous antibiotic therapy is usually needed for 7-14 days. Fever may take 5-7 days to subside. Staphylococcus aureus is a common causative organism of empyema, so use anti staphylococcal drug like Amoxicillin + Clavulanic acid; or cloxacillin, with Gentamicin, in presence of staphylococcal stigmata (Box 3.2). When the child improves, continue Amoxy-Clav /Cloxacillin orally for a total of 4-6 weeks. In the absence of staphylococcal stigmata (as described in Box 3.2), penicillin or Ampicillin may be given in place of Cloxacillin to cover for Pneumococcus and H. Influenza which are the other important causes for empyema. In hemodynamically unstable cases (going into septicemic shock), use higher antibiotics like Ceftriaxone and Vancomycin for a wider coverage till culture sensitivity reports become available.
- **Supportive therapy:** Give oxygen and other supportive therapy as needed (nutritional support, and antipyretics/analgesic, if required).
- **Failure to improve:** If fever and other signs of illness continue beyond 5-7 days, despite adequate chest drainage and antimicrobial therapy, look for causes of non-response like phlebitis, pus collection at other sites in the body, resistant bacteria or less commonly tuberculosis. The antibiotics may then be revised to injection Co-Amoxyclav or other antibiotics as per the culture sensitivity of the pus.

3.4b: Air Leaks

- A child with pneumonia should be suspected to have pneumothorax in the presence of the following signs and symptoms:
  - Chest bulging on the affected side, if one side is involved
  - Shift of cardiac impulse away from the site of the pneumothorax
  - Decreased breath sounds on the affected side with resonant percussion note
  - Severe respiratory distress and cyanosis, in advanced cases
  - Severity of presentation may vary according to the extent of lung collapse, degree of intra-pleural pressure, and rapidity of onset.

Investigation: Chest X-ray is crucial for the confirmation of diagnosis.

Treatment: For urgent management, decompression needle, may be inserted in 2nd intercostal space. Thereafter, intercostal chest tube drain should be inserted.

3.5: UPPER RESPIRATORY INFECTION

These are common, self-limiting viral infections that require only supportive care.

- Soothe the throat and relieve the cough with a safe remedy, such as a warm, sweet drink.
- Use nasal saline drops, if nasal block is present.
- Antibiotics should not be given except for following indications:
  - Streptococcal pharyngitis
  - Acute suppurative otitis media (ASOM)

For other infections like Seasonal influenza/ Novel influenza, follow the current national guidelines

3.6: CHILD PRESENTING WITH WHEEZE

Wheeze is a high-pitched whistling sound on expiration usually heard by auscultation, occasionally audible without stethoscope in severe cases. To decide whether the child has wheeze or not, auscultate chest with a stethoscope.

In children below 2 years of age the most common cause of wheeze is bronchiolitis. Some children may have wheeze with recurrent lower respiratory infections also, called wheeze associated lower respiratory infection (WALRI). A proportion of these children may have wheeze in absence of viral infection and they may be diagnosed as preschool age multi- trigger asthma. Algorithm for assessment of children with wheeze is given in *Chart 3.5*.

History

- Similar episodes of wheeze/ respiratory difficulty in the past
- Night-time or early morning shortness of breath, cough or wheeze
- Dry cough
  - Aggravated by exertion (laughing, crying, running etc.)
  - More in early morning and night
- Response to bronchodilators
- Personal/ family history of allergy or asthma

Examination

- Wheezing during expiration
- Signs of hyperinflation
- Signs of respiratory distress (signs of severe respiratory distress are same as described in the section severe pneumonia)

Check responses to rapid-acting bronchodilator

- If the cause of the wheeze is not clear or if the child has fast breathing or chest indrawing in addition to wheeze, give a rapid-acting bronchodilator by one of the following methods and assess after 1 hour:
  - nebulized salbutamol

    OR
  - salbutamol by a metered dose inhaler with spacer device
- Assess the response after 1 hour- Signs of improvement are:
  - less respiratory distress (easier breathing)
  - lower chest wall indrawing less than before
  - improved air entry
- If there is no response to rapid acting bronchodilators, look for other causes like foreign body etc *(Box 3.3)*.

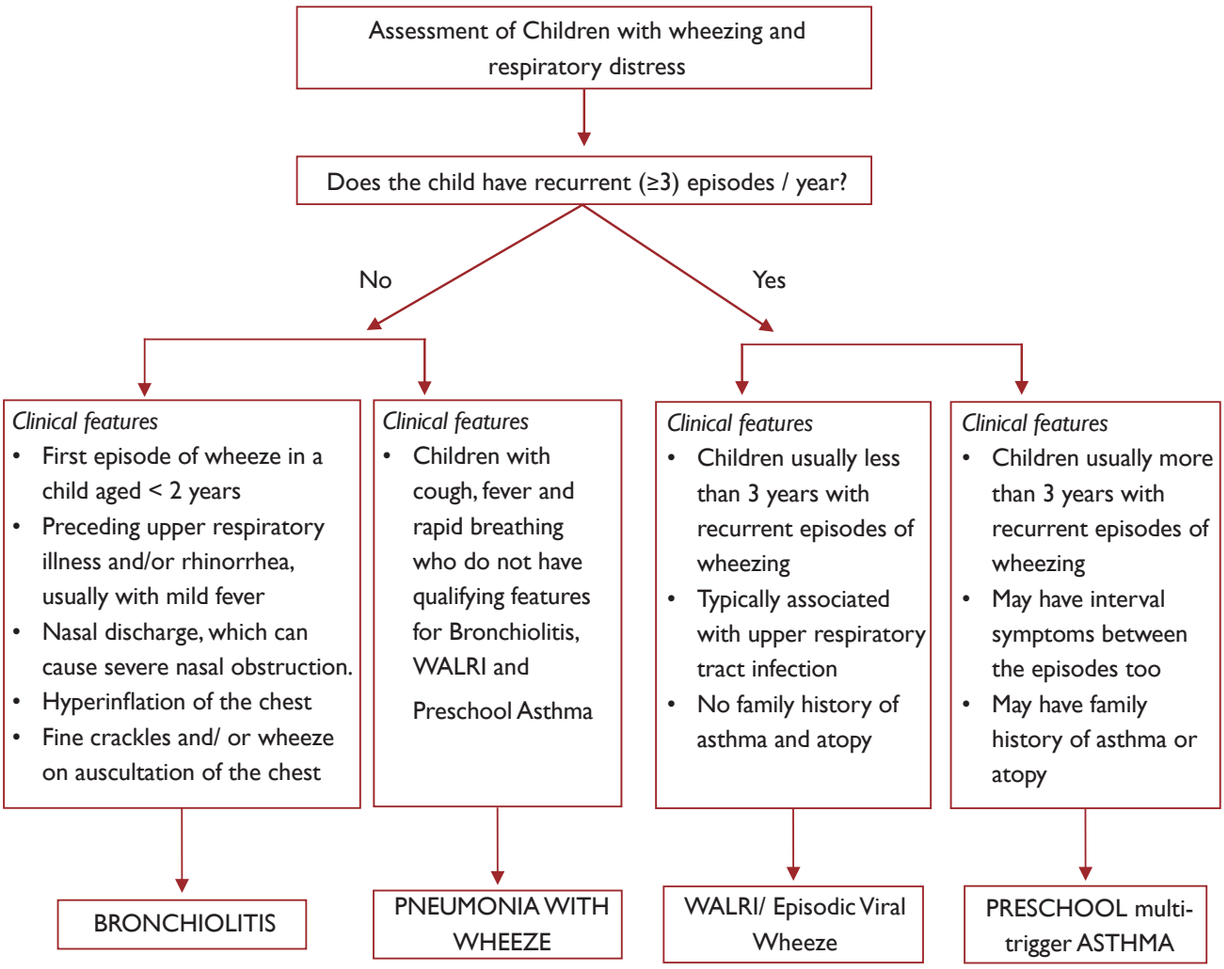
Box 3.3: When to suspect foreign body aspiration

Suspect for foreign body aspiration in a child with wheeze, if there is one or more of the following:

- History of sudden onset of distress or cough immediately or within hours of a choking episode
- Unilateral or localized wheeze
- Wheeze with poor or no response to bronchodilators
- Asymmetric air entry on chest examination
- Segmental or lobar pneumonia that fails to respond to antibiotic therapy

Refer such a child to a facility/hospital where bronchoscopy is possible. Emergency management of a child developing obstructed breathing or apnoea following foreign body aspiration has already been discussed in ETAT section.

Chart 3.5: Assessment of children with wheezing and respiratory distress



3.7: BRONCHIOLITIS

Bronchiolitis is a lower respiratory viral infection, which is typically most severe in young infants, occurs in annual epidemics and is characterized by airways obstruction and wheezing. It is most commonly caused by respiratory syncytial virus. Infants and young children with bronchiolitis may present with a wide range of clinical symptoms and severity from mild distress to impending respiratory failure.

Typical features of bronchiolitis include:

- age less than 2 years
- preceding upper respiratory illness and/or rhinorrhea
- mild fever
- difficulty in feeding, breastfeeding or drinking owing to respiratory distress
- lower chest wall indrawing
- hyperinflation of the chest, with increased resonance to percussion
- fine crackles and wheeze on auscultation of the chest
- nasal discharge, which can cause nasal obstruction.
- unpredictable response to a rapid-acting bronchodilator

Risk factors for severe disease include age less than 12 weeks, prematurity, underlying cardiopulmonary disease, or immunodeficiency.

Management

Mild cases (without respiratory distress) may be managed at home. Severe cases should be hospitalized. Supportive care is the mainstay of treatment for hospitalized children:

- Give oxygen to all children with severe respiratory distress or oxygen saturation ≤ 90%. The recommended method for delivering oxygen is by nasal prongs or a nasal catheter.
- All children should be monitored for correct position of the prongs and blocked nose with mucus. Check and record RR and SpO_2 at least every 3 hours.

Other treatment:

- Nebulized epinephrine (2 ml of inj. Epinephrine 1:1000 solution in 2 ml of normal saline) may decrease distress or improve oxygenation. The dose can be repeated 4 hourly for 1- 2 days depending on the severity and response.
- In case of severe disease, particularly if the child has personal or family history of atopy, beta 2 agonists like Salbutamol by nebulized route (0.15 mg /kg; minimum 1.25 mg) can be given. Continuation of further doses should be only if there is a clinical response with initial doses.
- 3% hypertonic saline nebulization (4 ml every 4 hours) may be tried for hospitalized children.
- Routine antibiotics have no role. It should be used in young infants or in a sick looking infant where the distinction from pneumonia may be difficult.

Supportive care

- If the child has fever that appears to be causing distress, give Paracetamol.
- Ensure that the hospitalized child receives daily maintenance fluids appropriate for age in case oral acceptance is poor, but avoid overhydration.
- Encourage breastfeeding and oral fluids whenever child is able to accept orally.
- Nasogastric feeding should be considered if child is unable to maintain oral intake (expressed breast milk should be given).
- Gentle nasal suction should be used to clear secretions in infants where nasal blockage appears to be causing respiratory distress.

Monitoring

- A hospitalized child should be assessed by a nurse at least every 3 hourly and by a doctor at least twice a day. Watch for signs of respiratory failure, i.e. increasing hypoxia and respiratory distress leading to exhaustion.

Complications

- If the child fails to respond to oxygen therapy or the child's condition worsens suddenly, obtain a chest X-ray to look for evidence of pneumothorax. If severe respiratory distress is persistent, consider transfer to a facility with ICU / ventilation facility.

Infection control

Bronchiolitis is very infectious and may be dangerous to other young children admitted in the hospital with other conditions. The following strategies may reduce cross-infection:

- Hand-washing by health personnel between patients, non-sharing of nebulizer tubes and oxygen tubing.

In addition, it is well established that exclusive breastfeeding for at least 6 months decrease the morbidity of respiratory infections in young children.

Discharge

An infant with bronchiolitis can be discharged when respiratory distress improves (no fast breathing/chest indrawing and maintaining SpO_2 >90 % on room air), clinically stable and the infant is feeding well.

Counsel families that infants are at risk for recurrent bronchiolitis if they live in families where adults smoke or if infants are not breastfed. Advise the parents against smoking and indoor pollution.

3.8: PNEUMONIA WITH WHEEZE

Children with cough, fever and rapid breathing who do not have qualifying features for Bronchiolitis, WALRI and Preschool Asthma, can have pneumonia with wheeze. Such cases are treated with antibiotics and bronchodilators as discussed before.

3.9: WALRI/ EPISODIC VIRAL WHEEZE

Children usually less than 3 years may present with recurrent episodes of wheezing. These episodes are typically associated with upper respiratory tract infection, which may occur around 6-8 times/year. In these cases, no family history of asthma or atopy is present. They should be treated with bronchodilators for a short period. Majority of them become normal with increasing age.

3.10: PRESCHOOL MULTITRIGGER ASTHMA

They have episodic wheezing with symptoms also occurring between episodes of upper respiratory tract infection associated wheeze, e.g. during sleep or with triggers such as activity, laughing or crying.

3.11: BRONCHIAL ASTHMA

Asthma is a chronic inflammatory condition with reversible airways obstruction generally seen in children more than 3 years of age. It is characterized by recurrent episodes of wheezing, cough, and difficult breathing, which responds to treatment with bronchodilators and anti- inflammatory drugs.

If the diagnosis is uncertain, give a dose of a rapid-acting bronchodilator. A child with asthma will often improve rapidly with such treatment, showing signs such as slower respiratory rate, less chest wall indrawing and less respiratory distress. However, a child with severe asthma may require several doses in quick succession before a response is seen. Severity of attack may be graded as mild to moderate, severe or life threatening as shown in *(Chart 3.6)*.

Chart 3.6: Classification of severity & grading of bronchial asthma attack

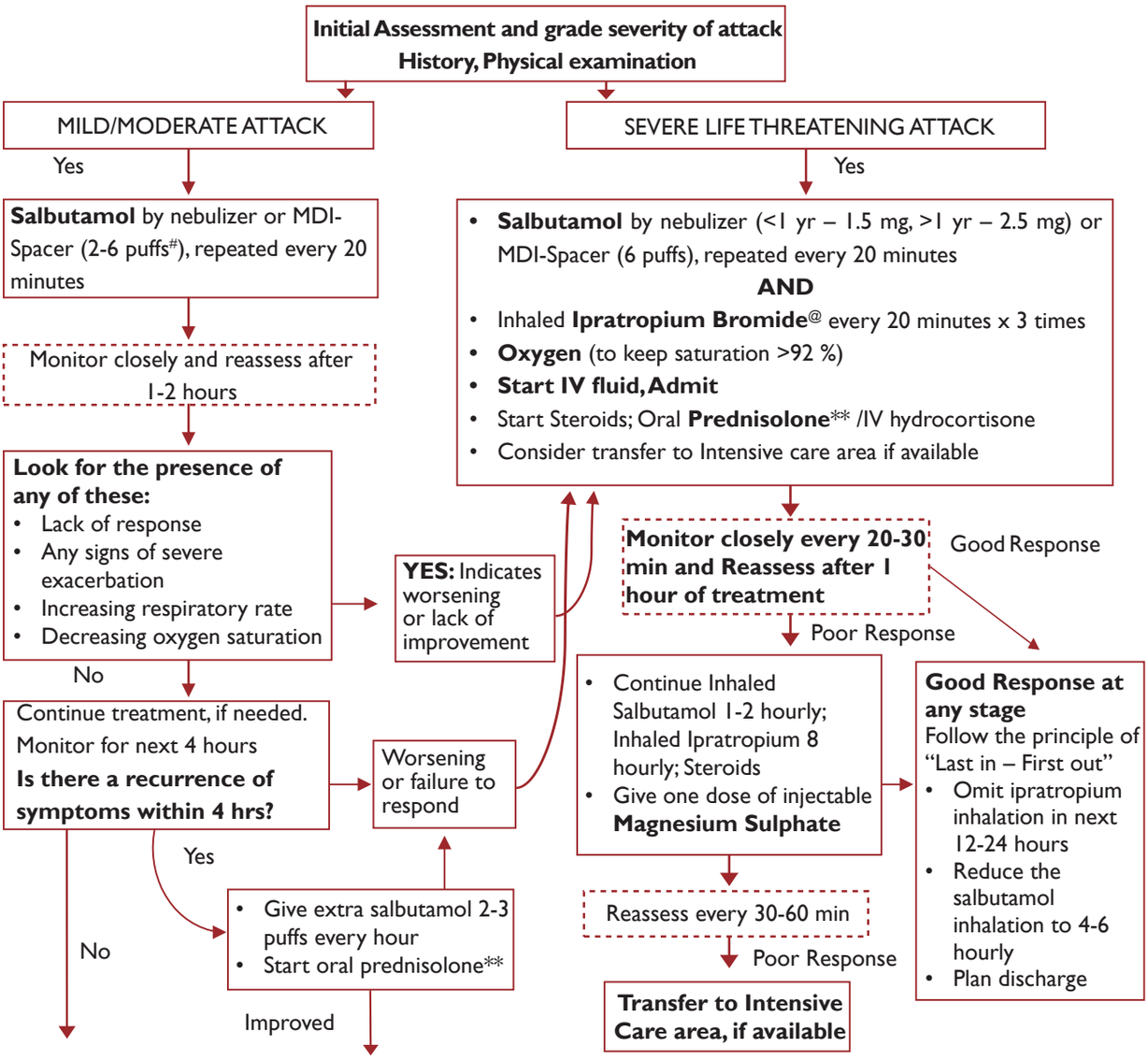
Mild-Moderate	Severe or Life threatening
• Talks in phrases • Prefers sitting to lying • Respiratory rate increased, but accessory muscles not used • Oxygen saturation ≥ 92 % on room air • Agitated	• Talk in words • Central cyanosis • Sits hunched forwards • Accessory muscles in use • Oxygen saturation < 92% on room air • Drowsy, confused or silent chest • Pulse rate > 200 bpm (0-3 years) or > 180 bpm (4-5 years)
Treatment of a child with acute life-threatening asthma	
• Start oxygen. • Simultaneously, initiate combined therapy with inhaled Salbutamol and Ipratropium. • Inj. Adrenaline (0.01ml/kg/dose; 1:1000 strength) can be given subcutaneously every 20 min, 3 times: ◆ If there is silent chest or ◆ If inhaled drug treatment is not possible or ◆ If there is associated anaphylaxis or angioedema. • Start maintenance intravenous fluids. • Start systemic steroids (Injection Hydrocortisone 5-10 mg/kg IV). Plan and arrange transfer to a higher facility in case you do not witness a significant response in the first hour. Continue treatment as a severe attack till transfer occurs to a facility with intensive care capacities.	

Treatment:

- A child with a first episode of wheezing and no respiratory distress can usually be managed at home with supportive care.
- All children with severe and life threatening attack, should be admitted in hospital.
- Mainstay of drug therapy is bronchodilators and steroids.

The types of drug used, their doses are largely governed by the severity of the attack *(see Chart 3.7)*.

Chart 3.7: Management and treatment of acute asthma in a hospital



*# **In mild – moderate exacerbation** number of puffs to be given every 20 minutes are: 2 puff in age less than 5years, 4 puffs in age more than 5 yrs. **In severe exacerbation**- Give 6 puffs every 20 minutes. Keep a gap of 15-30 seconds between two puffs. Each puff of Salbutamol has 100 microgram drug.*

*@**Ipratropium bromide:** 2 puffs of 80mcg MDI or 250mcg by nebulizer should be given every 20 minutes during first hour in children in life threatening conditions thereafter if needed it should be repeated every 8 hours.*

*****Prednisolone** 1–2 mg/kg/day, with a maximum of 20 mg/day for children under 2 years of age and 30 mg/day for children aged 2 –5 years, 60 mg/day in older children. Intravenous corticosteroids (Hydrocortisone IV 5-10 mg /kg) can be administered when patients are too dyspnoeic to swallow; if the patient is vomiting; or when patients require non-invasive ventilation or intubation.*

Medications to treat asthma can be classified as controllers or relievers. **Controllers** are medications taken daily on a long-term basis to keep asthma under clinical control chiefly through their anti-inflammatory effects. Controller medications reduce future risks such as exacerbations and decline in lung function. Inhaled glucocorticosteroids are currently the most effective and preferable controller. Other available controllers (less effective and more toxic) are Leukotriene receptor antagonist (LTRA), theophylline or low dose oral corticosteroids.

Relievers are medications used on as-needed bases that act quickly to reverse bronchoconstriction and relieve its symptoms.

Treatment of Mild/Moderate attack

Initial management would include the following:

- Give salbutamol via Nebulizer (0.15 mg/kg mimimum 1.25 mg to be given every 20 minutes) or via MDI-Spacer (2 puffs in children less than 5 years; 4 puffs in children more than 5 years' age, repeated every 20 minutes). Monitor closely and reassess the child after 1-2 hours.
- If the respiratory distress ***resolves completely***, and there are occasional or no rhonchi on auscultation, this is considered as a good response. Keep under observation for the next 4 hrs to see that the response is sustained. If improves and remains stable over next 3-4 hours send home on inhaled (preferable) or oral salbutamol.
- Patients with ***no response or deterioration*** (any signs of severe exacerbation, increasing respiratory rate, decreasing oxygen saturation) are treated as severe attack.
- If the ***response is partial***, but the child is stable and able to take orally, start oral steroids (Prednisone 1-2 mg/kg/day in 2-3 divided doses). Continue salbutamol via MDI 2-4 puffs or via nebulisation (0.15 mg/kg mimimum 1.25 mg) every hour. Keep under observation for the next 4 hours. If the patient deteriorates or does not respond treat as severe attack. If improves and remains stable over next 3-4 hours send home on oral steroids and inhaled salbutamol (oral salbutamol if inhaled is not available).

Severe life-threatening asthma

- Admit all children with severe life threatening asthma. Give free flow oxygen to keep ***oxygen*** saturation above 92%.
- Give rapid-acting bronchodilators
  - Give ***Salbutamol*** via Nebulizer (2.5 mg) or via MDI-Spacer (6 puffs), repeated every 20 minutes.
  - Give ***Ipratropium Bromide*** 250 mcg by nebulizer or 2 puffs of 80 mcg every 20 minutes for 1 hour.
  - Injection ***Adrenaline*** intramuscular/subcutaneously every 20 min three times can be given if there is silent chest and inhaled drug treatment is not possible (e.g. intubated child) or not available or there is associated anaphylaxis or angioedema.
- Give first dose of ***steroids*** (Injection Hydrocortisone 5-10 mg/kg stat, then 5 mg/kg, 6 hourly; maximum 300 mg; or oral Prednisolone 1-2 mg/kg (maximum 20 mg for children aged < 2 years, 30 mg for 2-5 years and 60 mg for older children), if not started so far.
- Start maintenance intravenous fluids.
- Monitor sensorium, respiratory rate, oxygenation, chest finding every 20-30 min initially and every 1-2 hrs once the patient starts responding.
- **If the child starts improving** or is stable, salbutamol inhalations are continued at 1 to 2 hours' interval depending upon the time for which the response to initial treatment is sustained. Ipratropium bromide should however be continued at 8 hourly intervals only. Once good response is seen, Ipratropium inhalation is stopped and then gradually the interval between Salbutamol inhalations is increased till it's being given every 6 hrs or so. At this stage discharge, can be planned.
- **If response is partial or poor:**
  - Continuous inhaled Salbutamol should be continued as before for another hour.
  - Add inhaled Ipratropium bromide if not added before. After the first three doses Ipratropium bromide should be given at 8 hourly intervals.
  - Continue Systemic steroids.

- **In case of poor or no response** after initial treatment with Salbutamol and Ipratropium:
  - Give Magnesium Sulphate (50%) 0.1 ml/ kg body weight (50 mg/kg) by adding to 50 ml of normal saline and then given as intravenous infusion over 20-30 min.
  - Transfer may be planned to a higher facility continuing the current level of treatment in case of any deterioration or if no response is seen in next 4-6 hours.
- Whenever patient shows good response and response is sustained for 4-6 hours, medications can be decreased gradually.

The **"last in-first out"** principle is used to withdraw medications. Ipratropium inhalation should be stopped in next 24 hours. Then the frequency of Salbutamol inhalation should be decreased to about 4-6 hourly *(see Chart 3.7).*

Monitoring

All hospitalized child should be assessed by a nurse every 20 minutes for 1-2 hours and then interval can be increased to 3-6 hours in stable children and by a doctor at least once a day. (Signs of improvement are SpO_2 >92%, slower breathing rate, less lower chest wall indrawing and less respiratory distress)

Complications

If the child fails to respond to the above therapy, or the child's condition worsens suddenly, obtain a chest X-ray to look for evidence of pneumothorax. Be very careful in making this diagnosis as the hyperinflation in asthma can mimic a pneumothorax on a chest X-ray.

Discharge and Follow-up

Consider for discharge when:

- The patient is stable (able to eat and drink without problems and does not need oxygen) and there is sustained relief in respiratory complaints.
- Need for Controller has been assessed
- Inhaler technique has been reviewed and corrected.
- Parents have been explained
  - Signs of recurrence and worsening of asthma
  - To avoid factors that precipitate exacerbation (e.g. smoking etc.)
  - To continue steroid for 3-7 days and then stop.
  - To give salbutamol via MDI on need basis (If MDI is not feasible tell them to start oral salbutamol).
  - To come for follow-up after 2-3 days

Practices not routinely recommended:

Antibiotics: Antibiotics are not routinely required since bacterial infections seldom trigger asthma. Consider antibiotics only in those who do not improve in response to bronchodilators, have purulent secretions or have radiological evidence of infection.

Mucolytics: These may dislodge thick secretions and increase airflow obstruction.

Sedatives: This group of drugs may depress the respiratory drive, suppress the cough reflex and mask the vital sign of deterioration of sensorium.

3.12: CONDITIONS PRESENTING WITH STRIDOR (Chart 3.8)

Stridor is a harsh noise during inspiration, which is due to narrowing of the air passages in the oropharynx, sub glottis or trachea. If the obstruction is below the larynx, stridor may also occur during expiration. The major causes of severe stridor are viral croup, foreign body inhalation, retropharyngeal abscess, diphtheria etc. It may also occur in early infancy due to congenital abnormalities e.g. laryngomalacia.

Viral croup

Croup causes obstruction of the upper airway, which, when severe, can be life-threatening. Most severe episodes occur in children ≤ 2 years of age.

Admit or refer child with moderate/ severe croup to a hospital where the respiratory care and intubation facility is available. While being transferred injectable Steroid, Inhaled Epinephrine, Oxygen should be given. **DO NOT TRY THROAT EXAMINATION** unless done in operation theatre (OT) or in the presence of an anesthetist as they may precipitate complete airway obstruction.

Monitoring:

- Keep the child calm, and avoid disturbance as much possible.
- If there are signs of incipient airway obstruction, such as severe indrawing of the lower chest wall and restlessness, consider intubating the child with an endotracheal tube one size smaller than the appropriate size; if expertise is available. This is preferred over tracheostomy, when feasible.
- If this is not possible, transfer the child urgently to a hospital where intubation or emergency tracheostomy can be done.

Intubation or tracheostomy should only be done by experienced staff

Chart 3.8: Differential diagnosis in a child presenting with stridor & Management of Viral Croup

Differential diagnosis in a child presenting with stridor	
Diagnosis	***In favour***
Viral Croup	• Barking cough • Respiratory distress • Hoarse voice
Diphtheria	• Bull neck appearance due to enlarged cervical nodes and oedema • Congested throat • Grey pharyngeal membrane • Blood-stained nasal discharge • Incomplete vaccination /No evidence of DPT vaccination
Retropharyngeal abscess	• Soft tissue swelling in posterior pharyngeal wall • Difficulty in swallowing • Fever • Toxic look
Foreign body	• Sudden history of choking • Respiratory distress
Epiglottitis	• Soft stridor • Toxic look • Little or no cough • Drooling of saliva • Inability to drink
Laryngomalacia	• Stridor starting during first month
Anaphylaxis	• History of allergen exposure • Wheeze • Shock • Urticaria and oedema of lips and face

Diagnosis & Management of Viral Croup		
Type	***Diagnosis***	***Treatment***
Mild croup	• A hoarse voice • A barking or hacking cough • Stridor that is heard only when the child is agitated.	• Home care (fluid, feeding, when to return) • Oral corticosteroids - (single dose of Dexamethasone 0.6 mg/kg or equivalent) can be given if patient is brought/referred to hospital.
Moderate to Severe croup	• Presence of any emergency sign (e.g. cyanosis or oxygen saturation ≤90%) and/ or • Stridor when the child is calm • and /or • Rapid breathing and lower chest in-drawing and/or • Drooling of saliva.	• Admit in hospital • Steroid – Single dose Inj. Dexamethasone (0.6 mg/kg) I/M or IV or oral Prednisolone (1-2 mg/kg). • Epinephrine (adrenaline) – Nebulized Epinephrine (1:1000 solution) 2 ml in 2 ml of normal saline • Antibiotics are not recommended. • Oxygen therapy • Intubation or Tracheostomy in children with incipient obstruction.

3.13: CONDITIONS PRESENTING WITH CHRONIC COUGH

A chronic cough is an unremitting cough that lasts ≥14 days. Many conditions may present with a chronic cough such as TB, pertussis, foreign body or asthma as shown in *Chart 3.9*.

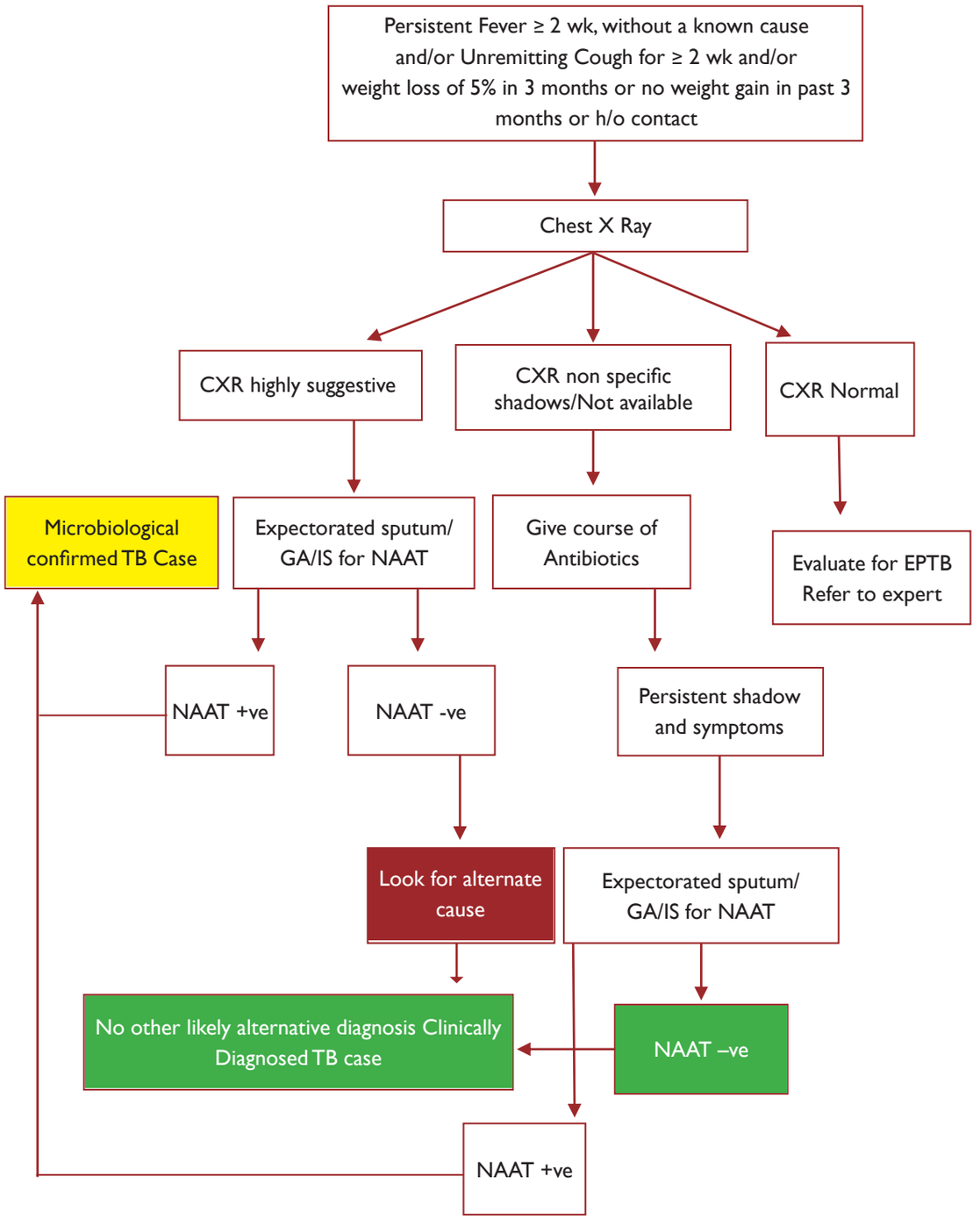
Chart 3.9: Differential diagnosis in children presenting with chronic cough

Diagnosis	***In favour***
TB	• Weight loss (>5% loss in last 3 months) • Anorexia • Enlarged liver and spleen • Persistent or intermittent fever • History of contact with tuberculosis case • Abnormal chest X-ray
Asthma	• History of recurrent wheeze • Hyperinflation of the chest • Prolonged expiration • Reduced air entry (in very severe airway obstruction) • Good response to bronchodilators
Pertussis	• Paroxysms of cough followed by whoop, vomiting, cyanosis or apnoea • Sub-conjunctival haemorrhages • Not received DPT /Pentavalent vaccination. • No fever
HIV	• Known or suspected maternal or sibling HIV infection • Failure to thrive • Oral or oesophageal thrush • Chronic parotitis • Skin infection with herpes zoster (past or present) • Generalized lymphadenopathy • Chronic fever • Persistent diarrhoea • Finger clubbing

3.14 :TUBERCULOSIS

- Early and prompt diagnosis of Tuberculosis (TB) in children is often difficult. A battery of tests is required to arrive at accurate diagnosis of TB in children. High index of suspicion of TB in a child is the first step in the diagnosis.
- Tuberculosis should be suspected among children presenting symptoms of prolonged / unexplained fever and / or cough for more than 2 weeks, with no weight gain or history of failure to thrive. It is to be remembered that cough may not be the predominant and constant symptom, unlike in an adult(Chart 3.10).
- Children presenting neurological symptoms like irritability, refusal of feeds/failure to thrive, headache, vomiting or altered sensorium and convulsions, may be suspected to have TB meningitis.
- History of contact with a presumptive TB patient or a diagnosed patient of pulmonary TB within the last 2 years reinforces the suspicion of tuberculosis. Special efforts should be made to elicit the history of contact with tuberculosis patient.
- The diagnosis is further based Chest X-ray examination.
- Sputum examination, if feasible, is a very helpful tool in the diagnosis. It is pertinent to remember that pulmonary TB among children is most often pauci- bacillary and there are practical difficulties in obtaining good quality sputum. All attempts to be made to collect a good quality specimen.
- Features suggestive of tuberculosis in chest X-ray include hilar adenopathy infiltrations, pleural effusion.
- **Upfront NAAT** is the recommended test for Mycobacterium Tuberculosis and should be used where tuberculosis is strongly suspected. Nucleic Acid Amplification Test (NAAT) are offered through either chip-based (Truenat) or cartridge-based (CBNAAT) testing in India. There are advantages of NAAT: firstly, rapid testing time of about 2 hours; secondly it detects presence of Mycobacterium tuberculosis as well as resistance to Rifampicin. Presently under NTEP, its recommended for respiratory (sputum, gastric lavage, induced sputum) and non-respiratory (lymph node aspirates, CSF, pleural fluid, and other body fluids) specimens from any child with probable pulmonary and/or extra pulmonary tuberculosis. Due to lack of evidence these recommendations do not apply to its use in stool, urine or blood.
- Loss of weight was defined as a loss of 5% or more of the highest weight recorded in the past three months.

Chart 3.10: Diagnostic algorithm for Pediatric Pulmonary tuberculosis (NTEP)



GA- gastric aspirate, IS- induced sputum

Highly suggestive Chest X-ray- miliary shadows, hilar or mediastinal lymphadenopathy or fibro-cavitatory lesions

Sputum for AFB smear should be done twice but sputum for NAAT should be done once only

Antibiotics like Linezolid and Fluoroquinolones should not be used as they have antitubercular activity

All TB cases should be offered testing for HIV

Children cannot usually bring out sputum and gastric aspirates are often negative with TB. Still, it is important to obtain early morning gastric aspirates, or sputum or pleural fluid for Ziehl-Neelsen (ZN) staining and examination for acid-fast bacilli and culture.

CASE DEFINITIONS

- **Microbiologically confirmed TB:**
  - presumptive TB patient with biological specimen positive for AFB, or positive for MTB on culture, or positive for TB through Quality Assured Rapid Diagnostic molecular test.
- **Clinically diagnosed TB case:**
  - A presumptive TB patient who is not microbiologically confirmed, but diagnosed with active TB by a clinician on the basis of X-ray, histopathology or clinical signs with a decision to treat the patient with a full course of Anti-TB treatment. In children, this is based on the presence of abnormalities consistent with TB on radiography, history of exposure to an infectious case, & clinical findings suggestive of TB in the event of negative or unavailable microbiological results.

Classification by anatomical site of disease:

- **Pulmonary tuberculosis (PTB):** any microbiologically confirmed or clinically diagnosed case of TB involving lung parenchyma or tracheo-bronchial tree.
- **Extra Pulmonary tuberculosis (EPTB):** any microbiologically confirmed or clinically diagnosed case of TB involving organs other than lungs e.g. pleura, lymph nodes, intestine, genitourinary tract, joint and bones, meninges etc.

Miliary TB classified as PTB because there are lesions in the lungs. A patient with both pulmonary and extra-pulmonary TB should be classified as a case of PTB.

Classification by H/O previous TB treatment

- New case - A TB patient who has never had treatment for TB or has taken anti-TB drugs for less than one month.
- Previously treated patients have received 1 month or more of anti-TB drugs from any source in the past.
  - Recurrent TB case- A TB Patient previously declared as successfully treated (cured/treatment completed) and is subsequently found to be microbiologically confirmed TB case.
  - Treatment after failure- those patients who have previously been treated for TB and whose treatment failed at the end of their most recent course of treatment.
  - Treatment after lost to follow-up- A TB patient previously treated for TB for 1 month or more and was declared lost to follow-up in their most recent course of treatment and subsequently found microbiologically confirmed TB case.
  - Other previously treated patients are those who have previously been treated for TB but who cannot be classified into any of the above classification.

Classification based on drug resistance

- Mono-resistant (MR): A TB patient, whose biological specimen is resistant to one first line anti-TB drug only.
- Poly-Drug Resistant (PDR): A TB patient, whose biological specimen is resistant to more than one first-line anti-TB drug, other than both Isoniazid (INH) and Rifampicin.
- Multi Drug Resistant (MDR): A TB patient, whose biological specimen is resistant to both isoniazid and Rifampicin with or without resistance to other first line drugs, based on the results from a quality assured laboratory.
- Rifampicin Resistant (RR): resistance to rifampicin detected using phenotypic or genotypic methods, with or without resistance to other anti-TB drugs excluding INH. Patients, who have any Rifampicin resistance, should also be managed as if they are an MDR TB case.
- Extensively Drug Resistant (XDR): A MDR TB case whose biological specimen is additionally, resistant to a fuoroquinolone (Ofloxacin, Levofloxacin, or Moxifloxacin) and a second-line injectable anti TB drug (Kanamycin, Amikacin, or Capreomycin) from a quality assured laboratory.

Treatment of Paediatric TB:

Accurate, timely, and evidence-based TB treatment is imperative for not only successful treatment outcome, but also to reduce the risk (FDC) of emergence of drug-resistant strains.

The principle of treatment for tuberculosis (other than confirmed drug-resistant forms of TB) is to administer daily fixed-dose combinations (FDC) of first-line anti-tuberculosis drugs in appropriate weight bands .There are two types of Paediatric FDCs available under NTEP-Formulation: Dispersible and Flavoured.

For all TB patients whether being treated in public or private sector, clinicians should follow Standards for TB Care in India (STCI) guidelines. In NTEP, the principle of treatment for tuberculosis (other than confirmed drug resistant forms of TB) is to administer daily fixed dose combinations of first – line anti-tuberculosis drugs in appropriate weight bands (see Chart 3.11).

The regimen for Drug-Sensitive TB (DSTB) cases: 2HRZE/4HRE is for H & R sensitive TB cases and cases with unknown sensitivity patterns.

- For Intensive Phase (IP): 3 Drugs FDC Dispersible Tablets (DT) (H 50, R 75, Z150) (10:15:30)
- For Continuation Phase (CP): 2 Drug FDC DT (H 50, R 75) (10:15)
- As Ethambutol is not available in the DT form, a non-DT 100 mg Ethambutol tablet is given for each Paediatric FDC during IP and CP
- Give Pyridoxine 10 mg to all children INH

Treatment is given in two phases:

- The intensive phase (IP) consists of 8 weeks (56 doses) of isoniazid (H), rifampicin (R), pyrazinamide (Z), and ethambutol (E) given under direct observation in daily dosages as per weight band categories.
- The continuation phase (CP) consists of 16 weeks (112 doses) of isoniazid, rifampicin, and ethambutol in daily dosages. Only pyrazinamide will be stopped in the continuation phase.

- The CP may be extended by 12-24 weeks in certain forms of TB like CNS TB, Skeletal TB, Disseminated TB, etc., based on the clinical decision of the treating physician on a case-to-case basis.
- Steroids as an adjunctive therapy is useful in patients with TB pericarditis and meningeal TB, with an initial high dose tapered downwards gradually over 6 - 8 weeks.

ANTI-TUBERCULAR DRUGS

Chart 3.11: Doses of anti-tuberculous drugs (NTEP)

		Daily	Maximum daily dose
Rifampicin	R	15 mg/kg/day (10-20 mg/day)	600 mg
Isoniazid	H	10 mg/kg (7-15 mg/kg) daily	300mg
Pyrazinamide	Z	35 mg/kg (30-40 mg/kg) daily	2000mg
Ethambutol*	E	20 mg/kg (15-25mg/kg) daily	1500mg
Streptomycin**	S	20 mg/kg (15-20 mg/kg) daily	1000 mg
**Ethambutol is given separately for children to monitor ophthalmic ADR.* ***Streptomycin is administered only in certain situations, like TB meningitis or if any first line drug need to be replaced due to adverse drug reactions as per weight of the patient*			
New pediatric ATT FDC bands as per NTEP			
Weight category	Number of tablets (dispersible FDCs)		
	Intensive phase		Continuation phase	
	HRZ	E	HR	E
	50/75/150	100	50/75	100
4-7 kg	1	1	1	1
8-11 kg	2	2	2	2
12-15 kg	3	3	3	3
16-24 kg	4	4	4	4
25-29 kg	3+1A*	3	3+1A*	3
30-39 kg	2+2A*	2	2+2A*	2

A= Adult FDC (HRZE= 75/150/400/275; HRE= 75/150/275

EXERCISE 3.1

1. Mayank, 13 months old child was brought to hospital with the complaints of cough & fever for four days. His respiration is very fast and there is severe chest in drawing.
   You have started emergency treatment in form of positioning and oxygen as you found his oxygen saturation 88%. When you examined him further, RR is 76/minutes. He looks lethargic, there is no history of convulsion, extremities are warm, and Mother tells you that Mayank is feeding poorly. On chest auscultation, you found equal air entry both side with occasional crepitations. Other systemic examinations are normal.

a. How will you classify Mayank's illness?

b. What investigations will you order for Mayank?

c. Write specific treatment which you will start?

d. Write supportive treatment if any required for Mayank.

e. How will you monitor him during first 48 hours?

f. Enumerate conditions in which you will start anti-staphylococcal treatment.

EXERCISE 3.2

2. A four-year-old Sonakshi has been brought to your hospital with cough, fever for a day along with difficulty in breathing. She has RR of 54 /minute She has similar episodes in past and her father is on Inhalation therapy. Her oxygen saturation is 94% on admission, has bilateral ronchi. Other systemic examination is normal.

a. What is most likely diagnosis?

b. How will you grade her disease?

c. What immediate treatment should be started?

d. Will you start antibiotics?

e. After 1 hour, on re-examination, she is better with RR of 30/minute. Write further management plan for her

EXERCISE 3.3

3. A 2.5-year-old boy is brought with complaints of: mild coryza for one day; difficulty in breathing for 6 hours; barking cough and; hoarseness of voice. On examination, the child is agitated, febrile, pale and also has stridor at rest. There are marked chest retraction and absent breath sound on auscultation. She had been hospitalized once with similar complaints at two years of age and has been well since then..

a. What is the diagnosis?

b. What is the severity?

c. What would be the appropriate management?

EXERCISE 3.4

4. A 4-year-old girl 10 kg has complaints of fever for around 1.5 months; decreased appetite for 1 month and; weight loss over past one month. On examination, she has bronchial breathing in right inter-scapular region. Sputum on microscopy revealed Acid fast bacilli. Write the daily dose of anti-tubercular treatment for this patient.

SECTION 4: MANAGEMENT OF CHILDREN WITH SHOCK

A critical component of the emergency care of very sick infants and children is identification and management of those presenting with shock. Timely administration of fluids and medications save many lives.

4.0: LEARNING OBJECTIVES:

After the completion of this section the participant should be able to:

- Describe the approach to classify various types of shock
- Manage children with different types of shock subsequent to initial management

4.1: SHOCK

Shock is defined as an acute failure of circulatory function leading to inadequate amounts of oxygen and other nutrients, delivered to body tissues and inadequate removal of tissue waste products. Inadequate tissue perfusion resulting in shock may result from loss of fluid (hypovolaemic), from defects of the pump (cardiogenic), abnormalities of vessels (distributive), flow restriction (obstructive) or inadequate oxygen-releasing capacity of blood (dissociative). As these functions involve several body systems, treatment needs to be decided for an individual patient based on causes and need to modify based on response.

You have already learnt that if the child has **cold hands, a CRT >3 seconds, and a fast and weak pulse**, then he or she is in **shock**. Although by using these signs you will be able to identify most of pediatric shock cases, it may miss early distributive shock like warm septic shock who do not have cold extremities and prolonged CRT.

All types of shock can result in impaired function of vital organs, such as the brain (decreased level of consciousness) and kidneys (low urine output). After initial fluid therapy, the ongoing management depends upon the type of shock. Following history and examination help in identifying and assessing a child with shock:

History

- History of diarrhoea
- Any febrile illness (e.g. dengue, meningitis, sepsis)
- Bleeding & trauma
- History of congenital or rheumatic heart disease
- Urine output

Examination

- Temperature and colour of the extremities
- Pulse rate
- Central and peripheral pulse volume
- Capillary refill time
- Blood pressure
- Consciousness level
- Any bleeding signs (petechiae, purpura)
- Signs of fluid overload - engorged neck veins, hepatomegaly, crepitations.

Classification of shock:

- **Hypovolemia/ Hemorrhagic shock** (loss of volume) - due to fluid loss or blood loss or poor intake.
- **Distributive shock** (inappropriate distribution of blood volume and flow) -Mainly due to sepsis **(Septic shock)** or anaphylaxis **(Anaphylactic shock)** and sometimes due to spinal cord injury **(Neurogenic shock)**.
- **Cardiogenic shock** (impaired cardiac contractility) mainly due to myocarditis, congenital or rheumatic heart disease.
- **Obstructive shock** (obstructed blood flow) in children with pneumothorax, critical outflow obstruction or cardiac tamponade.

