Republic of Rwanda
Ministry of Health

Rwanda Biomedical Centre
Healthy People, Wealthy Nation

RWANDA PAEDIATRIC TREATMENT GUIDELINES

Second Edition Nov. 2023

RWANDA PAEDIATRIC TREATMENT GUIDELINES

Second Edition Nov. 2023

CONTENTS

LIST OF FIGURES

LIST OF TABLES

FOREWORD

In 2015, the world set out new targets in the Sustainable Development Goals (SDGs) to be achieved by 2030. The proposed SDG target for child mortality aims to end preventable deaths of newborns and children under 5 years of age. SDGs targets for all countries to reduce neonatal mortality to 12 deaths per 1,000 live births and under-5 mortalities to 25 deaths per 1,000 live births. Rwandan ministry of health has a plan of achieving this target through improving the care offered to critically ill neonates and children. Empowering clinicians to develop and implement best practices guided by national guidelines and protocols will result in better patient care and target outcomes.

This paediatric treatment guidelines 2023 provides us with up-to-date evidence on early detection, diagnosis, and management of childhood and adolescent illness. In addition, new relevant chapters were included like paediatric critical care, genitourinary systems, adolescent health and paediatric obesity.

This is not a standalone guideline as it can be complemented with existing national program treatment guidelines.

I expect every healthcare provider in charge of assessing and managing sick children at all levels of the healthcare system to adhere to these guidelines in order to provide quality and effective case management of paediatric patients.

Prof Claude Mambo MUVUNYI
Director General
Rwanda Biomedical Centre

ACKNOWLEDGEMENTS

The Ministry of Health is grateful to all organizations and individuals who contributed to development of this National Paediatric Protocol, 2nd edition 2023. It would not have been finalized without the generous support of all who are involved in the domain of providing maternal, neonatal and childcare in Rwanda.

We offer our sincere gratitude and appreciation to different people and organizations for their guidance, feedback, leading and coordinating the efforts to develop this essential protocol. Our appreciation also goes towards partners and individuals who contributed to the realization of this manual, especially, Rwanda Paediatric Association, USAID, USAID Ingobyi Activity, PIH, WHO, ENABEL, Save the Children, Health Builders and UNICEF.

Special thanks to all members of RMNCH Technical Working Group and subgroups, our distinguished development partners as well as technical experts including Paediatricians and other individuals who specifically played a critical role in overseeing and coordination of this work until completion.

Dr Aline UWIMANA

Maternal, Child and Community Health Division Manager

LIST OF CONTRIBUTORS TO THE RWANDA PAEDIATRIC GUIDELINES SECOND EDITION 2023

1. Dr. Aimable Kanyamuhunga-Paediatric Haematologist /Oncologist CHUK
2. Dr. Florent Rutagarama Paediatric Endocrinologist RMH
3. Dr. Augustin Ndatinya Paediatric Allergologist/ Allergist RMH
4. Dr. Christian Umuhoza Senior Consultant Paediatrician CHUK
5. Dr. John Baptist Nkuranga Senior Paediatrician/ Neonatologist KFH
6. Dr. Pauline Mukeshimana Senior Paediatrician – Gisenyi DH
7. Dr. Uwiragiye Emmanuel Senior Paediatrician – Ruhengeri RRH
8. Dr. Rukabyarwema Jean Paul Senior Paediatrician – Muhima DH
9. Dr. Valens Karangwa Senior Paediatrician – Kibagabaga DH
10. Dr. Aicha Uwamahoro Senior Paediatrician – Rwanda Military hospital TH
11. Dr. Aimable Musafiri Senior Paediatrician – CHUB
12. Dr. Karambizi Angelique Senior Paediatrician – PIH / Kirehe DH
13. Dr. Janvier Dushimire Senior Paediatrician – Kibungo RRH
14. Dr. Bwiza Muhire Hippolyte Senior Paediatrician – Rwamagana Provincial H
15. Dr. Assumpta K Mwali – USAID Ingobyi Activity
16. Dr. Richard Kalisa – USAID Ingobyi Activity
17. Dr. Chantal Gégout - Technical Officer Nutrition WHO Rwanda
18. Dr. Ferdinand Bikorimana- RBC MCCH Division
19. Dr. Mujawamariya Mugabo Maria – Family Health Program Officer WHO/ Rwanda.
20. Dr. Stephenson Musiime Chief Consultant Paediatrician - USAID Ingobyi Activity consultant