4.2: STAGES OF SHOCK *(Figure 4.1)*

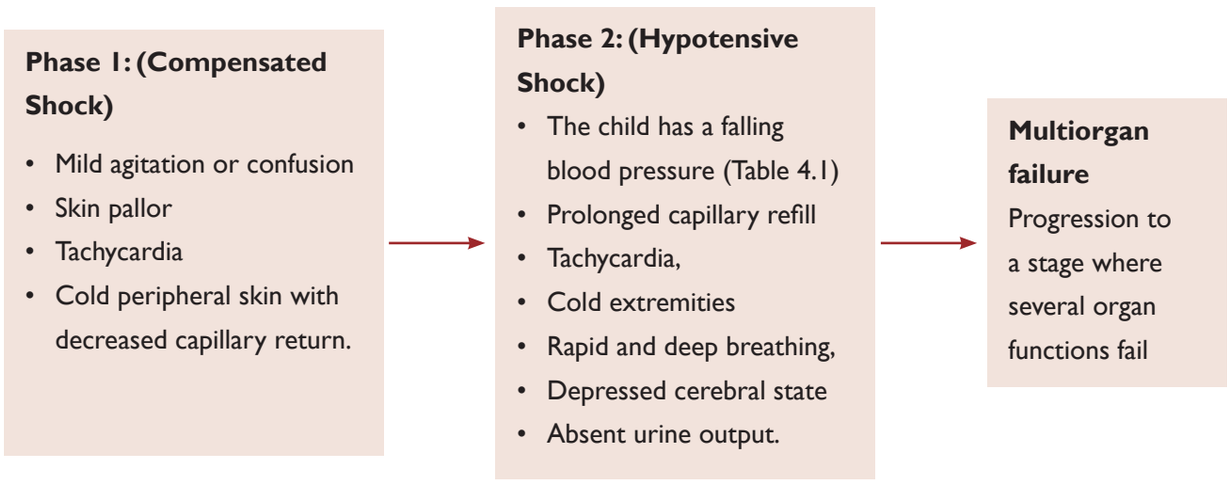


Figure 4.1: Stages of shock

Table 4.1: Definition of hypotension by systolic blood pressure and age

Age	Systolic blood pressure (mm Hg)
Term neonates	< 60
Infant (1 to 12 months)	< 70
Children 1 to 10 years	< 70 + (age in year x 2)

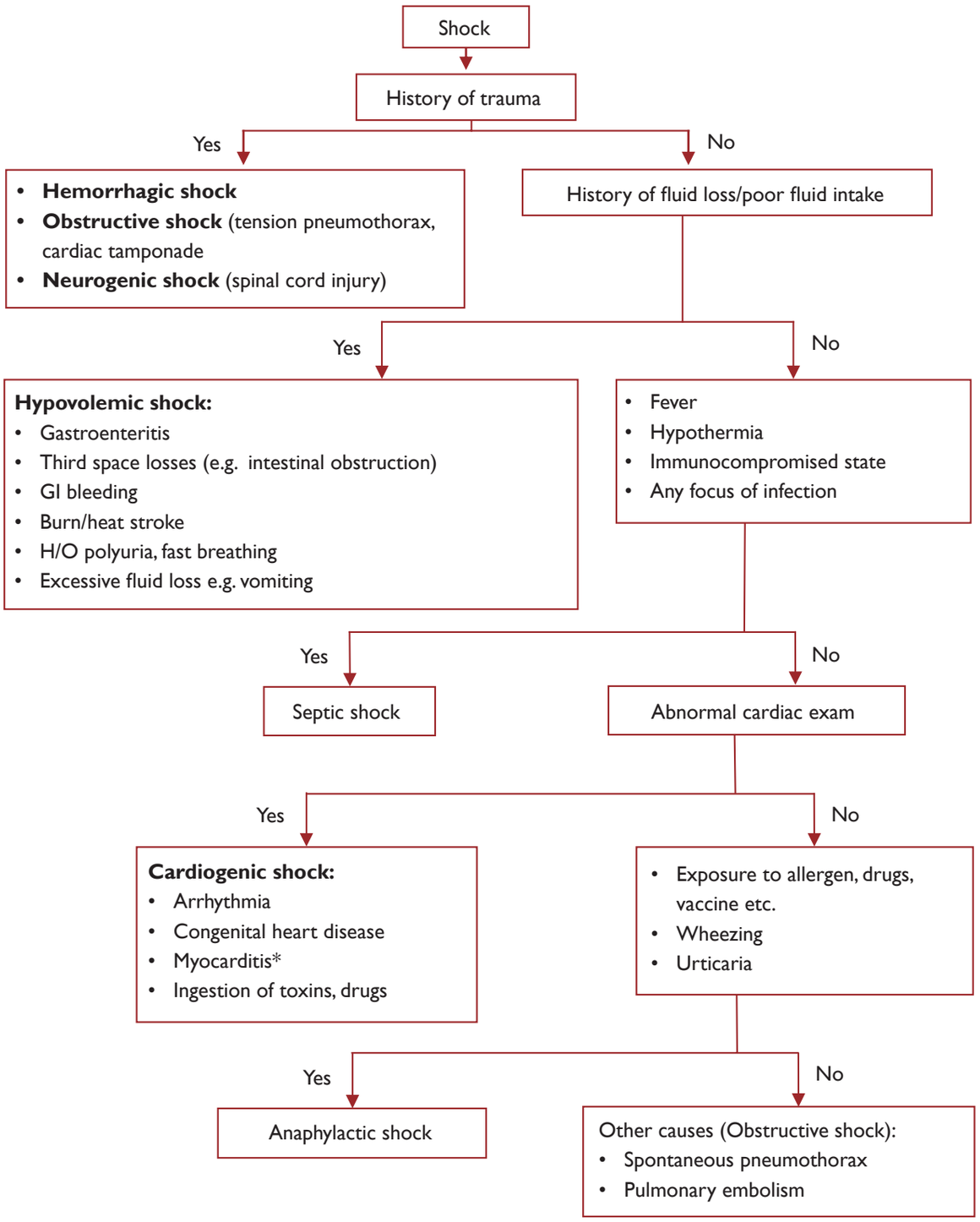
Approach to classification of shock in children is shown in ***Chart 4.1***.

4.3: MANAGEMENT OF SHOCK

General management:

1. **Management of airway and breathing:** Maintain a patent airway and support breathing as described in ETAT section. Give 100% oxygen and provide positive pressure ventilation (using bag-mask device with filter and tight seal in presence of COVID risk) if there is no spontaneous breathing. If the child is responsive and haemodynamically stable, allow the child to remain in most comfortable position (e.g. sitting in mother's/ caregiver's lap to decrease anxiety). Desired SpO_2 is 94-97 %.
2. **Fluid resuscitation:** You have already learnt initial fluid management in ETAT section. The further management strategy is decided on the basis of type and underlying condition leading to shock. After initial bolus, repeating fluid bolus may be appropriate in some settings, such as hypovolemic shock due to severe dehydration, but may be harmful in children with febrile illness, malnutrition, anaemia, cardiogenic shock, renal failure or fluid overload state. Close monitoring of vitals (RR, HR) every 5-10 minutes is critical during fluid resuscitation in all types of shock. Wherever available, Inferior Vena Cava (IVC) Collapsibility monitoring by ultrasound should be used to decide volume of fluids.
3. **Correction of underlying metabolic, electrolyte and acid base abnormalities:** Check and correct hypoglycemia, hypocalcemia and acidosis.

Chart 4.1: Diagnostic approach to a child with shock



**fever may be present in few infections like enteric fever, COVID etc.*

4. **Monitoring:** Assess the effectiveness of fluid resuscitation and inotropic therapy by frequent monitoring, every 5-10 minutes during first hour and then every 30 minutes.

   - Heart rate
   - Pulse rate
   - Level of consciousness
   - SpO_2
   - Blood pressure
   - Hepatomegaly and crepitations

   Also monitor

   - Temperature at 1-2 hourly interval
   - Urine output at 1-2 hourly interval, and
   - IVC diameter wherever available before deciding next fluid bolus

5. **Laboratory studies:** Following laboratory investigations may help in management-

   - Blood glucose at admission and 4-6 hourly interval
   - Hemogram
   - Serum electrolytes (sodium, potassium, calcium)
   - CRP
   - Chest X-ray

Following investigations should be done as per clinical indication, if facilities are available:

- Blood culture (all cases where septic shock is a possibility)
- Blood lactate
- Blood gas analysis
- Coagulation profile
- ECG and Echocardiography

6. **Medications:** Use vasopressors and other drugs as described in subsequent sections.

Management of different types of shock:

Hypovolemic shock:

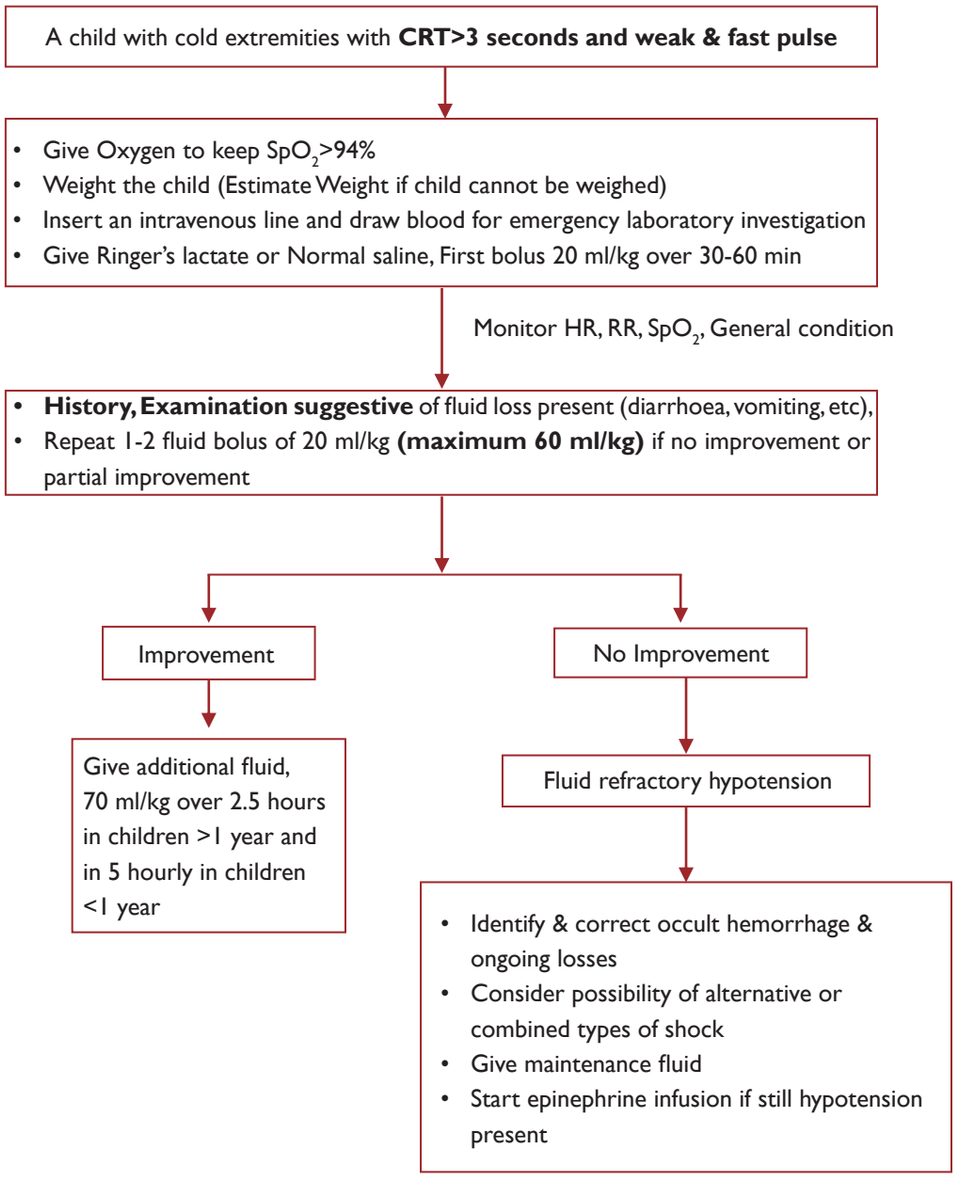
Hypovolemic shock is the most common type of shock. This can be due fluid loss due to diarrhoea, vomiting, third space losses (e.g. intestinal obstruction, hypoalbuminemia), or due to haemorrhage externally, or internally, and osmotic diuresis (diabetic ketoacidosis).

Timely administration of fluids is the key for preventing deterioration from compensated hypovolemic shock to hypotensive shock *(Chart 4.2)*.

Apart from fluid therapy, management include:

- Identification of type of volume loss (hemorrhagic versus non-hemorrhagic)
- Prevention and replacement of on-going losses (e.g. GI loss, Bleeding)
- Correction of dys-electrolytemia and acid base imbalance

Chart 4.2: The algorithm for management of hypovolemic shock



Distributive shock:

Distributive shock is a condition in which the majority of blood is inappropriately distributed in the vasculature. Distributive shock is caused by vascular dilatation, loss of blood vessel tone or capillary leak; which may occur due to **sepsis, anaphylaxis,** or a **neurological** problem. Sepsis is commonest cause of distributive shock in children.

Sepsis is defined as "life-threatening organ dysfunction caused by a dysregulated host response to infection". **Septic shock** is defined as a "subset of sepsis, in which underlying circulatory and cellular metabolism abnormalities are profound enough to substantially increase mortality". Clinically, septic shock can be identified in a child who have clinical features of sepsis, with persisting hypotension requiring vasopressors to maintain age appropriate minimum systolic BP and serum lactate level of >2 mmol/L despite adequate volume resuscitation.

Septic shock can be further divided into "warm" and "cold" shock. In **"warm"** shock, child will have warm, erythematous peripheral skin and wide pulse pressure in the setting of hypotension. If the **"cold"** shock, peripheral skin will be cold and pulse pressure will be narrow. *(Table 4.2)*.

Table 4.2: Differentiation between warm and cold shock

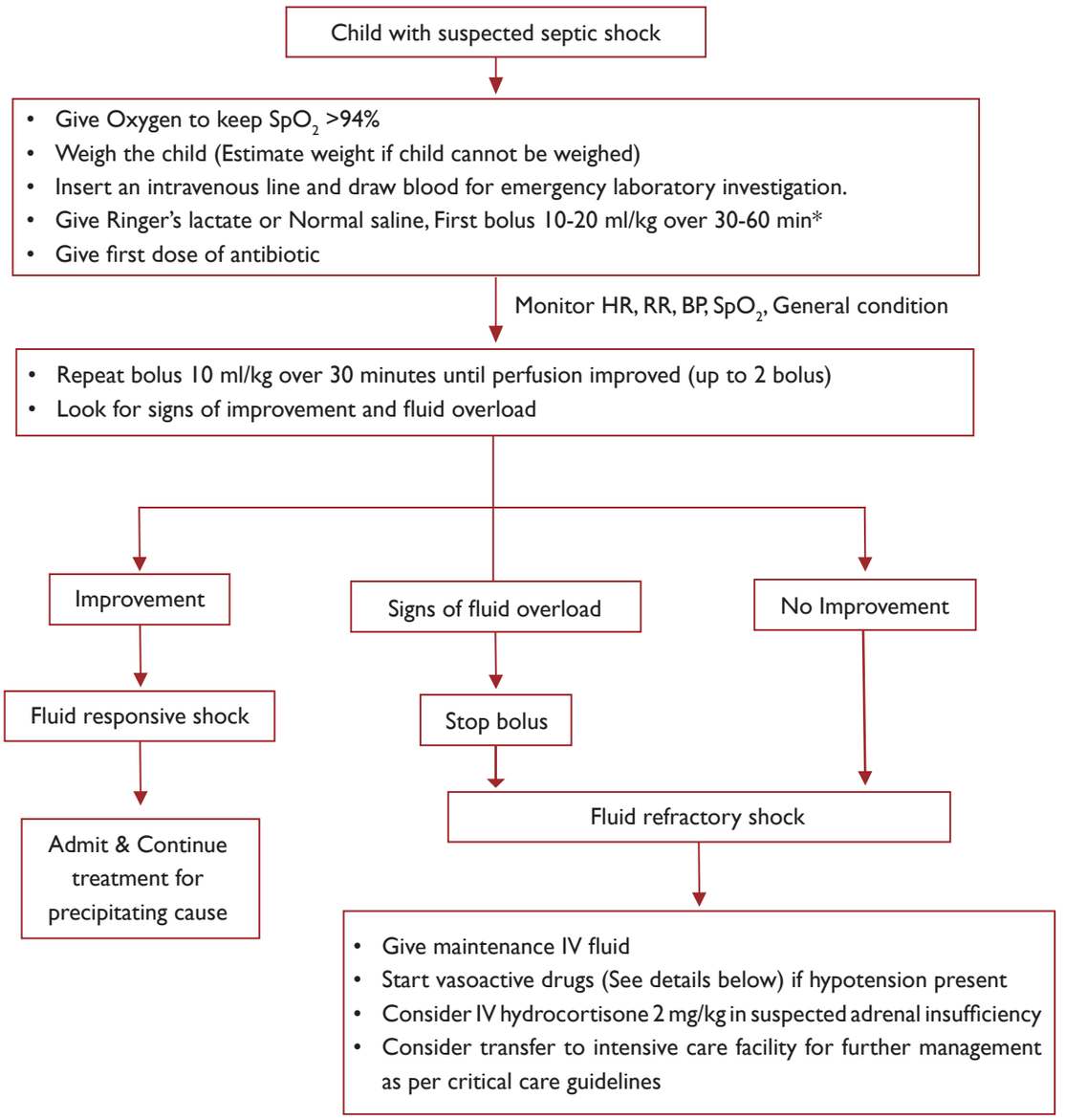
	WARM shock	COLD shock
Peripheral perfusion	Warm/flushed	Cold/clammy/cyanotic/mottled
Capillary refill	Brisk/flash; <2 seconds	Delayed; >3 seconds
Pulse	Bounding	Weak/thready
Heart rate	Increased	Increased
Blood pressure	May be normotensive	Usually hypotensive
Pulse pressure	Widened	Narrow

1. Management of septic shock (Chart 4.3):

The primary goals in initial management of septic shock are:

- **Restoration of hemodynamic stability**
  - Supportive therapy should be continued till the child has CRT of ≤2 seconds, normal blood pressure for age, normal pulses with no differential between peripheral and central pulses, warm extremities, urine output >1 ml/kg/hr, and normal mental status.
- **Identification and control of infection**
  - Broad spectrum empiric antimicrobials should be administered within 1 hour of the identification of septic shock. Blood cultures should be obtained before administering antibiotics when possible, but this should not delay initiation of antibiotics.
    - ✓ Combination of third generation Cephalosporin (Ceftriaxone: 50 mg/kg per dose IV every 12 hour or 100 mg/kg once daily or Cefotaxime 50 mg/kg per dose IV every 6 hours with aminoglycosides like Gentamicin (7.5 mg/kg/day OD) or Amikacin (15 mg/kg/day OD).
    - ✓ If sepsis is suspected to be due to S. aureus, then give Ceftriaxone/Cefotaxime with Vancomycin (15 mg/kg/dose every 6 hourly).
    - ✓ For children 1–3 months, give combination of third generation Cephalosporin like Cefotaxime (200 mg/kg/day divided 6 hourly) or Ceftriaxone (100 mg/kg/day divided 12 hourly) with Aminoglycosides like Gentamicin (7.5 mg/kg/day) or Amikacin (15 mg/kg/day).
  - The empiric drug choice should be modified in case of epidemic and endemic infections (e.g. Gram +ve cocci, gram-ve bacilli, salmonella, malaria, dengue, rickettsia etc.). Antifungals and antivirals should be added if clinical setting demands.
  - Continuation of therapy should be guided by clinical response and blood culture report.
- Give injection Hydrocortisone (2 mg/kg) in patients who are at risk of adrenal insufficiency. Patients at risk for adrenal insufficiency include children with severe septic shock and purpura, those who have previously received steroid therapies for chronic illness, and children with pituitary or adrenal abnormalities.
- In non-hypotensive children with severe haemolytic anaemia (severe malaria or sickle cell crises) blood transfusion is considered superior to crystalloid bolus.
- In cases of shock hemoglobin levels of 10 g/dl should be targeted. However, transfusion may be deferred unless Hb <7 gm/dl, if shock has improved.
- Maintain euglycaemia

Chart 4.3: Management algorithm for children with septic shock



- ***Begin Epinephrine at 0.1 µg/kg/min and titrate up to 1 µg/kg/min (1st choice) OR Norepinephrine at 0.1 µg/kg/min and titrate up to 2 µg/kg/min (1st choice in case of warm septic shock)***
- *If Epinephrine/norepinephrine not available, give Dopamine at 10 µg/kg/min and may increase up to 20 microgram*
- *Refer FURTHER READING for infusion preparations*
- *Gradually taper vasoactive drug/s after 24 hours for maintaining normal BP.*

FURTHER READING: Simplified calculation of IV infusion dosage of inotropic and vasopressor drugs

Amount of drug to be given in mg, as continuous IV infusion in next 8 hours:

= Weight of child (kg) × Desired infusion rate in µg/kg/min divide by 2

General instructions for solution preparation and infusion:

- For infusion, the inotropic and vasopressor agents can be diluted in commonly available IV solutions including NS, N/2 Saline, 5%D and 10%D.
- 1:10,000 (1 mg/10 ml) ampoule is the preferred preparation for adrenaline infusion. 1:1,000 ampoules are also available which is equivalent to 1 mg/ml.
- Some of inotropic drugs are available as a salt preparation. In such drugs, use the base amount of drug for infusion preparation (e.g. Inj. Norepinephrine contains Norepinephrine Tartrate, as 2mg/ml, however the amount of Norepinephrine base is 1mg/ml. Use the base concentration i.e. 1mg/ml for preparation of solution for Norepinephrine).
- Ensure a uniform rate of drug infusion. If Infusion pump is available, give drugs by infusion pump, and give maintenance IV fluids through a separate line. If Infusion pump is not available, the inotropic drug can be mixed with maintenance IV fluids, however, make sure that drip rate is carefully set so that harm due to faster or slower delivery of drug is prevented.

Example 1: For a continuous infusion of Epinephrine @ 0.1 µg/kg/min in a 12 kg child- Dose required = 12×0.1/2 =0. 6 mg of Epinephrine as continuous infusion in next 8 hours.

Example 2: For a continuous infusion of Noradrenaline @0.6 µg/kg/min in a 10 kg child- Dose required = 0.6×10/2 = 3 mg of Noradrenaline as continuous infusion in next 8 hours.

Anaphylaxis:

Anaphylaxis is defined as a serious allergic reaction that is rapid in onset and may cause death. It occurs when there is a sudden release of potent biologically active mediators from mast cells and basophils, leading to cutaneous (urticaria, angioedema, flushing), respiratory (bronchospasm, laryngeal oedema), cardiovascular (hypotension, dysrhythmias, myocardial ischemia), and gastrointestinal (nausea, colicky abdominal pain, vomiting, diarrhoea) symptoms.

The most common causes of anaphylaxis in children are different for hospital and community settings. Anaphylaxis occurring in the hospital results primarily from allergic reactions to medications (penicillin, cephalosporins, sulphonamides, vaccines). Food allergy due to egg, nuts, fish etc. is the most common cause of anaphylaxis occurring outside the hospital. Other causes include bites by honeybee, wasp, and ants. For approach to management of anaphylaxis refer to *Chart 4.4*.

Anaphylaxis is highly likely when any one of the following 3 criteria is fulfilled:

1. Acute onset of an illness (minutes to several hours), with involvement of the skin, mucosal tissue, or both (e.g., generalized urticaria, itching or flushing, swollen lips/tongue/uvula), and at least one of the following:
   - respiratory compromise (e.g., dyspnea, wheeze/bronchospasm, stridor, hypoxemia) or
   - reduced blood pressure or associated symptoms of end organ dysfunction (eg, hypotonia [collapse], syncope, incontinence);

OR

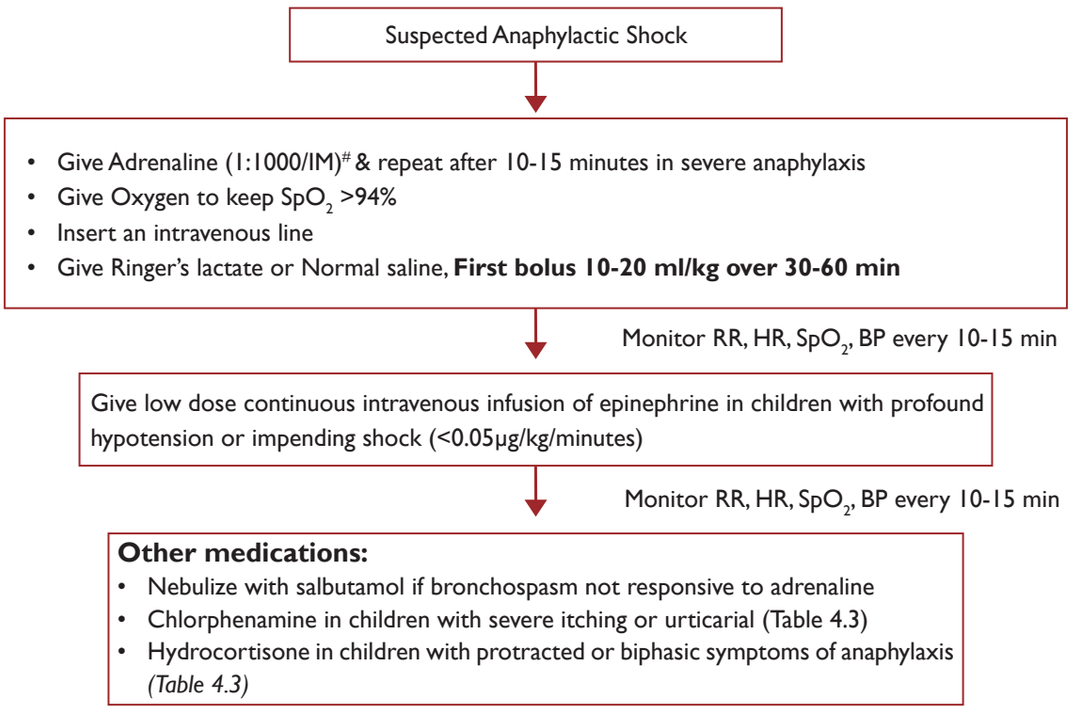
2. Two or more of the following that occur suddenly after exposure to a likely allergen for that patient (minutes to several hours):
   - involvement of the skin/ mucosal tissue (e.g, generalized urticaria, itch/flush, swollen lips/ tongue/uvula),
   - respiratory compromise (e.g, dyspnea, wheeze/bronchospasm, stridor, hypoxemia),
   - reduced blood pressure or associated symptoms (e.g, hypotonia [collapse], syncope, incontinence), or
   - persistent gastrointestinal symptoms (e.g, crampy abdominal pain, vomiting);

OR

3. Reduced blood pressure after exposure to a known allergen for that patient (minutes to several hours):
   - for infants and children, low systolic blood pressure (age-specific) or greater than 30% decrease in systolic blood pressure, and
   - for teenagers and adults, systolic blood pressure of less than 90 mm Hg or greater than 30% decrease from that person's baseline.

Epinephrine is the medication of choice for the first-aid treatment of anaphylaxis. Through vasoconstrictor effects, it prevents or decreases upper airway mucosal edema (laryngeal edema), hypotension, and shock. In addition, it has important bronchodilator effects and cardiac inotropic and chronotropic effects. Delayed epinephrine administration in anaphylaxis is associated with an increased risk of hospitalization and poor outcomes, including hypoxic-ischemic encephalopathy and death. Conversely, prompt prehospital epinephrine injection is associated with a lower risk of hospitalization and fatality. H1-antihistamines prevent and relieve itching and hives but do not relieve life-threatening respiratory symptoms, hypotension, or shock; therefore, drugs like H2-antihistamines and glucocorticoids, they are adjunctive treatments and are not appropriate for use as the initial treatment or the only treatment.

Chart 4.4: Approach to management of anaphylactic shock in children



 # SC is not effective,

IM doses of 1:1000 adrenaline (repeat after 5 min if no improvement) in age appropriate doses

***Child more than** 12 years: 500 micrograms IM (0.5 mL) **10-12 years:** 400 micrograms (0.4ml)*

***Child 7-10 years:** 300 micrograms IM (0.3 mL), **4-6 yrs:** 0.2ml*

***2-3 years:** 150 micrograms IM (0.15 mL), **1-2 years:** 0.1 ml, **<1 year:** 0.05-0.1 ml*

Table 4.3: Doses of Chlorpheniramine & Hydrocortisone

Age group	Chlorpheniramine (IM or slow IV)	Hydrocortisone (IM or slow IV)
Adult or child more than 12 years	10 mg	200 mg
Child 6-12 years	5 mg	100 mg
Child 6 months to 6 years	2.5 mg	50 mg
Child less than 6 months	250 microgram/kg	25 mg

Cardiogenic shock (Chart 4.5)

Cardiogenic shock is a subtype of shock that results due to myocardial dysfunction. Initial clinical features of cardiogenic shock may be indistinguishable from hypovolemic shock.

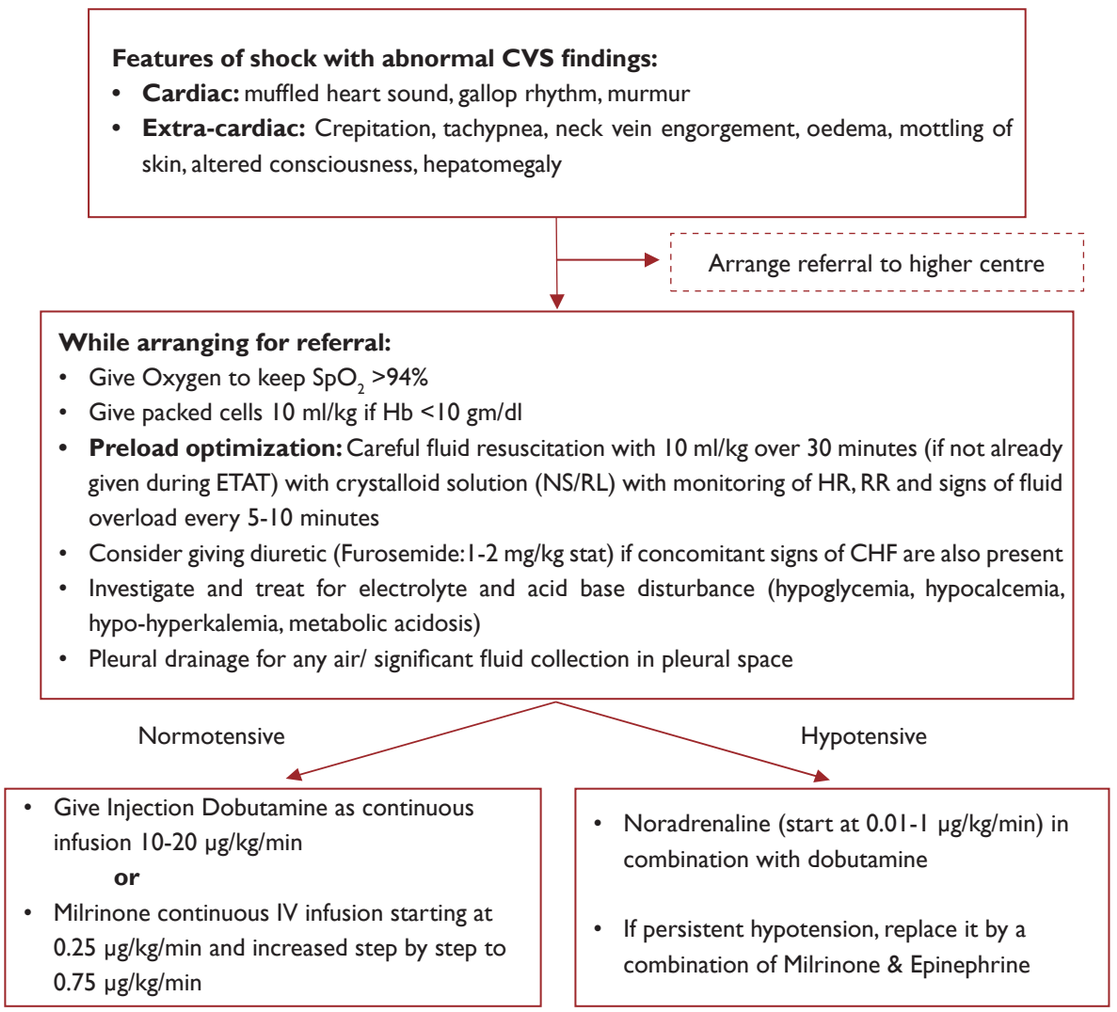
Following features suggest possibility of cardiogenic shock:

- Presence of muffled heart sounds/ gallop rhythm/ murmur
- B/L crepitations, fast breathing
- Neck vein engorgement
- Hepatomegaly
- Presence of oedema
- Altered consciousness
- Large heart size on chest x-ray.

Obstructive shock:

Obstructive shock and impaired cardiac output result when blood flow is physically obstructed. Acquired causes of obstructive shock include cardiac tamponade, tension pneumothorax and massive pulmonary embolism. Infants with ductal-dependent congenital heart lesions, such as hypoplastic left ventricle syndrome, may present in shock when the ductus arteriosus closes during the first few weeks of life. The management of obstructive shock requires specific interventions to relieve the obstruction to blood flow (e.g. Surgical drainage of tension pneumothorax/pleural effusion, pericardiocentesis).

Chart 4.5: Management of cardiogenic shock in children



Rarely you may find a child with shock who has signs related to multiple sub-classifications of shock. For example, a child with severe dengue may simultaneously have hypovolemic shock due to haemorrhage, distributive shock due to diffuse capillary leak, cardiogenic shock due to dengue induced myocarditis and obstructive shock due to pericardial and massive pleural effusion. Careful clinical examination is of utmost importance in these children, so that management can be directed to the multiple sub-classifications simultaneously, with careful monitoring for improvement or worsening.

EXERCISE 4.1

1. A 4-year-old child has sustained a road traffic accident and brought to emergency. He is breathing normally but lips look blue, has cold extremities, CRT >3 seconds and pulse rate of 148/minutes. Emergency staffs have managed airway, started oxygen by mask. When you examined, child looked lethargic, anxious and in pain. There was swelling over left thigh and pain on left lower limb movements.

   a. Classify the type of shock in this child

   b. What is lower limit of normal systolic pressure in this child?

   c. What are steps in initial fluid resuscitation for this child?

   d. After fluid resuscitation, the boy has HR-137/min, RR-40/min, and BP: 68-50 mm Hg. What is the most appropriate next step in management?

2. A 4.5-year-old girl is admitted in ward with an abscess on scalp. Over the last 24 hours, she has developed fever with chills. Her vital signs are: temperature- 39.8°C; heart rate- 150 beats/min; respiratory rate- 28 / min, and blood pressure- 80/30 mm Hg. Her extremities are warm and flushed, with a capillary refill time of <3 seconds.

   a. Classify the type of shock in this child.

   b. Outline the initial fluid and supportive therapy.

   c. What will be the initial inotrope of choice if child does not respond to fluid therapy?

SECTION 5: MANAGEMENT OF CHILD PRESENTING WITH LETHARGY, UNCONSCIOUSNESS, OR CONVULSIONS

Lethargy, unconsciousness, and seizures are common problems with which children are brought to emergency. They are associated with increased risk of mortality and long term neurocognitive sequelae.

5.0: LEARNING OBJECTIVES:

After the completion of this section the participant should be able to:

- Enumerate differentials of a child with coma
- Describe management steps for a child with acute encephalitis syndrome (AES)
- Enumerate the steps of management for a child with status epilepticus

You have already learnt the initial management of a child with coma/convulsions.

5.1: COMA/CONVULSIONS (Chart 5.1)

Definition

Impaired consciousness, implies a significant alteration in the awareness of self and of the environment, with varying degrees of wakefulness.

Coma, is characterized by the total absence of arousal and of awareness.

Encephalopathy, describes a clinical syndrome of altered mental status, manifesting as reduced consciousness or altered behaviour.

Acute Encephalitis Syndrome (AES) is defined as a condition in which a person of any age, at any time of year present with the acute onset of fever and a change in mental status (including symptoms such as confusion, disorientation, coma or inability to talk) AND/OR new onset of seizures (excluding simple febrile seizure).

History

The following history may help in the management of a child with coma/ convulsions:

- Fever, headache, vomiting, seizures, abnormal posturing
- Altered behaviour, cognition, personality changes, altered consciousness
- History of passing dark urine with yellowish discoloration of eyes & skin
- Prodromal symptoms - flu-like illness, diarrhoea

- Rash, vesicles, past history of chicken pox
- Residence: Rural/urban, endemic for cerebral malaria, any epidemic of AES in that area
- History of animal contact, insect bite, dog bite
- Drug or toxin exposure
- Known diabetes, congenital heart disease, chronic kidney or liver disease

Examination (Chart 5.2)

- The examination should begin with assessment of vital signs.
- Neurological examination at admission to document the level of consciousness and localization of brain dysfunction. It may also provide information about the potential causes. The level of consciousness must be recorded at interval.
- Look for icterus, rash, petechiae
- Pupillary size, shape, symmetry and response to light provide valuable clues to brainstem and third cranial nerve dysfunction. Unilateral pupillary dilatation in the comatose patient should be considered as evidence of oculomotor nerve compression from ipsilateral uncal herniation, unless proved otherwise.
- In herpetic encephalitis, neurological findings are mostly related to dysfunction of the fronto-temporal lobes, personality changes, confusion and disorientation. CT is usually normal in first 4-6 days of the disease.
- The presence of oculocephalic (doll's eye), oculovestibular, corneal, cough and gag reflexes are indicative of intact brainstems functions. Brainstems dysfunction is an important feature in some causes of viral encephalitis such as enterovirus 71, mumps and rabies.

Chart 5.1: Differential diagnosis for a child presenting with coma or convulsions

Diagnosis or underlying cause	In favour
Meningitis*	• Fever, lethargy, refusal to feed • Excessive irritability • Stiff neck or bulging fontanelle • Petechial rash (meningococcal meningitis) • Hypertonia • Headache, vomiting
Cerebral malaria (often seasonal)	• Blood smear or rapid diagnostic test positive for malaria parasites • Associated with fever • Jaundice • Anaemia • Convulsions • Hypoglycaemia • Splenomegaly
Febrile convulsions(not likely to be the cause of unconsciousness)	• Associated with fever • Age 6 months to 5 years • Prior episodes of short convulsions with fever • Tone – normal
Hypoglycaemia	• Blood glucose low (<45 mg/dl &<54 mg/dl in a severely malnourished child) • Responds to glucose treatment
Poisoning	• History of poison ingestion or drug overdose
Shock	• Poor perfusion • Rapid, weak pulse • Absence of convulsion
Acute glomerulonephritis with encephalopathy	• Raised blood pressure • Peripheral or facial oedema • Blood in urine • Decreased or no urine
Diabetic ketoacidosis	• High blood sugar • History of polydipsia and polyuria • Acidotic (deep, labored) breathing
Head injury	• Signs or history of head trauma

**The differential diagnosis of meningitis may include encephalitis, cerebral abscess or tuberculous meningitis. Consult a standard textbook of paediatrics for further guidance.*

Chart 5.2: Aetiology of coma and CSF finding

Aetiology of coma	
Look for	**If present, think of**
Pallor	Cerebral malaria, intracranial bleed, haemolytic uremic syndrome
Icterus	Hepatic encephalopathy, leptospirosis, complicated malaria
Rashes	Meningococcemia, Dengue, Measles, Rickettsial diseases, Arboviral diseases
Petechiae	Dengue, Meningococcemia, Hemorrhagic fevers
Head and scalp hematomas	Traumatic/non-accidental injury
Dysmorphism, Neurocutaneous markers	Post seizure coma
Abnormal Odour of exhaled breath	Diabetic Ketoacidosis, hepatic coma
Endemic area/seasonal	JE, Cerebral malaria

CSF findings in various types of meningitis (for children aged >2months)				
	Appearance	White blood cells/mm^3	Proteins (mg/dl)	Glucose (mg/dl)
Normal	Clear	<6, all mononuclear	<40	40-80 mg/dl(>2/3 of blood glucose)
Bacterial, untreated	Cloudy or purulent*	100-1000, (>85-90% neutrophils)	100-150	<1/2 of blood glucose
Bacterial, partially treated	Clear or slightly cloudy	500->1000 (>60% neutrophils)	70-100	Normal or <1/2 of blood glucose
Viral	Clear or slightly cloudy	<1000 (20-50% neutrophils)**	40-100***	>1/2 of blood glucose
Tubercular	Straw coloured or slightly cloudy	<300, mostly mononuclear	100-300	<1/2 of blood glucose

** May be clear during the first few hours of illness. (Source: Swanson D. Meningitis. Pediatrics in Review 2015; 36:514)*

***Early in the disease, the cells are often polymorphonuclear whereas mononuclear cell predominant later*

****May be high in HSV encephalitis*

5.2: INVESTIGATIONS

The CSF analysis is an important investigation in children with AES (Chart 5.2). CSF should not be done if there are signs of raised intracranial pressure (ICP). Fundus examination helps in identifying children with raised ICP by looking for papilledema. CSF should be examined for cytology, biochemistry, gram stain, Ziehl-Neelsen stain for acid fast bacilli, (bacterial culture, latex agglutination, PCR for HSV 1 and 2, and IgM antibodies for JE and for Dengue virus if facilities available). Concurrent blood sugar must also be measured to look for the CSF to blood glucose ratio.

Neuroimaging: Only CT scan may be possible in the emergency situation but it may give valuable information such as presence of bleed, cerebral oedema, temporal lobe hypodensities in herpes simplex encephalitis, thalamic abnormalities in JE and basal exudates and hydrocephalus in tubercular meningitis. If the cause of unconsciousness is not likely to be trauma/ bleeding, then CECT should be done.

Chart 5.3: Summary of management steps for a child with Acute Encephalitis Syndrome/ Meningitis/Viral Encephalitis/Cerebral Malaria etc

Rapid assessment and stabilization	• Establish and maintain airway: as described in section 2. ◆ Arrange referral (If the child is showing abnormal respiratory pattern) ◆ Intubate if facility available in presence of raised ICP, oxygen saturation <90% despite high flow oxygen and fluid refractory shock • Give oxygen to maintain oxygen saturation > 94% • Check blood glucose and give 5 ml/kg of 10% Dextrose if hypoglycaemic • Circulation: ◆ Establish IV access, ◆ Give fluid bolus (20 ml/kg NS) if child shows signs of shock ◆ If signs of circulatory impairment, start maintenance intravenous fluids • Take samples (CBC, Blood sugar, KFT, LFT, electrolytes, PS and RDT for malarial parasite). Also, send blood gas, lactate, serology for viruses if facility available. • Identify signs of cerebral herniation or raised ICP • Temperature: treat fever, hypothermia (see section 10) • Treat ongoing seizures with benzodiazepines, followed by Phenytoin loading
Investigation/Samples to be collected	• *See Annexure-6*
Start Empirical treatment* (must be started if CSF cannot be done/report will take time and patient sick)	• Ceftriaxone (100 mg/kg/day once daily or 50 mg/kg every 12 hours) • Acyclovir (10 mg/kg 8 hourly use in all suspected sporadic viral encephalitis) * • Artesunate** • If **Scrub Typhus** is suspected - IV Doxycycline or Chloramphenicol or Azithromycin
Supportive care and treatment	• Maintain euglycemia, maintain hydration *(see Section 10)* • Treat raised intracranial pressure, mild head-end elevation up to15- 30° • Give anticonvulsant if history of seizures or child has features of raised ICT
Prevention/treatment of complications and rehabilitation	• Aspiration pneumonia, nosocomial infections, coagulation disturbances • Psychological support to patient and family

** stop acyclovir, if an alternative diagnosis is confirmed*

*** stop artesunate if peripheral smear and RDT are negative for malaria*

5.3: SUPPORTIVE CARE (WITH OR WITHOUT SHOCK)

After stabilization of airway, breathing and circulation, other supportive care measures must be instituted along with the empirical treatment as mentioned above.

a. Maintenance intravenous fluids: Fluid therapy should be targeted to maintain euvolemia and normoglycaemia, and to prevent hyponatremia. Give isotonic fluids. Serum sodium should be monitored, and abnormalities of serum sodium should be corrected slowly.

b. Management of raised intracranial pressure: Raised intracranial pressure is a common cause of death in children with viral encephalitis. It is important to recognize and promptly manage signs of raised ICP. A common mistake in the emergency departments is to mistake decerebrate posturing for seizures, and inappropriately treat with anti-epileptic drugs

- Elevate head end by nearly 35 degrees.
- Consider intubation/referral if there is evidence of herniation, or if the patient has irregular respiration and inability to maintain airway.

- If there are signs of impending herniation, then the patient should be hyperventilated (wherever blood gas analysis is available aim for $PaCO_2$ of 30-35 mm Hg).
- Mannitol should be given with loading dose 5 ml/kg/dose followed by 2.5 ml/kg/dose 6 hourly, up to 48 hours. Do not give mannitol if intracranial bleed or renal failure are suspected.
- Hypertonic (3%) saline is preferable to mannitol in the presence of hypotension, hypovolemia, and renal failure. The dose is 0.1–1 ml/kg/hr by infusion; the serum sodium should be targeted to a level of 145-155 meq/l.

c. ***Maintain euglycaemia:*** Identify and treat hypoglycemia with intravenous dextrose (5 ml/kg 10% dextrose, then glucose infusion rate of 6–8 mg/kg/min). Blood glucose should be monitored and both hypo/hyperglycaemia should be avoided.

d. ***Treatment and prevention of seizures:*** *A benzodiazepine should be given IV (Lorazepam 0.1 mg/kg; max 4mg over 1 minute, diazepam 0.25 mg/kg ;max 10 mg, or midazolam 0.1-0.2 mg/kg ;max 5 mg) to terminate seizure followed by phenytoin loading IV (20 mg/kg).* Even if there is no history or clinical evidence of seizure, empirical anticonvulsants may be considered in children with deep coma or features of raised intracranial pressure.

5.4: PREVENTION/TREATMENT OF COMPLICATIONS AND REHABILITATION

Regular posture change must be done to prevent the development of bed sores. Passive movements of major joints and measures to prevent contractures are important.

Management of Meningitis & Cerebral Malaria are described in Section 7: Fever

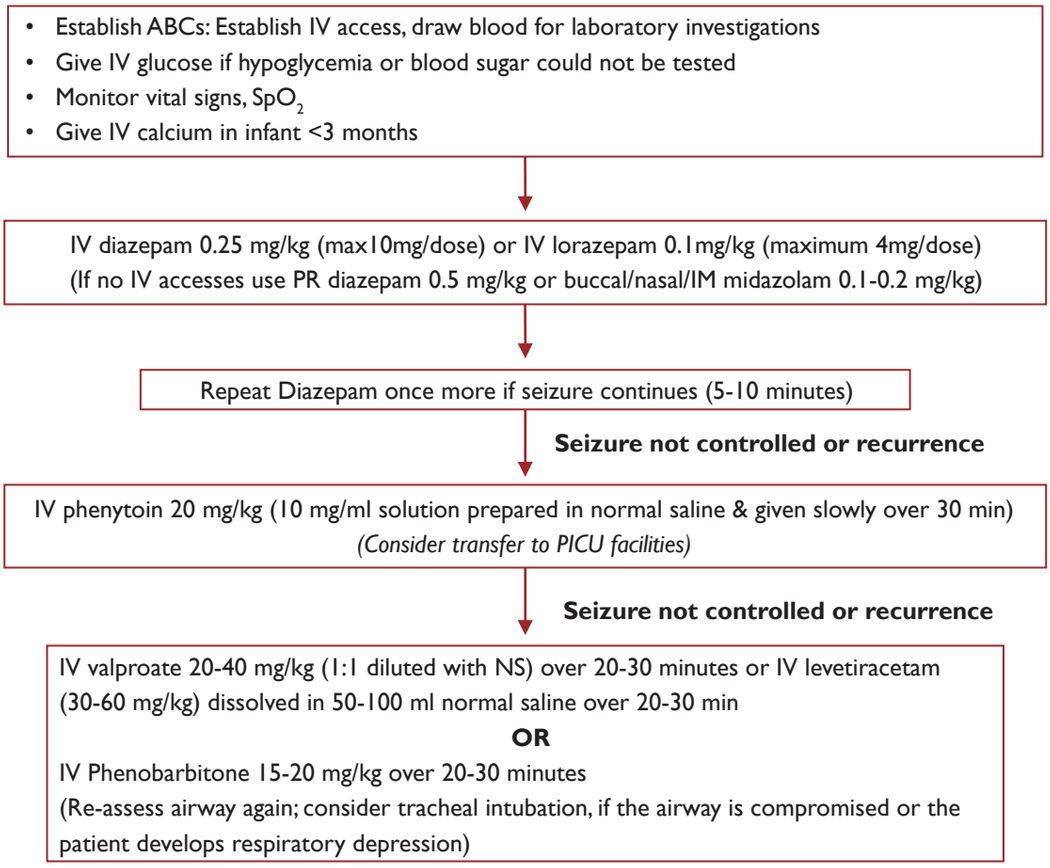
5.5: MANAGEMENT OF SEIZURES

5.5a: Status Epilepticus (SE)

Status epilepticus can be a first manifestation of any disease process leading to acute convulsive seizure or can occur in patients known to have epilepsy. SE is traditionally defined as seizure which has more than 30 min of continuous seizure activity or ≥2 sequential seizures without full recovery of consciousness between seizures (*See Chart 5.4* for management).

Children with seizure clusters are at increased risk of SE. A child who is brought to the hospital from outside in convulsive state should be considered to be in SE.

Chart 5.4: Management algorithm for status epilepticus



5.5b: Febrile Seizures

Febrile seizures are the most common seizures in childhood, occurring on average in 4% children. They are often classified as simple or complex febrile seizures, depending on their characteristics.

- **Simple febrile seizures** are defined as primary generalized seizures occurring in association with fever, lasting for less than 15 min and do not recur within 24 hours. A simple febrile seizure occurs between the age of 6 months to 5 years.
- **Complex febrile seizures** are characterized by partial onset, duration ≥ 15 minutes and recurrence within 24 hours.

Lumbar puncture is not indicated in all, but should be done infants and children with suspected meningitis. EEG and neuroimaging have no role in simple febrile seizures. Management includes definitive diagnosis, restraint in investigations, treatment of an acute episode and family counselling. Intermittent prophylaxis should be considered only if there are frequent seizure in a short period (3 or more in 6 months; 4 or more in a year) or if the seizure is prolonged for more than 15 min or requiring pharmacological therapy for control. Parents can be taught to use rectal diazepam (0.5 mg/kg/dose) or buccal or nasal, midazolam (0.2 mg/kg/dose) for termination of seizures.

5.5c: Management of first unprovoked seizure

- A good history is most important for diagnosis of a seizure.
- Eye and head deviation, incontinence, tongue-bite are fairly specific for a seizure, whereas unresponsiveness, confusion, clonic/tonic movements are suggestive, though these may be prominent in non-epileptic events as well.
- Neuroimaging would be needed when there are seizure cluster, focal deficits, altered sensorium.
- In the first seizure, Anti-epileptic drug (AED) is not recommended, but a detailed discussion with the parents is necessary. Option of home management of seizures (use of rectal diazepam/buccal or nasal midazolam if seizures are lasting for more than 5 minutes) should be given to the parents Box 5.1. However, all children with prolonged seizure should be brought to the hospital for clinical examination.

5.5d: Management of newly diagnosed epilepsy

- Long term AED treatment should be started after second seizure. The aim of treatment is complete seizure control without significant adverse effects.
- Anti-epileptic drugs are started in low doses and increased gradually upto a maximum dose till seizure control is achieved or side effects appear.
- Dosage needs to be adjusted to the child's daily activity. Extended release formulations in twice a day dosing are preferable.
- If no control is obtained with maximum doses of the first drug, then a second first line drug is initiated and the first drug tapered. If partial control is achieved, then a second AED should be added.
- There are no significant differences in the efficacy or tolerability of the four major first line anticonvulsants (phenobarbitone, phenytoin, valproate and carbamazepine). Carbamazepine and valproate appear to be better tolerated than phenobarbitone and phenytoin.

5.5e: Acute Symptomatic Seizures

A seizure occurring within a week of an acute brain insult (trauma, infection, toxic, metabolic or vascular insult) is called an acute symptomatic seizure. Serum calcium, electrolytes and glucose should be estimated for all these children. Lumbar puncture should be done in febrile infants and in those with suspected meningoencephalitis. A plain CT scan is indicated in traumatic brain injury and a contrast enhanced CT scan is indicated in children above 2 years, especially those presenting with convulsive seizures, focal seizures, cluster of seizure or focal neurological deficits to rule out granuloma.

Anti-epileptic drugs (AED) are required in the acute phase and can be withdrawn in a week in meningitis or in 3 months in illness with parenchymal involvement or acute traumatic brain injury. Epilepsy and focal seizures due to granuloma will require long duration of Anti- epileptic drugs.

Box 5.1: Per rectal Diazepam to stop convulsions (when no IV line is in place)

- Turn the child to his/her side and clear the airway (A recovery position).
- Give 0.5 mg/kg Diazepam injection solution per rectum using a small syringe without a needle (like a tuberculin syringe) preferably using a catheter. Flush the catheter, after giving drug.
- Check for low blood sugar.
- Give oxygen.
- If convulsions have not stopped after 10 minutes, repeat diazepam dose.

FURTHER READING: ANTICONVULSANT DRUGS

Anti Convulsants:

S.N	Name of drugs	Dose	Route of Administration	Indication	Limitation/ Side effects
1.	Phenobarbitone*	20-40 mg/kg As loading dose	I/V Slowly after dilution in normal saline	Convulsion in infants can be used in all age groups	Respiratory depression
2.	Phenytoin*	15-20 mg/kg as loading dose	I/V Slowly after dilution in normal saline	Convulsion in all age all groups	Arrythmia, hypotension, headache, drowsiness
3.	Sod.Valporate*	15-40 mg/kg	oral, IV	All age groups	Hepatotoxicity, Pancreatitis
4.	Diazepam	0.1-0.3 mg/kg	I/V slowly, Syrup, Suppository P\R	Uncontrolled Convulsions	May cause respiratory arrest in newborns & infants. Short acting
5.	Lorazepam	0.05-0.1 mg/kg	I/V Slowly	Uncontrolled Convulsion, Safe in infants	Tachycardea, depression Confusion blurred vision
6.	Midazolam	0.2 mg/kg	S/C, intra nasal IM,IV	Uncontrolled convulsion	Respiratory depression
7.	Levetiracetam	20-60 mg/kg as loading dose in 2 divided doses Max. 3000 mg	I/V oral	Uncontrolled convulsions	-

** Avoid/ use lower dose if child is already on same drug before*

Maintenance Dose:

- Phenobarbitone 3-5 mg/kg/day I/V or oral
- Phenytoin 5-8 mg/kg/day I/V or oral
- Sodium Valproate 15-40 mg/kg/day Oral
- Levetiracetam 20-60 mg/kg/24 hrs I/V oral

For dosages of Diazepam refer *Table 2.4*.

5.6: APPROACH TO A CHILD WITH SUSPECTED POISONING/ ACCIDENT (DROWNING/ ELECTROCUTION)

Suspect poisoning in any unexplained illness in a previously healthy child. Consult standard textbook of paediatrics for management of exposure to specific poisons and/or consult National Poisons Information Centre (NPIC) for guidance *(Box 5.2)*.

Box 5.2: Address of National Poisons Information Centre (NPIC)

National Poisons Information Centre Department of Pharmacology
All India Institute of Medical Sciences
New Delhi -110029
Toll Free No – 1800 116 117

Only the principles for managing ingestion of few common poisons are given here.

Diagnosis

A diagnosis is based on a history from the child or carer, a clinical examination and the results of investigations, where appropriate.

- Obtain full details of the poisoning agent, the amount ingested and the time of ingestion. Attempt to identify the exact agent involved by examining container, when relevant. Check that no other children were involved.
- The symptoms and signs depend on the agent ingested and therefore vary widely.
- Check for signs of burns in or around the mouth or of stridor (upper airway or laryngeal damage), which suggest ingestion of corrosives.

Principles for ingested poisons:

- All children who present as poisoning cases should quickly be assessed for emergency signs (airway, breathing, circulation and level of consciousness), as some poisons depress breathing, cause shock or induce coma.
- Admit all children who have deliberately/accidently ingested iron, pesticides, paracetamol or some other drugs.
- Children who have ingested corrosives or petroleum products should not be sent home without observation for at least 6 hours. Corrosives can cause oesophageal burns, which may not be immediately apparent, and petroleum products, if aspirated, can cause chemical pneumonitis and pulmonary oedema, which may take some hours to develop.

- Check for hypoglycemia; if blood glucose estimation facility is not available and the child has a reduced level of consciousness, treat as hypoglycemia.
- Identify the specific agent and remove or adsorb it as soon as possible. Treatment is most effective if given as quickly as possible after the poisoning event, ideally within 1 hour.
- Vomiting should not be attempted in suspected hydrocarbon (petrol/ kerosene oil) or corrosive (acid/ alkali) ingestion.
- If the child has swallowed other poisons, never use salt as an emetic, as this can be fatal.
- Mix charcoal in 8–10 times volume of water, e.g. 5 g in 40 ml of water. If possible, give the whole amount at once; if the child has difficulty in tolerating it, the charcoal dose can be divided (see Table 5.5.)
- Undertake gastric lavage only if staff has experience in the procedure, if ingestion was less than 1 hour previously and the condition is life-threatening.

Table 5.5: Amount of activated charcoal per dose

Children ≤ 1 year of age	0.5-1 g/kg
Children 1–12 years of age	25–50 g
Adolescents and adults	25–100 g

If the child has ingested corrosives or petroleum derivatives, gastric lavage should not be done.

Make sure a suction apparatus is available in case the child vomits. Place the child in the left lateral head-down position. Measure the length of tube to be inserted. Pass a nasogastric tube into the stomach and ensure that the tube is in the stomach. Perform lavage with 10 ml/kg of normal saline (0.9%). The volume of lavage fluid returned should approximate the amount of fluid given. Lavage should be continued until the recovered lavage solution is clear of particulate matter.

Give a specific antidote, if this is indicated. Contact National Poisons Information Centre, AIIMS, New Delhi, in case antidote is not known.

- Give general care.
- Keep the child under observation for 4–24 hours, depending on the poison swallowed.
- Keep unconscious children in the recovery position.
- Consider transferring the child to higher center if child is deteriorating or has severe respiratory distress or is in congestive heart failure.

Management of snakebite

Snake bite should be considered in any case of severe pain or swelling of a limb or in any unexplained illness presenting with bleeding or abnormal neurological signs. Some cobras spit venom into the eyes of victims, causing pain and inflammation.

First aid treatment: The first aid recommended is based around the mnemonic "Do it R.I.G.H.T."

It consists of:

R. = Reassure the patient. 70% of all snakebites are from non-venomous species. Only 50% of bites by venomous species actually envenomate the patient.

I = Immobilize in the same way as a fractured limb. Use bandages or cloth to hold the splints, not to block the blood supply or apply pressure. Do not apply any compression in the form of tight ligatures, they don't work and can be dangerous!

G.H. = Get to Hospital immediately. Traditional remedies have NO PROVEN benefit in treating snakebite.

T = Tell the doctor of any systemic symptoms such as ptosis that manifest on the way to hospital.

Incision, suction, electric shocks, cryotherapy and washing the wound are contraindicated.

Diagnosis and testing

Bite marks to determine whether the biting species was venomous or non-venomous are of no use. Many venomous species are in possession of more than one set of fangs and non-venomous species can leave just two punctures from enlarged teeth, which can appear to be fang-like.

General signs include shock, vomiting and headache. Local swelling that may gradually extend up the bitten limb. Few patients may show features of bleeding i.e. external from gums, wounds or sores; internal, especially intracranial. Also signs of neurotoxicity like respiratory difficulty or paralysis, ptosis, bulbar palsy (difficulty in swallowing and talking), limb weakness or signs of muscle breakdown i.e. muscle pains and black urine.

The 20 Minute Whole Blood Clotting Test (20WBCT) was adopted as the standard test for coagulopathy. It is simple to carry out but requires a clean, new and dry test tube. A few mL of fresh venous blood is left undisturbed for 20 minutes, and then gently tilted. If the blood is still liquid this is evidence of coagulopathy and confirms that the biting species is Viperine. Cobras or Kraits do not cause anti-hemostatic symptoms.

Anti-Snake Venom administration criteria:

Anti-Snake Venom (ASV) should not be used without evidence of systemic envenomation or severe local swelling. Essentially systemic envenomation will be evident from the 20WBCT, signs of spontaneous bleeding or by visual recognition of neurological impairment such as ptosis. Severe local symptoms are defined as swelling rapidly crossing a joint or involving half the bitten limb, in the absence of a tourniquet. Once the tourniquet has been removed for more than one hour, if the swelling continues, this should be viewed as venom generated and not due to the continuing effect of the tourniquet. Purely local swelling is not grounds for administering ASV.

ASV doses and administration:

As each vial of polyvalent ASV neutralises 6 mg of Russells viper venom, the initial dose is 8-10 vials for both adults and children. Maximum ASV dose is around 25 vials. ASV should be administered over one hour.

Adverse reactions, either anaphylactoid or pyrogenic, have often been identified as reasons not to administer ASV in smaller local hospitals (Box 5.3). The fear of these potentially life threatening reactions has caused reluctance amongst some doctors to treat snakebite. However, if handled early and with the primary drug of choice, these reactions are easily surmountable and should not restrict doctors from treating snakebite.

Box 5.3: Symptoms suggesting allergic reaction

- Urticaria, itching, chills
- Diarrhoea, abdominal cramps, nausea, vomiting
- Fever, tachycardia, hypotension
- Angio-oedema

Management of allergic reactions:

1. ASV to be discontinued
2. 0.01mg/kg (0.5 mg.) of 1:1000 adrenaline should be given IM.
3. In addition, to provide longer term protection against anaphylactoid reactions, 100 mg of hydrocortisone and 10 mg of H1 antihistamine should be administered IV in adolescents and adults while the dose for children is 0.2 mg/kg of antihistamine IV and 2 mg/kg of hydrocortisone IV.
4. If after 10 to 15 minutes the patient's condition has not improved or is worsening, a second dose of adrenaline is given. This can be repeated for a third and final occasion but in the vast majority of reactions, 2 doses of adrenaline will be sufficient.
5. Once the patient has recovered, the ASV can be restarted slowly for 10-15 minutes, keeping the patient under close observation. Then the normal drip rate should be resumed.

Repeat doses of ASV

In anti-hemostatic bites, once the initial dose has been administered over one hour, no further ASV is given for 6 hours. Twenty WBCT test every 6 hours, will determine if additional ASV is required. This reflects the period the liver requires to restore clotting factors.

In the case of neurotoxic bites, once the first dose has been administered, and a Neostigmine test (atrophine sulphate 50 microgram/kg IV followed by IM Neostigmine 0.04 mg/kg and patient is observed for 30-60 minutes for signs of improved neuromuscular transmission) given, the victim is closely monitored. If after 1-2 hours, the victim has not improved or has worsened, then a second and final dose should be given. At this point the victim will have received sufficient neutralizing capacity from the ASV, and will either recover or require mechanical ventilation; in either event further ASV will not help.

Other Treatment

Surgical opinion: Seek a surgical opinion if there is severe swelling in a limb, it is pulseless or painful or there is local necrosis.

Supportive care

- Give fluids orally or by nasogastric tube according to daily requirements. Keep a close record of fluid intake and output.
- Provide adequate pain relief.
- Elevate the limb if swollen.
- Give anti-tetanus prophylaxis.
- Antibiotic treatment is not required unless there is tissue necrosis at the wound site.
- Avoid IM injections.
- Monitor the patient very closely immediately after admission, then hourly for atleast 24 hours, as envenoming can develop rapidly.

SCORPION STING

Scorpion stings can be very painful for days. Systemic effects of venom are much commoner in children than adults.

Diagnosis

Signs of envenoming can develop within minutes and are due to autonomic nervous system activation.

Signs include:

- Profuse sweating
- Shock
- High or low blood pressure
- Fast and/or irregular pulse
- Nausea, vomiting, abdominal pain
- Breathing difficulty (due to heart failure) or respiratory failure
- Muscle twitches and spasms

Treatment

First Aid

Transport to hospital as soon as possible.

Hospital care

If there are signs of severe envenoming, give scorpion antivenom, if available (as for snake antivenom infusion). Pulmonary oedema is a very common manifestation of scorpion sting envenomation. Prazosin (30 microgram/kg/dose), a postsynaptic alpha-1 blocker, counteracts the effect of excessive catecholamines and arrests the development of severe systemic features.

Other treatment

- Treat heart failure, if present.
- Consider use of prazosin and shifting to ICU, if there is pulmonary oedema where they are managed with diuretics and support like dobutamine sodium nitropruside.

Supportive care

Give oral paracetamol or oral/ IM morphine according to severity. If very severe, infiltrate site with 1% lignocaine, without adrenaline.

EXERCISES 5.1

1. Eighteen months old Kareena has been admitted with the complaints of fever for 2 days, not recognizing parents since night and two episodes of seizures since morning. On admission, her breathing was normal, AVPU (response to pain +), extremities were warm. Emergency staffs have managed her airway and positioned in recovery position, started oxygen, checked blood sugar and found it 60 mg. When you checked RDT for malaria, it was negative.

   a. Write empirical treatment.

   b. Write supportive treatment.

2. Fourteen months old Salman was brought to emergency with fever (39.2^{0}C) and convulsing. He is very hot to touch. Nursing officer put IV line and checked blood sugar which was normal. Salman's airway was managed, kept in recovery position, oxygen was started and one dose of diazepam was given. Seizure continued despite a diazepam dose. Systemic examination did not reveal any abnormality. He has regained consciousness after 2 doses of diazepam.

   a. What is most probable diagnosis?

   b. Write management plan for Salman?

SECTION 6: APPROACH TO A CHILD PRESENTING WITH DIARRHOEA

Diarrhoeal diseases are a leading cause of morbidity and mortality among under-five children. Although diarrhoeal deaths have significantly declined in recent years; it remains unacceptably high in developing countries.

6.0: LEARNING OBJECTIVES:

After completion of this section the participants should be able to:

- Assess & classify dehydration in a child presenting with diarrhoea
- Manage cases of diarrhoea with or without dehydration
- Manage cases of dysentery
- Assess & manage children with persistent diarrhoea
- Facilitate setting up of an ORT corner in the facility

6.1: DIARRHOEA

Diarrhoea is defined as the passage of three or more loose or watery stools in last 24 hours. However, recent change in consistency and character of the stools is more important than the number of stools. A breast-fed baby may normally pass as many as 8-10 semi formed, pasty stools daily that does not amount to diarrhoea.

6.2: WHAT ARE THE TYPES OF DIARRHOEA?

Three clinical forms of diarrhoea have been identified – acute diarrhoea, persistent diarrhoea and chronic diarrhoea. **Acute diarrhoea** is diarrhoea, which is sudden in onset and is of less than 14 days duration while diarrhoea that lasts 14 days or more is known **as persistent diarrhoea**. Up to 20% of episodes of diarrhoea become persistent. Persistent diarrhoea often causes nutritional problems and contributes to deaths in children.

Chronic diarrhoea is diarrhoea which is lasting more than 2 weeks and is insidious in onset. When this is accompanied with failure of absorption of one or more nutrients, it is known as malabsorption syndrome.

Acute diarrhoea may be further subdivided into **acute watery diarrhoea and acute dysentery**. Dysentery is characterized by presence of visible blood in the stools and is usually associated with abdominal cramps and fever.

6.3: APPROACH TO A CHILD PRESENTING WITH DIARRHOEA

History:

- Frequency of stools in last 24 hours
- Number of days of diarrhoea
- Visible blood in stools
- Tenesmus (abdominal cramps)
- Vomiting
- Fever
- Urine output

In addition, following history helps in the management:

- Treatment received – ORS, Zinc or other drug treatment
- Feeding history- breastfeeding, formula, use of bottle, dilution of feeds etc.

Examination (Look for):

- Signs of dehydration (as described in Chart 6.1)
- Blood in stools
- Signs of severe malnutrition
- Abdominal distension.

Investigations:

Investigations are not useful in majority of acute diarrhoea cases. Following investigations may help in specific conditions:

- **Stool routine & microscopy:** There is no benefit of routine stool microscopy unless cholera is suspected.
- **Stool culture & sensitivity:** May help in persistent diarrhoea.
- **Serum electrolytes:** If excessive irritability persists after rehydration or history of convulsion is present.
- **Renal function tests:** should be done if there is low or nil urine output over more than 6 hours after rehydration.

6.4: ASSESSING DEHYDRATION

Children with watery diarrhoea lose water, sodium, chloride, potassium, zinc, and bicarbonate in the stools. These combined losses of fluid & electrolytes cause clinical features like dehydration, acidosis, potassium depletion, shock or circulatory collapse and death. Infants with acute diarrhoea are more prone to dehydration than older children. Dehydration occurs when these losses are not adequately replaced and there are deficits of water and electrolytes.

Most of the diarrhoeal deaths occur due to dehydration. Hence, the hydration status of the child determines the immediate management. For all children with diarrhoea, their hydration status should be assessed & classified as severe dehydration, some dehydration or no dehydration *(Chart 6.1)*.

i. **LOOK at the general condition - Is the child lethargic or unconscious? Restless and irritable?**
If the child is not alert but responds to voice, he or she is lethargic. If an infant who is irritable initially, becomes calm when breastfeeding but again becomes restless and irritable when he stops breastfeeding then he has the sign "restless and irritable" due to dehydration.

ii. **LOOK for sunken eyes.**
The eyes of a child who is dehydrated may look sunken. Decide if you think the eyes are sunken. In case of doubt, ask the mother/caregiver if she thinks her baby's eyes look unusual.

iii. **PINCH the skin of the abdomen. Does it go back: Very slowly (longer than 2 seconds)? Slowly?**
Ask the mother/caregiver to place the child on the examining table so that s/he is lying flat on the back with arms at the sides and legs straight. You can also ask the mother/caregiver to hold the young infant or child so s/he is lying flat in her lap.

Locate the area on the child's abdomen halfway between the umbilicus and the side of the abdomen *(see Figure 6.1)*. To do the skin pinch, use your thumb and first finger. Do not use your fingertips because this will cause pain. Place your hand so that when you pinch the skin, the fold of skin will be in a line with the child's body and not across the child's body. Firmly pick up all the layers of skin and the tissue under them. Pinch the skin for one second and then release it.

When you release the skin, look to see if the skin pinch goes back.

- Very slowly (longer than 2 seconds)
- Slowly
- Immediately

If the skin stays up for even a brief time after you release it, decide that the skin pinch goes back slowly.

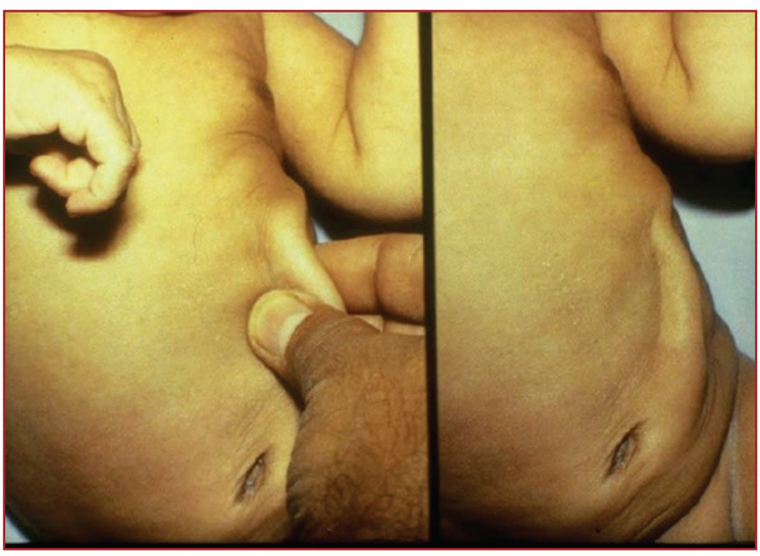


Figure 6.1: Checking skin pinch

iv. OFFER the child fluid - Is the child not able to drink or drinking poorly? Drinking eagerly, thirsty?

- Ask the mother/caregiver to offer the child some water in a cup or spoon. Watch the child drink.
- A child is ***not able to drink*** if he is not able to suck or swallow when offered a drink.
- A child has the sign ***drinking eagerly, thirsty*** if it is clear that the child wants to drink. When the water is taken away, see if the child is unhappy because he wants to drink more. If the child takes a drink only with encouragement and does not want to drink more, he does not have the sign "drinking eagerly, thirsty" and has **normal thirst**.
- Now use these 4 clinical signs for classifying dehydration *(Chart 6.1)*.

Indications for hospitalization in acute watery diarrhoea:

- Presence of emergency signs (e.g. Not breathing, Gasping or severe respiratory distress, unconsciousness, convulsion, shock or severe dehydration).
- Children with severe acute malnutrition with dehydration.
- Children with associated co-morbid conditions which require inpatient management e.g. severe pneumonia.
- Age less than 2 months with some dehydration.

Chart 6.1: Assessment and classification of dehydration

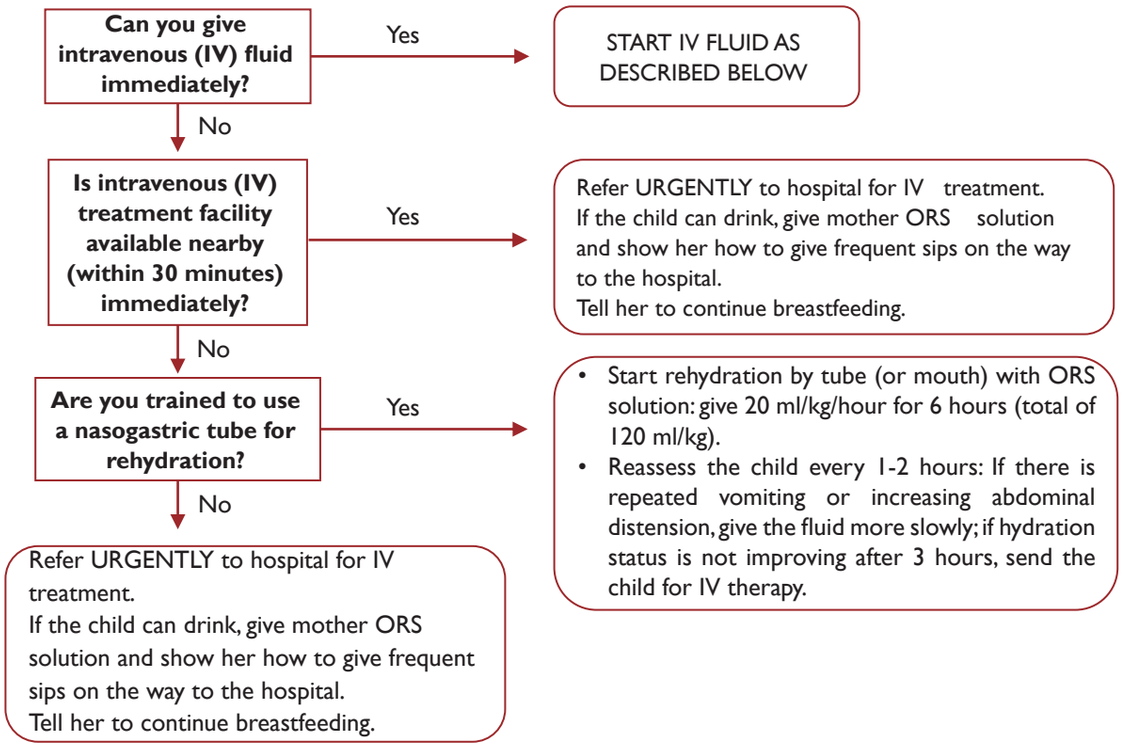
Signs or symptoms	Classification
Two or more of the following signs: • Lethargy/ unconsciousness • Sunken eyes • Unable to drink or drinks poorly • Skin pinch goes back very slowly (>2 seconds)	**Severe dehydration**
Two or more of the following signs: • Restlessness, irritability • Sunken eyes • Drinks (ORS/plain water) eagerly, thirsty • Skin pinch goes back slowly	**Some dehydration**
Not enough signs to classify as some or severe Dehydration	**No dehydration**

6.5: MANAGEMENT OF CHILDREN WITH SEVERE DEHYDRATION: PLAN-C

Severe dehydration is an emergency sign and requires immediate rehydration. Follow the arrows. If answer is YES, go across. If NO, go down as shown in *Chart 6.2*.

Chart 6.2: Algorithm for management of severe dehydration (Plan-C)

START HERE



IV Rehydration

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

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

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

- Reassess the child every 15-20 min till a strong radial pulse is detectable. Thereafter reassess the hydration status after every 1-2 hours. If hydration status is not improving, give the IV drip more rapidly. Monitor number of stools, vomiting and urine output.
- Also, give ORS (about 5ml/kg/hour) as soon as the child can drink: usually after 3-4 hours (infant) or 1-2 hours (children).
- Reassess an infant after 6 hours and a child after 3 hours. Classify dehydration. Then choose the appropriate Plan (A, B or C) to continue treatment. **
- Observe for signs of overhydration (sudden increase in respiratory rate, chest retractions, heart rate; appearance of crepitations in chest; increase in liver span) throughout IV rehydration.

*****All children should be sent home only when maintaining hydration for 6 hours on ORS after rehydration.***

FURTHER READING: Nasogastric Rehydration: Use this if IV rehydration is not possible

Use a sterile NG tube 8-10 F size for children less than 2 years and 10-12 F for children 2-5 years.

- Place the patient on his or her back, with the head slightly raised. Older children and adults may prefer to sit up.
- Measure the length of tube to be inserted by placing the tip just above the navel. Then stretch the tubing over the back of the ear and forward to the tip of the nose. Mark the tube with a piece of tape where it touches the end of the nose. This mark shows the length of tubing needed to reach from the tip of the nose to the stomach. Moisten the tube with a water-soluble lubricant or plain water; do not use oil.
- Pass the tube through the nostril having larger opening. Gently advance it until the tip is in the back of the throat. Each time the patient swallows, advance the tube another 3.5 cm. If the patient is awake, ask him or her to drink a little water.
- If the patient chokes, coughs repeatedly or has trouble breathing, the tube has probably passed into the trachea. Pull it back 2cm – 4cm until the coughing stops and the patient is comfortable. Wait a minute, and then try to insert the tube again.
- Advance the tube each time the patient swallows until the tape marker reaches the nose. If the patient is comfortable and not coughing, the tube should be in the stomach.
- Look into the patient's mouth to be certain that the tube is not coiled in the back of the throat. Confirm that the tube is in the stomach by attaching a syringe and withdrawing a little stomach fluid. You could also do this by placing a stethoscope just above the navel. Inject air into the tube with an empty syringe. Listen for the air entering the stomach.
- Fasten the tube to the face with tape and attach IV tubing that is connected to a clean IV bottle containing ORS solution. Regulate the infusion to a rate of 20 ml/kg per hour, or less with careful monitoring.
- If an IV bottle is not available, a syringe (with the barrel removed) can be attached to the tube and used as a funnel. Hold the syringe above the patient's head and pour ORS solution into it at regular intervals.

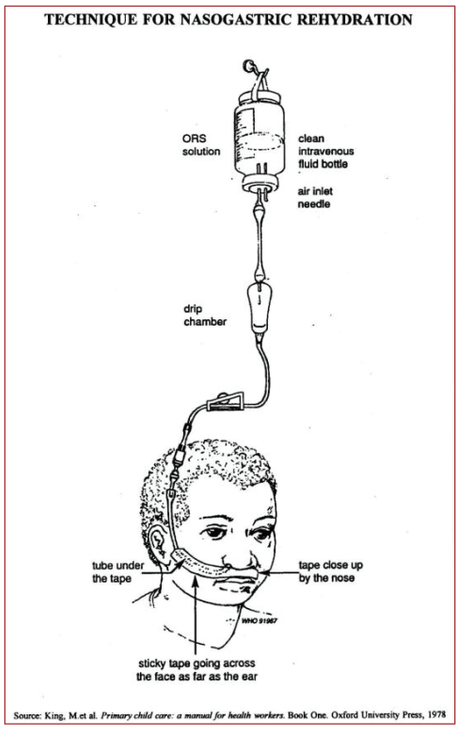


Figure 6.2: Technique for Nasogastric Rehydration

Management of electrolyte imbalances

Electrolyte abnormalities: should be suspected if excessive irritability persists even after rehydration or there is history of convulsion.

- **Hypernatremia -** Some children with diarrhoea, especially young infants, may develop hypernatremia (serum sodium>150 mEq/L) which usually follows use of hypertonic drinks (canned fruit juices, carbonated cold drinks, incorrectly prepared salt and sugar solution). These children are extremely thirsty, out of proportion to their other signs of dehydration and may present with excessive irritability and convulsion. Most of the children improve with oral rehydration solution. If the child is unable to drink orally, Ringer lactate should be given initially and later switch over to ORT. Monitor urine output and serum sodium every 4-6 hourly.
- **Hyponatremia –** Hyponatremia is defined as serum sodium <130 mEq/L and usually develops in children with diarrhoea who ingest only large amount of water or drink fluids that contains very little salts. These children can present with seizures. Almost all children with hyponatremia are successfully rehydrated with ORS. For children who are unable to drink orally, give IV Ringer lactate. Monitor urine output and serum sodium every 4-6 hourly.
- **Hypokalemia -** If potassium loss during diarrhoea is not replaced adequately, this may lead to hypokalemia (serum potassium <3 mEq/L). Hypokalemia may result in muscle weakness (hypotonia), acute onset flaccid paralysis (neck flop, quadriparesis, respiratory paralysis). Mild hypokalemia gets corrected with rehydration with ORS and use of Potassium rich food items like banana. Oral Potassium supplementation is needed in malnourished children. Severe hypokalemia (less than 2.5 mEq/L or presence of cardiac arrhythmia) should be treated with IV Potassium in maintenance fluid (maximum 60 mEq/L of IV fluids) if renal functions are adequate *(Box 6.2)*.

Box 6.2: Potassium supplementation in hypokalemia

- Inj. Potassium Chloride contains 2 mEq/ml of potassium.
- Addition of 1 ml KCl per 100 ml of maintenance fluid will increase potassium concentration by 20 mEq/L
- 15 ml of syrup Potassium Chloride contains 20 mEq of potassium
- Total duration of oral supplementation should be 10-14 days

- **Metabolic acidosis -** Should be suspected if child has fast breathing and air hunger without any chest signs. Most cases tend to correct spontaneously with rehydration. ORS contains adequate bicarbonates /citrate to counter acidosis.
- **Renal function tests -** should be done in case there is low or nil urine output over more than 6 hours after rehydration. If renal functions are deranged, then the child should be referred to a higher center equipped with facility of dialysis.

When to treat for cholera?

In areas where cholera is endemic, and a child above 2 years comes with severe dehydration, give an antibiotic effective against cholera (Doxycycline is the first line recommended drug) to children above 2 years. The dose of Doxycycline is 100 mg tab between 4-5 years and 50 mg (1/2 tab) between 2-4 years, single dose. If possible, send stool for hanging drop & culture.

6.6: MANAGEMENT OF CHILDREN WITH SOME DEHYDRATION: PLAN-B

Rehydration therapy in some dehydration can usually be carried out with an ORS solution. Evidence shows that there is no clinically important difference between oral glucose-electrolyte solutions and intravenous (IV) fluid therapy for managing children with some dehydration. ORT is effective, simpler, less expensive, comforting to mothers/caregivers and children, and allows mothers'/caregivers' active participation in the process of management of their children.

How much ORS to be given for some dehydration? *(Table 6.1)*

- For correction of fluid and electrolytes, administer 75 ml/kg body weight of ORS over a period of 4 hours.
- If the child wants more, give more.
- Allow breastfeeds in between.
- Reassess after 4 hours, classify dehydration.
- If child has some dehydration again, allow foods and repeat Plan-B i.e. 75 ml/kg ORS over 4 hours.

Table 6.1: ORS for some dehydration

Age*	Up to 4 months	4 months up to 12 months	12 months up to 2 years	2 years up to 5 years
Weight	<6 kg	6 - <10 kg	10 - <12 kg	12 - 19 kg
ORS	200-400 ml	400 - 700 ml	700-900 ml	900-1400 ml

** Use the child's age only when do not know the weight.*

Show the mother/caregiver how to give ORS solution:

Find a comfortable place in the clinic for the mother/caregiver to sit with her child. Tell her how much ORS solution to give over the next 4 hours. If the child is less than 2 years, show her how to give a spoonful frequently. If the child is older, show her how to give frequent sips from a cup. Sit with her while she gives the child the first few sips from a cup or spoon.

If the child vomits, the mother should wait about 10 minutes before giving more ORS solution. She should then give it more slowly. Encourage the mother to pause to breastfeed whenever the child wants to. When the child finishes breastfeeding, resume giving the ORS solution again as shown in Figure 6.3. If the child is not drinking the ORS solution well, try another method of giving the solution. You may try using a dropper or a syringe without the needle.

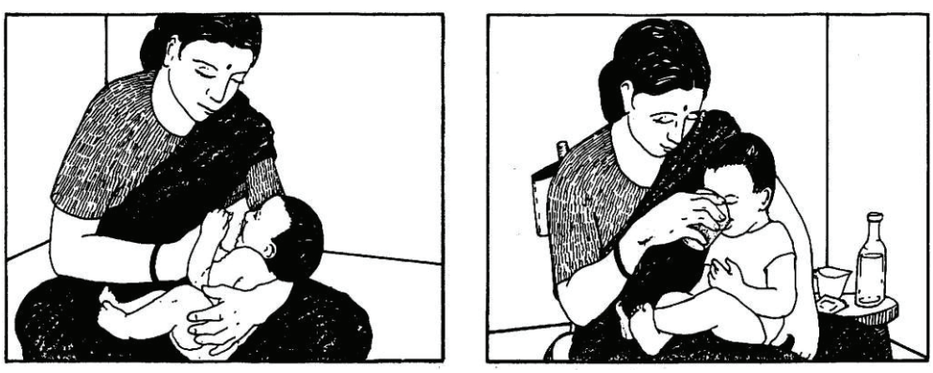


Figure 6.3: Continue Feeding

In some conditions, ORT may be contraindicated or the patient is unable to drink (e.g. painful oral conditions, lethargy, severe vomiting, paralytic ileus etc.). ORT may not be effective in some conditions such as high rate of purging (>10 ml/kg/hr or more than 10 stools per day), persistent vomiting (>3 times/hour), inability or refusal to drink, glucose malabsorption, incorrect preparation of ORS solution and abdominal distension (ileus). For such children IV fluid therapy for short duration may be helpful.

For severely malnourished children, rehydration should be slow, over 10-12 hours under close monitoring to avoid overhydration or heart failure *(see Section 9)*.

6.7: MANAGEMENT OF CHILDREN WITH NO DEHYDRATION: PLAN-A

Plan-A is required in children with no dehydration for the replacement of ongoing losses of water and electrolytes due to continuing diarrhoea to prevent dehydration. Plan A involves counselling the child's mother/ caregiver about the 4 Rules of Home Treatment.

4 Rules of Plan-A treatment:

Rule-1: Give more fluids than normal

Mothers and caregivers should be advised to continue the fluids which the child is taking and to give extra fluids to compensate for ongoing losses. If the child is being breastfed, advise the mother to breastfeed frequently and for longer at each feed. If the child is exclusively breastfed, give ORS solution or clean water in addition to breast milk. After the diarrhoea stops, exclusive breastfeeding should be resumed.

In non-exclusively breastfed children, give one or more of the following:

- ORS solution
- food-based fluids (such as soup, rice water and yoghurt drinks)
- clean water

Fluids high in sugar (such as cola, apple juice, and sport drinks which contain less than 20 mmol/L sodium and have high osmolality of 350-750 mOsm /L) may exacerbate the diarrhoea and should be avoided. Mothers/ caregivers should be counselled that the diarrhoea usually stops in 3-5 days. ORS solution will not stop diarrhoea but it replaces the fluid and salts that the child loses in the diarrhoea and prevents the child from getting sicker.

Amount of ORS for ongoing losses:

To prevent dehydration, advise the mother /caregiver to give ORS as follows and as much extra fluids as the child may take:

- For children < 2 years, about 50–100 ml after each loose stool
- For children ≥ 2 years, about 100–200 ml after each loose stool.

Tell the mother/caregiver to give small sips from a cup. If the child vomits, wait 10 minutes, and then give more slowly. She should continue giving extra fluid until the diarrhoea stops. When you give the mother ORS, show her how to mix the ORS solution and give it to her child *(see Box 6.3)*. Ask the mother to practice doing it herself while you observe her.

Box 6.3: Teaching mother/caregiver preparation of ORS

The steps for making ORS solution are:

- Wash hands with soap and water.
- Pour all the powder from one packet into a clean container. Use any available container, such as a jar, bowl or bottle.
- Measure 1 litre of clean water (amount recommended on the packet). Use clean drinking water for ORS preparation.
- Pour the water into the container. Mix well until the powder is completely dissolved. Do not put your finger into the solution.

Explain to the mother that she should prepare fresh ORS solution each day in a clean container, keep the container covered, and throw away any solution remaining from the day before (after 24 hours).

Rule-2: Continue feeding (including breastfeeding)

To prevent growth faltering, good nutrition must be maintained, both during and after an episode of diarrhoea. There is no physiologic basis for 'resting' the bowel during or after the episode of acute diarrhoea. It has also been observed that children breast-fed throughout the illness, and fed soon after initial rehydration, tend to gain more weight on recovery compared with those who are not fed, or fed restricted amounts of food. Thus, breast-feeding should continue throughout episodes of diarrhoea, and normal feeding should be initiated as soon as initial rehydration is accomplished.

During diarrhoea, decreased food intake and nutrient absorption and increased nutrient requirements often combine to cause weight loss and failure to grow. Malnutrition can make diarrhoea more severe, more prolonged and more frequent than in well-nourished children. This vicious cycle can be broken by giving nutrient-rich foods during diarrhoeal episodes and after the recovery from diarrhoeal episode.

Rule-3: Give zinc supplements

Zinc deficiency is common in India and other developing countries. Deficiency is common due to low intake of animal foods, high dietary phytate, and overall inadequate diets. Zinc supplements have positive effects on immune and mucosal barrier functions.

All children aged 2-6 months with acute diarrhoea should receive Zinc in dose of **10 mg daily for 14 days** and should be started as early as possible. Children above 6 months should be given **20 mg daily for 14 days.** Zinc supplementation benefit is not only limited to current diarrhoeal episodes but also prevents subsequent diarrhoeal morbidity.

Rule-4: Bring the child back after 5 days if diarrhoea is persisting or earlier if s/he has any of the danger signs (thirsty, irritable/ restless, fever, high purge rate, repeated vomiting, blood in stool, eating or drinking poorly, lethargic).

Antimicrobial agents

Most infectious diarrhoeas have a self-limiting course, i.e. they resolve over a period of time, during which supportive measures such as management of dehydration and maintaining the patient's usual diet are important. Antibiotics are indicated only for associated systemic infections, dysentery, cholera, or presence of severe acute malnutrition. Inappropriate use of antibiotics increases risk of persistent diarrhoea.

Probiotics

Current evidence suggests that probiotics reduce the number of diarrhoeal stools and the duration of diarrhoea by approximately one day. This benefit is strain and dose dependent, Lactobacillus rhamnosus GG being the most effective strain followed by Saccharomyces boulardi. This should not be used routinely as it is not cost-effective for majority of patients. The benefit is more when given early in the course and is more effective in otherwise healthy infants and young children with watery diarrhoea secondary to viral gastroenteritis but not in invasive bacterial infections.

Antisecretory Drugs

Antisecretory Drugs like Racecadotril should not be used in view of its safety concerns.

Binding agents and anti-motility drugs are harmful for children with diarrhoea and should not be given.

6.8: DYSENTERY

Dysentery is diarrhoea with visible blood. It is usually associated with fever, abdominal cramps and rectal pain. Most episodes in children are due to *Shigella* but can be caused by *Salmonella, E.coli, C. jejuni* and infrequently by *E. histolytica.*

Box 6.4: Indications for hospitalization in children with dysentery

- Age less than 12 months
- Presence of dehydration
- H/O measles in last 3 months
- Presence of severe acute malnutrition
- Presence of complications –shock, abdominal distension, convulsion etc.
- Fails to respond to two commonly used oral antibiotics

Key steps of management for children with visible blood in stool are as follows (Chart 6.3):

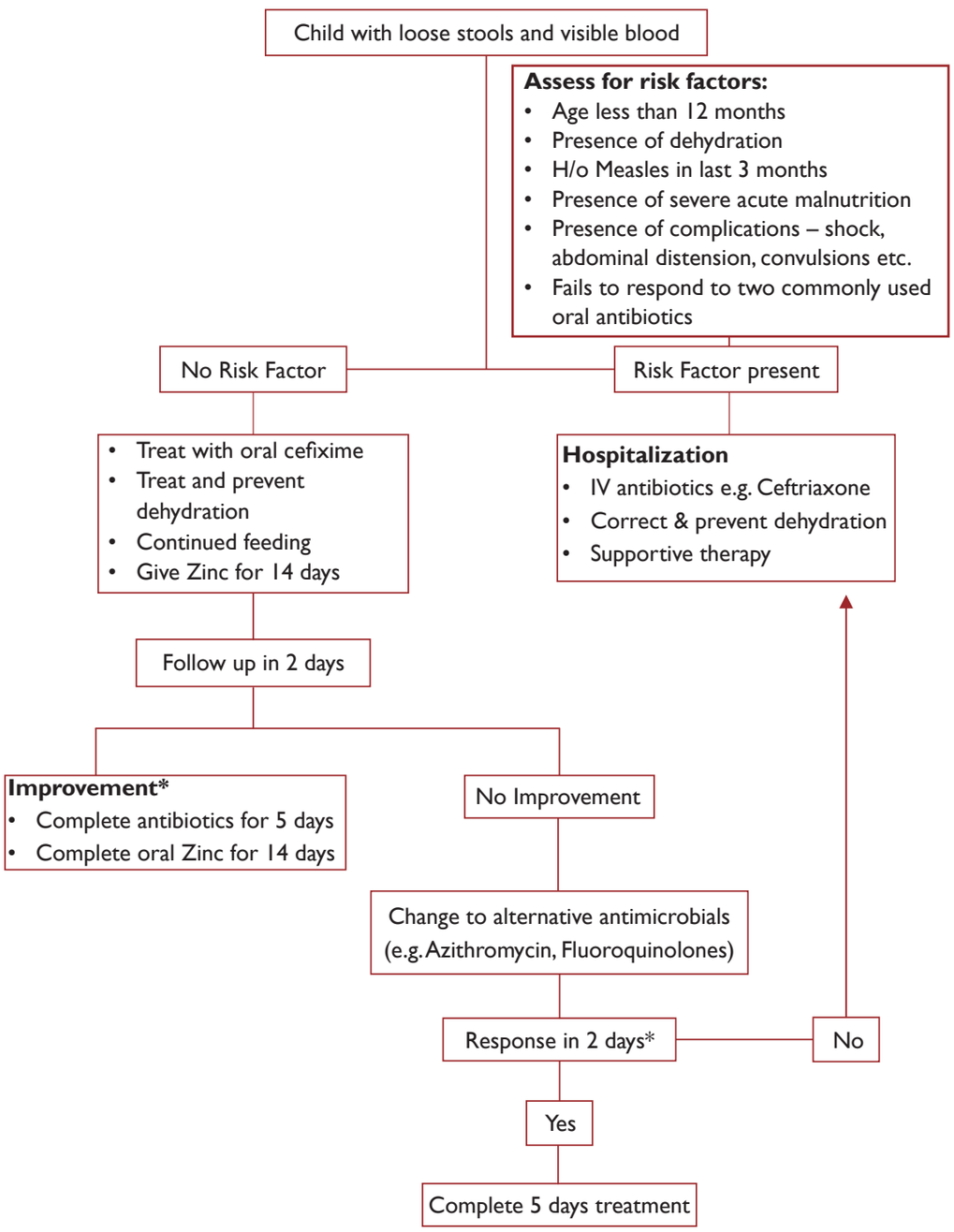
- Treat all cases with oral antimicrobials effective against most local shigella strains:
  - In admitted children(Box 6.4) give IM/IV Ceftriaxone (80-100 mg/kg) once daily for at least 5 days.
  - When there is no indication for hospitalization, give oral Cefixime 10-15 mg/kg in two divided doses for 5 days. Other alternative drugs are Azithromycin, Fluroquinolones (e.g. Ciprofloxacin, Ofloxacin and Norfloxacin).
- Correct & prevent dehydration as described earlier.
- Prescribe a Zinc supplement as done for children with watery diarrhoea.