ACRONYMS

ABC : Airway, Breathing, Circulation
ABG : Arterial Blood Gases
ACE : Angiotensin Converting Enzyme
ACT : Artemisinin Combination Therapy
ACTH : Adrenocorticotrophic Hormone
ADH : Antidiuretic Hormone
AHF : Acute Heart Failure
AIDS : Acquired Immunodeficiency Syndrome
ALAT : Alanine Transaminase
ALCAPA: Aberrant Left Coronary Artery from the Pulmonary Artery
ARA : Angiotensin Receptor Antagonists
ARDS : Acute Respiratory distress Syndrome
ARF : Acute Rheumatic Fever
ASLO : Anti-Streptolysin O
AST : Aspartate Aminotransferase
AVSD : Atrio Ventricular Septal defect
AVPU : Alert, Voice, Pain, Unresponsive
BBE : Benzyl Benzoate Emulsion
BCG : Bacille Calmette -Guérin
BD, BID : Twice per day
BE : Base Excess
BP : Blood Pressure
BW : Birth Weight
CAB : Circulation Airway Breathing
CBC : Complete Blood Count
CCF : Congestive Cardiac Failure
CHD : Congenital Heart disease
CK, CPK : Creatinine (Phospho) Kinase
CKD : Chronic Kidney disease
CMV : Cytomegalovirus
CNS : Central Nervous System
COPD : Chronic Obstructive Pulmonary disease
CPR : Cardio Pulmonary Resuscitation
CRC : Corrected Reticulocyte Count
CRP : C – Reactive Protein
CSF : Cerebrospinal Fluid
CT : Computerized Tomography
CVD : Cardiovascular disease
CVS : Cardiovascular System
CXR : Chest X-Ray
DIC : Disseminated Intravascular Coagulation
DKA : Diabetic Keto-Acidosis

DM : Diabetes Mellitus
DNA : Deoxyribonucleic Acid
DVT : Deep Venous Thrombosis
EBV : Epstein - Barr virus
ECG : Electrocardiogram
EEG : Electroencephalography
ENT : Ear Nose and Throat
ESR : Erythrocyte Sedimentation Rate
FBC : Full Blood Count
GER : Gastroesophageal Reflux
GFR : Glomerular Filtration Rate
GTCS : Generalized Tonic Clonic Seizures
GIT : Gastro-Intestinal Tract
GORD : Gastro-Oesophageal Reflux diseases
GXM : Group and Cross-Match
Hb : Hemoglobin
HCV : Hepatitis C Virus
HHS : Hyperosmolar Hyperglycemic State
HIE : Hypoxic Ischemic Encephalopathy
HIV : Human Immunodeficiency Virus
HR : Heart Rate
HSV : Herpes Simplex Virus
HT : Hematocrit
HTN : Hypertension
HZV : Herpes Zoster Virus
ICU : Intensive Care Unit
IE : Infective Endocarditis
IM : Intra-muscular
IR : Intrarectal
INH : Isoniazid
INR : International Normalized Ratio
ITP : Idiopathic Thrombocytopenic Purpura
IU : International Units
IV : Intravenous
JVP : Jugular Venous Pressure
KD : Kidney disease
KOH : Potassium Hydroxide
LBW : Low Birth Weight
LDH : Lactate dehydrogenase
LE : Lupus Erythematosus
LGS : Lennox-Gastaut Syndrome
LFM : Life Style Modification
LFT : Liver Function Tests

LGIB : Lower Gastro-Intestinal Bleeding
LMWH : Low Molecular Weight Heparin
LP : Lumbar Puncture
LV : Left Ventricle
MAP : Mean Arterial Pressure
MCV : Mean Cell Volume
MRI : Magnetic Resonance Imaging
NHL : Non-Hodgkin's Lymphoma
NGT : Nasogastric Tube
NPO : Nil Per Os (Nil By Mouth)
NSAID : Non-Steroidal Anti Inflammatory drugs
NVE : Native Valve Endocarditis
OD : Once per day
ORS : Oral Rehydration Salts
PA : Postero-Anterior
PaO2 : Partial Pressure Oxygen
PCP : Pneumocystis Pneumonia
PDA : Patent ductus Arteriosus
PE : Pulmonary Embolus
PEF : Peak Expiratory Flow
PEEP : Positive End Expiratory Pressure
PO : Per Os (Take orally)
PPI : Proton Pump Inhibitor
PT : Prothrombin Time
PTT : Partial Thromboplastin Time
QID : Four times a day
PUD : Peptic Ulcer disease
RBC : Red Blood Cell
RNA : Ribonucleic Acid
RHD : Rheumatic Heart diseases
RSV : Respiratory Syncytial Virus
RR : Respiratory Rate
RV : Right Ventricle
SBP : Systolic Blood Pressure
SL : Sublingual
SLE : Systemic Lupus Erythematosus
SSSS : Staphylococcal Scaled skin Syndrome
SMEI : Severe Myoclonic Epilepsy of Infancy
T4 : Thyroxin
TB : Tuberculosis
TDS, TID : Three times per day
TORCHES : Toxoplasmosis Other Rubella Cytomegalovirus Herpes
TSH : Thyroid Stimulating Hormone

UGIB : Upper Gastro-Intestinal Bleeding
ULN : Upper Limit of Normal
UTI : Urinary Tract Infection
VLBW : Very Low Birth Weight
VSD : Ventricular Septal defect
VZV : Varicella-Zoster Virus
WAS : Wiskott Aldrich Syndrome
WBC : White Blood Count
WHO : World Health Organization

CHAPTER 1: PAEDIATRIC CRITICAL CARE MANAGEMENT

1.1 TRIAGE

Triage is the process of rapidly screening sick children soon after their arrival in hospital, in order to identify:

- Those with emergency signs, who require immediate emergency treatment;
- Those with priority signs, who should be given priority in the queue so that they can be assessed and treated without delay; and
- Non-urgent cases, who have neither emergency nor priority signs.

First check for emergency signs in three steps:

- ***Step 1*.** Check whether there is any airway or breathing problem; start immediate treatment to restore breathing, manage the airway and give oxygen.
- ***Step 2***. Quickly check whether the child is in shock or has diarrhoea with severe dehydration.
  - Give oxygen and start IV fluid resuscitation.
  - In trauma, if there is external bleeding, compress the wound to stop further blood loss.
- ***Step 3***. Quickly determine whether the child is unconscious or convulsing. Give IV glucose for hypoglycaemia and/or an anti-convulsant for convulsing.

Emergency signs include:

- Obstructed or absent breathing
- Severe respiratory distress
- Central cyanosis
- Signs of shock (cold hands, capillary refill time longer than 3 seconds, high heart rate with weak pulse, and low or unmeasurable blood pressure)
- Coma (or seriously reduced level of consciousness)
- Convulsions
- Signs of severe dehydration in a child with diarrhoea (lethargy, sunken eyes, very slow return after pinching the skin or any two of these).

***If emergency signs are found*:**

- After giving emergency treatment, proceed immediately to assessing, diagnosing and treating the underlying problem.
- Carry out emergency investigations (blood glucose, blood smear, haemoglobin [Hb]). Send blood for typing and cross-matching if the child is in shock, appears to be severely anaemic or is bleeding significantly.

Note: Children with these signs require immediate emergency treatment to avert death.

The priority signs

Identify children who are at higher risk of dying. These children should be assessed without unnecessary delay. If a child has one or more emergency signs, don't spend time looking for priority signs. If no emergency signs are found, check for priority signs:

- Tiny infant: any sick child aged < 2 months
- Temperature: child is very hot

- Trauma or other urgent surgical condition
- Pallor (severe)
- Poisoning (history of)
- Pain (severe)
- Respiratory distress
- Restless, continuously irritable or lethargic

Referral (urgent)