- Re-evaluation after 2 days
- Monitor for complications. Abdominal distension indicates possibility of toxic ileus and decreased urine output raises possibility of hemolytic uremic syndrome (HUS).

Provide supportive care

Supportive care includes the prevention or correction of dehydration and continued feeding. Never give drugs for symptomatic relief of abdominal pain and rectal pain, or to reduce the frequency of stools, as they can increase the severity of the illness.

Chart 6.3: Management of children with Dysentery



**disappearance of fever, less blood in stools, fewer stools, improved appetite, decreased abdominal pain & improved activity*

Nutritional management

Ensuring a good diet is very important as dysentery has a marked adverse effect on nutritional status.

Manage complications

- **Potassium depletion:** This can be prevented by giving ORS solution (when indicated) or potassium-rich foods such as bananas, coconut water or dark green leafy vegetables.
- **High fever:** If the child has high fever (≥38.5°C or ≥101.3°F) which appears to be causing distress, give paracetamol (15 mg/kg/dose 6-8 hourly, not to exceed 60 mg/kg/day).
- **Rectal prolapse:** Gently push back the rectal prolapse using a surgical glove or a wet cloth. Take help of surgeons.
- **Convulsions:** Convulsions may occur because of electrolyte imbalances (hyper or hyponatremia, hypocalcemia) or because of bacteremia and meningitis especially in young infants. A short term maintenance anticonvulsant treatment is indicated if there are repeated or prolonged episodes.
- **Haemolytic-uraemic syndrome:** Where laboratory tests are not possible, suspect haemolytic-uraemic syndrome (HUS) in patients with easy bruising, pallor, altered consciousness, and low or no urine output, and refer these cases to higher center.

6.9: PERSISTENT DIARRHOEA

Persistent diarrhoea is diarrhoea, with or without blood, which starts acutely and lasts 2 weeks or more. When there is some or severe dehydration, persistent diarrhoea is classified as 'severe'. In recent years, persistent diarrhoea has emerged as major cause of mortality accounting for more than one-third of all diarrhoea deaths. With better management of dehydration, deaths due to acute diarrhoea have reduced.

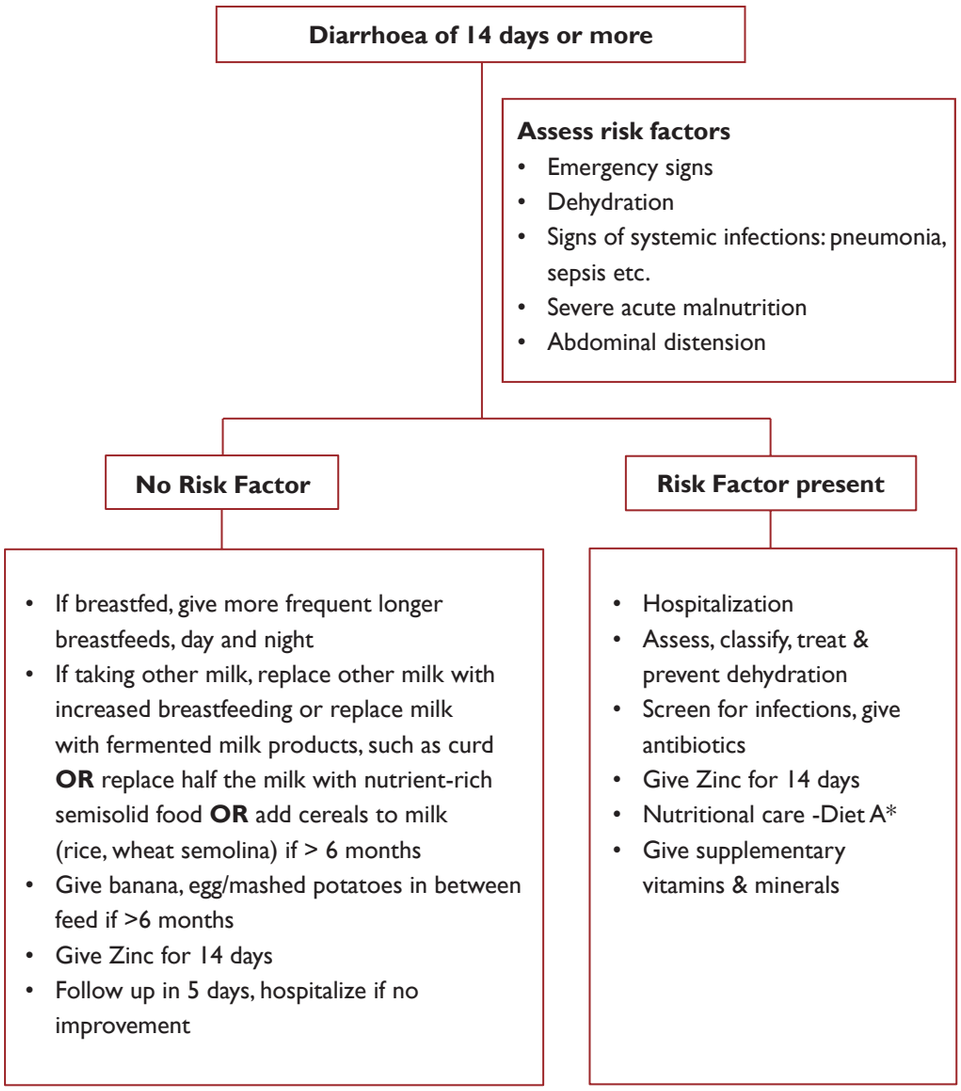
Steps of management (Chart 6.4)

1. **Assess, classify, treat & prevent dehydration**
2. **Screen for infections & give antimicrobials**
   Persistent diarrhoea may be presentation of non-intestinal infections like pneumonia, UTI, sepsis, otitis media see Box 6.5. Look for these conditions. Look for intestinal infections by stool routine and culture if facility is available. Investigate for HIV if there are other clinical signs e.g. oral thrush or other risk factors.
3. **Give Zinc for 14 days**
4. **Nutritional management**
5. **Give supplementary multivitamins and minerals**

Box 6.5: Indications for hospitalization in persistent diarrhoea

- Dehydrated (severe persistent diarrhoea), or
- Has associated severe malnutrition or severe illness, or
- Failure of routine OPD management for persistent diarrhoea

Chart 6.4: Management of Persistent Diarrhoea



**If diarrhoea more than 10 per day on Diet-A for more than 72 hours or no weight gain on Diet A for 7 days, change to Diet-B*

**Change diet after 1- 2 weeks of improvement. Children on Diet-B should be shifted to Diet–A before starting normal diet.*

Treatment

1. Assess, classify, treat & prevent dehydration: Most children with persistent diarrhoea and dehydration are successfully rehydrated with ORS. A few children, however, may have impaired glucose absorption and ORS solution may not be effective. When these children are given ORS, their stool volume increases markedly, thirst increases and signs of dehydration worsen. These children require IV rehydration for correction.

2. **Screen for infections & give antimicrobials**

   - **Associated systemic infection:** Combination of parenteral Ampicillin and Gentamicin is usually effective for sepsis, pneumonia and UTI. Antibiotics should be changed as per culture sensitivity report if it is available.
   - **Presence of gross blood in stools:** Give IV or IM Ceftriaxone (80-100 mg/kg/day) once daily or an oral Cefixime for 5 days.

- **Amoebiasis:** Give oral Metronidazole 10 mg/kg/dose, 3 times a day for 5 days only if:
  - Microscopic examination of fresh faeces carried out in a reliable laboratory reveals trophozoites of E. histolytica with red blood cells, **or**
  - Two different antibiotics, which are usually effective for Shigella locally, have been given without clinical improvement.
- **Giardiasis:** Give oral Metronidazole 5 mg/kg/dose, 3 times a day, for 5 days if trophozoites of Giardia lamblia are seen in the faeces.

3. Give zinc supplements for 14 days

4. Nutritional Management

Nutritional management is critical part of management in persistent diarrhoea. Children treated in hospital require special diets and the goal is to give a daily intake of at least 110 kcal/kg.

- **Up to 6 months:**
  - Encourage exclusive breastfeeding. Counsel mothers to give more frequent & prolonged feeds.
  - Help mothers who are not breastfeeding exclusively to do so. Send to Lactation Counsellor / IYCF counselling center, if available for improving feeding practices.
  - If child is not breastfeeding, give a breast milk substitute that is low in lactose such as curd feeds. Use a spoon or cup; do not use a feeding bottle. Once the child improves, help the mother to re-establish lactation with the help of lactation counsellors.
- **6 months or older:**

  Feeding should be restarted as soon as the child can eat. Reduced lactose diet (Diet-A) should be given 6 times a day to achieve a total intake of at least 110 K calories/kg/day. Many sick children will eat poorly, until any serious infection has been treated for 24– 48 hours. Such children may require nasogastric feeding initially.

  Secondary lactose intolerance may occur in rotavirus and other infective diarrhoea. Most of these children improved on low lactose diet. Even for children with secondary lactose intolerance breastfeeding is most nutritious diet. Do not stop breastfeeding rather encourage all mothers to continue breastfeeding.

Recommended diets for persistent diarrhoea

Given below are three diets recommended for children and infants aged >6 months with severe persistent diarrhoea. If there are signs of dietary failure or if the child is not improving after 7 days of treatment, stop the first diet and give the next diet for 7 days *(Box 6.6, 6.7)*.

The Initial Diet A: [Reduced lactose diet, milk rice gruel, rice with curd, dalia]

Ingredients	Measure	Approximate quantity
Milk	1/3 cup	40 ml
Sugar	½ level tsp	2 g
Oil	½ level tsp	2 g
Puffed rice powder*	4 level tsp	12.5 g
Water		To make 100 ml

**can be substituted by cooked rice*

Preparation

- Mix milk, sugar, rice together
- Add oil
- Add boiled water & mix well

The feed can now be given to the child.

The second Diet B: [Lactose-free diet with reduced starch]

About 50-70% of children improve on the initial Diet A. Remaining children, if free of systemic infection are changed to Diet B which is milk (lactose) free and provides carbohydrates as a mixture of cereals and glucose. Milk protein is replaced by chicken, egg or pulses.

Ingredients	Measure	Approximate quantity
Egg white	3 level tsp	15 g
Glucose	¾ level tsp	3 g
Oil	1 level tsp	4 g
Puffed rice powder*	2 level tsp	7 g
Water		To make 100 ml

**Can be substituted with cooked rice*

Preparation

Whip the egg white well. Add puffed rice powder, glucose, oil and mix well. Add boiled water and mix rapidly to avoid clumping.

The Third Diet C: [Monosaccharide based diet]

Overall 80-85% patients with severe persistent diarrhoea will recover with sustained weight gain on the initial Diet A or the second Diet B. A small percentage may not tolerate a moderate intake of the cereal in Diet B. These children are given the third diet (Diet C) which contains only glucose and a protein source as egg or chicken. Energy density is increased by adding oil to the diet.

Ingredients	Measure	Approximate quantity
Chicken / Egg white	2 ½ level tsp / 5 level tsp	12 g / 25 g
Glucose	¾ level tsp	3 g
Oil	1 level tsp	4 g
Water		To make 100 ml

Preparation

Boil chicken, remove the bones and make chicken puree. Mix chicken puree with glucose and oil. Add boiled water to make a smooth paste.

Or

Whip the egg white well. Add glucose, oil and mix well. Add boiled water and mix rapidly to avoid clumping.

Box 6.6: Good response to diet

- Adequate food intake
- Weight gain>5 gm/kg/day
- Fewer diarrhoeal stools
- Absence of fever & better activity

Box 6.7: Failure to diet

- An increase in stool frequency (usually to >10 watery stools a day), often with a return of signs of dehydration
- Failure to establish weight gain within 7 day

The most important criterion is weight gain. Ensure at least three successive days of increasing weight (>5gm/kg/day) before you conclude that weight gain is occurring. Give additional fruits like banana, papaya and well-cooked vegetables to children who are responding well see Box 6.6. After recovery, resume an appropriate diet for their age, including milk, which provides at least 110 Kcal/kg/day. Children may then return home, but follow them up regularly to ensure continued weight gain and compliance with feeding advice.

5. Give supplementary multivitamins and minerals

Provide vitamin A (single large dose) if the child has not received it as pre-referral treatment (Table 6.3). In addition to vitamin A, children with persistent diarrhoea also require supplementation with other multivitamins and minerals (Table 6.4).

Table 6.3: Vitamin A Single dose

< 6 months	50,000 IU
6 - 12 months	1,00,000 IU
>12 months & < 8 kg	1,00,000 IU
>12 months & ≥ 8 kg	2,00,000 IU

Table 6.4: RDA for 1-year-old child

Micronutrient	Dose
Folate	50 mcg
Zinc	10 mg
Vitamin A	400 mcg
Iron	10 mg
Copper	1 mg
Magnesium	80 mg

Monitoring

Check the following parameters daily during hospital stay:

- Body weight
- Temperature
- Food intake
- Number of diarrhoeal stools

EXERCISE 6.1

1. Sana 13 months old female baby is brought to emergency with history of loose motions for 2 days. Her admission weight is 9 Kg.

   On examination Sana is lethargic, her eyes are sunken and her skin pinch is very slow. When she is offered fluid, she is not able to drink.

   a. Classify the hydration status of Sana?

   b. Which plan of treatment you will start?

   c. Write the type of fluid, amount and duration over which you will rehydrate?

   d. What will you monitor during rehydration?

After 3 hours, you re-examined Sana. She now looks alert, eyes are normal, skin pinch goes back immediately and she is drinking normally.

e. What is hydration status now?

f. Will you discharge her or observe in clinic/hospital?

g. What discharge advise you will give her parents?

2. Fourteen months old Irfan is brought to hospital with history of loose motions & vomiting for 3 days. On examinations, he is irritable, eyes are normal, skin pinch is slow and he drinks eagerly when offered fluid?

   a. Classify hydration status

   b. Write treatment plan for this child.

EXERCISE 6.2

1. Akbar, 3 years old child is brought to hospital with loose stool, pain abdomen and fever for two days. Akbar also has visible blood in stool. Akbar does not show any emergency signs and has no dehydration. There is no past history of measles. His weight is 11 kg.

   a. Write treatment for Akbar.

   b. After what interval you will call Akbar for follow-up?

   c. Now there is no blood in stool, no abdominal pain, and he is passing semi formed stool with occasional mucus. What advise you will give?

2. Sonu is 8 months old and weighs 6.0 kg. He has had diarrhoea for 20 days. He has some dehydration. He has been referred with classification of severe persistent diarrhoea, moderate underweight and anaemia. His diet includes animal milk, cooked cereal, and some mashed vegetables.

   a. Should Sonu be admitted to the health facility?

b. Name some non-intestinal infections which may be causative?

c. Write treatment plan for Sonu.

d. What diet will you give to Sonu?

e. Enumerate criteria for changing the diet?

SECTION 7: CASE MANAGEMENT OF CHILDREN PRESENTING WITH FEVER

Fever is a common problem for which children are brought to the hospital. It is a characteristic feature of many diseases, both infectious and non-infectious.

7.0: LEARNING OBJECTIVES:

After completion of this section, participants should be able to:

- Describe management of confirmed or suspected cases of malaria
- Describe management of children with meningitis
- Describe investigations & treatment for enteric fever
- Describe management of UTI & Septicemia
- Describe management of dengue fever
- Describe management of scrub typhus

7.1: FEVER

Fever is defined as an axillary temperature of more than 37.5°C. The main aim in these cases is to differentiate serious, treatable infections from mild self-resolving febrile illnesses like URI, viral fever etc. As discussed in ETAT section, look for emergency signs and initiate treatment before taking detailed history and examination.

Following history & examination may help you in reaching a diagnosis:

History

- Duration and pattern of fever
- Recent contact with a person with an infectious disease like COVID-19, Influenza etc.
- Cough/cold/sore throat
- Loose stools, blood in stools
- Pain on passing urine, increase in frequency of urine
- Convulsions or seizures
- Headache, vomiting, excessive irritability or inconsolable crying
- Stiff neck or neck pain
- Skin rash
- Ear pain
- History of recent travel to endemic areas
- Vaccination history

Examination

- **General:** drowsiness or altered consciousness, pallor, jaundice, lymphadenopathy, oedema
- **Head and neck:** bulging fontanel, stiff neck, discharge from ear, swelling or tenderness in mastoid region, congestion/tonsils enlargement of membrane in throat
- **Chest:** rate and pattern of breathing, reduced air entry, added sounds
- **CVS –** Tachycardia, character of heart sounds, murmur
- **Abdomen:** distension, tenderness, enlarged spleen or enlarged liver
- **Limbs:** swelling, redness, warmth, difficulty in moving joint or limb (cellulitis, septic arthritis, osteomyelitis)
- **Skin**
  - Pyoderma
  - Haemorrhagic rash: purpura, petechiae (meningococcal infection, dengue)
  - Maculopapular rash (measles, other viral infections)

Differential diagnosis

You can classify fever cases into three major categories

- Fever without localized signs (Chart 7.1)
- Fever with localized signs (Chart 7.1)
- Fever with rash (Chart 7.2)
- Fever lasting than 7 days (Chart 7.2)

Chart 7.1: Differential diagnosis of fever without and with localized signs

Differential diagnosis of fever wihtout localized signs	
Diagnosis	**In favour**
COVID -19	Fever of less than 10 days with any of the following: • H/o contact with COVID-19 patient • Signs of severe pneumonia • SpO_2 < 92% on room air • Loss of smell/taste
Malaria	• Sudden onset of fever with rigors, followed by sweating • Generalized weakness (prostration) or lethargy • Positive blood film or rapid diagnostic test for Malaria parasites • Anaemia • Enlarged spleen
Septicaemia	• Seriously ill, with no apparent cause • Purpura, petechiae • Shock • Sick look
Typhoid	• Protracted fever with H/O vomiting/pain • Hepatosplenomegaly, diffuse mild tenderness • Jaundice
Urinary tract infection	• Abdominal pain • Loin or suprapubic tenderness • Crying on passing urine • Passing urine more frequently than usual • Incontinence in previously continent child

Differential diagnosis of fever with localized signs	
Diagnosis	**In favour**
Pneumonia	• Cough with fast breathing • Lower chest wall indrawing • Grunting • Nasal flaring • Coarse crackles, consolidation, effusion
Viral upper respiratory tract infection	• Symptoms of cough or cold • No systemic problem
Meningitis	• Altered level of consciousness • Convulsions • Vomiting, headache • Excessive irritability (excessive crying in infants) • Stiff neck • Bulging fontanelle • Meningococcal rash (petechial or purpuric)
Otitis media	• Pus draining from ear • Ear pain
Mastoiditis	• Tender swelling behind the ear
Osteomyelitis	• Local tenderness • Refusal to move the affected limb • Refusal to bear weight on leg
Septic arthritis	• Joint hot, tender, swollen
Skin and soft tissue infection	• Cellulitis • Skin boils • Pustules • Pyomyositis (purulent infection of muscles)
Hepatitis	• Severe anorexia, vomiting • Abdominal pain • Yellowish discoloration of eyes & urine

Chart 7.2: Differential diagnosis of fever with rash & lasting more than 7 days

Differential diagnosis of fever with rash*	
Diagnosis	**In favour**
Measles	• Generalized maculopapular rash • Cough, runny nose, red eyes • Mouth ulcers • Recent exposure to a measles case
Viral infections	• Fever, myalgia, cough, loose stools • Transient non-specific rash
Dengue haemorrhagic fever	• High grade fever with headache and bodyache • Thrombocytopenia • Bleeding from nose or gums or in vomitus • Bleeding in stools or black stools • Skin petaechiae or purpura • Enlarged liver and spleen • Shock • Positive tourniquet test
Typhus	• Outbreak of typhus in region • Characteristic macular rash • Myalgia
Relapsing fever	• Petaechial rash, skin haemorrhages • Jaundice • Tender enlarged liver and spleen • History of previous episode of relapsing fever • Positive blood smear for Borrelia

** fever with rash is a notifiable disease*

Differential diagnosis of fever lasting more than 7 days	
Diagnosis	**In favour**
Abscess	• Tender or fluctuant mass • Local tenderness
Rheumatic fever	• Heart murmur, which may change over time • Arthritis or arthralgia • Cardiac failure • Persistent, fast pulse rate • Pericardial friction rub • Chorea
Kala-azar	• Endemic area • Enlarged spleen and/or liver • Anaemia • Weight loss
Tuberculosis	• Weight loss • Anorexia, night sweats • Cough • Lymphadenopathy • Enlarged liver and/or spleen • Family history of TB
Childhood Malignancies	• Weight loss • Anaemia • Bleeding manifestations • Lymphadenopathy • Enlarged liver and/or spleen • Mass or lump in the body
Infective endocarditis	• Weight loss • Enlarged spleen • Anaemia • Heart murmur or underlying heart disease • Petaechiae • Splinter haemorrhages in nail beds • Microscopic haematuria • Finger clubbing

In this section management of a few common conditions of fever are described.

7.2: Malaria

Malaria is a major health problem in India. Plasmodium vivax and Plasmodium falciparum infections are responsible for most cases. A case of uncomplicated malaria usually presents with fever, rigors, headache, bodyache, fatigue, anorexia, nausea and vomiting. The patient often has anaemia and/or splenomegaly and/or hepatomegaly. Serious complications may sometimes develop suddenly over a span of time, as short as 12-24 hours and may lead to death, if not treated promptly and adequately. Use of appropriate anti-malarial drugs is very important to save lives in malaria cases.

Indication for hospitalization: You will need to admit severe malaria cases. Uncomplicated malaria cases should be managed on OPD basis.

When do you classify malaria as severe?

You will classify malaria as severe in presence of any of the following complications in a child who has a positive microscopy or Rapid Diagnostic Test (RDT) for malaria:

- **Impaired consciousness or coma** persisting for >30 minutes after seizure.
- **Prostration:** Generalized weakness so that a person is unable to sit, stand or walk without assistance.
- **Multiple convulsions** i.e. more than 2 episodes in last 24 hours.
- **Acidosis:** A base deficit of >8 mEq/L or a plasma bicarbonate level of <15 mmol/L or venous plasma lactate ≥5 mmol/L (rapid, deep, laboured breathing).
- **Hypoglycemia:** Blood glucose <45 mg/dL in normal children/ <54 mg/dL in children with severe acute malnutrition.
- **Severe anaemia:** Hb ≤5 g/dl or Haematocrit of ≤15% with a parasite count >10000/µL.
- **Renal impairment:** Plasma or serum creatinine >3 mg/dl or blood urea >120 mg/dL.
- **Jaundice:** Plasma or serum bilirubin >3 mg/dL with parasite count >100000/µL.
- **Pulmonary oedema:** Radiologically confirmed or oxygen saturation <92% on room air with a respiratory distress often with chest indrawing and crepitations on auscultation.
- **Significant bleeding:** Recurrent or prolonged bleeding from the nose, gums, or venipuncture sites; haematemesis or melaena.
- **Shock/impaired circulation**
- **Hyperparasitemia:** 5% or more parasitized RBCs.

Remember:

- *If severe malaria is suspected and the initial blood smear is negative for malaria parasite, perform a rapid diagnostic test, if available. If the test is positive, treat for severe malaria but continue to look for other causes of severe illness (including severe bacterial infections). If the rapid diagnostic test is negative, an alternative diagnosis is more likely.*
- *If confirmation of malaria from a blood smear or rapid diagnostic test is likely to take more than 1 hour, then start antimalarial treatment and decide about continuation of antimalarial treatment when reports are available. Perform a lumbar puncture to exclude bacterial meningitis in a child with severe malaria and altered level of consciousness or in coma. If lumbar puncture is delayed and bacterial meningitis cannot be excluded, give antibiotic which is effective in meningitis in addition to antimalarial treatment.*
- *Thrombocytopenia is increasingly being seen with both vivax and falciparum malaria. Although presence of thrombocytopenia does not lead to case classification as severe malaria, cases with thrombocytopenia need careful attention for bleeding manifestations and need for platelet transfusions.*

How to treat severe malaria cases?

- **Provide emergency treatment, if emergency signs are present** *(see Section 2: ETAT)*.
- If the child is unconscious, **minimize the risk for aspiration pneumonia** by inserting a nasogastric tube and removing the gastric contents by suction. Keep the airway open, and place the patient in recovery position.
- **Treat hypoglycaemia:** Give 5 ml/kg of 10% glucose (dextrose) solution IV rapidly. Recheck the blood glucose after 30 minutes, and repeat the dextrose (5 ml/kg), if the level is low. If blood glucose cannot be measured and hypoglycaemia is suspected, give glucose empirically.
- **Treat convulsions** with rectal or IV diazepam. Do not give prophylactic anticonvulsants.

Start antimalarial treatment

Parenteral (intravenous or intramuscular) artesunate is the drug of choice for the treatment of severe malaria (irrespective of the species of Plasmodium). If it is not available, parenteral Artemether or Quinine should be used. Once a patient has received at least 24 hours of parenteral therapy and can tolerate oral therapy, complete treatment with 3 days of an oral Artemisinin- based Combination Therapy (ACT). Also, give a single dose of Primaquine (0.75 mg/kg) for gametocidal action, unless the child is <12 months of age.

Children weighing <20 kg should receive a higher dose of Artesunate (3 mg/kg/dose) than older children (2.4 mg/kg/dose) to ensure equivalent exposure to the drug.

What treatment should be given to a patient of suspected severe malaria who needs referral (pre-referral treatment)?

Administer a single intramuscular dose of Artesunate and refer to an appropriate facility for further care. Where intramuscular Artesunate is not available use intramuscular Artemether or, if that is not available, use intramuscular Quinine. Where intramuscular injections of Artesunate are not available, treat children<6 years with a single rectal dose (10 mg/kg) of Artesunate and refer immediately to an appropriate facility for further care *(Chart 7.3)*.

Chart 7.3: Chemotherapy for severe and complicated P. Falciparum malaria (Adapted from NVBDCP 2015 recommendations & WHO Guidelines)

Initial parenteral treatment for at least 24 hours CHOOSE ONE of the following three options:	**Follow-up treatment, when patient can take oral medication following parenteral treatment**
Artesunate: Children <20 kg: 3mg/kg/dose. Children >20 kg 2.4 mg/kg IV or IM given on admission (Time=0), then at 12 hours and 24 hours and then once a day. **OR**	**Full oral course of area-specific ACT:** In North Eastern states: Age-specific ACT-AL[#] for 3 days + Primaquine single dose on second day
Artemether: 3.2 mg/kg body weight IM given on admission then 1.6 mg/kg per day. **OR**	In other states: Treat with: ACT-SP[$] for 3 days + Primaquine single dose on second day
Quinine: 20 mg quinine salt/kg body weight on admission (IV infusion or IM injection in divided doses) followed by maintenance dose of 10 mg/kg 8 hourly; diluted in 5% dextrose and infused over 4 hours. The infusion rate should not exceed 5 mg salt/kg/ h. Loading dose of 20 mg/kg should not be given, if the patient has already received Quinine.	**Quinine 10 mg/kg three times a day with:** Doxycycline 100 mg once a day in children >8yrs **OR** Clindamycin (20 mg/kg/day in three divided doses) in children under 8 years of age, to complete 7 days of treatment.

Note: The parenteral treatment in severe malaria cases should be given for minimum of 24 hours once started (irrespective of the patient's ability to tolerate oral medication earlier than 24 hours)

[*]*ACT-Artemisinin based combination therapy*

[#]*AL-Artemether-Lumefantrine combination*

[$]*ACT-SP -Artesunate-Sulphadoxine-Pyrimethamine combination*

Provide Supportive care

- Examine frequently for signs of dehydration or fluid overload, and treat appropriately. Ensure that they receive daily fluid requirements, and monitor fluid status carefully by keeping a careful record of fluid intake and output.
- Nasogastric feeding for children who are hemodynamically stable, but unable to feed.
- Avoid giving corticosteroids and other anti-inflammatory drugs.

How to manage common complications of severe malaria?

1. Severe anaemia

Severe anaemia is indicated by severe palmar pallor, often with a fast pulse rate, difficult breathing, confusion or restlessness. Signs of heart failure such as gallop rhythm, enlarged liver and, rarely, pulmonary oedema (fast breathing, fine basal crackles on auscultation) may be present due to severe anaemia.

Box 7.1: Indications for blood transfusion in severe malaria

- All children with a haematocrit <15 or Hb ≤5 g/dl.
- Haematocrit between 15-20; (Hb 5-7 g/dl) with any of the following:
  - shock or clinically detectable dehydration
  - impaired consciousness
  - respiratory distress (deep, labored breathing)
  - heart failure
  - very high parasitaemia (>5% of red cells parasitized)

- Give 10 ml/kg packed cells or 20 ml/kg whole blood over 3–4 hour.
- Check the respiratory rate and pulse rate every 15 min. If there is any evidence of fluid overload (facial puffiness, enlarged liver, tachypnea, tachycardia) due to the blood transfusion, give IV Furosemide (1–2 mg/kg) and transfuse very slowly.
- After the transfusion, if the Hb remains low i.e <5g/dl, repeat the transfusion *(Box 7.1)*.
- Give a daily Iron–Folate tablet or Iron syrup for 14 days at discharge and follow up after 14 days. Treat for 3 months, as it takes 2-4 weeks to correct anaemia and 1-3 months to build up iron stores.

1. **Respiratory distress**

   Respiratory distress is commonly caused by systemic metabolic acidosis and presents as deep, laboured breathing, while the chest is clear on auscultation. It may also be due to congestive cardiac failure in case of severe anaemia, aspiration pneumonia in a comatose child, or fluid overload in case of acute kidney injury; all three being common complications of severe malaria.

The management of respiratory distress includes:

- Supplemental oxygen to keep SpO2 >94%
- Correction of dehydration
- Correction of severe anaemia
- Titration of fluid therapy according to urine output

Monitor response by continuous clinical observation (oxygen saturation, Hb, packed cell volume, blood glucose and acid–base balance if available)

Monitoring

- Monitor temperature, pulse rate, respiratory rate (if possible, blood pressure) every 6 hours during the first 48 hours.
- Monitor the blood glucose level every 3 hour until the child is fully conscious.
- The IV infusion rate should be checked hourly.
- Children with cold extremities, hypoglycaemia on admission, respiratory distress and/or deep coma are at greatest risk of death and must be kept under very close observation.
- Keep a careful record of fluid intake (including IV infusions) and output.
- Monitor and report immediately any change in the level of consciousness, convulsions or the child's behavior.

Uncomplicated malaria

All fever cases should be suspected of malaria after ruling out other common causes and should be investigated for confirmation of malaria by microscopy or rapid diagnostic test (RDT). The presentation of uncomplicated malaria is highly variable and may mimic many other causes of fever.

Diagnosis

Diagnose uncomplicated malaria if the child has:

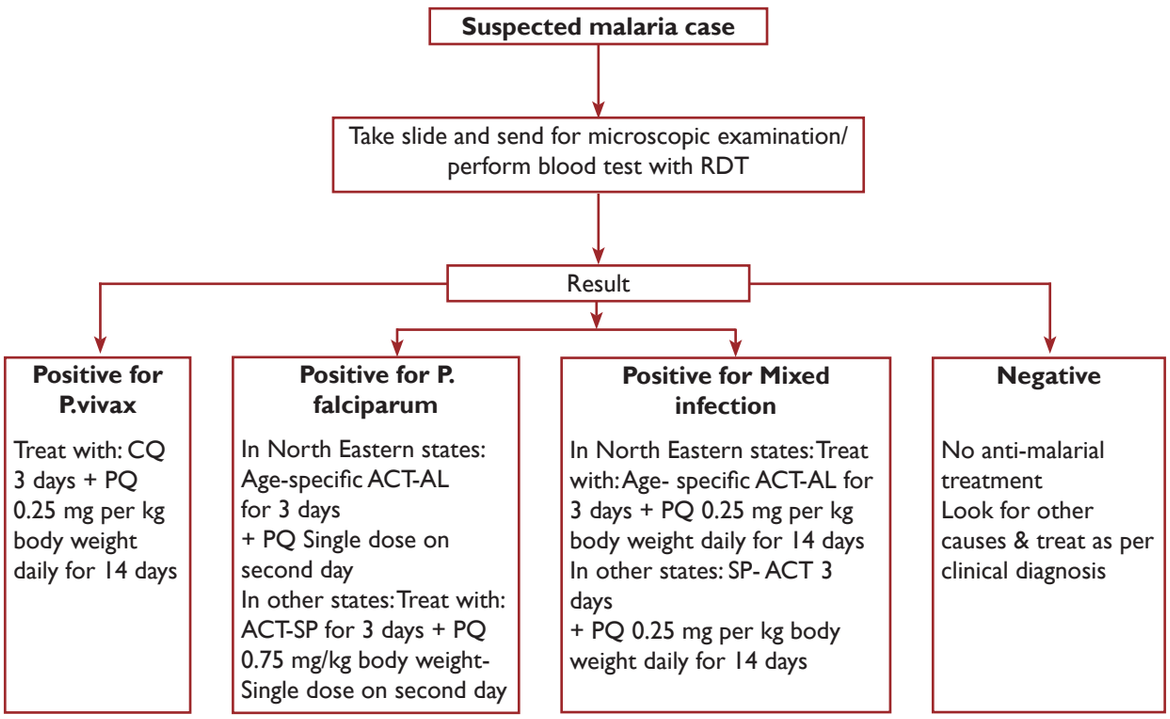
- Fever (temperature ≥ 37.5°C or ≥ 99.5°F) or history of fever, AND
- A positive blood smear or positive rapid diagnostic test for malaria, AND
- No signs of severe malaria

Follow-up

Ask the mother/caregiver to return if the fever persists after 3 days treatment, or sooner if the child's condition gets worse. Reassess the child to exclude the possibility of other causes of fever.

Further Reading: *Algorithm for diagnosis of Malaria*

- When microscopy result is available within 24 hours, **OR**
- When microscopy result is not available within 24 hours, but a bivalent RDT is available



ACT-AL– Artemisinin-based Combination Therapy- Artemether–Lumefantrine

ACT-SP– Artemisinin-based Combination Therapy (Artemether+Sulfadoxine-Pyrimethamine)

CQ– Chloroquine

PQ–Primaquine

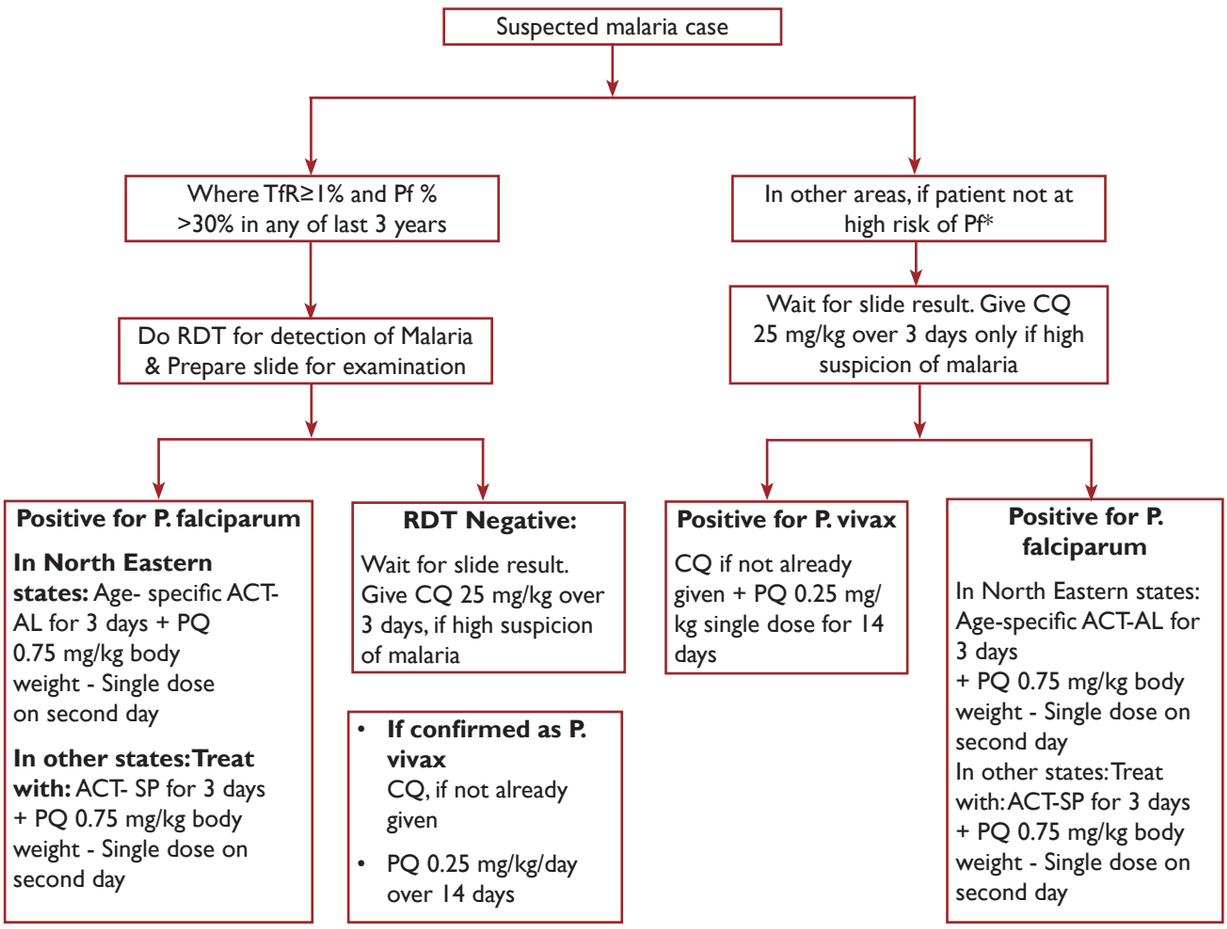
Further Reading : WHO in recent update (WHO Malaria Update 2023)

Recommended use of primaquine in children above 6 months.

- WHO recommends 0.25mg/kg single dose on first day of treatment for falciparum malaria without G6PD testing and for vivax or mixed infections 0.5mg/kg of primaquine for 7 days in children above 6 months as compliance may be better than 0.25 mg/kg for 14 days. G6PD deficiency should be ruled out for both 0.25 or 0.5 mg/kg doses regimen
- When G6PD status is unknown and G6PD testing is not available, a decision to prescribe primaquine should be based on an assessment of the risks and benefits of adding primaquine.

Further Reading: *Algorithm for diagnosis of Malaria*

When microscopy result is not available within 24 hours and Monovalent RDT is used.



**TfR = Test falciparum rate*

Note: PQ is contra-indicated in pregnancy and in children under one year (infant)

ACT-AL– Artemisinin-based Combination Therapy- Artemether – Lumefantrine;
ACT-SP– Artemisinin-based Combination Therapy (Artemether + Sulfadoxine-Pyrimethamine)
CQ – Chloroquine;
PQ– Primaquine

Further Reading : WHO in recent update (WHO Malaria Update 2023)
Recommended use of primaquine in children above 6 months.

- WHO recommends 0.25mg/kg single dose on first day of treatment for falciparum malaria without G6PD testing and for vivax or mixed infections 0.5mg/kg of primaquine for 7 days in children above 6 months as compliance may be better than 0.25 mg/kg for 14 days. G6PD deficiency should be ruled out for both 0.25 or 0.5 mg/kg doses regimen
- When G6PD status is unknown and G6PD testing is not available, a decision to prescribe primaquine should be based on an assessment of the risks and benefits of adding primaquine.

7.3: Meningitis

Meningitis is one of the important causes of mortality and brain damage in infants and children. History and examination is summarized in Box 7.2. Early diagnosis of meningitis is essential for effective treatment.

Box 7.1: History and examination in a suspected case of meningitis

Look for a history of:

- Convulsions
- Vomiting
- Inability to drink or breastfeed
- Headache or pain in back of the neck
- Irritability/inconsolable cry
- Recent head injury
- H/O ear discharge

On examination, look for:

- Altered level of consciousness
- Lethargy
- Irritability
- Neck stiffness
- Bulging fontanelle in infants
- Non-blanching petaechial rash or purpura

Also, look for signs of raised intracranial pressure:

- Decreased consciousness level
- Hypertension, bradycardia
- Rigid posture or posturing
- Focal paralysis in any of the limbs
- Irregular breathing
- Unequal pupils

Bacterial meningitis: Suspect bacterial meningitis in presence of fever with seizures; or unconsciousness; or severe headache. Bulging fontanelle in young children and the presence of meningeal signs are common features in meningitis. Skin lesions are common in meningococcemia. The possibility of viral encephalitis or tuberculous meningitis must be considered as differential diagnosis in children with meningeal signs.

Laboratory investigations

The diagnosis is confirmed with a lumbar puncture and analysis of the CSF. Already described in *Chart 5.2*

Treatment

Start treatment with antibiotics immediately, if meningitis is clinically suspected and the CSF is obviously cloudy. You should also start antibiotics if meningitis is clinically suspected and a lumbar puncture is not possible or is contraindicated or is traumatic. Lumbar puncture is contraindicated in following situations:

- Raised intracranial pressure
- Coagulopathy (deranged PT/PTTK) or severe thrombocytopenia (platelet count<50,000 cu/mm)
- Shock
- Patient with hemodynamic instability
- Skin infection over LP site

Antimicrobial therapy

- Start IV antibiotics as soon as possible.
  - Ceftriaxone: 50 mg/kg per dose IM or IV every 12 hour; or 100 mg/kg once daily for 10 days administered as a slow IV push or deep IM injections.

    OR

    Cefotaxime: 50 mg/kg per dose IM or IV every 6 hour for 10 days.

  - If meningitis is suspected to be due to S. aureus (patients presenting with shock, penetrating head trauma, neurosurgical procedures, deep seated abscesses, endocarditis) then give Ceftriaxone/Cefotaxime and Vancomycin (15 mg/kg/dose every 6 hourly).
  - For children 1 – 3 months, give combination of third generation Cephalosporin like Cefotaxime (200 mg/kg/day divided 6 hourly) or Ceftriaxone (100 mg/kg/day divided 12 hourly) with aminoglycosides like Gentamicin (7.5 mg/kg/day once daily) or Amikacin (15 mg/kg/day once daily).
- Review and modify treatment as per clinical condition and available CSF results. If CSF results do not suggest meningitis, look for other causes.

Supportive therapy

- Maintain airway and breathing in a comatose or convulsing child by suctioning of secretions, intubation and mechanical ventilation where indicated.
- Insert nasogastric tube and allow continuous drainage in comatose patients, in order to prevent aspiration pneumonia.
- Consider fluid boluses and inotropic support if the child presents in shock. Maintenance fluid should not be restricted if the patient doesn't have features of raised intracranial pressure.
- Check blood sugar and correct hypoglycemia using a bolus of 10% Dextrose (5 ml/kg).
- Raised intracranial pressure (ICP) can be managed by head end elevation, intravenous Mannitol (loading dose 5ml/kg/dose followed by 2.5ml/kg/dose 6 hourly of 20% Mannitol) or Hypertonic Saline (3% saline) at (0.1-1ml/kg/hr). The other alternative is oral Glycerol 1 gm/kg 4-6 hourly and Acetazolamide (50-70 mg/kg/day) divided in 3-4 doses. If raised ICP is refractory to medical management, patient can be referred to a higher center for urgent neuroimaging and surgical intervention.

- Manage convulsions with IV or IM Midazolam (0.1-0.2 mg/kg/dose) or IV (0.3 mg/kg/dose) or rectal Diazepam (0.5 mg/kg/dose). This treatment should be followed by IV Phenytoin (20 mg/kg loading dose followed by 5 mg/kg/24-hour maintenance dose). Stop Phenytoin when the patient is seizure free for 48 hours.
- Manage fever using Paracetamol (15 mg/kg/dose every 4-6 hourly with total dose not exceeding 60 mg/kg/day) oral or rectal suppository (in children with coma/convulsions).

Management of complications: During acute stage the complications like dehydration, electrolytes derangement, hypoglycaemia, seizures, respiratory failure, and shock may occur. Monitor and treat appropriately.

If there is a poor response to treatment:

- Repeat lumbar puncture after 48 hours, if fever is still present and the child's overall condition is not improving. Upgrade the antibiotics, if CSF findings have not improved or worsened. Choice of antibiotics should be guided by CSF culture report wherever available.
- Consider the presence of common complications, such as subdural effusions (persistent fever plus focal neurological signs or reduced level of consciousness) or a cerebral abscess. If these are suspected, refer the child to a hospital with specialized facilities for further management.
- Look for other sites of infection that may be the cause of fever, such as thrombophlebitis at injection sites, arthritis or osteomyelitis.

Tuberculous meningitis

Tuberculous meningitis may have an acute or chronic presentation, with the duration of presenting symptoms varying from days to months. It may present with cranial nerve deficits or any other neurological deficit, or a more indolent course involving headache, meningismus and altered mental status. The initial symptoms are usually nonspecific, including headache, vomiting, photophobia and fever.

In children with fever and neurological symptoms and signs, consider tuberculous meningitis if any of the following is present:

- Fever has persisted for 14 days.
- Fever has persisted for >7 days, and a family member has tuberculosis.
- A chest X-ray suggests tuberculosis.
- The patient is unconscious and remains so despite treatment for bacterial meningitis.
- The patient is known to have HIV infection or is exposed to HIV.
- The CSF has a moderately high white blood cell count, elevated protein and low glucose*(Chart 5.2),* or this pattern persists despite adequate treatment for bacterial meningitis.

Follow NTEP Guidelines for specific treatment *(see Chart 3.10).* Provide supportive treatment as discussed in the previous section.

7.4a: Septicaemia

Septicaemia should be considered in a child with acute fever who is severely ill, when no other cause is found. Septicaemia can also occur in association with meningitis, pneumonia, urinary tract infection or any other bacterial infection. The common causative agents include Streptococcus, Haemophilus influenza, Staphylococcus aureus and enteric Gram-negative bacilli such as Escherichia coli and Klebsiella (in patients with severe malnutrition/ immunodeficiency states.

Diagnosis

The child's history helps to determine the likely source of sepsis. Always undress the child fully and examine carefully to look for:

- Signs of local infection such as abscess, cellulitis, joint swelling, ear discharge, pus points over tonsils.
- Signs of meningeal irritation (neck retraction, bulging fontanelle).
- Signs of deep seated infections such as tenderness and guarding in abdomen, renal angle fullness/tenderness.
- Bleeding manifestations such as petechiae, purpura, ecchymosis.

Investigations

The investigations will depend on presentation but may include:

A. Bedside tests: blood sugar (by glucometer), urine microscopy, smear for malaria parasite/RDT.

B. Laboratory investigations:

- complete blood count
- CRP
- urinalysis and culture
- blood culture
- chest X-ray

Treatment

Start empirical broad spectrum antibiotics immediately;

- Give IV Ampicillin at 50 mg/kg every 6 hours plus IV Gentamicin 7.5 mg/kg once a day for 7-10 days; alternatively, give Ceftriaxone at 80-100 mg/kg IV once daily, over 30-60 minutes for 7-10 days.
- When Staphylococcal infection is strongly suspected, or the patient has septic shock, give antibiotics effective against Staphylococcus (as discussed under section on meningitis).
- Give supportive treatment as discussed in earlier sections.

Monitoring

- The child should be checked by a nurse, at least every 3 hours and by a doctor, at least twice a day.
- Check for the presence of new complications, such as shock, cyanosis, reduced urine output, signs of bleeding (petaechiae, purpura, bleeding from venipuncture sites) or skin ulceration.

7.4b: Typhoid Fever

Consider typhoid fever if a child presents with fever > 38°C persisting for 3 days or more plus any of the following: vomiting, abdominal pain, loose stools, headache, malaise, loss of appetite or cough (Table 7.1).

The main clinical features of typhoid are:

- Fever with no obvious focus of infection
- Signs of systemic upset, e.g. inability to drink or breastfeed, convulsions, lethargy, disorientation or confusion, vomiting
- Hepatosplenomegaly, tender or distended abdomen

Typhoid fever can present atypically in young infants as an acute illness with shock and hypothermia.

Table 7.1: Standard case definition

Confirmed case	• A patient with persistent fever (38°C or more) lasting 3 or more days, with laboratory confirmed S. typhi organisms (blood, bone marrow). • A clinical compatible case that is laboratory confirmed.
Probable case	• A patient with persistent fever (38°C or more) lasting 3 or more days, with a positive sero-diagnosis or antigen detection test but no S. typhi isolation • A clinical compatible case that is epidemiologically linked to a confirmed case in an outbreak.

Source: Guidelines for management of typhoid fever, WHO 2011

Diagnosis

- The definitive diagnosis of typhoid fever depends on the isolation of S. typhi organisms from the blood or bone marrow or stool.
- The classical Widal test measuring agglutinating antibody titers against S. typhi in serum has only moderate sensitivity and specificity. It can be negative in up to 30% of culture- proven cases of typhoid fever and can be falsely positive in many circumstances.
- Leucopenia or pancytopenia is seen in 10-25% cases.

Treatment

More than 90% of patients can be managed at home with oral antimicrobials. A close medical follow-up is needed to check for complications or failure to respond to therapy. However, the emergence of multidrug-resistant strains has reduced the choice of effective antimicrobial available in many areas. There is need to use culture and sensitivity tests to guide the choice of antibiotics.

Most cases may be managed with Cefixime 16-20 mg/kg/day divided into two doses (maximum dose - 400 mg i.e. 200 mg twice daily) for 10-14 days. Cases requiring hospitalization should be treated with Ceftriaxone (80 mg/kg I/V or IM once daily). Alternative drugs are Azithromycin (10-20 mg/kg once daily or divided into 2 doses for 7-10 days), Ciprofloxacillin (15 mg/kg/day in two divided doses), Ofloxacillin (10 mg/kg/day), Chloramphenicol (50-75 mg/kg/day divided in 6 hourly doses) and Co-trimoxazole (8 mg/kg/dose divided in two doses).

Supportive measures are important in the management of typhoid fever, such as oral or intravenous hydration, antipyretics, appropriate nutrition and blood transfusions, if indicated. Monitor for complications like GI bleeding, myocarditis, encephalopathy etc.

7.5: Urinary Tract Infection

Urinary tract infection (UTI) is common in infants and children. In young children, urinary tract infection often presents as nonspecific signs. Suspect urinary tract infection in all infants and children with:

- Fever of ≥38 °C for at least 24 hours without obvious cause
- Vomiting, poor feeding
- Irritability, lethargy, failure to thrive, abdominal pain, loose stools, jaundice (especially in young infants)
- Specific symptoms such as increased frequency, pain on passing urine, abdominal (loin) pain

A careful examination should be done to look for features suggesting underlying structural abnormality (distended bladder, enlarged kidneys, tight phimosis, vulval synechiae, palpable fecal mass, patulous anus, neurological deficit in lower limbs, previous surgery of the urinary tract, anorectal malformation or meningomyelocele) that can predispose the child to urinary tract infection.

UTI can be clinically diagnosed as either cystitis (uncomplicated UTI) or pyelonephritis (complicated UTI). Cystitis is inflammation of the urinary bladder mucosa with symptoms including dysuria, frequency, urgency, malodorous urine, incontinence, haematuria, and suprapubic pain. Pyelonephritis is diffuse pyogenic infection of the renal pelvis and parenchyma with symptoms including fever.

Diagnosis

The diagnosis requires analysis of urine by dipstick or microscopy and urine culture.

Sample collection

A midstream clean voided urine sample is preferred in toilet-trained children. In sick or non- toilet trained children aseptic bladder catheterization to obtain urine sample is preferred. Suprapubic aspiration is an invasive technique which requires expertise, has got the least chance of contamination and is preferred in infants <6months.

Investigations

- Urine dipstick: If dipstick is positive for leukocyte esterase or nitrite, UTI is very likely.
- Microscopy: in an uncentrifuged sample >10 WBCs per high power field are suggestive of UTI.
- Urine culture: It is said to be positive if it grows a single bacterial species with a colony count of:
  1. ≥1000-50000 CFU/ml – in a sample obtained by bladder catheterization
  2. ≥10^4 CFU/ml (with symptoms of UTI)-in a clean voided urine sample
  3. ≥10^5 CFU/ml (without symptoms of UTI)- in a clean voided urine sample

Treatment

The oral drugs used are Co-Amoxyclav (45mg/kg/day in two divided doses) or Cefixime (8-10 mg/kg/day in two divided doses). Cotrimoxazole (4 mg/kg/dose of trimethoprim equivalent twice daily) can also be used if local sensitivity pattern is favorable. Ciprofloxacin (10-20 mg/kg/day in two divided doses) is a second line drug for treatment of complicated UTI. Indications for admission is summarized *(Box 7.3).*

Table 7.3: Indications for admission in children with UTI

- Infants younger than 3 months
- Severely ill children (sepsis, dehydration and vomiting)
- Concern of noncompliance
- Fever persisting after 3 days of appropriate antibiotic treatment as shown by the sensitivity testing

In above cases start parenteral treatment and switch to oral drugs after 2-3 days. Among the parenteral drugs Ceftriaxone (75 mg/kg in single or two divided doses) or Aminoglycosides (Gentamicin 7.5 mg/kg OD or Amikacin 15 mg/kg OD) are used as first line drugs. Antibiotics can be changed according to culture/sensitivity report, if there is poor clinical response to empirical antibiotics.

Duration of therapy

In case of febrile UTI, parenteral antibiotic therapy should be continued until the child is afebrile, after which oral antibiotics should be given for 7-14 days. If a child has only cystitis and is >3 months old, only 5 days of antibiotic therapy is adequate.

Follow-up

Refer all patients with a first episode UTI to a higher centre for Ultrasound evaluation of urinary tract. Patients having recurrent UTI (>2 episodes), abnormal ultrasound or those who are <6 months should be subjected to VCUG (voiding cystourethrogram) and DMSA (Dimercaptosuccinic acid) scan to rule out vesico-urethral reflux and structural defects.

7.6: Dengue

Dengue ranks as the most important, rapidly emerged mosquito-borne viral disease in recent years.

Dengue viral infected child may be asymptomatic or symptomatic and clinical manifestations vary from undifferentiated fever to florid haemorrhage and shock. The clinical presentations depend on various factors such as age, immune status of the host, the virus strain and primary or secondary infection. Infection with one dengue serotype gives lifelong immunity to that particular serotype. A second infection with a different serotype is more severe; see *Table 7.2.*

Table 7.2: Dengue fever: Phases of disease & common complications

1.	Febrile phase (2-7 days)	Dehydration; high fever may cause neurological disturbances and febrile seizures in young children
2.	Critical phase(3-7 days)	Shock from plasma leakage; severe haemorrhage; organ impairment
3.	Recovery phase (24-48 hours after critical phase)	Hypervolemia (only if intravenous fluid therapy has been excessive and/or has extended into this period)

Clinical criteria:

Dengue fever (DF)– An acute febrile illness of 2-7 days duration with two or more of the following manifestations: headache, retro-orbital pain, myalgia, arthralgia, rash, positive tourniquet test or hemorrhagic manifestations.

Tourniquet test: *The tourniquet test is performed by inflating a blood pressure cuff to a midpoint between the systolic and diastolic pressure and maintaining for five minutes. The test is considered positive when 10 or more petechiae per one square inch area over forearm are observed. In DHF, the test usually gives a definite positive test with 20 petechiae or more.The test may be negative or only mildly positive during the phase of profound shock (DSS)*

Dengue haemorrhagic fever - Clinical features as stated above with thrombocytopenia (platelet count <100,000/cumm), haemorrhagic tendencies, and evidence of plasma leakage (rise in haematocrit > 20%, pleural effusion or ascites).

Dengue shock syndrome - All the above criteria with evidence of circulatory failure [rapid and weak pulse and narrow pulse pressure (<20 mmHg) or hypotension]. In compensated shock systolic blood pressure is maintained but child has tachycardia, quiet tachypnoea (tachypnoea without increased effort), and peripheral vasoconstriction with reduced skin perfusion (manifested as cold extremities and delayed capillary refill time of > 2 seconds and weak volume peripheral pulses). As peripheral vascular resistance increases, the diastolic pressure rises towards the systolic pressure and the pulse pressure (the difference between the systolic and diastolic pressures) narrows. The patient is considered to have compensated shock if the systolic pressure is maintained at the normal or slightly above normal range but the pulse pressure is ≤ 20 mmHg .

DF with warning signs and symptoms–

- Recurrent vomiting
- Abdominal pain/tenderness
- Lethargy/restlessness
- Pleural effusion/ascites
- Hepatomegaly
- Increased Hct>20%

If the patient has dengue with warning signs or signs of dehydration, judicious volume replacement by intravenous fluid therapy from this early stage may modify the course and the severity of disease.

Expanded Dengue Syndrome (EDS)– In EDS, usual manifestations of DF/DHF are commonly associated with co-morbidities and with various other co-infections. Clinical manifestations observed in EDS are given in *Table 7.3*.

Table 7.3: Atypical Manifestations of Dengue Fever (EDS)

System	Unusual or atypical manifestations
CNS involvement	Encephalopathy, encephalitis, febrile seizures, inctracranial bleed
GI involvement	Acute Hepatitis/fulminant hepatic failure, cholecystitis, cholangitis, Acute pancreatitis
Renal involvement	Acute renal failure, Haemolytic uremic syndrome, acute tubular necrosis
Cardiac involvement	Cardiac arrhythmia, cardiomyopathy, myocarditis, pericardial effusion
Respiratory	Pulmonary oedema, ARDS, Pulmonary haemorrhage, Pleural effusion
Eye	Conjunctival bleed, macular haemorrhage, visual impairment, optic neuritis

Diagnosis

Dengue fever can be diagnosed using the clinical and laboratory criteria as described above *(see also further reading)*. Antigen testing or serology can be done for confirmation of diagnosis. See *Chart 7.4* for case classification.

Management of dengue fever

The case management of dengue fever includes classification of severity of infection *(Chart 7.1),* maintaining adequate intravascular volume (oral or intravascular, depending upon severity classification *(Chart 7.5, 7.6, 7.7)* and close monitoring of the vitals, platelet count and haematocrit. Platelet transfusion may be indicated in some cases as listed in *Box 7.4*. All cases of dengue fever should be reported to the local/district health authorities, as it is a notifiable disease.

Box 7.4: Dengue Fever: Indication of Platelet transfusion

- Platelet count less than 10000/cu.mm in absence of bleeding manifestations (Prophylactic platelet transfusion)
- Haemorrhage with or without thrombocytopaenia

Packed cell transfusion /fresh frozen plasma (FFP) along with platelets may be required in cases of severe bleeding with coagulopathy. Whole fresh blood transfusion doesn't have any role in managing thrombocytopaenia.

Referral centres receiving severely ill dengue patients must be able to give prompt attention to referred cases. Beds should be made available to those patients who meet the admission criteria, even if elective cases have to be deferred. If possible, there should be a designated area to cohort dengue patients, and a high-dependency unit for closer monitoring of those with shock. These units should be staffed by doctors and nurses who are trained to recognize high-risk patients and to institute appropriate treatment and monitoring. A number of criteria may be used to decide when to transfer a patient to a high dependency unit. These include:

- early presentation with shock (on days 2 or 3 of illness);
- severe plasma leakage and/or shock;
- undetectable pulse and blood pressure;

- severe bleeding;
- fluid overload;
- organ impairment (such as hepatic damage, cardiomyopathy, encephalopathy, encephalitis and other unusual complications).

Criteria for discharge:

The admitted patients who have recovered from acute dengue having no fever for at least 24 hours, normal blood pressure, adequate urine output, no respiratory distress and persistent platelet count >50,000/cu.mm should be discharged from hospital.

Outpatient treatment is summarized in Chart 7.8.

Chart 7.4: Dengue Case classification

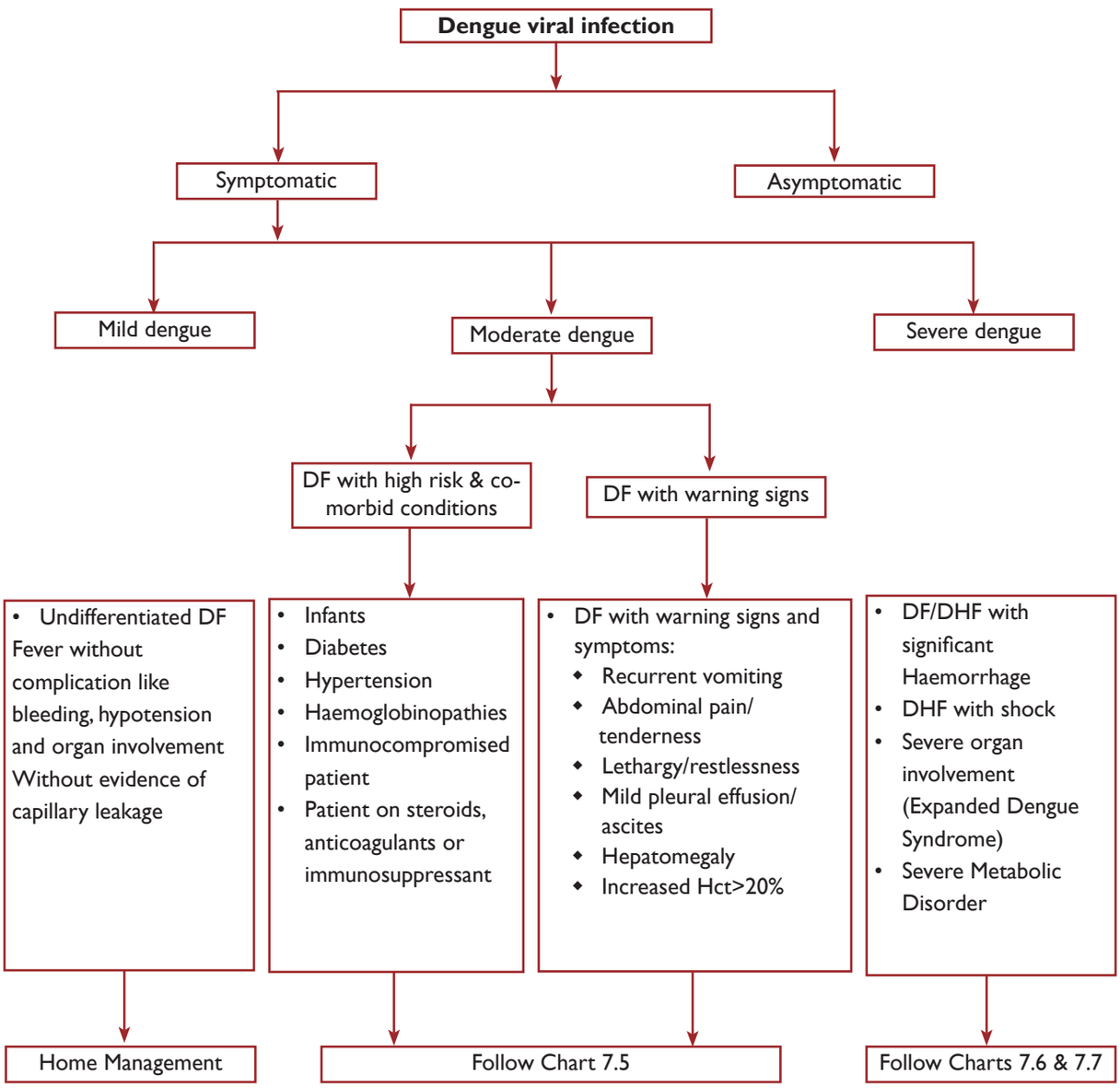
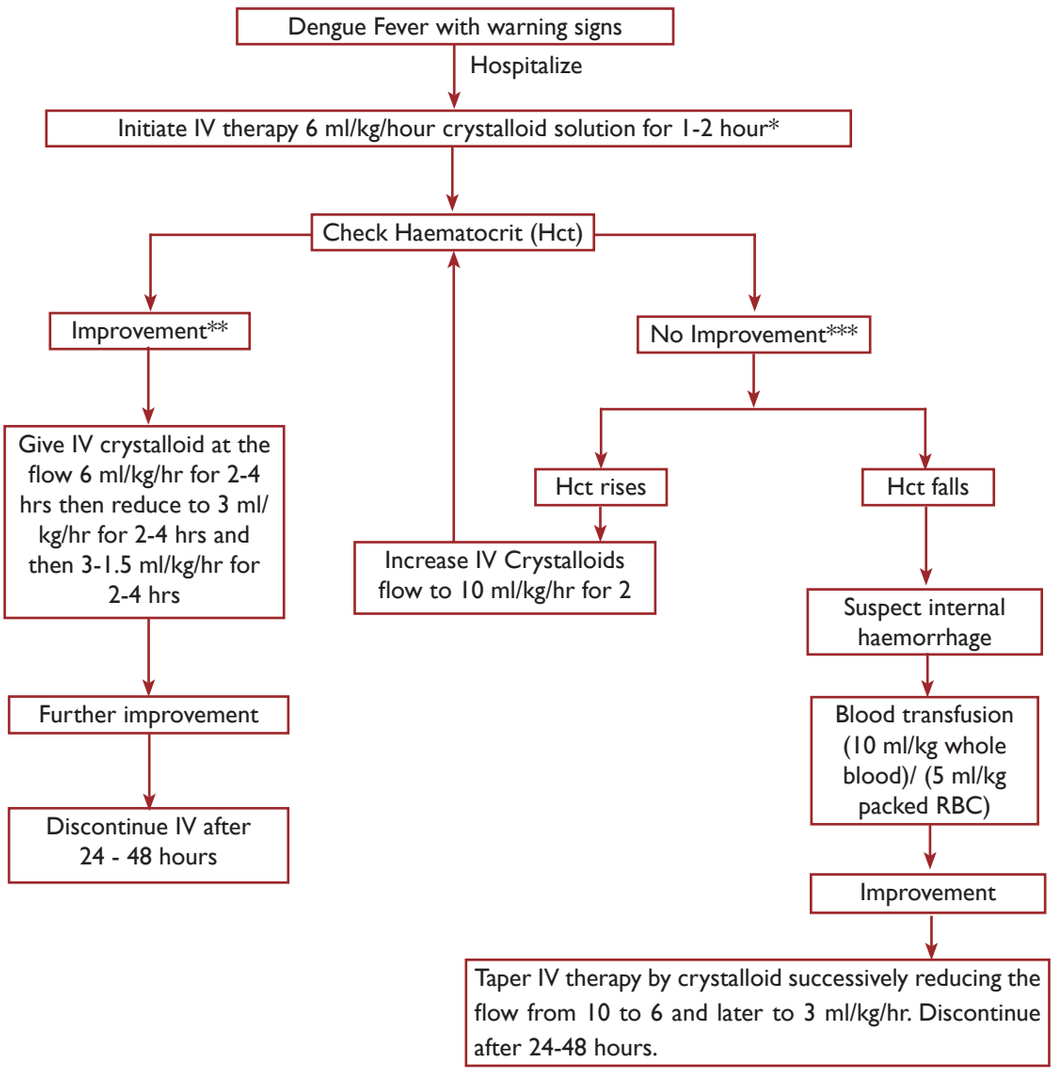


Chart 7.5: Volume replacement algorithm for patients with dengue fever with warning signs



Notes:

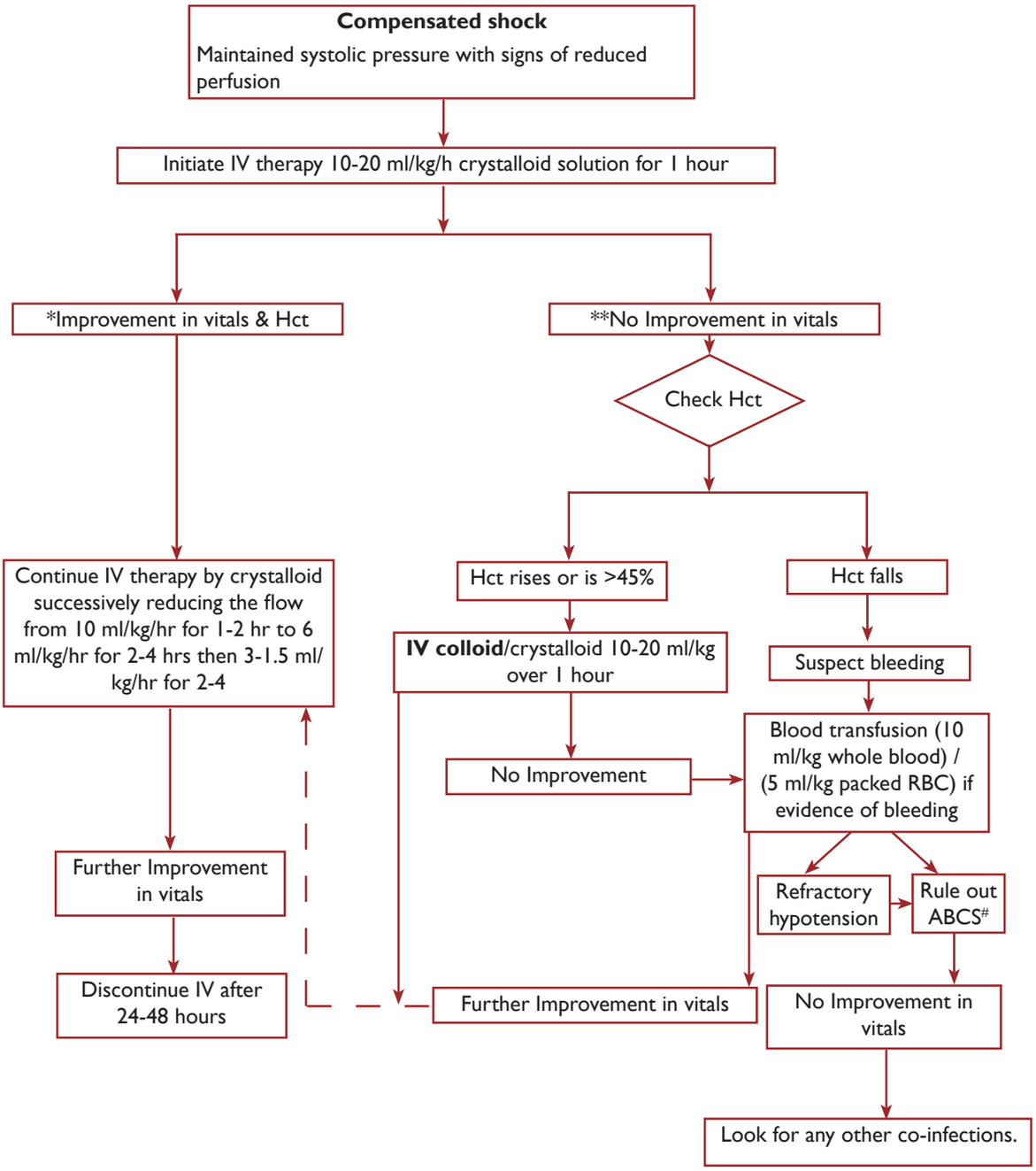
* Fluid requirement should be calculated according to lean body mass

**Improvement: Hct falls, pulse rate and blood pressure stable, urine output rises

*** No Improvement: Hct or pulse rate rises, pulse pressure falls below 20 mmHg, and urine output falls

Co-morbid conditions : If the patient has dengue with co-existing conditions but without warning signs, encourage oral fluids. If not tolerated, start intravenous fluid therapy of 0.9% saline or Ringer's lactate with or without glucose at the appropriate maintenance rate. Use the ideal body weight for calculation of fluid infusion for obese and overweight patients. Patients may be able to take oral fluids after a few hours of intravenous fluid therapy. Thus, it is necessary to revise the fluid infusion frequently. Give the minimum volume required to maintain good perfusion and urine output. Intravenous fluids are usually needed only for 24-48 hours.

Chart 7.6: Volume replacement algorithm for patients with severe Dengue Fever with compensated shock



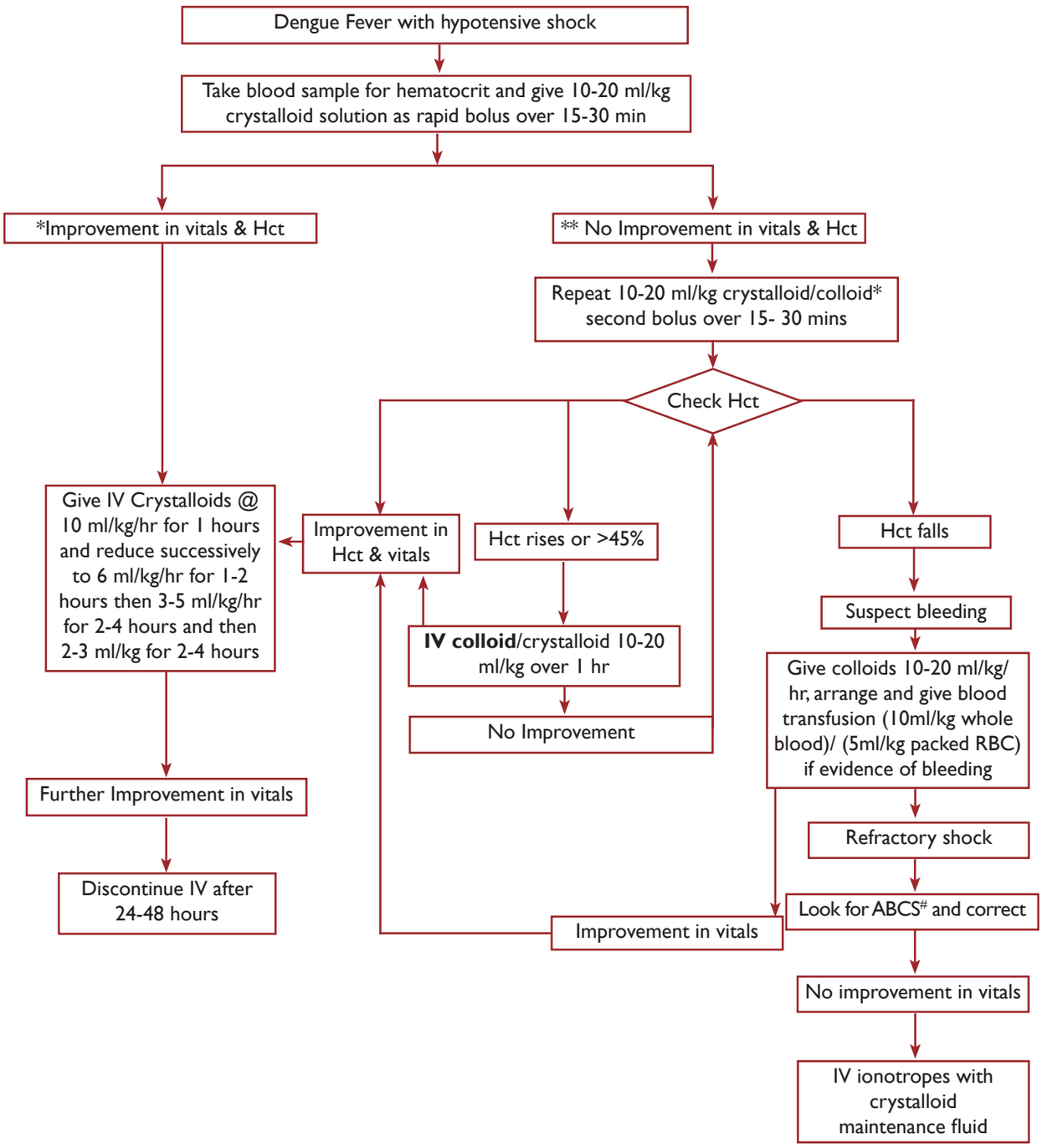
Crystalloid: Normal Saline, ringer lactate
Colloid: Dextran 40/degraded gelatine polymer (polygeline)
#ABCS = Acidosis, Bleeding, Blood sugar, Calcium, Serum sodium and potassium

Notes:

*Improvement: Hct falls, pulse rate and blood pressure stable, urine output rises
** No Improvement: Hct or pulse rate rises, pulse pressure falls below 20 mmHg, urine output falls

- Unstable vital signs: urine output falls, signs ofshock
- In cases of acidosis, Ringer's lactate solution should not be used
- Serial platelet and Hct determinations: drop in platelets and rise in Hct are essential for early diagnosis of DHF
- Cases of DHF should be observed every hour for vital signs and urine output

Chart 7.7: Volume replacement algorithm for patients with hypotensive shock (systolic BP <2 SD below normal for the age)



Crystalloid: Normal Saline, Ringer Lactate
Colloid: e.g. Hemaccel, Dextran 40/degraded gelatine polymer (polygeline)
#ABCS = Acidosis, Bleeding, Calcium (also sodium, potassium), Sugar

Notes:

* Improvement: Hct falls, pulse rate and blood pressure stable, urine output rises
** No Improvement: Hct or pulse rate rises, pulse pressure falls below 20 mmHg, urine output falls

- Unstable vital signs: urine output falls, signs of shock
- In cases of acidosis, hyperosmolar or Ringer's lactate solution should not be used
- Cases of DHF should be observed every hour for vital signs and urine output

Chart 7.8: Outpatient management & case definition for diagnosis of dengue fever

Outpatient management of dengue fever	
During the febrile phase (may last 2-7 days) and subsequent critical phase (1-2 days): • Follow CBCs • Watch for dehydration • Watch for warning signs, including decreasing platelet count and increasing haematocrit • Watch for defervescence (indicating beginning of critical phase)	
Advise patient or their family to do the following	
Control the fever • Give Acetaminophen every 6 hours (maximum 4 doses per day). • Do not give Ibuprofen, Aspirin, or Aspirin containing drugs. • Sponge patient's skin with tepid water when temperature is high.	**Prevent spread of dengue within your house** • Use bed nets for the patient as well as for others to prevent mosquito bite. • Kill all mosquitoes in house. • Empty open water containers.
Prevent dehydration: Dehydration occurs when a person loses too much fluid (from high fever, vomiting, or poor oral intake). Give plenty of fluids (not only water) and watch for signs of dehydration.	**Watch for warning signs as temperature declines 3 to 8 days after symptoms began:** Return IMMEDIATELY to clinic or emergency department if any of the warning signs appear.
Case definitions for diagnosis of dengue fever	
Probable DF/DHF: A case compatible with clinical description of dengue fever during outbreak: **OR** Non-ELISA based NS1 antigen/IgM positive. (A positive test by RDT will be considered as probable due to poor sensitivity and specificity of currently available RDTs). **Confirmed dengue fever:** A case compatible with the clinical description of dengue fever with at least one of the following: 1. Isolation of the dengue virus (virus culture +VE) from serum, plasma, leucocytes. 2. Demonstration of IgM antibody titre by ELISA positive in single serum sample. 3. Demonstration of dengue virus antigen in serum sample by NS1-ELISA. 4. IgG sero-conversion in paired sera after 2 weeks with four-fold increase of IgG titre. 5. Detection of viral nucleic acid by polymerase chain reaction (PCR).	

FURTHER READING: *Dengue Management Do's and Don'ts*

Do tell outpatients when to return: Teach them about warning signs and their timing, and the critical period that follow defervescence.

Do recognize the critical period: The critical period begins with defervescence and lasts for 24-48 hours. During this period, some patients may rapidly deteriorate.

Do closely monitor fluid intake and output, vital signs, and haematocrit levels: Ins and outs should be measured at least every shift and vitals at least every 4 hours. Haematocrit should be measured every 6-12 hours at minimum during the critical period.

Do recognize and treat early shock: Early shock (also known as compensated or normotensive shock) is characterized by narrowing pulse pressure (systolic minus diastolic BP approaching 20 mmHg), increasing heart rate, and delayed capillary refill or cold extremities.

Do administer colloids (such as albumin) for refractory shock: Patients who do not respond to 1-2 boluses of isotonic saline should be given colloids instead of more saline.

Do give Packed RBCs or whole blood for clinically significant bleeding: If haematocrit is dropping with unstable vital signs or significant bleeding is apparent, immediately transfuse blood.

Don't use corticosteroids: They are not indicated and can increase the risk of GI bleeding, hyperglycemia, and immunosuppression.

Don't give half normal (0.45%) saline: Half normal saline should not be given, even as a maintenance fluid, because it leaks into third spaces and may lead to worsening of ascites and pleural effusions.

Don't assume that IV fluids are necessary: First check if the patient can take fluids orally. Use only minimum amount of IV fluid to keep the patient well-perfused. Decrease IV fluids rate as hemodynamic status improves or urine output increases.

7.7: Scrub Typhus

Rickettsial diseases are being increasingly recognized in India. Rickettsioses, of which scrub is the commonest, have been reported from several States in India including Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Bihar, West Bengal, Meghalaya, Rajasthan, Maharashtra, Karnataka, Tamil Nadu and Kerala.

Scrub typhus is the commonest occurring rickettsial infection in India. The infection is transmitted through the larval mites or 'chiggers' belonging to the family *Trombiculidae*. Incidence of scrub typhus is higher among rural population. Cases are more likely to have exposure to rodents at home or at work, and to occupational (farming) or recreational activities which expose them to the risk of encountering chiggers sitting in grass blades, bushes and shrubs. The disease is seasonal in many parts of India, which correlates with the appearance and activity of mites.

Presenting manifestations

- Acute fever is the most common presenting symptom often associated with breathlessness, cough, nausea, vomiting, myalgia and headache.
- Eschar is an early clinical manifestation representing localized necrosis at the site of chigger bite. Eschars are painless, punched out ulcers upto 1 cm in width, with a black necrotic centre (resembling the mark of a cigarette burn), which is surrounded by an erythematous margin. Eschar is a pathognomonic sign of scrub typhus.

- Other presenting features may be headache, lymphadenopathy, multi-organ involvement like liver, lung and kidney and acute respiratory distress.
- Rash (visible in fair skinned people) is considered as hallmark of rickettsial disease, though it is neither seen at presentation nor in all patients. Presence of rash is common in spotted fever and is extremely rare in scrub typhus. Rash usually becomes apparent after 3-5 days of onset of symptoms. Initially rash is in the form of pink, blanching, discrete maculae which subsequently becomes maculopapular, petechial or haemorrhagic.

Complications

The complications of scrub typhus usually develop after the first week of illness. Jaundice, renal failure, pneumonitis, acute respiratory distress syndrome (ARDS), septic shock, myocarditis and meningoencephalitis are various complications known with this disease. In several cases, pneumonia is one of the most frequent complications of scrub typhus which manifests as a non-productive cough and breathlessness.

Untreated rickettsial infections have case fatality rates as high as 30-45 per cent with multiple organ dysfunction, if not promptly diagnosed and appropriately treated.

Investigations

1. Acute febrile illness of five days or more with or without eschar should be suspected as a case of rickettsial infection (if eschar is present, fever of less than five days duration should be considered as scrub typhus).
2. Case showing titres of 1:80 or above in OX2, OX19 and OXK antigens by Weil-Felix test and an optical density (OD) > 0.5 for IgM by ELISA is considered positive for members of typhus and spotted fever groups of Rickettsiae.
3. A confirmed case is the one in which Rickettsial DNA is detected in eschar samples or whole blood by PCR.

Supportive laboratory Investigations

- Total leucocytes count (TLC) during early course of the disease may be normal or there may be leukopenia but later in the course of the disease, leucocytosis is seen, i.e. WBC count > 11,000/µl.
- Thrombocytopenia (i.e. < 1,00,000/µl) is seen in majority of patients.
- Raised transaminase levels are also observed.
- Chest X-ray shows infiltrates, mostly bilateral.

Treatment

- Referral to secondary or tertiary centre in case of complications like ARDS, acute renal failure, meningoencephaliltis, multi-organ dysfunction. Give Doxycycline before referral.
- In fever cases of duration of five days or more where malaria, dengue and typhoid have been ruled out and scrub typhus is a possibility give Doxycycline in the dose of 4.5 mg/ kg body weight/day in two divided doses or Azithromycin10 mg/kg body weight for five days.

In complicated cases (multiorgan involvement)

Intravenous Chloramphenicol 50-100 mg/kg/day 6-hourly doses to be administered as infusion over one hour initially followed by oral therapy to complete 7-15 days of therapy.

Or

Give intravenous Doxycycline (wherever available) 2.2 mg/kg/dose twice daily if weight is less than 40 kg and 100 mg twice daily if more than 40 kg in 100 ml Normal Saline as infusion over half an hour initially followed by oral therapy to complete 7-15 days of therapy.

Or

Intravenous Azithromycin in the dose of 10 mg/kg in 100 ml Normal Saline over one hour once daily for 1-2 days followed by oral therapy to complete five days of therapy.

Management of the individual complications should be done as per the existing practices.

EXERCISE 7.1

1. 3 years old John has been brought with fever for 3 days and impaired consciousness for 6 hours and one episode of seizure on the way while coming to the hospital. He is breathing normally, is unconscious but responding to painful stimuli, extremities are warm. On arrival, you have started emergency treatment – positioning, oxygen and anticonvulsant.

   History & examination – Weight -14 kg, Temp- 39°C, Pallor ++, RR-28/min, No signs of meningeal irritation, Spleen 3 cm. His peripheral smear is positive for P. falciparum, Blood Sugar-60mg/dl, Hb - 4 gm/dl, Blood urea/ Serum Creatinine- Normal.

   a. What is likely diagnosis

   b. What other complications does John have?

   c. Write specific treatment which you will start?

   d. What supportive treatment will John need?

EXERCISE 7.2

1. 13 months old Sharad has been brought with history of fever for 2 days and impaired consciousness and one episode of seizure on the way to the hospital. He is breathing normally, unconscious but responding to painful stimuli, extremities are warm. On arrival, you have started emergency treatment –positioning, Oxygen.

   History & examination – Weight -8 Kg, Temp- 39°C, No Pallor, RR-38/min, Signs of meningeal irritation +, no splenomegaly. His peripheral smear is negative for malarial parasite, Blood Sugar- 40 mg/dl, Hb -11.5gm/dl, Blood urea/Serum Creatinine- N, CSF- 250 cells, 90% polymorphs, Protein 68mg/dl, Sugar 30mg/dl, Fundus -Normal.

   a. What is the likely diagnosis?

   b. What complications does Sharad have?

   c. Write specific treatment which you will start?

   d. What supportive treatment will Sharad need?

2. Deepak, a 4-year-old child, weighing 11 kg, was brought to the hospital emergency with history of fever and cough for 1 month, headache and vomiting for 7 days and one episode of generalised seizures followed by loss of consciousness for 2 hours. On examination, his vitals were: temperature 38°C, heart rate 80/min with good volume peripheral pulses, respiratory rate 40/min, BP 110/88 mmHg, and SpO2 98% on room air. There was intermittent stiffening and extension of all four limbs and no localisation of pain. His chest X ray showed consolidation of left lower zone. He has received intravenous antibiotics (ceftriaxone) in appropriate doses for 5 days prior to hospitalization without any clinical improvement.

   A detailed history revealed that the mother had completed a course of antitubercular therapy about 6 months back for pulmonary tuberculosis.

   a. What is the most likely diagnosis?

   b. Write the supportive and definitive treatment plan considering the above diagnosis in mind?

   c. What other investigations would you plan to confirm the diagnosis?

EXERCISE 7.3

1. A five-year-old child, weighing 20 kg is brought to hospital with history of fever, generalized rash, body ache and headache for 5 days and extreme lethargy and abdominal pain for one day. On examination, he is conscious, his temperature is 38°C, PR – 110/min, BP – 98/60 mmHg, CFT/CRT <3 sec, RR – 26/min. He has erythematous, maculo-papular rash all over body. His tourniquet test is positive

   a. What is the most likely diagnosis?

   b. What are the important investigations to confirm the diagnosis?

   c. Outline the management plan.

2. A five-year-old child weighing 25 kg is brought to hospital with history of fever, headache, bodyache and rash for 7 days. The parents reveal that the child has been excessively sleepy for last 12 hours and has coldness of hands and feet. He has not been accepting anything orally and has not passed urine for last 12 hours.

   On examination, he is drowsy and confused. His temperature is 36°C, HR-150/minute, pulse are feeble. His CBC shows HB-15.2, HCT-46, TLC-3200, platelet count-49000.

   a. What is the most likely diagnosis?

   b. Outline the initial management plant.

   After initial management with volume replacement therapy (bolus), there is no improvement in vitals. The repeat haematocrit comes to 38.

   c. What complication will you suspect and what is the next step in management?

SECTION 8: MANAGEMENT OF CHILDREN WITH ANAEMIA

Anaemia is very common in children in developing countries. Mild to moderate anaemia is a common co-morbidity in children attending health facility for various conditions.

8.0: Learning Objectives

After completion of this section the participant should be able to:

- Describe approach to a case of anaemia
- Discuss treatment of nutritional anaemia
- Enumerate indications for blood transfusion

Assess anaemia/pallor in each patient attending the health facility. Severe anaemia in a child is suggested by the presence of severe palmar pallor and may be associated with a fast pulse rate, difficulty in breathing, or confusion or restlessness. There may be additional signs of heart failure such as gallop rhythm, an enlarging liver and rarely pulmonary oedema.

8.1: Clinical Approach

Nutritional anaemia is the most common cause of anaemia in children. Nutritional anaemia results from deficiency of iron, folic acid and vitamin B12. Iron deficiency anaemia (IDA) commonly occurs in later part of infancy and preschool children particularly if they are not receiving balanced diet. Physical examination of children with IDA is usually unremarkable. They do not have significant hepatosplenomegaly or lymphadenopathy. Children having anaemia due to folic acid and/or B12 deficiency (megaloblastic anaemia) may have hyperpigmentation of knuckles and occasionally bleeding manifestations due to thrombocytopenia.

Common findings in history and physical examination, one should look for are listed in *Table 8.1*.

Table 8.1: Findings on anaemia in children

Take a history concerning	On examination, look for
• 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 • Lymph node enlargement • Previous blood transfusions • Similar illness in the family (siblings)	• Severe palmar pallor • Skin bleeds (petechial and/or purpuric spots) • Lymphadenopathy • Hepato-Splenomegaly • Signs of heart failure (gallop rhythm, raised JVP, respiratory distress, basal crepitations) • Yellowish discoloration of eyes • Sternal tenderness

8.2: Laboratory Diagnosis

- Haemoglobin<11 gm/dl in children aged 6 months - 5 years indicates anaemia.
- Complete blood counts and examination of peripheral blood smear should be done in all anaemic children.
- Blood films should be examined for malaria parasites, particularly in high malaria risk areas.
- Stool examination for ova, cyst and occult blood may be done.
- Blood counts should be performed using electronic cell counter, if available. Children with IDA will have microcytic-hypochromic anaemia. IDA will have red cell distribution width (RDW) >16%. Usually, leucocyte counts and platelet counts are normal. A high reticulocyte count indicates hemolytic anemia.
- Children with folate and/or B12 deficiency will have macrocytic anaemia. These cases may have associated leucopenia and/or thrombocytopenia. The reticulocyte count is also low. Bone marrow examination is required in presence of abnormal clinical examination and when aplastic anaemia is suspected. Such cases should be referred for specialized investigation as in these cases other causes resulting in alterations in blood counts (bi/pancytopenia) and macrocytosis need to be excluded.

8.3: Treatment

All children with IDA should be treated using oral iron 2-3 mg/kg/day (dose of elemental iron). Older children who can take tablets can be given IFA tablets. Iron therapy should be continued for a period of 8-12 weeks after normal haemoglobin level is achieved.

The children on iron therapy should be evaluated for response to treatment. Iron therapy results in prompt clinical response (return of appetite, decreased irritability). Repeat complete blood count with peripheral smear and reticulocyte count after two weeks of therapy. The reticulocyte count should increase with iron therapy. Children not responding to treatment should be evaluated for compliance to treatment and adequacy of dose and presence of infections such as UTI and chronic infections. Patients may be investigated for other causes of anaemia like haemolytic anaemia, especially in population where haemolytic anaemia is common.

For treatment of megaloblastic anaemia, due to B12 deficiency, give therapeutic dose of B12 along with iron and folic acid, for at least 3 months.

Deworming

- Worm infestations are common in India. Give deworming agents to all children more than one year with anaemia at the time of discharge.

Albendazole (tab 400 mg, syrup 400 mg/10 ml)

- 1 tab (or 10 ml) once, then every 6 months – if the child >2 years
- ½ tab (or 5 ml), once every 6 months if the child ≤ 2 years

Blood Transfusion

Indications, method and precautions are described in Section 10.

- Cases of severe anaemia with hepato-splenomegaly/splenomegaly, if malaria has been excluded or not strongly suspected (haemolytic anaemia, leukemia).
- Children with similar history in the family (haemolytic anaemia e.g. thalassemia, sickle cell anaemia).
- Cases of severe anaemia with significant lymphadenopathy, bleeding manifestations.
- Cases of severe anaemia with abnormal/immature cells or marked leucocytosis or bicytopenia or pancytopenia on smear examination (bone marrow failure).

- *Investigations in such cases should be done before blood transfusion.*
- *Iron therapy should be avoided in confirmed cases of hemolytic anaemia.*

EXERCISE 8.1

1. Karishma, a 2-year-old female child, weighing 9 kg is brought to hospital with history of increasing pallor and lethargy for two months. The mother tells that the child has become irritable, is not interested in playing and refuses to eat anything. Her feeding history revealed that the child was predominantly on milk feeds and took cereal-based feed only occasionally.

   On examination, she has severe pallor, temperature – 37°C, pulse rate 100/min, BP - 88/54 mmHg and respiratory rate 30/min. Her systemic examination is normal and haemoglobin is 3 gm/dl.

   a. What is the most likely diagnosis?

   b. What investigations will you order? Outline the initial treatment?

   c. Discuss further treatment and follow-up?

SECTION 9: ASSESSING THE NUTRITIONAL STATUS & MANAGEMENT OF CHILDREN WITH MALNUTRITION

Malnutrition remains one of the most common causes of morbidity and mortality among children. Risk of mortality in children with mild to moderate malnutrition is approximately 2.2 times higher than children with normal nutritional status. Children with severe acute malnutrition usually have 8-9 times higher risk of mortality with common infections like pneumonia, diarrhoea etc. These deaths may be prevented by early detection of growth faltering, timely intervention to prevent further deterioration of nutritional status and protocol based treatment to children with severe acute malnutrition. The high case fatality rates among severely malnourished children can be reduced by using standardized and easily implementable protocols. You have already learnt about difference of management for children with SAM right from emergency management in *Section 2.*

9.0: Learning Objectives

After completion of this section the participant should be able to:

- Describe how to assess the child's nutritional status.
- Identify children with acute malnutrition.
- Counsel mothers/caregivers of children with moderate acute malnutrition.
- Perform initial assessment of children with severe acute malnutrition.
- Provide treatment and care to children with severe acute malnutrition.

9.1: Assessment of Child's Nutritional Status

A child's growth provides important information on the adequacy of the child's nutritional status and health. Anthropometric measurements and plotting it on a growth chart is most commonly used method for determining nutritional status. WHO growth standards have been accepted by GOI for determining nutritional status of children less than 5 years. There are separate standards for boys and girls (*see Chart 9.1*).

9.1.1: Determination of nutritional status by Weight

The parameter "weight for age" reflects bodyweight in relation to age. While a single reading gives limited information about nutritional status, serial recording of weight on a 'weight for age' chart gives a good idea about the child's growth over a period of time.

Chart 9.1: WHO Growth Reference Charts

Weight for length reference card (below 87 cm)

Boy's weight					Length	Girl's weight (Kg)				
-4 SD	-3 SD	-2 SD	-1 SD	Median	(cm)	Median	-1 SD	-2 SD	-3 SD	-4 SD
1.7	1.9	2.0	2.2	2.4	**45**	2.5	2.3	2.1	1.9	1.7
1.8	2.0	2.2	2.4	2.6	**46**	2.6	2.4	2.2	2.0	1.9
2.0	2.1	2.3	2.5	2.8	**47**	2.8	2.6	2.4	2.2	2.0
2.1	2.3	2.5	2.7	2.9	**48**	3.0	2.7	2.6	2.3	2.1
2.2	2.4	2.6	2.9	3.1	**49**	3.2	2.9	2.7	2.4	2.2
2.4	2.6	2.8	3.0	3.3	**50**	3.4	3.1	2.9	2.6	2.4
2.5	2.7	3.0	3.2	3.5	**51**	3.6	3.3	3.1	2.8	2.5
2.7	2.9	3.2	3.5	3.8	**52**	3.8	3.5	3.3	2.9	2.7
2.9	3.1	3.4	3.7	4.0	**53**	4.0	3.7	3.5	3.1	2.8
3.1	3.3	3.6	3.9	4.3	**54**	4.3	3.9	3.7	3.3	3.0
3.3	3.6	3.8	4.2	4.5	**55**	4.5	4.2	3.9	3.5	3.2
3.5	3.8	4.1	4.4	4.8	**56**	4.8	4.4	4.2	3.7	3.4
3.7	4.0	4.3	4.7	5.1	**57**	5.1	4.6	4.4	3.9	3.6
3.9	4.3	4.6	5.0	5.4	**58**	5.4	4.9	4.6	4.1	3.8
4.1	4.5	4.8	5.3	5.7	**59**	5.6	5.1	4.9	4.3	3.9
4.3	4.7	5.1	5.5	6.0	**60**	5.9	5.4	5.1	4.5	4.1
4.5	4.9	5.3	5.8	6.3	**61**	6.1	5.6	5.4	4.7	4.3
4.7	5.1	5.6	6.0	6.5	**62**	6.4	5.8	5.6	4.9	4.5
4.9	5.3	5.8	6.2	6.8	**63**	6.6	6.0	5.8	5.1	4.7
5.1	5.5	6.0	6.5	7.0	**64**	6.9	6.3	6.0	5.3	4.8
5.3	5.7	6.2	6.7	7.3	**65**	7.1	6.5	6.3	5.5	5.0
5.5	5.9	6.4	6.9	7.5	**66**	7.3	6.7	6.5	5.6	5.1
5.6	6.1	6.6	7.1	7.7	**67**	7.5	6.9	6.7	5.8	5.3
5.8	6.3	6.8	7.3	8.0	**68**	7.7	7.1	6.9	6.0	5.5
6.0	6.5	7.0	7.6	8.2	**69**	8.0	7.3	7.0	6.1	5.6
6.1	6.6	7.2	7.8	8.4	**70**	8.2	7.5	7.1	6.3	5.8
6.3	6.8	7.4	8.0	8.6	**71**	8.4	7.7	7.2	6.5	5.9
6.4	7.0	7.6	8.2	8.9	**72**	8.5	7.8	7.4	6.6	6.0
6.6	7.2	7.7	8.4	9.1	**73**	8.7	8.0	7.5	6.8	6.2
6.7	7.3	7.9	8.6	9.3	**74**	8.9	8.2	7.7	6.9	6.3
6.9	7.5	8.1	8.8	9.5	**75**	9.1	8.4	7.8	7.1	6.5
7.0	7.6	8.3	8.9	9.7	**76**	9.2	8.5	8.0	7.2	6.6
7.2	7.8	8.4	9.1	9.9	**77**	9.4	8.7	8.1	7.4	6.7
7.3	7.9	8.6	9.3	10.1	**78**	9.6	8.9	8.3	7.5	6.9
7.4	8.1	8.7	9.5	10.3	**79**	9.8	9.1	8.5	7.7	7.0
7.6	8.2	8.9	9.6	10.4	**80**	10.1	9.2	8.7	7.8	7.1
7.7	8.4	9.1	9.8	10.6	**81**	10.3	9.4	8.8	8.0	7.3
7.9	8.5	9.2	10.0	10.8	**82**	10.5	9.6	9.0	8.1	7.5
8.0	8.7	9.4	10.2	11.0	**83**	10.7	9.8	9.2	8.3	7.6
8.2	8.9	9.6	10.4	11.3	**84**	11.0	10.1	9.4	8.5	7.8
8.4	9.1	9.8	10.6	11.5	**85**	11.2	10.3	9.7	8.7	8.0
8.6	9.3	10.0	10.8	11.7	**86**	11.5	10.5	9.7	8.9	8.1

Weight-for-Height reference card (87 cm and above)

Boy's weight					Height	Girl's weight (Kg)				
-4 SD	-3 SD	-2 SD	-1 SD	Median	(cm)	Median	-1 SD	-2 SD	-3 SD	-4 SD
8.9	9.6	10.4	11.2	12.2	**87**	11.9	10.9	10.0	9.2	8.4
9.1	9.8	10.6	11.5	12.4	**88**	12.1	11.1	10.2	9.4	8.6
9.3	10.0	10.8	11.7	12.6	**89**	12.4	11.4	10.4	9.6	8.8
9.4	10.2	11.0	11.9	12.9	**90**	12.6	11.6	10.6	9.8	9.0
9.6	10.4	11.2	12.1	13.1	**91**	12.9	11.8	10.9	10.0	9.1
9.8	10.6	11.4	12.3	13.4	**92**	13.1	12.0	11.1	10.2	9.3
9.9	10.8	11.6	12.6	13.6	**93**	13.4	12.3	11.3	10.4	9.5
10.1	11.0	11.8	12.8	13.8	**94**	13.6	12.5	11.5	10.6	9.7
10.3	11.1	12.0	13.0	14.1	**95**	13.9	12.7	11.7	10.8	9.8
10.4	11.3	12.2	13.2	14.3	**96**	14.1	12.9	11.9	10.9	10.0
10.6	11.5	12.4	13.4	14.6	**97**	14.4	13.2	12.1	11.1	10.2
10.8	11.7	12.6	13.7	14.8	**98**	14.7	13.4	12.3	11.3	10.4
11.0	11.9	12.9	13.9	15.1	**99**	14.9	13.7	12.5	11.5	10.5
11.2	12.1	13.1	14.2	15.4	**100**	15.2	13.9	12.8	11.7	10.7
11.3	12.3	13.3	14.4	15.6	**101**	15.5	14.2	13.0	12.0	10.9
11.5	12.5	13.6	14.7	15.9	**102**	15.8	14.5	13.3	12.2	11.1
11.7	12.8	13.8	14.9	16.2	**103**	16.1	14.7	13.5	12.4	11.3
11.9	13.0	14.0	15.2	16.5	**104**	16.4	15.0	13.8	12.6	11.5
12.1	13.2	14.3	15.5	16.8	**105**	16.8	15.3	14.0	12.9	11.8
12.3	13.4	14.5	15.8	17.2	**106**	17.1	15.6	14.3	13.1	12.0
12.5	13.7	14.8	16.1	17.5	**107**	17.5	15.9	14.6	13.4	12.2
12.7	13.9	15.1	16.4	17.8	**108**	17.8	16.3	14.9	13.7	12.4
12.9	14.1	15.3	16.7	18.2	**109**	18.2	16.6	15.2	13.9	12.7
13.2	14.4	15.6	17.0	18.5	**110**	18.6	17.0	15.5	14.2	12.9
13.4	14.6	15.9	17.3	18.9	**111**	19.0	17.3	15.8	14.5	13.2
13.6	14.9	16.2	17.6	19.2	**112**	19.4	17.7	16.2	14.8	13.5
13.8	15.2	16.5	18.0	19.6	**113**	19.8	18.0	16.5	15.1	13.7
14.1	15.4	16.8	18.3	20.0	**114**	20.2	18.4	16.8	15.4	14.0
14.3	15.7	17.1	18.6	20.4	**115**	20.7	18.8	17.2	15.7	14.3
14.6	16.0	17.4	19.0	20.8	**116**	21.1	19.2	17.5	16.0	14.5
14.8	16.2	17.7	19.3	21.2	**117**	21.5	19.6	17.8	16.3	14.8
15.0	16.5	18.0	19.7	21.6	**118**	22.0	19.9	18.2	16.6	15.1
15.3	16.8	18.3	20.0	22.0	**119**	22.4	20.3	18.5	16.9	15.4
15.5	17.1	18.6	20.4	22.4	**120**	22.8	20.7	18.9	17.3	15.6

9.1.2 How to plot weight on the Growth Chart?

Select the appropriate Growth Chart i.e. weight for age, weight for height/ length based on the child's sex. Growth measurements will be plotted on the selected charts.

How to interpret plotted Weight?

Figure 9.1: Plotting weight on Growth Chart

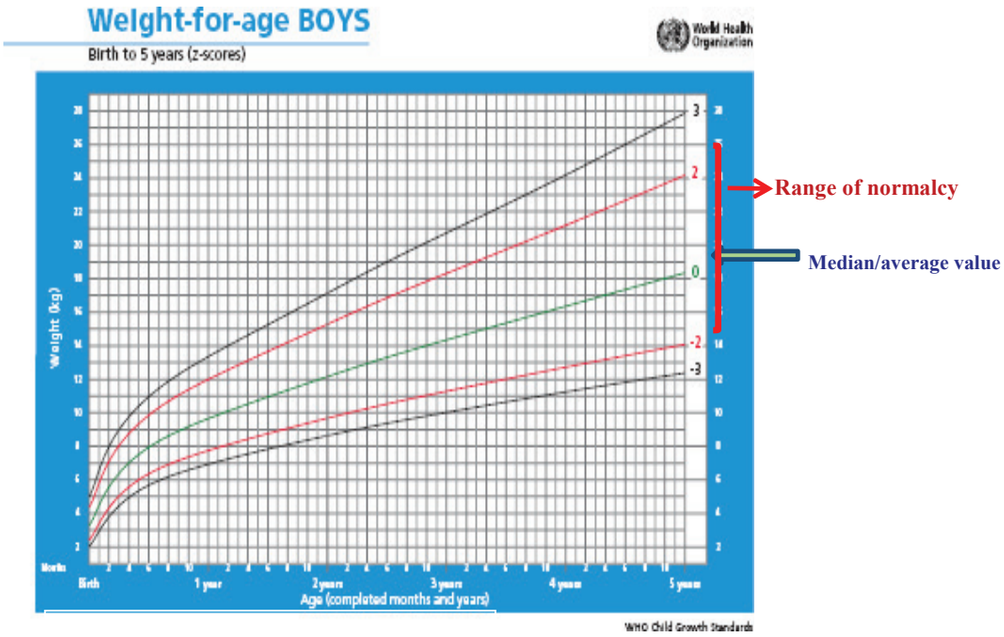


Figure 9.2: Interpretation of Growth Chart

If a child has been weighed only once, the information does not say much about the child's growth, but only about the child's body weight relative to the standard for his or her age *(Figure 9.1)*. When the child is followed up and weighed again, the situation may become clearer. Some infants are constitutionally small, and others are born with low birth weight due to prematurity or intrauterine growth restriction. These children may have low weight-for-age, but they may grow satisfactorily following the lowest standard curve *(Figure 9.3)*

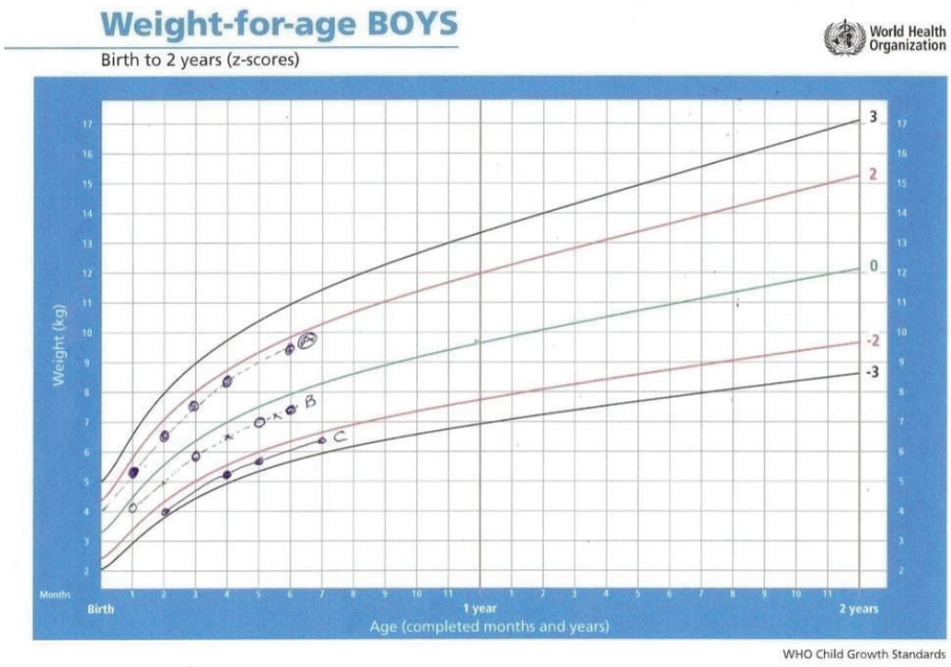
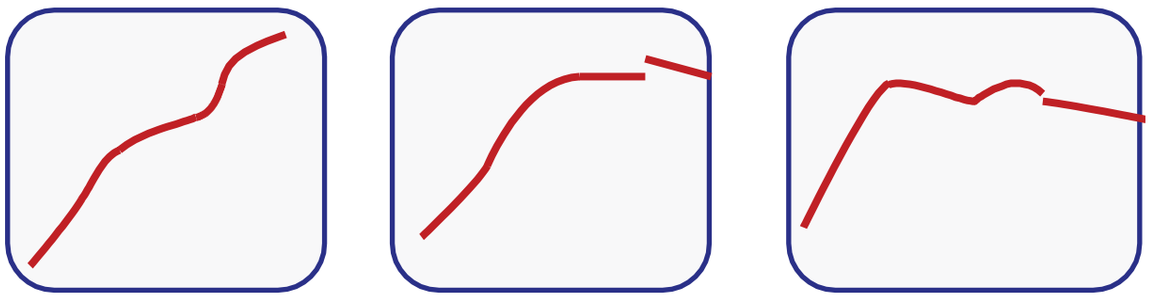


Figure 9.3: Serial recording of weight on growth chart

In a child growing normally, a serial recording of these parameters in a growth chart over time should yield a curve parallel to one of the standard growth curves on the growth chart. When the child's growth parameters falter, serial recordings on a growth chart will no longer be parallel to the standard growth curves (Figure 9.4)



Growing well: encourage mother to feed as before

Growth curve flattening: urgent assessment needed

Losing weight: urgent assessment needed

Figure 9.4: Various patterns observed on serial plotting on Weight for Age Chart

If a child's weight is not increasing, or if it is increasing more slowly than the standard curve for more than 1 month in babies less than 4 months of age, or for 2 months in older children, then the child has growth faltering.

Growth faltering is common in the first 2 years of life, and may be the first sign of inadequate feeding in an otherwise healthy child. *Weight for age* chart should be maintained for every child by serial weight monitoring till 5 years of age. Beyond that, BMI for age chart may be maintained.

Most common reason for growth faltering is inappropriate feeding practices. Timely recognition and counselling by skilled health staff will improve their nutritional status. If a child's growth curve is falling in spite of optimal feeding, the child may be ill with an undiagnosed infection. Children who are losing weight need a full medical assessment. Close follow-up is needed to ensure that weight gain is achieved within two weeks. Any sharp increase in a child's growth also requires attention.

9.1.3 Mother and Child Protection Card

The Mother and Child Protection Card is a maternal and child care entitlement card introduced jointly by Ministry of Health and Family Welfare and Ministry of Women and Child Development. It is unique in linking maternal, newborn and child care and focuses on the child holistically by integrating health, nutrition and development. It is meant to promote key family care behaviours, highlights danger signs, and link families to the health referral system. It includes separate growth charts (weight-for-age) for girls and boys from 0-3 years. The card includes information and key messages for promoting optimal infant and young child feeding also.

9.1.4 Classification of nutritional status with combined use of Weight & Length

Low weight for age may result from nutritional deficiencies of acute or chronic in nature. This differentiation is important for management purposes. For differentiating between acute and chronic malnutrition we need to measure other parameters like length/height, mid upper arm circumference (MUAC) etc.

For grading nutritional status, we need to calculate SD score of indices like weight for age, weight for height, height for age etc.

9.1.4a: What is an SD-score/Z score?

SD-score is a way of comparing a measurement (in this case a child's weight-for-length), to an "average". The "averages" used here are WHO Growth Reference values for weight-for-height and weight-for-length. A table is given in the Chart *9.1*, that shows the SD-scores for children of different weights and heights. Although, SD-scores generally are not comparable to percentage of the median, the SD-score (W/H) may be loosely interpreted as follows:

- -1 SD approximately corresponds to 90% of the median weight-for-height.
- -2 SD approximately corresponds to 80% of the median weight-for-height.
- -3 SD approximately corresponds to 70% of the median weight-for-height.

9.1.4b: How to determine SD score for Weight for Length/ Height SD score?

- First, find the child's length or height in the middle of the W/H SD score table *(see Chart 9.1)*.
- Look at the top of the column to see what the child's SD-score is. The child's weight may be between two SD-scores. If so, indicate that the weight is between these scores by writing less than (<). For example, if the score is between -1 SD and -2 SD, write < -1SD.
- Refer to the reference table for "weight for length". Remember to use left side for male gender and right for female. There are separate charts for children less than 87 cm and more than 87 cm *(Chart 9.1)*.

Example: a boy is 63 cm in length and weighs 6.5 kg.

- Take the table, look in the length column and look for the figure 63cm.
- Take a ruler or a piece of card; place it under the figure 63 cm in the chart and the other figures on the same line. On this line find the figure corresponding to the weight of the boy, in this case 6.5. Look to see what column this figure is in. In this case it is in the MEDIAN WEIGHT column. In this example the child's weight is normal in relation to his LENGTH. He therefore has an appropriate weight for his length.

Example: A girl is 78 cm tall and weighs 8.1 kg

This child's weight is between the column -2 & -3 Z-score. Her weight for length is < -2SD.

NOTE: It may be that the weight or the height is not a whole number.

Example: A boy is 80.4 cm tall and weight 7.9 kg. 80.4cm is not in the table.

For the height/length: If the length or height is between those listed, round up or down as follows: If the length/height is 0.5 or more cm greater than the next lower length/height, round up. Otherwise, round down as it is in the following example.

For the weight: Looking at the table, for a length of 80 cm if the weight is 7.9 kg., so it will be interpreted as <-3SD.

By using anthropometric indices (weight/age, length or height /age, weight/length/ height) nutritional status may be graded in following four categories *(Chart 9.1)*

- Normal
- Underweight
- Wasting
- Stunting

As shown in *Figure 9.5,* low weight for age (underweight) may result from malnutrition of acute onset (wasting) or chronic in nature (stunting). To determine whether it is acute or chronic, we need to use other parameters /indices like weight for height and length/height for age.

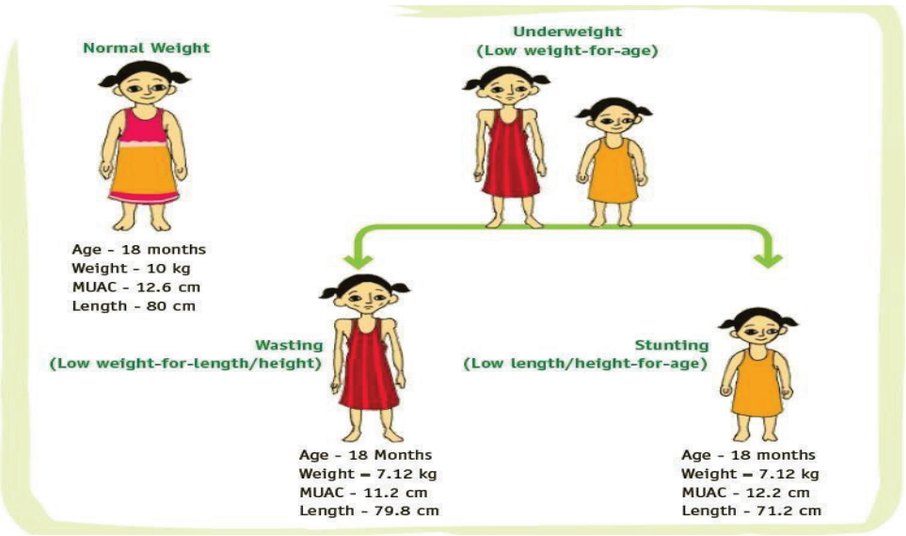


Figure 9.5: Classification of Nutritional Status

Chart 9.2: WHO classification of nutritional status & identification of acute malnutrition (wasting)

WHO classification of nutritional status			
SD score	**Growth Indicator**		
	Height/Length-for-age	**Weight-for-age**	**Weight-for-height/length**
+2SD to -2 SD	Normal	Normal	Normal
< -2 SD to -3 SD	Stunted	Underweight	Wasted or Moderate acute malnutrition
< -3 SD	Severely Stunted	Severely Underweight	Severely wasted or Severe acute malnutrition
Identification of acute malnutrition (wasting)			
Moderate Acute Malnutrition • Weight-for-height between -2SD and-3SD **AND /OR** • Mid upper arm circumference (MUAC) 11.5 to 12.4cm **AND** • No Oedema			
Severe Acute Malnutrition			
For infants aged <6 months • Weight for length is <-3 SD score of median of WHO child growth standards***AND/OR** • Bilateral pitting pedal oedema **		**For children aged 6-59 months** • Weight for length/height is <-3 SD score of median of WHO child growth standards **AND/OR** • MUAC<11.5 cm **AND/OR** • Bilateral pitting pedal oedema **	

**Use visible severe wasting in emergency settings, if measurements not possible and for children who has length <45 cms*

*** No other cause of oedema e.g. nephrotic syndrome, CHF etc.*

9.2: IDENTIFICATION OF CHILDREN WITH ACUTE MALNUTRITION (WASTING)

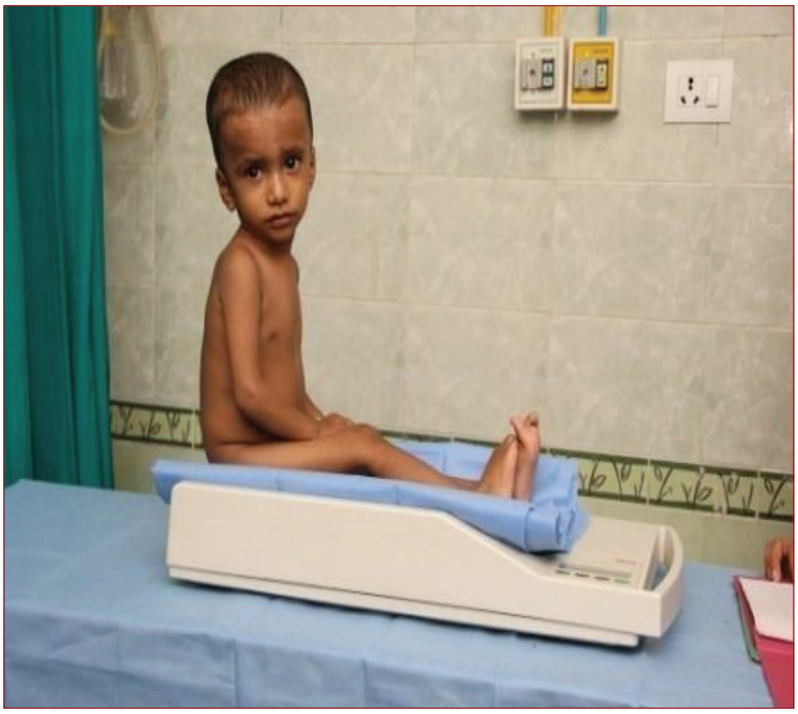
(Chart 9.2)

Children with acute malnutrition have higher risk of death due to physiological changes in the body also known as reductive adaptation. They need different management protocol and follow-up plans.

You can identify children with acute malnutrition by calculating weight for length/height SD score, measuring mid upper arm circumference (MUAC), and by looking for bilateral pitting oedema. Method of measuring weight, length, height and MUAC is described in *Chart 9.3*.

Chart 9.3: Method of measuring weight, length, height & MUAC

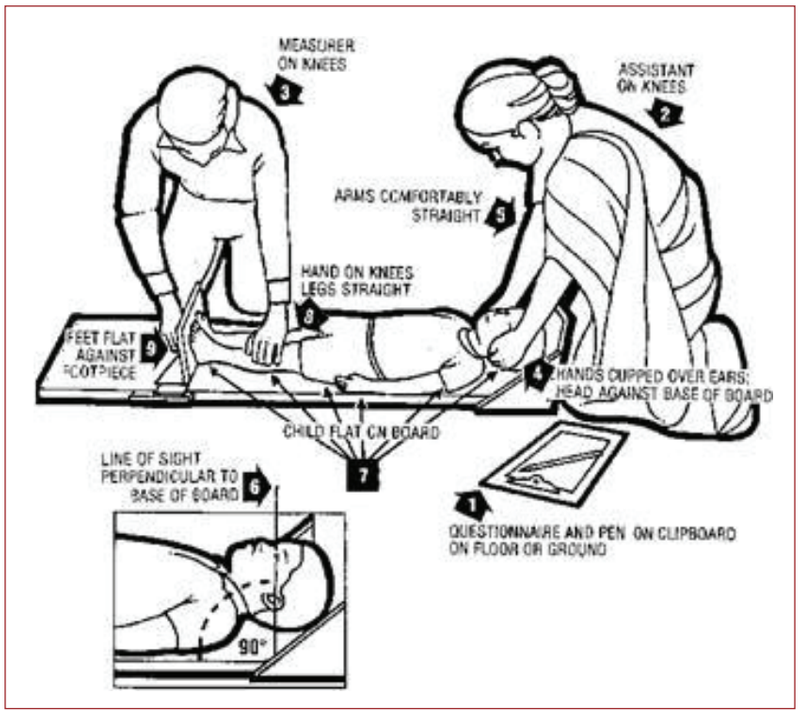
Figure 9.6 (a): Measuring Weight



Key Points to Remember

- Remove the child's clothes, shoes, socks & hair braids, & ornaments to minimum as per weather conditions.
- Cover in a blanket or woollen shawl while carrying to the scale.
- Put a paper / cloth on the pan
- Set the weighing scale to zero before putting the child on thepan
- Place the child on the pan, wait for child to settle and weight to stabilize
- Allow mother/caregiver to stand near weighing scale & make the baby calm.
- Measure weight in gm & enter in the recording Performa immediately.
- Repeat the measurement & record.
- In case the difference of two measurements is more than 10 g, take third measurement and take the average of two nearest measurements.

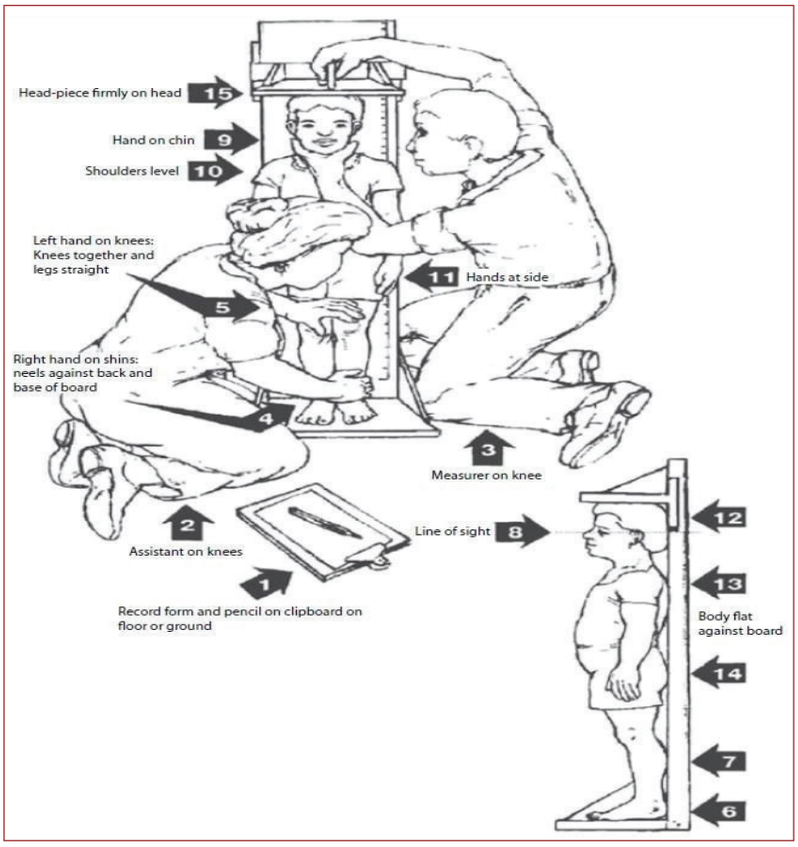
Figure 9.6 (b): Measuring Length



Key Points to Remember

- Length is measured using a special device known as an infantometer which has a headboard and sliding foot piece. Lay the measuring board flat, on a stable, level table
- One person should stand or kneel behind the headboard and position the child lying on his back on the measuring board, supporting the head and placing it against the headboard.
- The other person should stand alongside the measuring board and support the child's trunk as the child is positioned on the board.
- Position the crown of the head against the headboard, compressing the hair (Remove hair braids).
- Hold the head with two hands and tilt upwards until the eyes look straight up, and the line of sight is perpendicular to the measuring board.
- Check that the child lies straight along the centre line of the measuring board and does not change position
- Measure length to the last completed 0.1 cm and record immediately on the case recording form.

Figure 9.6 (c): Measuring Height

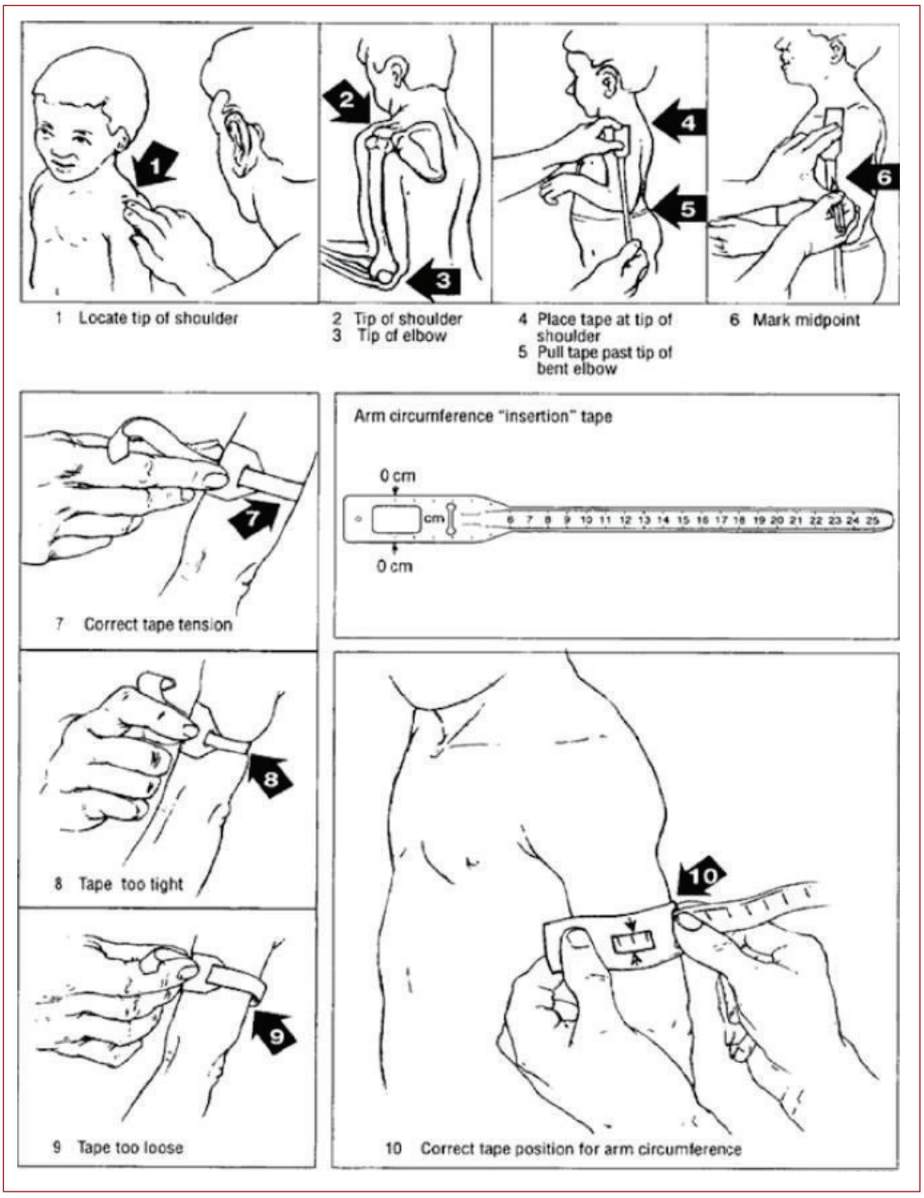


Key Points to Remember

- One person should kneel or crouch near the child's feet and help the child stand with back of the head, shoulder blades, buttocks, calves and heels touching the vertical board.
- Hold the child's knees and ankles to keep the legs straight and feet flat.
- Prevent children from standing on their toes.
- Young children may have difficulty standing to full height. If necessary, gently push the child's tummy to help him stand straight to full height.
- The other person should bend to the level of the child's face and position the head so that the child is looking straight ahead (line of sight is parallel to the base of the board).
- Place thumb and forefinger over the child's chin to help keep the head in an upright position.
- With the other hand, pull down the head board to rest firmly on top of the head and compress hair.
- Measure height to the last completed 0.1 cm and record it immediately on the case recording sheet.

- If a child is less than 2 years old (or less than 87 cm if the age is not available), measure recumbent length.
- If the child is aged 2 years or older (or 87 cm or more if the age is not available) and able to stand, measure standing height.
- If a child less than 2 years old will not lie down for measurement of length, measure standing height and add 0.7 cm to convert it to length. If a child aged 2 years or older cannot stand, measure recumbent length and subtract 0.7 cm to convert it to height.

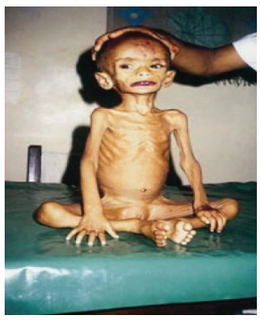
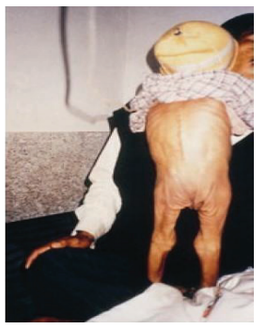
Figure 9.6 (d): Measuring Mid Upper Arm Circumference



If using a 3-colour MUAC tape

Color Zones	MUAC Measurement	Nutritional Status
Green	≥ 12.5 cm	No acute malnutrition
Yellow	11.5 cm to 12.4 cm	Moderate acute malnutrition
Red	<11.5 cm	Severe acute malnutrition

9.2.1 How to check for wasting/severe wasting?

Look at the front view of the child and decide: Is the outline of the child's ribs easily seen? Does the skin of the upper arms look loose? Does the skin of the thighs look loose?	
Look at the back of the child and decide: Are the ribs, shoulder bones and spine easily seen? Is there any wasting seen on buttocks?	

9.2.2 How to check for bilateral pitting oedema?

Oedema in a child with SAM starts from the dependent part i.e. feet in a mobile child. As the severity of oedema increases, it extends to the legs. In severe cases, it may also be seen on upper limbs and face (anasarca).

To check for oedema, grasp both feet so that they rest in your hands with one thumb on top of each foot. Press your thumbs gently for more than three seconds. Child has bilateral pitting oedema if pit (dents) remains in both feet when you lift your thumbs see *Figure 9.6*.

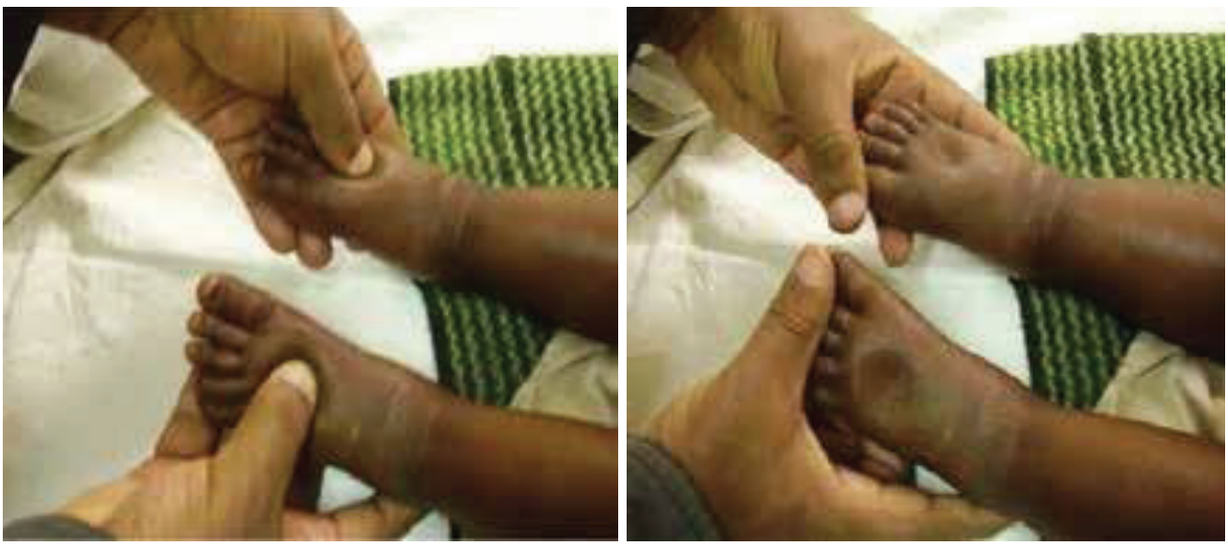


Figure 9.6: Checking for pedal oedema

9.3: HOW TO MANAGE CHILDREN WITH MODERATE ACUTE MALNUTRITION?

All children with moderate acute malnutrition should be assessed for their feeding practices and underlying medical conditions. Counsel mothers/caregivers so that they can give feeds in adequate amount, frequency which has adequate energy density and are hygienic. Counsel mothers for food diversity and active feeding. Advice follow-up after 15 days.

If any underlying medical condition is identified (cleft palate, congenital heart disease, infections etc), they should be treated or referred to higher centre. If no underlying medical conditions are identified, you should counsel mothers for giving appropriate feeds for the age.

9.4: ASSESSMENT OF CHILDREN WITH SEVERE ACUTE MALNUTRITION

A good history and physical examination is required for treatment. Important history and examination points are summarized in *Table 9.1*.

A child with severe acute malnutrition, without medical complications and with good appetite may be managed in community based management programme, if available. If community based management is not available, admit all children with severe acute malnutrition in health care facility/ Nutrition Rehabilitation Centre/ SAM treatment unit.

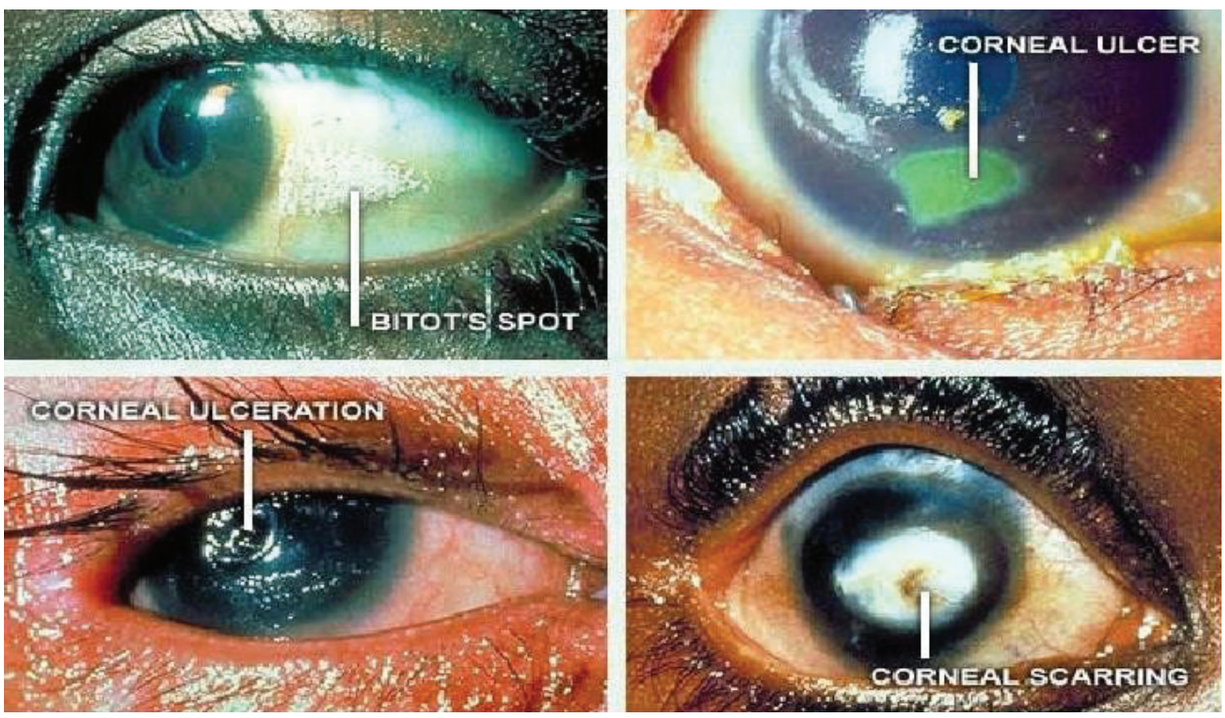


Figure 9.7: Vitamin A deficiency signs

Note: Child with vitamin A deficiency is likely to be photophobic and will keep the eyes closed. It is important to examine the eyes very gently to prevent corneal rupture

Table 9.1: History & Examination in severe acute malnutrition

Take a history concerning	On examination, look for:
• Duration of sickness • Recent intake of food and fluids • Usual diet (before the current illness) • Breastfeeding • Complementary feeds- introduction time, quality, quantity • Duration and frequency of complaints if any: diarrhoea (watery/bloody), vomiting (number), fever, cough • Loss of appetite • Contact with open case of tuberculosis • History of measles in last 3 months • Known or suspected HIV infection • Immunization status • Health of parents • Family circumstances (to understand the child's social background)	• Look for emergency signs • Anthropometry- weight, height or length, mid-upper arm circumference • Baseline pulse, heart rate, respiratory rate • Sensorium • Oedema • Lymphadenopathy • Signs of dehydration, if history of diarrhoea (general condition, sunken eyes, skin pinch and thirst) • Signs of shock (cold hands, slow capillary refill, weak and fast pulse) • Palmar pallor • Eye signs of vitamin A deficiency *(Figure 9.7):* - Dry conjunctiva or cornea, - Bitot's spots - Corneal ulceration - Keratomalacia • Localizing signs of infection, including ear and throat infections, skin infection or pneumonia • Fever (temperature >37.5°C/ 99.5°F) • Hypothermia (axillary temperature <35°C/95°F) • Mouth ulcers/ Oral thrush • Skin changes *(Figure 9.8)* - Hypo or hyperpigmentation - Desquamation - Ulceration (spreading over limbs, thighs, genitalia, groin, and behind the ears) • Systemic examination- hepatosplenomegaly, any murmur or deformities, hypertonia (cerebral palsy) • Signs of meningeal irritation • Exudative lesions (resembling severe burns) often with secondary infection (including Candida).

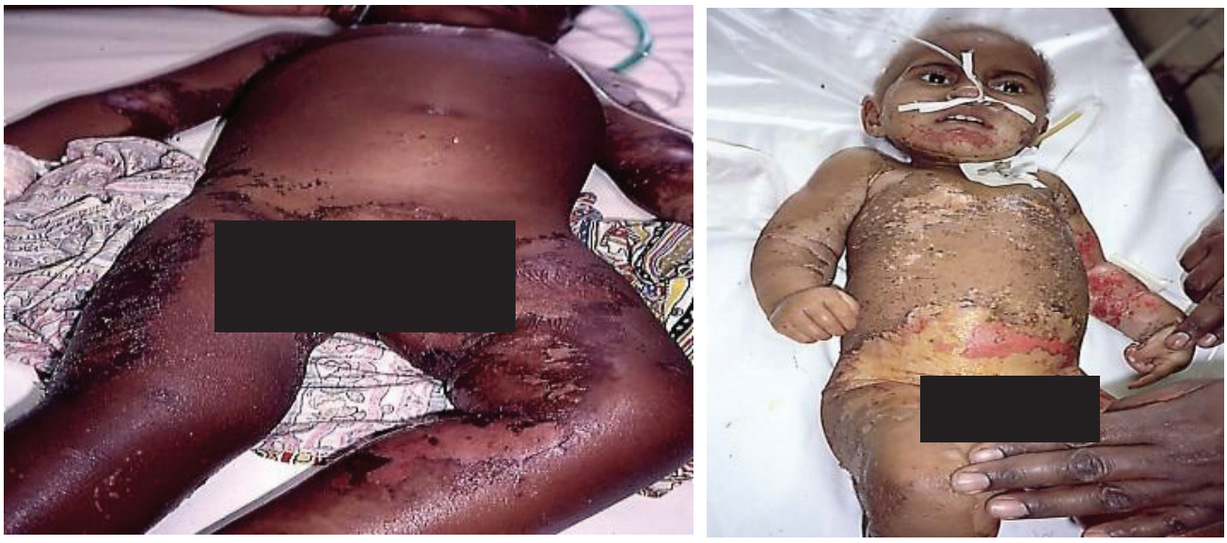


Figure 9.8: Skin changes in oedematous severe acute malnutrition.

9.4.1: Laboratory Tests

- Blood glucose-
  - At admission
  - During stabilization, if child is hypothermic or lethargic
- Haemoglobin or packed cell volume in all children
  - Peripheral smear if child has anaemia/palmar pallor
- Serum electrolytes e.g. sodium, potassium, and calcium whenever possible
- Screening for infections: - Children with SAM often harbour occult infections. Screen for common infections by following investigations
  - Total and differential leukocyte count, blood culture
  - Urine routine & microscopy
  - Urine culture
  - Chest x-ray
  - Blood smear for Malaria; if febrile

Additional investigations depending on clinical situation and availability of Investigations

- Screening for HIV (when suspected based on history and clinical signs/ symptoms (recurrent infections, presence of oral thrush, lymphadenopathy, unexplained death of parents, persistent diarrhoea, parotid enlargement) and tuberculosis if chest x-ray is showing opacities or history of contact is present.
- Any other specific test required based on geographical location or clinical presentation e.g. Celiac disease

9.4.2 Organization of care

On admission, the child with severe acute malnutrition should be separated from other children who have infectious diseases. and kept in a warm area (25-30°C, with no draughts), and constantly monitored. Facilities for therapeutic feed preparations, and accurate weighing are needed (Chart 9.4).

Chart 9.4: Therapeutic Diet Preparation

F-75 Starter diets:

Contents (Per 100 ml)	Starter (F-75) diet Amount for 100ml	Starter (F-75) diet (Cereal Based) Amount for 100ml
Milk (ml) (Cow's milk/ toned milk)	30	30
Sugar (g)	10	7
Vegetable oil (g)	2	2
Puffed Rice (Murmura) (g)	-	3.5
Water to make (ml)	100	100
Energy (kcal/100 mL)	75	75
Protein (g/100 mL)	0.9	1.1
Lactose (g/100 mL)	1.2	1.2

**Adapted from IAP Guidelines 2006*

***Powdered puffed rice may be replaced by commercial pre-cooked rice preparations (in same amounts)*

*******Important note about adding water****: Add just the amount of water needed to make 100 ml of formula. Do not simply add 100 ml of water, as this will make the formula too dilute. A mark for 100 ml should be made on the mixing container for the formula, so that water can be added to the other ingredients up to this mark.*

F-100 Catch-up diets:

Contents (Per 100 ml)	Catch-up (F-100) diet Amount for 100ml	Catch-up (F-100) diet (Cereal Based) Amount for 100ml
Milk (ml) (Cow's milk/ toned milk)	90	75
Sugar (g)	7.5	2.5
Vegetable oil (g)	2	2
Puffed Rice (Murmura) (g)	-	7
Water to make (ml)	100	100
Energy (kcal/100 mL)	100	100
Protein (g/100 mL)	2.9	2.9
Lactose (g/100 mL)	4.2	3

**Adapted from IAP Guidelines 2006*

***Powdered puffed rice may be replaced by commercial pre-cooked rice preparations (in same amounts)*

*******Important note about adding water:*** *Add just the amount of water needed to make 100 ml of formula. Do not simply add 100 ml of water, as this will make the formula too dilute. A mark for 100 ml should be made on the mixing container for the formula, so that water can be added to the other ingredients up to this mark.*

The catch-up cereal based low lactose (lower osmolarity) diets are recommended for those with persistent diarrhoea.

How to prepare the feed:

- Wash hands before measuring ingredients
- Mix sugar and oil, then add the fresh milk. Add boiled, cooled water up to 100 ml, stirring all the time. Whisk vigorously so that oil does not separate out. If using milk powder, mix milk and sugar in a jug, then add oil and stir to make a paste. Add cooled boiled water to the 100 ml mark.
- Milk cereal diets do need cooking. Mix the rice flour, milk or milk powder, sugar, oil in a measuring jug. Slowly add cooled, boiled water up to 100 ml. Transfer to cooking pot and whisk the mixture vigorously. Boil gently for 4 min, stirring continuously. Some water will evaporate, so transfer the mixture to a measuring jug and add enough water to make 100 ml. Cooking can be avoided if you use puffed rice powder or commercial pre-cooked rice preparation as cereal flour. The above charts give the composition for 100 ml diet. Prepared diet may be kept at room temperature for 2 hours or 12 hours wherever there is a facility for refrigeration.
- The initial cereal based low lactose (low osmolarity) diet is recommended for those with persistent diarrhoea.

9.5: PROVIDING GENERAL TREATMENT FOR MALNUTRITION

There are 10 essential steps in two phases: an initial stabilization phase and a longer rehabilitation phase (*Chart 9.5*). Majority of SAM children are successfully managed using these ten steps.

Chart 9.5: Ten Steps of management of SAM children

S.no	Steps	Stabilization Phase		Rehabilitation Phase
		Days 1-2	Days 3-7	Weeks 2-6
1.	Treat/Prevent Hypoglycemia	→		
2.	Treat/Prevent Hypothermia	→		
3.	Treat/Prevent Dehydration	→		
4.	Correct Electrolyte Imbalance	→	→	→
5.	Treat/Prevent Infection	→	→	
6.	Correct micro-nutrient deficiencies	→	→	→
	Iron supplementation	No iron →	→	Iron →
7.	Start Cautious Feeding	→	→	
8.	Achieve Catch-up Growth			→
9.	Provide Sensory Stimulation and Emotional Support	→	→	→
10.	Prepare for Follow up			→

During management, remember the following broad principles:

- Do not give I/V fluids routinely.
- Do not give diuretics or albumin to treat oedema.
- Do not give high protein formula.
- Do not give iron during the stabilization phase.

9.5.1 Hypoglycaemia

All severely malnourished children are at risk of developing hypoglycemia (blood glucose <54 mg/dl) which is an important cause of death. Measure blood sugar on admission and subsequently in children who become lethargic. If the blood glucose cannot be measured, assume hypoglycemia.

9.5.2a Treat & prevent hypoglycemia

- If the child is lethargic, unconscious, or convulsing, give IV 10% glucose 5 ml/kg followed by 50 ml of 10% glucose or sucrose by NG tube.
- If not lethargic, unconscious, or convulsing, give the first feed of F-75/Starter diet. If the first feed is not quickly available give 50 ml of 10% glucose or sugar solution (4 rounded teaspoon of sugar in 200 ml or one cup of water) orally or by nasogastric tube, followed by the first feed as soon as possible.
- Give 2-hourly feeds, day and night, at least for the first day.
- Give appropriate antibiotics.
- Keep the baby warm and check temperature 8 hourly.

9.5.2b Monitoring

- If the initial blood glucose was low, repeat the measurement after 30 minutes.
- If glucose is again <54 mg/dl, repeat the 10% glucose or sugar solution.

9.5.3 Hypothermia

If the axillary temperature is <35°C (<95°F) or does not register on a normal thermometer, assume hypothermia. Treat all hypothermic children for hypoglycaemia and for infection as well.

9.5.3a Maintain warm room

- Place the bed in a warm, draught-free part of the ward and keep the child covered.
- Change wet nappies, clothes and bedding to keep the child and the bed dry.
- Avoid exposing the child to cold (e.g. after bathing, or during medical examinations).

9.5.3b Treat hypothermia

- Make sure the child is clothed (including the head). Cover with a warmed blanket and place a heater (not pointing directly towards child) or put the child on the mother's bare chest or abdomen (skin-to-skin) and cover mother –baby pair with a blanket.
- Take the child's temperature 2-hourly until it rises to more than 36.5°C. Take it half- hourly if a heater is being used.
- Check for hypoglycemia whenever hypothermia is found.
- Give 2 hourly feed through the night till the time temperature is stable.

9.5.4 Dehydration

9.5.4a Recognize dehydration

Correct estimation of dehydration is difficult in severely malnourished children. Many of the signs that are normally used to assess dehydration are unreliable in a child with severe acute malnutrition. A severely malnourished child is usually apathetic when left alone and irritable when handled. In severely malnourished child, the loss of supporting tissue and absence of subcutaneous fat make the skin thin and loose. It flattens very slowly when pinched, or may not flatten at all. Oedema if present may mask diminished elasticity of the skin.

Ask the mother/caregiver if the child had watery diarrhoea or vomiting. If the child has watery diarrhoea or vomiting, assume dehydration and give ORS *(Table 9.2).*

Remember a child with severe acute malnutrition may be dehydrated even in the presence of oedema.

9.5.4b Treatment

Since signs of dehydrations are not very reliable, rehydration orally or through a nasogastric tube is recommended. It is also important to remember that these children are not able to handle high sodium load and are at risk of hypokalemia due to reduced muscle mass.

Remember: Use IV rehydration only if the child has signs of shock and is lethargic or unconsciousness

Table 9.2: Calculate amount of ORS to give

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

**Starter (F-75) diet & ORS is given in alternate hours (e.g. Starter at 2, 4,6 hrs & ORS at 3, 5, 7 hrs) until the child is rehydrated*

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

If the child has already received IV fluids for shock and is switching to ORS, omit the first 2- hour treatment and start with the amount for the next period of up to 10 hours.

Which ORS to be used?

WHO recommended ORS for SAM children (ReSoMal) is not commercially available in India. If hygienic preparation is available, you can *prepare modified ORS for SAM by dissolving one sachet (1litre) of low- osmolarity oral rehydration salt, adding and dissolving 50g of glucose/sugar and 45 ml of Potassium Chloride syrup or 30 ml of Potassium chloride injection in water to make a total voume of 2 Litre in place of 1 Litre (40 mEq/L of Potassium).* In case preparation of modified ORS is not possible, start rehydration with low osmolarity ORS. If the child has profuse watery diarrhoea or cholera is suspected, use low osmolarity ORS without any modification for rehydration.

Monitoring the child who is taking ORS: Check following signs at the beginning and then every 30 minutes

- Respiratory rate
- Pulse rate/ heart rate
- Urine output
- Frequency of stools and vomiting

If you find signs of over hydration (increasing respiratory rate by 5/min and pulse rate by 15/min), stop ORS immediately and reassess after 1 hour.

Prevent dehydration from on-going losses:

Measures to prevent dehydration from continuing watery diarrhoea are similar to those for well-nourished children.

- If the child is breastfed, continue breastfeeding.
- Give ORS 50-100 ml after each watery stool between feeds to replace stool losses.

9.5.4c Shock in severely malnourished children

Management of shock depends upon cause of the shock. However, it is often difficult to differentiate shock due to dehydration & sepsis on clinical signs. Children with dehydration will respond to IV fluids while those with septic shock and no dehydration will not respond.

Give IV fluids to severely malnourished child if:

- Child is lethargic or unconscious
- Has cold hands plus
  - Slow capillary refill (longer than 3 seconds), AND
  - Weak and fast pulse

You have already learnt management of shock in SAM children in Section 2.

9.5.5 Electrolyte imbalance

Give supplemental potassium at 3-4 mmol/kg/day for at least 2 weeks. Potassium can be given as syrup Potassium Chloride; the most common preparation available has 20 mmol/15 ml.

- On day 1, give 50% Magnesium Sulphate IM once (0.3mL/kg up to a maximum of 2 ml). Thereafter, give extra Magnesium (0.4-0.6 mmol/kg daily i.e. 0.2-0.3 ml/kg of 50% Magnesium Sulphate) orally. If oral commercial preparation is not available, you can give injection Magnesium Sulphate (50% which has 2 mmol/ml) orally mixed with feeds.
- Prepare food without adding salt to avoid Sodium overload.

9.5.6 Infection

Children with SAM often harbour infections without manifestations. Hence, assume all children with severe malnutrition admitted in a hospital have an infection and give broad spectrum antibiotics see below (*Chart 9.6*).

Chart 9.6: Recommended antibiotics for children with SAM

Status	Antibiotics
All admitted case without medical complication and good appetite	• Give Oral Amoxicillin 15 mg/kg /dose three times per day for 5 days
All admitted cases with any complications other than shock, meningitis and dysentery	• Inj. Ampicillin 50 mg/kg/dose 6 hourly and Inj. Gentamicin 7.5 mg/kg once a day for 7 days • Add inj. Cloxacillin 100 mg/kg/day 6 hourly, 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. Cefatoxime 150 mg/kg/day in 3 divided doses or Ceftriaxone100 mg/kg/day in 2 divided doses along with Inj. Gentamicin 7.5 mg in single dose for 10-14 days. • Do not give second dose of Gentamicin until child has passed urine.
Meningitis	• IV Cefatoxime 50mg/kg/dose 6 hourly OR Inj. Ceftriaxone 50 mg/kg/ per dose 12 hourly, plus Inj. Amikacin 15mg kg/day single dose.
Dysentery	• Give Cefixime 8-10 mg/kg /day in 2 divided doses/day for 5 days. If the child is sick, give Inj. Ceftriaxone 100 mg/kg once a day or divided in 2 doses for 5 days
On Discharge	• 200 mg albendazole for children aged 12-23 months, 400 mg albendazole for children aged 24 months or more.

9.5.6a Duration of antibiotic therapy depends on the diagnosis i.e.

- Suspicion of clinical sepsis: at least 7 days
- Culture positive sepsis: 10-14 days
- Meningitis: at least 14-21 days
- Deep seated infections like arthritis and osteomyelitis: at least 4 weeks

9.5.6b Treat associated conditions

- Give antimalarials, if blood smear or RDT is positive for malaria parasites.
- Start ATT if tuberculosis is diagnosed as per NTEP recommended criteria.
- Suspect and investigate for HIV if he has also other problems like persistent diarrhoea, oral thrush, pneumonia, parotid swelling or generalized lymphadenopathy. For investigations and treatment follow NACO guidelines.
- Severe anaemia: Give whole blood or packed cell transfusion, if Hb is <4g/dl or Hb is 4- 6 g/dl and child has respiratory distress. Give 10 ml/kg slowly over 4-6 hours and give Inj. Frusemide 1 mg/kg at the start of the transfusion.
- If keratomalacia /corneal ulcer present, give Vitamin A dose, instil Ciprofloxacin eye drops 2-3 hourly and atropine eye drops 3 times a day for 7-10 days. Also cover the eyes with pad and bandage.
- Skin lesions: Bathe or soak the affected areas for 10 min in 1% Potassium Permanganate solution and apply antibacterial cream and any barrier cream (zinc cream) to the raw areas.

9.5.6c Response to treatment for infection

- **Good response**
  - Alert and active
  - Improved activity and weight gain >5 gm/kg/day
  - Absence of clinical and lab. evidence of infections
  - Absence of complications like hypoglycaemia or hypothermia

- **Poor response**
  - Lethargic, poor activity
  - Poor appetite or no weight gain
  - Clinical/ lab. evidence of infections
  - Appearance of danger signs

9.5.7 Micronutrients

Vitamin A: Give one dose oral vitamin A to all children with SAM unless there is evidence that child has received vitamin A dose in last 1 month or has oedema on admission *as shown in Table 9.3.*

Table 9.3: Recommended oral dose of Vitamin A according to child's age

Age	Vitamin A Dose
<6 months	50 000 IU
6-12 months or if weight <8 kg	100 000 IU
>12 months or if weight ≥ 8 kg	200 000 IU

**3 doses in case signs of Vitamin A deficiency on Day 1, Day 2 and Day 15*

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

- **Multivitamin supplement:** Twice Recommended Daily Allowance (should also contain vitamin A, C, D, E and B12 and not just vitamin B-complex)
- **Folic acid:** 5 mg on day 1, then 1 mg/day
- **Elemental Zinc:** 2 mg/kg/day (if the child has diarrhoea, give 10 mg to children aged less than 6 months and 20 mg to children aged 6-59 months for 14 days)
- **Copper:** 0.3 mg/kg/day (if separate preparation not available use of multivitamin mineral commercial preparation containing copper)
- **Iron:** Start daily iron supplementation after two days of the child being on Catch up formula (F 100). Give elemental iron in the dose of 3 mg/kg/day in two divided doses, preferably between meals. **(Do not give iron in stabilization and transition phase).**

9.5.8 Initiate feeding

Basic principles of initial feeding are:

- Start feeding as early as possible.
- Feed the child if alert and drinking even during rehydration.
- Give frequent and small nutrient rich feeds of low osmolarity and low lactose.
- Offer 130 ml/kg/day of feed (100 ml/kg/day if child has severe oedema), 80-100 Kcal/kg/day and 1-1.5 g/kg/day of proteins.
- Use nasogastric feeding till child takes orally 80% of all feeds.
- If the child is breastfed, continue breastfeeding but give the feed first.
- Ensure night feeds.

9.5.8a What is Starter diet/ F-75?

F-75 is the starter formula which is being used during initial management. It is started as soon as possible and continued for 2-7 days until the child is stabilized. Severely malnourished children cannot tolerate usual amounts of proteins and sodium at this stage, or high amounts of fat. They may die if given too much protein or sodium. F-75/ starter formula is specially made to meet the child's needs without overwhelming the body's systems in the initial stage of treatment which provides 75 calories/100 ml and 0.9 gm of protein/100 ml (Chart 9.7).

9.5.8b Feed the child F-75/ starter diet orally, or by NG tube if necessary:

- **Oral feeding**

It is best to feed the child with a cup and spoon. Encourage the child to finish the feed. Encourage breastfeeding on demand between F-75 feeds.

- **Nasogastric feeding**

It may be necessary to use a NG tube if child is very weak or having oral ulcers. Use an NG tube if the child does not take 80% of the feed for 2-3 consecutive feeds.

Remove the NG tube when the child takes:

- 80% of the day's amount orally; or
- Two consecutive feeds fully by mouth.

9.5.8c Criteria for increasing volume/decreasing frequency of feeds, see Table 9.4

- If there is vomiting, significant diarrhoea, or poor appetite, continue 2 hourly feeds.
- If there is little or no vomiting, diarrhoea is less than before, and finishing most feeds (≥ 80%) are consumed, change to 3-hourly feeds.
- After a day on 3-hourly feeds: If there is no vomiting, occasional diarrhoea, and most feeds (≥ 80%) are consumed, change to 4 hourly.

Table 9.4: Recommended schedule with gradual increase in feed volume is as follows

Days	Frequency	Volume/kg/feed	Volume/kg/day
1-2	2 hourly	11 ml	130 ml
3-5	3 hourly	16 ml	130 ml
6 onwards	4 hourly	22 ml	130 ml

If the child has mild or moderate oedema continues with same feed chart (130 ml/kg). If the child has gross oedema (+++), reduce the volume to 100 ml/kg/day (*see feed chart 9.8 for amounts*).

Chart 9.7: Starter (F-75) Diet Reference Card

Weight of child (kg)	Volume of Starter diet per feed (ml)[a]			Daily total 130 (ml/kg)	80% of daily total (minimum)
	Every 2 hours[b] (12 feeds)	Every 3 hours[c] (8 feeds)	Every 4 hours (6 feeds)		
2.0	20	30	45	260	210
2.2	25	35	50	286	230
2.4	25	40	55	312	250
2.6	30	45	55	338	265
2.8	30	45	60	364	290
3.0	35	50	65	390	310
3.2	35	55	70	416	335
3.4	35	55	75	442	355
3.6	40	60	80	468	375
3.8	40	60	85	494	395
4.0	45	65	90	520	415
4.2	45	70	90	546	435
4.4	50	70	95	572	460
4.6	50	75	100	598	480
4.8	55	80	105	624	500
5.0	55	80	110	650	520
5.2	55	85	115	676	540
5.4	60	90	120	702	560
5.6	60	90	125	728	580
5.8	65	95	130	754	605
6.0	65	100	130	780	625
6.2	70	100	135	806	645
6.4	70	105	140	832	665
6.6	75	110	145	858	685
6.8	75	110	150	884	705
7.0	75	115	155	910	730
7.2	80	120	160	936	750
7.4	80	120	160	962	770
7.6	85	125	165	988	790
7.8	85	130	170	1014	810
8.0	90	130	175	1040	830
8.2	90	135	180	1066	855
8.4	90	140	185	1092	875
8.6	95	140	190	1118	895
8.8	95	145	195	1144	915
9.0	100	145	200	1170	935
9.2	100	150	200	1196	960
9.4	105	155	205	1222	980
9.6	105	155	210	1248	1000
9.8	110	160	215	1274	1020
10.0	110	160	220	1300	1040

[a]*Volumes in these columns are rounded to the nearest 5 ml*

[b]*Feed 2-hourly for at least the first day. Then, when little or no vomiting, modest diarrhoea (<5 watery stools per day), and finishing most feeds, change to 3-hourly feeds*

[c]*After a day on 3-hourly feeds. 'If not vomiting, less diarrhoea, and finishing most feeds, change to 4-hourly feeds.*

Chart 9.8: Starter (F-75) Diet Reference Card for Children with Severe Oedema (+++)

Weight (Kg)	Volume of Starter diet per feed (ml)[a]			Daily total 100 (ml/kg)	80% of daily total (minimum)
	Every 2 hoursb (12 feeds)	Every 3 hours (8 feeds)	Every 4 hours (6 feeds)		
3.0	25	40	50	300	240
3.2	25	40	55	320	255
3.4	30	45	60	340	270
3.6	30	45	60	360	290
3.8	30	50	65	380	305
4.0	35	50	65	400	320
4.2	35	55	70	420	335
4.4	35	55	75	440	350
4.6	40	60	75	460	370
4.8	40	60	80	480	385
5.0	40	65	85	500	400
5.2	45	65	85	520	415
5.4	45	70	90	540	430
5.6	45	70	95	560	450
5.8	50	75	95	580	465
6.0	50	75	100	600	480
6.2	50	80	105	620	495
6.4	55	80	105	640	510
6.6	55	85	110	660	530
6.8	55	85	115	680	545
7.0	60	90	115	700	560
7.2	60	90	120	720	575
7.4	60	95	125	740	590
7.6	65	95	125	760	610
7.8	65	100	130	780	625
8.0	65	100	135	800	640
8.2	70	105	135	820	655
8.4	70	105	140	840	670
8.6	70	110	145	860	690
8.8	75	110	145	880	705
9.0	75	115	150	900	720
9.2	75	115	155	920	735
9.4	80	120	155	940	750
9.6	80	120	160	960	770
9.8	80	125	165	980	785
10.0	85	125	165	1000	800
10.2	85	130	170	1020	815
10.4	85	130	175	1040	830
10.6	90	135	175	1060	850
10.8	90	135	180	1080	865
11.0	90	140	185	1100	880
11.2	95	140	185	1120	895
11.4	95	145	190	1140	910
11.6	95	145	195	1160	930
11.8	100	150	195	1180	945
12.0	100	150	200	1200	960

[a]Volumes in these columns are rounded to the nearest 5 ml. [b]Feed 2-hourly for at least the first day.Then, when little or no vomiting, modest diarrhoea (<5 watery stools per day), and finishing most feeds, change to 3-hourly feeds
[c]After a day on 3-hourly feeds. If not vomiting, less diarrhoea, and finishing most feeds, change to 4-hourly feeds.

9.5.8d Monitoring

Monitor and record

- Amounts of feed offered and left over
- Stool frequency and consistency
- Vomiting
- Daily body weight

9.5.9 Catch-up growth (Chart 9.9)

9.5.9a Recognize readiness for transition

Signs that a child has reached this phase are:

- Return of appetite (easily finishes 4-hourly feeds of F-75/ Starter Diet)
- Most/all of the oedema has gone.

Begin giving F-100/ Catch up diet slowly and gradually. Make a gradual transition from starter to catch-up formula.

9.5.9b Feeding formula: What is Catch-up diet/F-100?

F-100 is used as a catch-up formula to rebuild wasted tissues. F-100/Catch up diet contains more calories and protein.

- Replace the starter F-75 with an equal amount of catch-up F-100 for 2 days. Give a milk- based formula, such as catch-up F-100 which contains 100 kcal/100 ml and 2.9 gm of protein per 100 ml.
- Then on the 3rd day: Increase each successive feed by 10 ml as long as child is finishing feeds. Continue increasing the amount until some feed remains uneaten (max. 220 ml/kg/day).
- Frequent feeds, unlimited amounts with a target of
  - 150-220 kcal/kg/day
  - 4-6 g of protein/kg/day.

If the child is breastfed, continue to breastfeed between feeds. However, breast milk does not have sufficient energy and protein to support rapid catch-up growth, so give F-100 as indicated.

Chart 9.9: Catch up (F-100) Diet Reference Card for Rehabilitation Phase

Weight of child (kg)	Range of volumes per 4-hourly feed of Catch up diet (6 feeds daily)		Range of daily volumes of Catch up diet	
	Minimum (ml)	Maximum (ml)[a]	Minimum (150 ml/kg/day)	Maximum (220 ml/kg/day)
2.0	**50**	**75**	**300**	440
2.2	55	80	330	484
2.4	60	90	360	528
2.6	65	95	390	572
2.8	70	105	420	616
3.0	75	110	450	660
3.2	80	115	480	704
3.4	85	125	510	748
3.6	90	130	540	792
3.8	95	140	570	836
4.0	100	145	600	880
4.2	105	155	630	924
4.4	110	160	660	968
4.6	115	170	690	1012
4.8	120	175	720	1056
5.0	125	185	750	1100
5.2	130	190	780	1144
5.4	135	200	810	1188
5.6	140	205	840	1232
5.8	145	215	870	1276
6.0	150	220	900	1320
6.2	155	230	930	1364
6.4	160	235	960	1408
6.6	165	240	990	1452
6.8	170	250	1020	1496
7.0	175	255	1050	1540
7.2	180	265	1080	1588
7.4	185	270	1110	1628
7.6	190	280	1140	1672
7.8	195	285	1170	1716
8.0	200	295	1200	1760
8.2	205	300	1230	1804
8.4	210	310	1260	1848
8.6	215	315	1290	1892
8.8	220	325	1320	1936
9.0	225	330	1350	1980
9.2	230	335	1380	2024
9.4	235	345	1410	2068
9.6	240	350	1440	2112
9.8	245	360	1470	2156
10.0	250	365	1500	2200

[a]*Volumes in these columns are rounded to the nearest 5 ml.*

[b]*If the child's weight is between the weights given on the Catch-up diet Reference Card, use the range for the nearest lower weight.*

9.5.10 Sensory stimulation

As children become malnourished they gradually reduce their activity. They do not play, cry, smile, complain or show normal emotions – they become lethargic and feeble. Because they do not cry when they are hungry, thirsty or distressed a busy mother/caregiver thinks that her child does not need more attention than she is giving to the child; the child is unintentionally neglected. Emotional and physical stimulation can substantially reduce the risk of permanent mental retardation and emotional impairment. Recovery is faster in children who receive sensory stimulation and are involved in play daily. Teach mother/caregiver to give structured play therapy for at least 15 minutes two times daily.

9.5.11 Monitoring progress, discharge & follow-up

9.5.11a Monitoring progress during treatment

- If good weight gain i.e. >10 gm/kg/day, continue with the same treatment
- If moderate weight gain i.e. 5-10 gm/kg/day, check whether intake targets are being met or if infection has been overlooked
- If poor weight gain (see table 9.5) i.e. <5gm/kg/day, make a full assessment, particularly for:
  - Inadequate feeding
  - Untreated infection
  - HIV infection
  - Psychological problems

Table 9.5: Failure to respond to treatment

	Time
Primary failure	
Failure to regain appetite	Day 4
Failure to start to loose oedema	Day 4
Oedema still present	Day 10
Secondary failure	
Failure to gain at least 5 gm/kg of body weight per day during rehabilitation for 3 successive days.	

Table 9.6: Criteria for discharge from hospital care/NRC

	Criteria
Child	• Oedema has resolved • Average weight gain in last 3 consecutive days (≥ 5 gm/kg/day) • All infections and other medical complications have been treated • Child has received micronutrients supplementation for 10-14 days • Immunization is updated • Child is eating an adequate amount of food
Mother or caregiver	• Knows how to prepare energy dense foods and how to feed the child • Knows how to give prescribed medications, vitamins, folic acid and iron at home • Knows how to make appropriate toys and play with the child • Knows how to give home treatment for diarrhoea, fever and acute respiratory infections and how to recognize danger signs for which medical assistance must be sought • Follow-up plan is discussed and understood
After Discharge from health facility/ NRC each child must come for follow up visit every fortnightly (15 days) for 2 months in the NRC/ health facility.	

9.5.11b Discharge (Table 9.6)

The child should be followed till:

- Clinically well, And
- Weight for height is ≥-2 SD/MUAC 12.5cm*, And
- No oedema for two consecutive follow up visits* (if child had oedema on admission)

Anthropometric Criteria used for admission should be followed for discharge criteria also. If the child had oedema on admission, then either W/H or MUAC can be used.

EXERCISE 9.1

1. Determine weight-for-height (or weight- for- length) SD scores for the following cases. (The participants should refer to Chart 9.2 of the Training Module depicting the reference charts)
   a. Reena is a 2-year-old girl. Her weight is 6.9 Kg and length is 75 cm. What is her weight for height SD score?

   b. Rahul is a 4-year-old boy. His weight is 13 Kg and height is 95 cm. What is his weight for height SD score?

   c. Vikas is a 3-year-old boy. His weight is 9.8 Kg and height is 88 cm. What is his weight for height SD score?

   d. Soni is a 1-year-old girl. Her weight is 5.1 Kg and length is 72 cm. What is her weight for height SD score?

   e. Kishan is a 6-month old boy. His weight is 7.3 Kg and length is 67 cm. What is his weight for height SD score?

EXERCISE 9.2

1. Determine nutrition status of children using measurements given below.

Name	Age (months)	Sex	Weight (kg)	Length/ Height (cm)	SD Scores	MUAC	Oedema	Nutrition Status
Prince	12	M	9.8	73		12.8	No	
Rani	15	F	7.2	75		11.8	No	
Ritika	26	F	10.4	89		12.3	No	
Dinesh	32	M	10.5	95		12.1	Yes	
Iqbal	20	M	6.4	83		11.5	No	
Nitin	5	M	4.2	64		10.9	No	
Sakina	8	F	4.2	72		10.6	No	

EXERCISE 9.3

1. 14 months Ramesh has been brought to hospital with poor feeding. He weighs 5.6 kg and his length is 72.5cms. Examination history shows that his airway and breathing is normal and he has become unconscious while coming to hospital. His mid upper arm circumference is 11.6 cm and there is no pedal oedema. His blood sugar is 40 mg/dl and temperature is 36°C.
   a. Do you think Ramesh has SAM?

   b. Is Ramesh hypoglycemic?

   c. Does he have hypothermia?

   d. What immediate treatment you will give to Ramesh?

EXERCISE 9.4

1. Radha, a 7 months old child has been brought to hospital with history of diarrhoea& vomiting for 5 days with no blood in stools. Her weight was 5 kg, MUAC 9.2 cm and she has sunken eyes and very slow skin pinch and did not accept the offered fluids.

   a. Does Radha have signs of dehydration?

   b. How will you treat Radha?

2. Tina, 2 years old girl, was admitted as SAM with diarrhoea in the hospital and has given treatment for hypoglycaemia and her repeated blood glucose is normal. Her weight was 6.5 kg, temperature 36.7°C she was alert and drinking eagerly. Her skin pinch is slow and eyes are not sunken.

   a. What immediate treatment will you give her?

EXERCISE 9.5

1. When you examine Radha after 30 minutes, she is better and accepting ORS orally. What antibiotics and micro nutrient supplementation should be given to her?

2. Anu weighs 6 kg and length is 82 cm. She does not have any airway problem, doesn't have convulsion. Capillary refill time is less than 3 seconds. She is lethargic and has blood sugar of 40mg/dl, axillary temperature is 34.8 degree centigrade and has mild dermatosis.
   a. What two antibiotics should Anu be given now? Determine the dose of each antibiotic

   b. Write the electrolyte and micronutrient supplementation you will give to Anu ?

SECTION 10: SUPPORTIVE CARE

Supportive care is critical for preventing complications and death in sick children. In this section, you will learn about supportive management of sick children.

10.0: LEARNING OBJECTIVES

After completion of this section, the participants should be able to:

- Describe indications for oxygen therapy
- Describe methods of oxygen delivery
- Describe management of sick children with hypoglycemia
- Calculate maintenance fluid requirements
- Support and promote optimal feeding practices in sick children
- Enumerate guiding principles of complementary feeding

10.1: BASIC PRINCIPLES FOR CARE OF SICK CHILDREN

In order to provide good inpatient care, hospital policies and working practices should promote the basic principles of child care, such as:

- Communicating with the parents
- Arranging the paediatric ward so that the most seriously ill children receive the closest attention and are close to oxygen and other emergency treatments
- Keeping the child as comfortable as possible and controlling pain, especially in invasive procedures
- Preventing the spread of hospital-acquired infection by encouraging staff to wash their hands regularly and other measures
- Keeping the area warm in which young infants or children with severe acute malnutrition, are being looked after, in order to prevent complications like hypothermia.

10.2: OXYGEN THERAPY

10.2.1: When to start oxygen therapy

For all children who have any serious problem with their airway or breathing, give oxygen immediately after securing the airway, while you continue to assess for other problems

- Pulse oximetry is recommended to determine the presence of hypoxaemia in all children.
- When the child has only respiratory distress, oxygen supplementation is recommended at SpO2 <90% while children presenting with other ETAT emergency signs with or without respiratory distress should receive oxygen therapy if their SpO2 is <94%.
- When pulse oxymeter is not available or pulse oxymeter does not pick saturation in conditions like shock, hypothermia, the necessity for oxygen therapy should be guided by clinical signs.

- Oxygen should also be given to children with very severe pneumonia, bronchiolitis or asthma who have:
  - Central cyanosis
  - Inability to drink (when this is due to respiratory distress)
  - Severe lower chest wall in-drawing
  - Labored or very fast breathing (Respiratory rate ≥70/min)
  - Grunting with every breath (in young infants)
  - Depressed mental status.

10.2.2: Sources of oxygen to treat hypoxemia

There are three possible sources of oxygen:

- **Oxygen concentrators** work by pumping room air through a zeolite canister to remove nitrogen, thus concentrating the oxygen. The device is of moderate cost, requires little maintenance, and, once purchased, produces oxygen continuously at low cost. However, a continuous electrical supply is required.
- **Oxygen cylinders** are easy to use, requiring only a flow meter and appropriate tubing. The oxygen in cylinders is, however, relatively expensive and maintaining a constant supply is often difficult, especially at peripheral hospitals. They are also more useful during transportation of patients from one hospital to other.
- **Central supply of oxygen:** Large hospitals usually have central oxygen supply and oxygen ports as source of oxygen.

10.2.3: Oxygen delivery

- Give oxygen to a child in a non-threatening manner as anxiety increases oxygen consumption and possibly respiratory distress.
- If a child is upset by one method of oxygen support, you should attempt to deliver the oxygen by an alternative technique.
- If the child is unconscious, manage airway and do suction to maintain the airway.
- In an alert child with respiratory difficulty allow him to remain in a position of comfort because they will assume a position that promotes optimal airway patency and minimizes respiratory effort.
- It is important to have the proper equipment to control oxygen flow rates.
- **Nasal prongs are the preferred method of delivery in most circumstances, as they are safe, non-invasive, reliable and do not obstruct the nasal airway.** Severely ill children. Start oxygen initially by nasal prongs at a standard flow rate (0.5-1 L/min for infants and 2-4 L/min for older children).
- Face masks (flow rate >4 L/min), nasal or nasopharyngeal catheters may be used as an alternative only when nasal prongs are not available.
- The use of head boxes is not recommended because of oxygen wastage.

Nasal prongs are short tubes inserted into the nostrils. Place them just inside the nostrils and secure with a piece of tape on the cheeks near the nose (see *Figure 10.1).* Care should be taken to keep the nostrils clear of mucus, which could block the flow of oxygen. Prongs come in different sizes for adults and children. Nasal prongs are best for delivering oxygen to young infants and children with severe croup or pertussis; do not use a nasal catheter as they provoke paroxysms of coughing.

Nasal prongs are preferred method for oxygen administration because of minimal wastage of oxygen by this method (see Figure 10.2).

Figure 10.1: Nasal prongs correctly positioned and secured

Oxygen mask: The soft vinyl pediatric mask is often poorly tolerated by infants & toddlers but may be accepted by older children. A flow rate of 6-10 litres/minute should be kept and titrated with SpO2 monitoring.

Oxygen hood (Head box): A clear plastic shell that encompasses the patients head is very well tolerated by infants; allows easy access to the chest, trunk and limbs and permits control of inspired oxygen. A high flow rate is required (10-15 litres/minute). Oxygen hood is too small to use with children older than 1 year.

A. Infant size prongs
B. Adult size prongs

Note: the distance between the outlet tubes is larger and the tubes are thicker

C. Joined prongs for adults with a connector

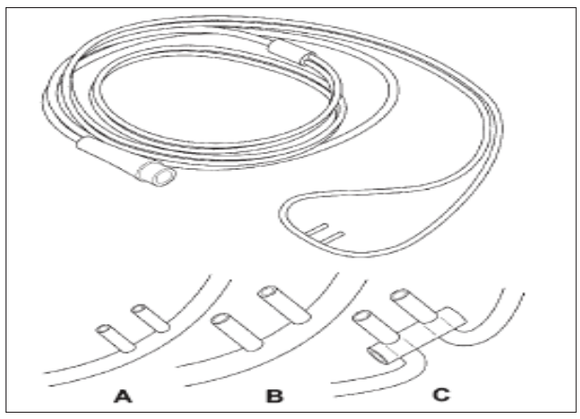


Figure 10.2: Nasal Prongs with Tubing

Nasopharyngeal catheter: This is a 6 or 8 FG catheter which is passed to the pharynx just below the level of uvula which is a distance equivalent to that from the side of nostril to the front of the ear. Humidification is required when oxygen is delivered through nasopharyngeal catheter. The bubble humidifier should be filled with clean warm water. The water should be changed daily.

Nasal catheter is made from tubing of 6 or 8 FG size such as a nasogastric tube or suction catheter. The tubing is inserted into either nostril a distance equivalent to that from the child's nostril to the inner eyebrow. It must then be firmly secured using tape, and connected to the oxygen. The tip of the catheter should NOT be visible below the uvula. Set a flow rate of 0.5-1 liters for infants and 1-2 liters/min for older children. Remove and clean the nasal catheter or prongs at least twice a day.

For standard flow oxygen therapy, humidification is not needed. However, if high flow oxygen >4 L/min is given through nasal cannula for more than one h, effective heated humidification should be added.

10.2.4: Monitoring during Oxygen Therapy

Monitor the child at least every 3 hours to identify and correct any problems, including:

- Oxygen saturation, by pulse oximeter
- Position of nasal prongs
- Leaks in the oxygen delivery system
- Oxygen flow rate
- Airway obstruction by mucus (clear the nose with a moist wick or by gentle suction)

10.2.5: Duration of Oxygen Therapy

Oxygen therapy can be stopped when a child no longer has ETAT emergency signs and maintains oxygen saturation ≥90% in room air.

When the child is stable and improving, take the child off oxygen for 15 min. If the SpO2 readings in room air remain ≥90%, discontinue oxygen but check again 30 min later and every 3 hours thereafter on the first day off oxygen to ensure that the child remains stable.

10.3: MAINTAIN TEMPERATURE

Manage hypothermia

- Young infants and malnourished babies cool down much faster than adults because they cannot maintain a stable body temperature if exposed to cold.
- If a baby has an axillary temperature of less than 36.5 degree centigrade (97.7°F), the baby has **'hypothermia'.**
- The method selected for maintaining temperature will depend on the severity of hypothermia and availability of staff and equipment.

Severe Hypothermia (<32°C or 89.6°F)

- Warm the baby immediately using a pre warmed radiant warmer with aim to increase 1-2 degree centigrade per hour till the child's temperature reaches 36.5 degree centigrade
- Remove cold or wet clothing, if present. Dress the baby in warm clothes and a cap, and cover with a warm blanket if not under radiant warmer.
- Check and treat for hypoglycemia
- Treat for sepsis
- Start IV fluids
- Provide oxygen

Mild to Moderate Hypothermia (32°C to < 36.5°C)

- Warm the young infant using skin to skin contact by the mother.
- If mother is not available, skin to skin contact may be provided by the father or any other adult.
- Ensure that the temperature of the room where the rewarming takes place is at least 25°C.
- If skin to skin contact is not possible or young infant is having life-threatening problem (e.g. sepsis, severe breathing difficulty), radiant warmer should be used.
- Encourage mother to breastfeed more frequently. If the baby cannot be breastfed, give feed using an alternative feeding method.
- Check blood glucose and treat if hypoglycemia detected.
- If the baby's temperature is not up to 36.5°C after 2 hours of 're-warming', reassess the baby for other problems like sepsis etc.

Management of Fever

Fever is not an indication for antibiotic treatment and may help the immune defense against infection. However, high fever (≥38.5°C or 101.3°F) can have harmful effects such as:

- Reducing the appetite
- Making the child irritable
- Precipitating convulsions in some children aged between 6 months and 5 years
- Increasing oxygen consumption (e.g. in a child with very severe pneumonia, heart failure or meningitis).

Treatment with oral Paracetamol should be given if the baby has a fever of ≥ 38.5°C. The dose of Paracetamol is 15 mg/kg, 6 hourly. Children with fever should be lightly clothed, kept in a warm but well-ventilated room, and encouraged to increase their oral fluid intake. Sponging with tepid water lowers the temperature during the period of sponging. All children with fever should be carefully examined for finding etiology. Ibuprofen/ other NSAID/Aspirin should not be used due to risk of severe complications like Reye Syndrome.

10.4: MAINTAIN BLOOD SUGAR

Check blood sugar in every sick child who is less than 2 months old, unconscious, has history of convulsion, has possibility of malaria or with severe acute malnutrition.

Check the Blood Sugar

Where blood glucose results can be obtained quickly (e.g. with Glucometer), this should be measured immediately. Hypoglycaemia is present if the measured blood glucose level is low <2.5 mmol/l (45 mg/dl) in a well-nourished or <3 mmol/litre (54 mg/dl) in a severely malnourished child.

You will need a drop of blood, taken from the heel of a young infant or by finger prick from an older infant or child, or from blood obtained at the insertion of an intravenous line as shown in Figure 10.3.

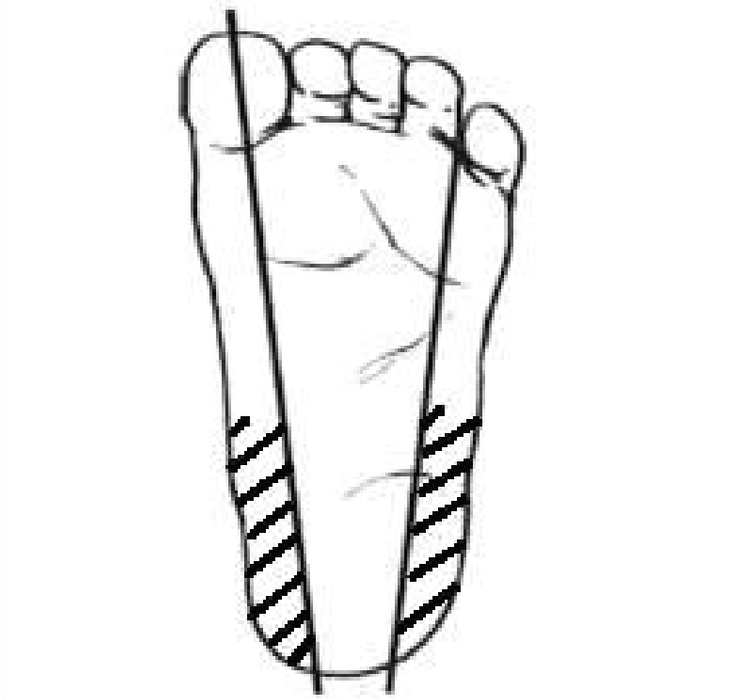


Figure 10.3: Suitable Areas for Heel Stab

Management of sick children with hypoglycemia who have coma/convulsion

- Insert an IV line and draw blood for emergency laboratory investigations.
- Give 5 ml/kg of 10% glucose solution rapidly by IV injection (see Table 10.1 below).
- Recheck the blood glucose in 30 minutes. If it is still low, repeat 5 ml/kg of 10% glucose solution see Table 10.1.
- Feed the child as soon as he/she is conscious.

Table 10.1: Amount of glucose

Age/weight	Volume of 10% glucose solution to give as bolus (5 ml/kg)
< 2 months (<4 kg)	15 ml
2 - <4 months (4 - <6 kg)	25 ml
4 - <12 months (6 - <10 kg)	40 ml
1 - <3 years (10 - <14 kg)	60 ml
3 - <5 years (14 - 19 kg)	80 ml

**If IV access is not available give the same amount by NG tube*

If the child is not able to feed without danger of aspiration, give:

- IV maintenance fluids or
- Milk or sugar solution via nasogastric tube.

Box 10.1 summarizes steps to prevent low blood sugar.

Box10.1: How to prevent low blood sugar

- **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 expressed breastmilk or a breast-milk substitute. If neither of these is available, give sugar water*
  Give 30-50 ml of milk or sugar water* before departure.
- **If the child is not able to swallow:**
  - Give 50 ml of milk or sugar water* by nasogastric tube
  - If no nasogastric tube available, give 1 teaspoon of sugar moistened with 1-2 drops of water sublingually and repeat doses every 20 minutes to prevent relapse.

*How to make sugar water: Dissolve 4 level tsp of sugar (20 g) in a 200 ml cup of clean water.

10.5: FLUID MANAGEMENT

Sick children often need maintenance fluids, if enteral feed is not possible or contraindicated see Chart 10.1.

Chart 10.1: Maintenance fluid requirements

Weight (kg)	Volume in 24 hrs	Rate (ml/hr)	Drip rate drops/ minute) adult IV set (20 drops = 1 mL)	Drip rate (drops/minute) pediatric burette (60 drops= 1 mL)
3	300	13	4	13
4	400	17	6	17
5	500	21	7	21
6	600	25	8	25
7	700	29	10	29
8	800	33	11	33
9	900	38	13	38
10	1000	42	14	42
11	1050	44	15	44
12	1100	46	15	46
13	1150	48	16	48
14	1200	50	17	50
15	1250	52	17	52
16	1300	54	18	54
17	1350	56	19	56
18	1400	58	19	58
19	1450	60	20	60
20	1500	63	21	63
21	1525	64	21	64
22	1550	65	22	65
23	1575	66	22	66
24	1600	67	22	67
25	1625	68	23	68

Note: *Give the sick child more than the above amounts if he or she has fever (increase by 10% for every 1°C of fever).*

The total daily fluid requirement of a child is calculated from the following formula:

- First 10 Kg - 100 ml/kg
- Next 10 kg - 50 ml/kg (1000ml+50 ml x weight in kg above 10kg)
- Next each additional kg -25 ml/kg (1500ml +25 ml x weight in kg above 20 kg)

For example, an 8 kg infant receives 8 x 100 ml = 800 ml per day, a 15 kg child (10 x 100) + (5 x 50) =1250 ml per day.

Choice of intravenous fluids

The risk of hyponatraemia may be increased with use of solutions containing very low sodium in paediatric patients, in comparison with fluids with a sodium content of 75-150 mmol/litre. Solutions containing low sodium, such as 0.18% sodium chloride with 4% glucose, or 5% glucose, should not be used for rehydration or fluid maintenance. Appropriate sodium- containing IV maintenance fluids should contain glucose to avoid hypoglycaemia and starvation ketosis in children who are unable to feed orally or by nasogastric tube.

- **Resuscitation:** Children who are severely dehydrated or with signs of shock should be resuscitated with isotonic IV solutions (normal saline 0.9% or Ringer's lactate).
- **Intravenous maintenance fluid:** Children who require IV fluids for maintenance should be managed with Ringer's lactate solution with 5% dextrose or 0.9% normal saline with 5% glucose or half-normal saline with 5% glucose (N/2 with 5D). Use 0.18% saline with 5% dextrose (N/5 with 5D) in infants less than 3 months of age. Add potassium chloride 20 mEq per 100 ml of these fluids

Monitoring fluid intake

Pay careful attention to maintain adequate hydration in very sick children, who are not accepting orally. If there is no contraindication, feeds, may be given through nasogastric tube.

If fluids have to be given IV, it is important to monitor infusion closely because of the risk for fluid overload, which can lead to heart failure or cerebral oedema. If it is impossible to monitor the IV fluid infusion closely, the IV route should be used only for the management of severe dehydration, septic shock, delivering IV antibiotics and for children for whom oral fluids are contraindicated (such as those with perforation of the intestine or other surgical abdominal problems).

10.6: PAIN CONTROL FOR PROCEDURES

- Use local anaesthetics for painful lesions in the skin or mucosa or during painful procedures (Lidocaine1-2% infiltration).
- Apply Lidocaine gel (with gloves) on a gauze pad to painful mouth ulcers before feeds; acts within 2-5 min.

10.7: BLOOD TRANSFUSION

Indications for blood transfusion

- Acute blood loss, when 20-30% of the total blood volume has been lost, and bleeding is continuing
- Severe anaemia
- Septic shock (if IV fluids are insufficient to maintain adequate circulation; transfusion to be given in addition to antibiotic therapy). Refer to Section 5: shock.
- Whole fresh blood is required to provide plasma and platelets for clotting factors, if specific blood components are not available

Storage of blood

Use blood that has been screened and found negative for transfusion-transmissible infections. Do not use blood that has passed its expiry date or has been out of the refrigerator for more than 2 hr. Large-volume, rapid transfusion at a rate >15 ml/kg per hr of blood stored at 4 °C may cause hypothermia, especially in small infants.

Problems in blood transfusion

Blood can be the vehicle for transmitting infections (e.g. malaria, syphilis, hepatitis B and C, HIV). Therefore, screen donors for as many of these infections as possible. To minimize the risk, give blood transfusions only when essential.

Severe anaemia

- Give a blood transfusion as soon as possible to:
  - All children with a Haematocrit of ≤12% or Hb of ≤4 g/dl
  - Less severely anaemic children (Haematocrit, 13-18%; Hb, 4-6 g/dl) with any of the following clinical features:
    - clinically detectable dehydration
    - shock
    - impaired consciousness
    - heart failure
    - deep, laboured breathing

- If packed cells are available, give 10 ml/kg over 3-4 h in preference to whole blood. If not available, give fresh whole blood (20 ml/kg) over 3-4 h.
- Check the respiratory rate and pulse rate every 15 min. If either rises or there is other evidence of heart failure, such as basal lung crepitations, enlarged liver or raised jugular venous pressure, transfuse more slowly. If there is any evidence of fluid overload due to the blood transfusion, give IV furosemide at 1-2 mg/kg, up to a maximum total of 20 mg.
- After the transfusion, if the Hb remains below 7 gm/dl, transfusion may be repeated.
- In children with severe acute malnutrition, fluid overload is a common and serious complication. Give packed cells when available or whole blood at 10 ml/kg (rather than 20 ml/kg).

Giving a blood transfusion

Before transfusion, check that:

- The blood is of the correct group, and the patient's name and number are on both the label and the form.
- The blood transfusion bag has no leaks.
- The plasma is not pink or has large clots, and the red cells do not look purple or black.
- Make baseline recordings of the child's temperature, respiratory rate and pulse rate.
- The blood is thawed to room temperature.

During transfusion:

- If available, use an infusion device to control the rate of transfusion.
- Check that the blood is flowing at the correct speed @ 3 drops/kg/min with micro drip set.
- Look for signs of a transfusion reaction (see below), particularly carefully in the first 15 min of transfusion.
- Record the child's general appearance, temperature, pulse and respiratory rate every 30 min.
- Record the times the transfusion was started and ended, the volume of blood transfused and any reactions.

After transfusion:

Reassess the child. If more blood is needed, a similar quantity should be transfused and the dose of Furosemide (if given) repeated.

10.8: SUPPORTING BREAST FEEDING

Breastfeeding is most important for protecting infants from illness and for their recovery from illness.

- Exclusive breastfeeding is recommended from birth until 6 months of age.
- Continued breastfeeding, with adequate complementary foods, is recommended from 6 months to ≥ 2 years.
- Health workers treating sick young children have the responsibility to encourage mothers to breastfeed and to help them overcome any difficulties.

How to help a mother who complains pain or difficulties in breastfeeding?

- Maintain lactation in mothers of sick children.
- Health workers should help mothers in maintaining lactation by encouraging mothers to stay with children and teaching them method of expressing breast milk.

Expressing the breast milk

There are certain situations where mother will need to express her milk to maintain milk production.

Expressing milk is useful for:

- Working mothers (leave breast milk for a baby when goes to work).
- Feed a low-birth-weight baby who cannot breastfeed directly.
- Feed a sick baby, who cannot suckle /swallow.
- Keep up the supply of breast milk when a mother or baby is ill.
- Prevent leaking when a mother is away from her baby.
- Help with breast conditions, e.g. engorgement.

Breast milk can be stored for about 6 hours at room temperature or up to 24 hours in a refrigerator.

How to Stimulate the Oxytocin Reflex?

- Help the mother psychologically: Build her confidence. Try to reduce any source of pain or anxiety. Help her to have good thoughts and feelings about the baby.
- Give Privacy.
- Some mothers can express easily in a group of other mothers who are also expressing for their babies.

- Hold her baby with Skin-to-Skin contact if possible. She can hold her baby on her lap while she expresses or look, at a photograph of her baby.
- Warm her breasts with a warm compress or a warm shower. For example, she can apply a warm compress or have a warm shower.
- Stimulate her nipples. She can gently pull or roll her nipples with her fingers.
- Massage or stroke breasts lightly. Some women find that it helps if they stroke the breast gently with finger tips or with smooth side of a comb. Some women find that it helps to gently roll their closed fist over the breast towards the nipple.
- Helper can give back massage to mother as illustrated in Figure 10.4.

Ask a helper to rub her back

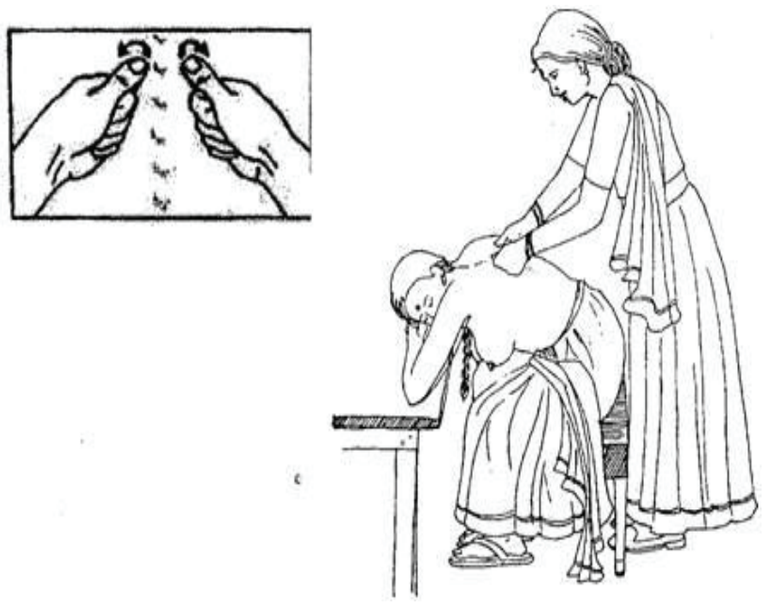


Figure 10.4: Back Massage

How to express breast milk by hand?

Teach a mother to do this herself. Use breast model to explain steps.

Teach her to:

- Wash her hands thoroughly.
- Sit or stand comfortably, and hold the container near her breast.
- Put her thumb on her breast above the nipple and areola, and her first finger on the breast below the nipple and areola, opposite the thumb. She supports the breast with her other fingers.
- Press her thumb and first finger slightly inwards towards the chest wall. She should avoid pressing too far or she may block the milk ducts.
- Press her breast behind the nipple and areola between her finger and thumb. She should press on the larger ducts beneath the areola. Sometimes in a lactating breast it is possible to feel the ducts. They are like pods, or peanuts. If she can feel them, she can press on them.
- Press and release, press and release. This should not hurt - if it hurts, the technique is wrong.

Initially milk may not come but after pressing a few times, milk starts to drip out. It may flow in streams if the oxytocin reflex is active. Press the areola in the same way from the sides, to make sure that milk is expressed from all segments of the breast. Avoid rubbing or sliding her fingers along the skin. The movement of the fingers should be more like rolling. Avoid squeezing the nipple itself. Pressing or pulling the nipple cannot express the milk. It is the same as the baby sucking only the nipple.

Express one breast for at least 3-5 minutes until the flow slows; then express from the other side; and then repeat both sides. Explain mothers that for adequate expression, it may take approximately 20-30 minutes, especially in the first few days when only a little milk is produced.

Assessing a breastfeed

Take a breastfeeding history by asking about the infant's feeding and behaviour. Observe the mother while breastfeeding to decide whether she needs help.

Observe:

- How the infant is attached to the breast *(refer to Figure 10.5)*. Signs of good attachment are:
  - more areola visible above infant's mouth
  - mouth wide open
  - lower lip turned out
  - infant's chin touching the breast
- How the mother holds her infant *(refer to Figure 10.6)*?
  - should be held close to the mother
  - should face the breast
  - body should be in a straight line with the head
  - whole body should be supported
- How the mother holds her breast?

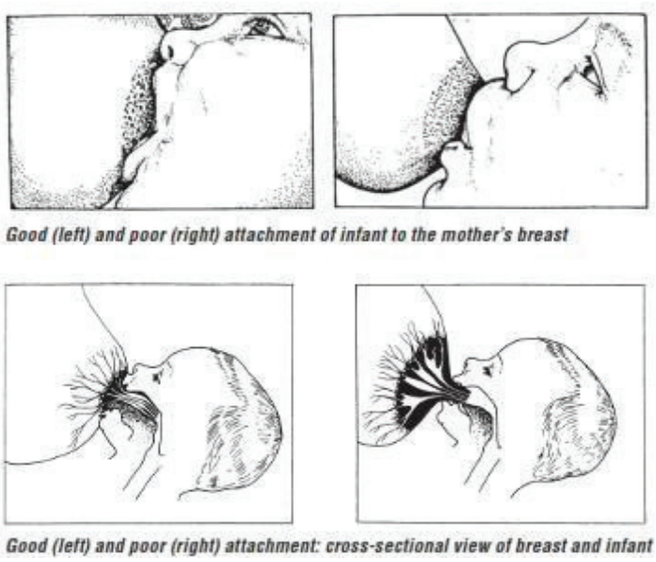
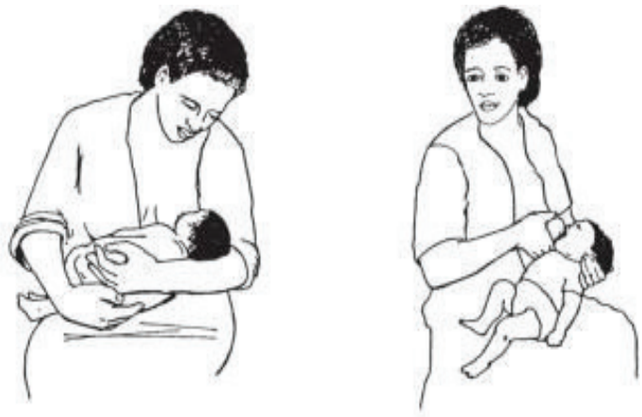


Figure 10.5: Signs of good attachment



Good (left) and poor (right) positioning of infant for breastfeeding

Figure 10.6: How the mother holds her infant

Overcoming difficulties (Chart 10.2)

1. Not enough milk

Almost all mothers can produce enough breast milk for one or even two infants; however, sometimes an infant is not getting enough breast milk. The signs are:

- poor weight gain (infant weighing less than the birth weight after 2 weeks, or <500 g/month or <125 g/weeks for first 3 months).
- passing a small amount of concentrated urine (less than six times a day).

Common reasons why an infant may not be getting enough breast milk are:

- poor breastfeeding practices: poor attachment (very common cause), delayed start of breastfeeding, feeding at fixed times, no night feeds, short feeds, use of bottles, pacifiers, other foods and fluids
- psychological factors in the mother: lack of confidence, worry, stress, depression, dislike of breastfeeding, rejection of infant, tiredness
- mother's physical condition: chronic illness (e.g. TB, severe anaemia or rheumatic heart disease), contraceptive pill, diuretics, pregnancy, severe malnutrition, alcohol, smoking, retained piece of placenta (rare)
- Infant's condition: illness or congenital anomaly (such as cleft palate or congenital heart disease) that interferes with feeding.

A mother whose breast milk supply is reduced will need help to increase it, while a mother who has stopped breastfeeding may need help to relactate.

Help a mother to breastfeed again by:

- keeping the infant close to her and not giving him or her to other carers
- ensuring plenty of skin-to-skin contact between the mother and the infant at all times
- offering the infant her breast whenever the infant is willing to suckle
- helping the infant to take the breast by expressing breast milk into the infant's mouth, and positioning the infant so that he or she can easily attach to the breast
- avoiding use of bottles, teats and pacifiers. If necessary, express the breast milk and give it by cup. If this cannot be done, artificial feeds may be needed until an adequate milk supply is established.

2. How to increase the milk supply?

The main way to increase or restart the supply of breast milk is for the infant to suckle often in order to stimulate the breast.

- Give other feeds from a cup while waiting for breast milk to come. Do not use bottles or pacifiers. Reduce the other milk by 30–60 ml per day as the mother's breast milk starts to increase. Monitor the infant's weight gain.

3. Refusal or reluctance to breastfeed

The main reasons why an infant might refuse to breastfeed are:

3.1 The infant is ill, in pain or sedated.

- If the infant is able to suckle, encourage the mother to breastfeed more often. If the infant is very ill, the mother may need to express breast milk and feed by cup or nasogastric tube until the infant can breastfeed again.
- If the infant is in hospital, arrange for the mother to stay with the infant in order to breastfeed.
- Help the mother to find a way to hold her infant without pressing on a painful place.
- Explain to the mother how to clear a blocked nose. Suggest short feeds, more often than usual, for a few days.
- A sore mouth may be due to Candida infection (thrush) or teething. Treat with a topical antifungal. Give Clotrimazole 2-4 drops into the mouth four times a day for 7 days. If this is not available, apply 0.5% Gentian Violet solution. Encourage the mother of a teething infant to be patient and keep offering the breast.
- If the mother is on regular sedation, reduce the dose or try a less sedating alternative.

3.2 There is difficulty with the breastfeeding technique

- Help the mother with her technique: ensure that the infant is positioned and attached well without pressing on the infant's head or shaking the breast.
- Advise her not to use a feeding bottle or pacifier: if necessary, use a cup.
- Treat engorgement by removing milk from the breast; otherwise mastitis or an abscess may develop. If the infant is not able to suckle, help the mother to express her milk.

3.3 A change has upset the infant.

Changes such as separation from the mother, a new caregiver, illness of the mother, a change in the family routine can upset the infant and cause refusal to breastfeed.

4. Low-birth-weight and sick infants

Infants with a birth weight < 2.5 kg need breast milk even more than larger infants; often, however, they cannot breastfeed immediately after birth, especially if they are very small.

Infants who cannot breastfeed

Non-breastfed infants should receive either:

- Expressed breast milk (preferably from their own mothers) or donor human milk where safe and affordable milk-banking facilities are available
- Undiluted boiled and cooled animal milk

The recommended amount of milk is as follows:

- *Infants ≥ 2.0 kg:* Give 150 ml/kg daily, divided into eight feeds at 3-h intervals.
- *For Infants <2.0 kg:* Follow guidelines for low-birth-weight infants.
- If the child is too weak to suck but can swallow, feeding can be done with a cup. Feed by naso-gastric or oro-gastric tube if the child is lethargic or severely anorexic or unable to swallow.

Chart 10.2: Key feeding problems and possible solutions

Feeding Practices	Possible Solution
Complementary feed started too early (<6 months of age)	• Build mother's confidence that she can produce all the breast milk that the child needs • Suggest giving more frequent, longer breastfeeds day or night, and gradually reducing other milk or foods
Complementary feed is Delayed	• Offer small amounts of soft mashed cereals, pulses, vegetables and fruits • Try one new food at a time for 2-3 days • If a child refuses a particular food, try again after a week
Complementary feeds that are introduced are too thin or lack variety	• Offer mashed soft foods and gradually increase the consistency (thicker) as the child gets older • Offer chopped fine family foods to 10-12 months old children • Offer locally available variety of foods such as cereals, pulses, seasonal vegetables, green leafy vegetables and fruits • Add 1 teaspoon of cooking oil to the food
Child eating inadequate amounts of foods	• Feed frequently as the child gets older • Feed 6-9 months old babies at least ½ a katori/sitting 4 times a day (total at least 2 katoris a day) • Feed 10-12 months old babies at least ½ a katori/sitting 5 times a day (total at least 2½ katori a day) • Breastfeed before offering food to the baby
Child does not show interest in eating	• Encourage the child to eat • Talk to child by describing the texture, smell and taste of the food. • Be patient and affectionate while feeding the child • Discourage from threatening, forcing or showing anger at the child who refuses to eat
Child eats from a common plate with older sibling	• Feed the child from a separate bowl • Sit with the child and feed the child attentively without distraction • Monitor the amount of food the child eats • Supervise the child while feeding
If the child is not eating well during illness	• Continue to breastfeed more frequently and for longer time, if possible • Use soft, varied, appetizing, favorite foods to encourage the child to eat as much as possible • Offer frequent small feedings • Clear a blocked nose if it interferes with feeding • Expect that appetite will improve as child gets better
Child is fed from a bottle	• Recommend substituting a cup for a bottle • Inform the mother that a cup is easier to clean and does not interfere with breastfeeding. • Show the mother how to feed the child with a cup

10.9: NUTRITIONAL MANAGEMENT OF SICK CHILDREN *(Chart 10.3)*

The principles for feeding sick infants and young children are:

- Continue breastfeeding.
- Do not withhold food.
- Give frequent, small feeds, every 2–3 h.
- Coax, encourage, and be patient.
- Feed by nasogastric tube if the child is severely anorexic.
- Promote catch-up growth after the appetite returns.

The food provided should be:

- palatable (tasty and easier to chew for the child)
- easily digested
- nutritious: rich in energy and nutrients.

The basic principle of nutritional management is to provide a diet with sufficient energy- producing foods and high-quality proteins. Foods with a high oil or fat content are recommended; up to 30–40% of the total calories can be given as fat. In addition, feeding at frequent intervals is necessary to achieve high energy intake. For sick children, provide multivitamin and mineral supplements.

The child should be encouraged to eat relatively small amounts frequently. If young children are left to feed themselves or have to compete with siblings for food, they may not get enough to eat.

A blocked nose, with dry or thick mucus, may interfere with feeding. Put drops of saline into the nose with a moistened wick to help soften the mucus.

A minority of children who are unable to eat for a number of days (e.g. due to impaired consciousness in meningitis or respiratory distress in severe pneumonia) may have to be fed through a nasogastric tube. The risk for aspiration can be reduced if small volumes are given frequently and by ensuring before each feed that the tube is in the stomach.

To supplement the child's nutritional management in hospital, feeding should be increased during convalescence to make up for any lost weight. It is important that the mother or caregiver offer food to the child more frequently than normal (at least one additional meal a day) after the child's appetite increases *(Chart 10.4)*.

Chart 10.3: Feeding recommendations during sickness and health*

Up to 6 months of age
• Breastfeed as often as the child wants, day and night, at least eight times in 24 h. Frequent feeding produces more milk. • If child is < 1 week and is low birth weight, feed at least every 2 to 3 h. Wake the baby for feeding after 3 h. • Do not give other foods or fluids.
6–12 months
• Breastfeed as often as the child wants day and night, at least eight times in 24 h. ◆ Give adequate servings of locally appropriate nutrient-dense foods, well mashed or finely chopped, increasing gradually (see Table 10.3 for examples) ◆ three times per day if breastfed ◆ five times per day if not breastfed, plus 1-2 cups of milk
12 months to 2 years
• Breastfeed as often as the child wants. • Give a variety of adequate servings of locally appropriate nutrient-dense foods or family foods five times a day. • Offer one or two snacks between meals and continue to encourage and patiently feed the child during meals.
≥ 2 years
• Give family foods at three meals each day. Also, twice a day, give nutritious food between meals. • Talk with your child during meals and keep eye contact.

** A good daily diet should be adequate in quantity and include an energy-rich food (for example, thick cereal with added oil), meat, fish, eggs or pulses and fruit and vegetables.*

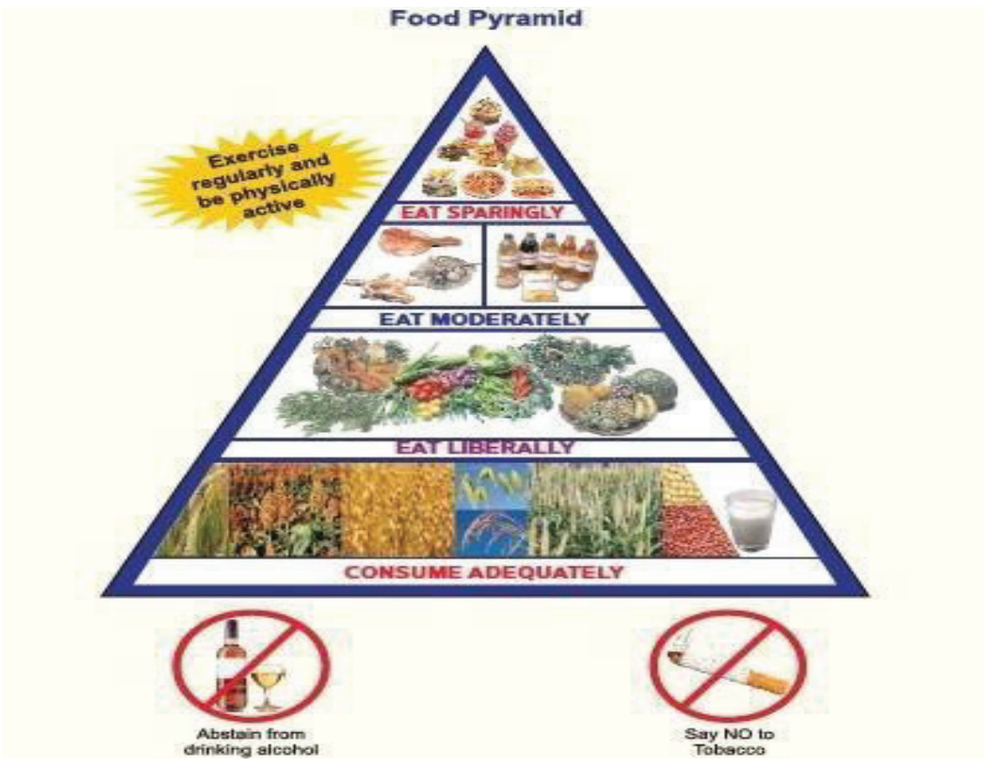


Figure 10.7: Food pyramid photo for balanced diet of a child

(Source: NIN, Hyderabad, Dietary Guidelines 2010)

Chart 10.4: Guiding Principles for Complementary Feeding of the Breastfed Child

- Practice exclusive breastfeeding from birth to 6 months of age, and introduce complementary foods at 6 months of age (180 days) while continuing to breastfeed.
- Continue frequent, on-demand breastfeeding until 2 years of age or beyond.
- Practice responsive (active) feeding, applying the principles of psychosocial care.
- Practice good hygiene and proper food handling.
- Start at 6 months of age with small amounts of food and increase the quantity as the child gets older, while maintaining frequent breastfeeding.
- Gradually increase food consistency and variety as the infant grows older, adapting to the infant's requirements and abilities.
- Increase the number of times that the child is fed complementary foods as the child gets older.
- Feed a variety of nutrient-rich and energy-dense foods from the family pot to ensure that all nutrient needs are met.
- Use iron rich complementary foods or vitamin-mineral supplements for the infant, as needed.
- Increase fluid intake during illness, including more frequent breastfeeding, and encourage the child to eat soft, favourite foods. After illness, give food more often than usual and encourage the child to eat more.

10.10: MONITORING THE CHILD'S PROGRESS

Monitoring procedures

In order for monitoring to be effective, the health worker must know:

- The correct administration of the treatment
- The expected progress of the child
- The possible adverse effects of the treatment
- The complications that may arise and how they can be identified
- Possible alternative diagnosis in a child who is not responding to treatment

Children treated in hospital should be checked and findings recorded regularly, so that any deterioration in their condition or complications, adverse effects to treatment or errors in the administration of treatment can be identified promptly. The frequency of monitoring depends on the severity and nature of the illness.

Children who are seriously ill should be visited by a doctor (or other senior health professional) soon after admission to hospital. These visits should be seen as an opportunity to encourage communication between the families of sick children and hospital staff.

10.11: TIMING OF DISCHARGE FROM THE HOSPITAL

In general, in the management of acute infections, a child can be considered ready for discharge after the clinical condition has improved significantly (afebrile, alert, eating and sleeping normally), and oral treatment has been started.

A decision on when to discharge should be made on an individual basis, taking into consideration factors such as:

- the family's home circumstances and how much support is available to care for the child
- the staff's judgments of the likelihood that the treatment course will be completed at home
- the staff's judgment of the likelihood that the family will return immediately to hospital if the child's condition worsens.

The timing of discharge of a child with severe acute malnutrition is particularly important. In each case, the family should be informed of the possible discharge date, so that appropriate arrangements can be made to support the child at home.

If the family removes the child prematurely against the advice of the hospital staff, counsel the mother on how to continue treatment at home, and encourage her to bring the child for follow- up and to make contact with the local health worker for help in the follow-up care of the child.

10.12: CHECKING THE MOTHER'S HEALTH

If the mother is sick, provide treatment for her, and help to arrange follow-up at a first-level health facility close to her home. Check the mother's nutritional status, and give any appropriate counselling. Check the mother's immunization status, and, if needed, give her tetanus toxoid. Make sure the mother has access to family planning and birth spacing and counselling about preventing sexually transmitted and HIV infections. If the child has TB, the mother and other members of the family should have a chest X-ray and sputum examination. Make sure the mother knows where to have them, and explain why they are needed.

10.13 : CHECKING IMMUNIZATION STATUS

See the child's immunization card, and determine whether all the vaccinations recommended for the child's age have been given. Note any vaccinations the child still needs, and explain this to the mother. Give the vaccinations before the child leaves hospital, and record them on the card.

10.14: PROVIDING FOLLOW-UP CARE

Advise all mothers who are taking their children home after assessment in the hospital when to go to a health worker for follow-up care. Mothers may need to return to hospital:

- for a follow-up visit within a specified number of days (e.g. when it is necessary to check progress or the response to an antibiotic)
- if signs appear that suggest that the illness or injury (e.g. head injury) is worsening
- for the child's next vaccination.

It is especially important to teach the mother the signs that indicate the need to return to hospital immediately.

Follow-up for feeding and nutritional problems

- If a child has a feeding problem and changes in feeding have been recommended,
- Follow up in 5 days to see whether the mother has made the changes, and give further counselling if needed.
- If the child has anaemia, follow up in 14 days to check compliance and providefurther supply of oral iron.
- If the child has a very low weight, additional follow-up is needed in 30 days, which involves weighing the child, reassessing feeding practices and giving further nutritional counselling.

When to return immediately

Advise the mother to return immediately if the child develops any of the following signs:

- unable to drink or breastfeed
- becomes sicker
- develops a fever
- signs of illness return after discharge from hospital
- a cough or cold: fast or difficult breathing
- diarrhoea: blood in stool or drinking poorly

Next 'well-child' visit

Remind the mother about the child's next visit for immunization, and record the date on the mother's card or the child's immunization record.

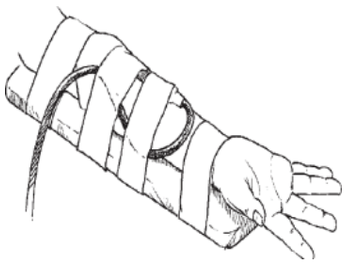
Annexures

Annexure-1: Insertion of an Indwelling Intravenous Cannula in a Peripheral Vein

- Identify an accessible peripheral vein. In young children aged >2 months, this is usually the cephalic vein in the antecubital fossa or the fourth inter digital vein on the dorsum of the hand.
- An assistant should keep the position of the limb steady and should act as a tourniquet by obstructing the venous return with his or her fingers lightly closed around the limb or use a tourniquet.
- Clean the surrounding skin with an antiseptic solution (such as spirit, iodine, isopropyl alcohol or 70% alcohol solution), then introduce the cannula into the vein and insert most of its length.
- Fix the catheter securely with tape (see the figure below)
- Apply a splint with the limb in an appropriate position (e.g. elbow extended, wrist slightly flexed)

Care of the cannula:

- Secure the cannula when introduced. This may require splinting neighboring joints to limit the movement of the catheter.
- Keep the overlying skin clean and dry. Flush and fill the cannula with normal saline immediately after the initial insertion and after each injection.



Securing cannula in vein

Common complications:

Superficial infection of the skin at the cannula site is the commonest complication. The infection may lead to thrombophlebitis, which will occlude the vein and result in fever. The surrounding skin is red and tender. Remove the cannula to reduce the risk of further spread of the infection.

Intravenous drug administration through an indwelling cannula:

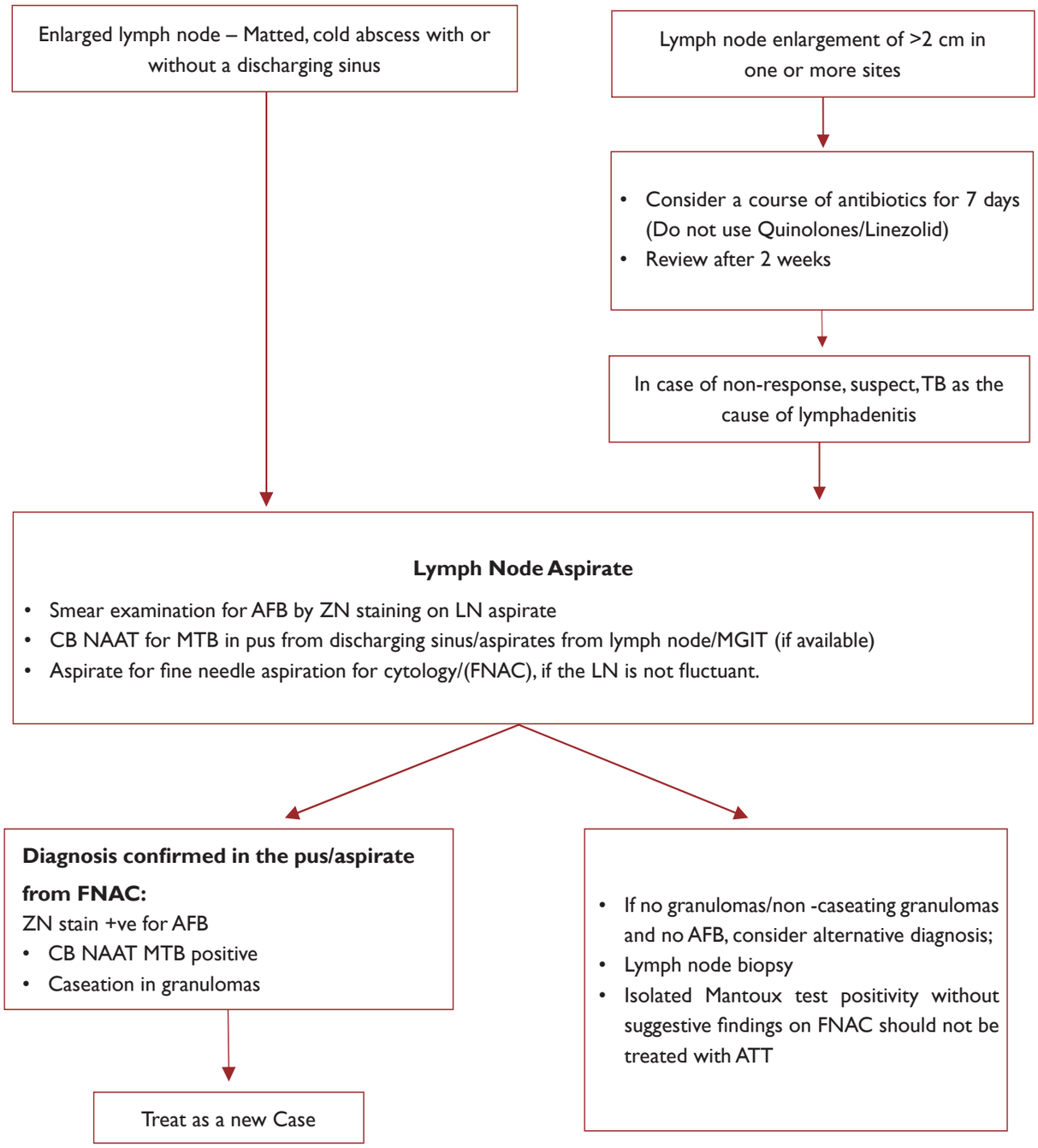
Attach the syringe containing the IV drug to the injection port of the cannula and inject the drug. Once all the drug has been given, flush with normal saline until all the blood has been expelled and the catheter is filled with the solution.

Annexure-2: Appropriate sizes of pediatric equipment according to age (weight) of child

Equipment	0-5 months (3-6 kg)	6-12 months (4-9 kg)	1-3 years (10-15 kg)	4-7 years (16-20 kg)
AIRWAY AND BREATHING				
Laryngoscope	Straight blade	Straight blade	Child Macintosh	Child Macintosh
Uncuffed tracheal tube	2.5-3.5	3.5-4.0	4.0-5.0	5.0-6.0
Suction catheter (French gauge)	6	8	10/12	
CIRCULATION				
IV Cannula	24/22	22	22/18	20/16
Central venous cannula	20	20	18	18
OTHER EQUIPMENT				
Nasogastric tube[a]	8	10	10-12	12
Urinary catheter[a]	5 feeding tube	5 feeding tube/F8	Foley 8	Foley 10

[a]*Sizes in French gauge, which are equivalent and indicate the circumference of the tube in millimeters.*

Annexure-3: Algorithm for diagnosis of Pediatrics Tubercular lymphadenopathy



Annexure-4: Procedure for collection of Gastric Aspirate and Induced sputum

GASTRIC ASPIRATION / LAVAGE (GL)

Gastric lavage should be collected in the morning preferably in an admitted patient after overnight fasting before the child wakes up. A nasogastric tube should be gently placed at night before the child sleeps. If this is not feasible gastric lavage can also be collected, if the child is brought to the health facility in the morning after overnight fasting. The length of the tube to be inserted is equal to the distance measured from tip of the nose to tragus plus from tragus to the xiphisternum. Tube can be advanced for an inch extra so as to reach the stomach. The position of the tube should be checked by pushing 5 ml air through the nasogastric tube and hearing for a gush of air below the xiphisternum. Sample can be aspirated in the morning, while the child is still asleep, by connecting 10 ml syringe to the nasogastric (NG) tube. Sample should be collected over two consecutive days. If gastric aspirate is less than 10 ml the position of the Ryles tube should be rechecked and an extra 10 ml normal saline should be introduced through the same NG tube. If still aspirate is less than 10 ml, the patient should be rotated to the left lateral position and again aspiration tried though the nasogastric tube. If still no aspirate an extra 10 ml normal saline should be introduced through the same NG tube and aspiration repeated. It still no aspirate, the patient should be turned to right lateral position and gentle suction done again through the nasogastric tube. If Gastric Aspirate is still less than 10 ml, additional normal saline of 10 ml should be introduced via nasogastric tube until a minimum of 10 ml is aspirated. After procedure, the nasogastric tube should be gently removed by closing its cap or pinching the tube.

INDUCED SPUTUM:

Sputum induction should be undertaken after 2-3 hours fasting on two consecutive days. Baseline values of respiratory rate, pulse rate, chest retractions, wheeze, oxygen saturation should be taken prior to the nebulisation. These parameters should be monitored before and during the procedure and for a duration of 30 minutes after taking the sample. Child should be first nebulised with asthalin 0.2 mg/kg in 5 ml normal saline. This step is to prevent respiratory distress in children who are predisposed it after being nebulized with hypertonic saline. Then child should then be nebulized with 5 ml of hypertonic (3%) sterile saline via a jet nebulizer attached to oxygen at a flow rate of 7 - 10 L/min for 10 to 15 minutes. Chest wall percussion should be done after nebulisation with asthalin and hypertonic saline. Chest wall percussion brings secretions from the peripheral to central airway, from where the child can cough them out. Thereafter sputum can be obtained either by expectoration in children able to do so or by suction through nasopharynx/oropharynx using sterile mucus extractor of 6 to 7 French size catheters. The length of the tube to be inserted is equal to the length measured from tip of the nose to the angle of the mandible. After inserting it to this length gentle suction is applied to the mucous extractor. Presence of mucous extractor in the tube tickles the throat to induce cough, or the child can be asked to cough. Procedure should be done in a ventilated room having an exhaust fan. All personnel involved should be wearing facemask during the procedure.

Annexure-5: Diagnosis & Treatment of Diphtheria and Pertussis

Diagnosis

- Carefully examine the child's nose and throat and look for a grey, adherent membrane.
  Great care is needed when examining the throat, as the examination may precipitate complete obstruction of the airway. A child with pharyngeal diphtheria may have an obviously swollen neck, termed a 'bull neck'.

Treatment

Antitoxin

- Give 40000 U Diphtheria antitoxin (IM or IV) immediately, because delay can increase the risk for mortality. As there is a small risk for a serious allergic reaction to the horse serum in the antitoxin, an initial intradermal test to detect hypersensitivity should be carried out, as described in the instructions, and treatment for anaphylaxis should be available.

Antibiotics

- Any child with suspected diphtheria should be given a daily deep IM injection of Procaine Benzylpenicillin at 50 mg/kg (maximum, 1.2 g) daily for 10 days. If not available give Erythromycin for 14 days.

Oxygen

- Avoid using oxygen unless there is incipient airway obstruction. Such cases should be referred to a higher health facility where tracheostomy may be performed. Signs such as severe lower chest wall indrawing and restlessness are more likely to indicate the need for tracheostomy (or intubation) than oxygen. However, oxygen should be given if there is incipient airway obstruction and intubation or a tracheostomy is deemed necessary.

Monitoring

- The child's condition, especially respiratory status, should be assessed by a nurse every 3 h and by a doctor twice a day. The child should occupy a bed close to the nursing station, so that any sign of incipient airway obstruction can be detected as soon as it develops.

Complications

- Myocarditis, flaccid paralysis of limbs, palatal palsy may occur 2-7 weeks after the onset of illness.

Preventive measures

- The child should be nursed in a separate room by staffs who are fully vaccinated against Diphtheria.
- Give all vaccinated household contacts a Diphtheria Toxoid booster and prophylaxis (oral Erythromycin 10 days)

PERTUSSIS

When should one suspect Pertussis?

1. In any individual with prolonged paroxysmal cough with or without whoop/post-tussive vomiting irrespective of the immunization status

   a. Prolonged cough: Defined as 2 weeks or more, the duration of cough to make one suspect pertussis has been variably defined as 2 weeks by the CDC and 3 weeks by the WHO. A, 2 week's cut off would be more sensitive as about 20% of confirmed cases have cough for <3 weeks. The diagnosis could be considered earlier if other typical features, such as whoop, are present.

b. Paroxysmal (spasmodic) cough with or without whoop/vomiting: A typical paroxysm consists of a series of rapid, forced expirations (usually 5-10) followed by gasping inhalation, leading to the typical whooping sound. Cyanosis, bulging eyes, protrusion of the tongue, salivation, lacrimation and distension of the neck veins occur during the paroxysm. Post-tussive vomiting is common. These paroxysms may occur several times per hour during both day and night. Attacks are triggered by yawning, sneezing or physical exertion.

Paroxysmal cough is an essential criterion as even partially immune individuals (previously vaccinated/ adolescents/adults) retain the paroxysmal nature of cough. However, the whoop and post-tussive vomiting components of the paroxysm may not be found in the partially immune and are therefore non-essential criteria.

c. Irrespective of immunization status: Pertussis can occur in immunized individuals because of limited protection provided by the vaccine. However, if the individual is unimmunized / partially immunized, the diagnosis of pertussis can be made with greater confidence.

2. Any individual with respiratory tract symptoms such as coryza, cough (paroxysmal/non- paroxysmal) during an outbreak or who has had contact with a suspect /case.
3. Any individual with a respiratory illness and presence of typical complications of pertussis such as hernia, rectal prolapse, sub conjunctival hemorrhages, seizures and encephalopathy.
4. Neonates or young infants with pertussis do not have the typical paroxysmal cough, whoop and post tussive vomiting. Instead the presentation is usually of apnea, respiratory failure, cyanosis, seizures, encephalopathy or an acute life threatening event.

Pertussis is most severe in young infants who have not yet been immunized.

Admit infants aged <6 months to hospital; also, admit any child with pneumonia, convulsions, dehydration, severe malnutrition or prolonged apnoea or any other danger signs.

Treatment

Antibiotics

- Give oral Erythromycin (12.5 mg/kg four times a day) for 10 days

OR

- Azithromycin at 10 mg/kg (maximum, 500 mg) on the first day, then 5 mg/kg (maximum, 250 mg) once a day for 4 days.

Oxygen

- Give oxygen to children who have spells of apnoea or cyanosis, severe paroxysms of coughing or low oxygen saturation ≤ 90% on a pulse oximeter.

Supportive care

- Avoid, as far as possible, any procedure that could trigger coughing, such as application of suction, throat examination or use of a nasogastric tube (unless the child cannot drink).
- Do not give cough suppressants, sedatives, mucolytic agents or antihistamines.
- Encourage breastfeeding or oral fluids.

Ensure adequate nutrition by giving small, frequent feeds.

Annexure-6: Guidelines for collection, storage and transport of samples

Type of Sample	Guidelines
Blood	• Collect within 4 days after the onset of illness for isolation of virus and at least 5 days after the onset of illness for detection of IgM antibodies. • A second, convalescent sample should be collected at least 10- 14 days after the first sample for serology. • Serum should be shipped on wet ice within 48 hours or stored at 4°C for a maximum period of 7 days. • In case a delay is anticipated, sera must be frozen at -20°C and should be transported to the specified laboratory on frozen ice packs.
Cerebrospinal fluid	• Send for cell count, bacteriology, biochemistry and virology -PCR, serology.
Swabs (naso-pharyngeal, throat, vesicle)	• Dacron/ Nylon swabs should be used, and put into virus transport medium. Swabs may be utilized for virus cultures and PCR.
Urine	• 10-20 ml of urine should be collected into sterile containers (without preservatives) for mumps virus culture and mumps PCR; store at -20°C.
Stool	• Stool should be collected for enterovirus culture into clean containers; store at -20°C
Brain biopsy	• Brain specimens should be collected unfixed into a sterile container. Brain smears can be used for viral antigen detection by immunofluorescent antibody staining, and for electron microscopy with negative staining. • Emulsified brain tissue is suitable for tissue culture and after proteinase K treatment for PCR.

Annexure-7: Japanese Encephalitis (JE)

Japanese Encephalitis (JE) is a mosquito borne zoonotic viral disease causing AES. The virus is maintained in animals and birds. Pigs and birds, particularly the birds belonging to Family Ardeidae (e.g. cattle egrets, pond herons, etc.) are the natural hosts.

The disease affects the central nervous system and can cause severe complications. The case fatality rate of this disease is very high and those who survive may suffer with various degrees of neurological sequelae. However, good clinical management is important to reduce the risk of disability or death from the disease.

Diagnosis

Clinical Manifestations

Japanese Encephalitis (JE) a prodrome of fever, headache, nausea, diarrhoea, vomiting, and myalgia occurs lasting for few days (1-5 days) followed by irritability, altered behaviour, convulsions and coma. The progression of disease is rapid. Signs of raised intra cranial tension are commonly present in acute stage of illness. The patient may develop difficulty of speech and other neurological deficits like ocular palsies, hemiplegia, quadriplegia and extrapyramidal signs in the form of dystonia, choreoathetosis and coarse tremors.

Case Definition of Suspected case

- Acute onset of fever, not more than 5-7 days duration.
- Change in mental status with/ without, new onset of seizures (excluding febrile seizures).

Other early clinical findings may include irritability, somnolence or abnormal behavior greater than that seen with usual febrile illness)

Laboratory-Confirmed case

A suspected case with any one of the following markers:

Note: Presence of rash on body excludes Japanese Encephalitis

- Presence of IgM antibody in serum and/ or CSF to a specific virus including JE/Entero Virus or others
- Four-fold difference in IgG antibody titre in paired sera
- Virus isolation from brain tissue
- Antigen detection by immunofluroscence
- Nucleic acid detection by PCR

Management

- Management of Acute Encephalitis Syndrome including Japanese Encephalitis is essentially symptomatic.

The treatment of the patients may require, as follow: -

1. Management of Airways and Breathing (see Section 2)
2. Management of Circulation (see Section 2)
3. Control of Convulsion and Intracranial pressure (see Section 5)
4. Control of Temperature (see Section 10)
5. Fluid and Electrolytes and Calories/ Nutrition (see section 10)
6. Investigations, Samples Collection & Transportation (See FURTHER READING)
7. Reporting of a case
8. Rehabilitation.

Annexure-8: Principle for poisons in contact with skin or eyes

Skin contamination

Remove all clothing and personal effects, and thoroughly clean all exposed areas with copious amounts of tepid water. Use soap and water for oily substances. Attending staff should take care to protect themselves from secondary contamination by wearing gloves and aprons.

Eye contamination

Rinse the eye for 10–15 minutes with clean running water or normal saline, taking care that the run-off does not enter the other eye if the child is lying on the side, when it can run into the inner canthus and out the outer canthus. Evert the eyelids and ensure that all surfaces are rinsed. Take ophthalmic pinion.

Principles for inhaled poisons

- Remove the child from the source of exposure.
- Urgently call for help.
- Administer supplementary oxygen if the child has respiratory distress, is cyanosed or has oxygen saturation ≤ 90%.
- Inhalation of irritant gases may cause swelling and upper airway obstruction, bronchospasm and delayed pneumonitis. Intubation, bronchodilators and ventilatory support may be required

- **Prevention of poisoning**

- Teach parents to keep drugs and poisons in proper containers and out of reach of children.
- Advise parents on first aid if poisoning occurs again.

Drowning

Initial assessment should include ensuring adequate airway patency, breathing, circulation and consciousness (the 'ABCs'). Check if there are any injuries, especially after diving or an accidental fall. Facial, head and cervical spine injuries are common.

Management

- Give oxygen and ensure adequate oxygenation.
- Remove all wet clothes.
- Use a nasogastric tube to remove swallowed water and debris from the stomach, and when necessary bronchoscopy to remove foreign material, such as aspirated debris or vomitus plugs, from the airway.
- Warm the child externally if the core temperature is > 32 °C by using radiant heaters or warmed dry blankets; if the core temperature is < 32 °C, use warmed IV fluid (39 °C) or conduct gastric lavage with warmed 0.9% saline.
- Check for hypoglycaemia and electrolyte abnormalities, especially hyponatraemia, which increase the risk of cerebral oedema.
- Give antibiotics for possible infection if there are pulmonary signs.

Electrocution

- Provide emergency care by ensuring airway patency, breathing and circulatory support. Provide oxygen, especially for children with severe hypoxia, facial or oral burns, loss of consciousness or inability to protect the airway, or respiratory distress.
- Assess for traumatic injuries such as pneumothorax, peritonitis or pelvic fractures.
- Begin normal saline or Ringer's lactate fluid resuscitation, and titrate to urine output of at least 2 ml/kg per hour in any patient with significant burns or myoglobinuria.
- Consider furosemide or mannitol for further diuresis of myoglobin.
- Give tetanus vaccine as indicated, and provide wound care. Treatment may include early fasciotomy when necessary.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