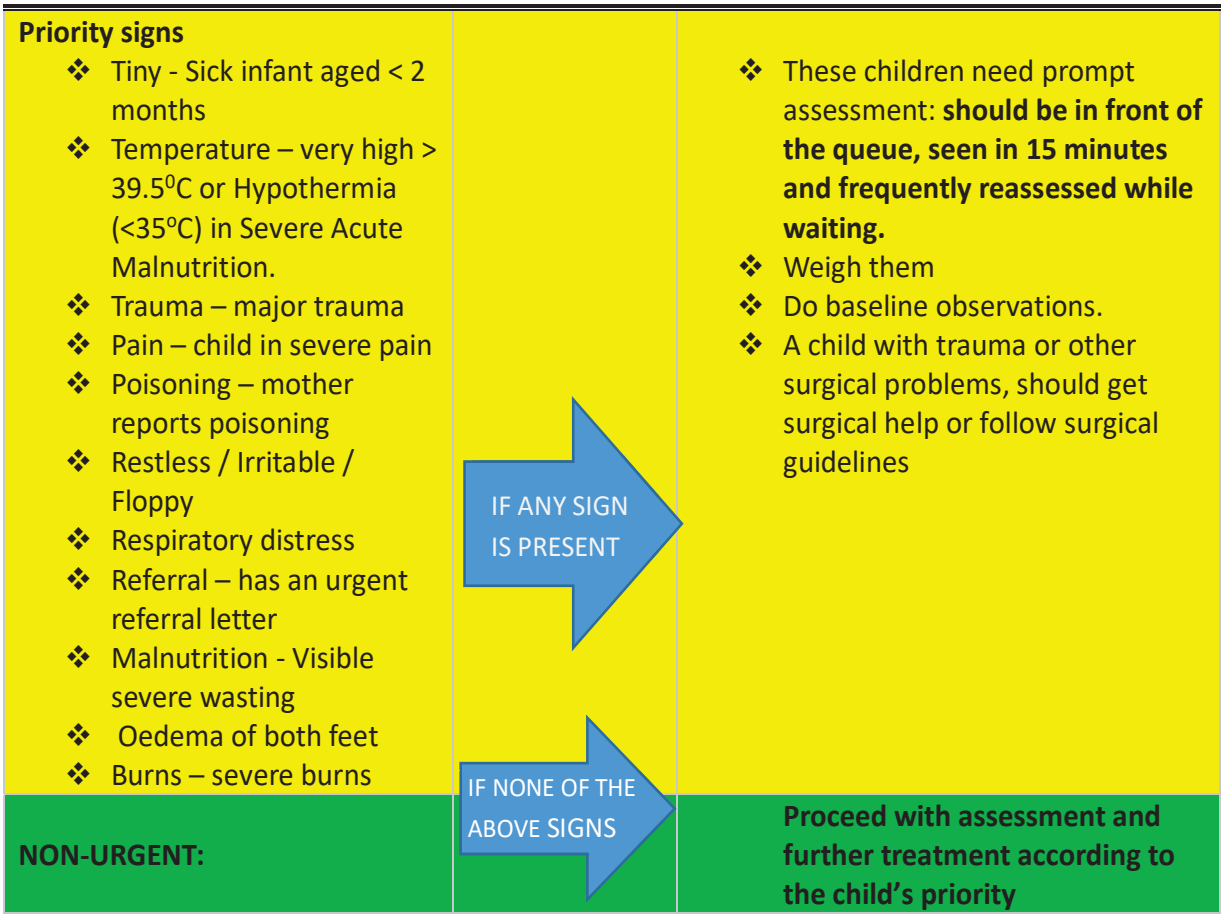
- Malnutrition: visible severe wasting or weight for length or weight-for-height<-3 SD or MUAC<11.5 cm
- Oedema of both feet (Pitting)
- Burns (major)

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

These children need prompt assessment (not 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 where available.

Table 1: ABCD for Triage
(Assessment should be in the order of Airway, Breathing, Circulation and Disability.
If there is any problem found, then intervention should be initiated as shown in the table below).

Airway and breathing ❖ Obstructed breathing ❖ Severe stridor ❖ Central Cyanosis ❖ Severe respiratory distress ❖ Weak / absent breathing	IF ANY SIGN IS PRESENT	❖ Immediate transfer to emergency ❖ Start Life support procedures ❖ Give oxygen ❖ Keep warm ❖ Weigh if possible
Circulation Cold Hands with any of: ❖ Capillary refill > 3 seconds ❖ Weak + fast pulse ❖ Slow (<60bpm) or absent pulse ❖ Active bleeding ❖ **Check for severe malnutrition**	IF ANY SIGN IS PRESENT	❖ Immediate transfer to emergency ❖ Start Life support procedures ❖ Give oxygen ❖ Stop any bleeding ❖ Keep warm ❖ Weigh if possible ❖ If no severe malnutrition: Give IV fluids rapidly via venous or intra-osseous lines ❖ If severe malnutrition: Give IV glucose, proceed with full assessment and treatment according to SAM guidelines
Coma / convulsing / confusion: AVPU = 'P or U' or Convulsions	IF AVPU<A	❖ Immediate transfer to emergency ❖ Manage the airway ❖ If convulsing, give diazepam rectally (If the IV line is installed use it instead of Rectal) ❖ Position the unconscious child ❖ Give IV glucose
Severe Dehydration (only in a child with diarrhoea and/or vomiting ❖ Diarrhoea plus any two of these signs: Lethargy. Sunken eyes, very slow skin pinch, unable to drink or drinks poorly ❖ **Check for severe malnutrition**	IF ANY SIGN IS PRESENT	❖ Immediate transfer to emergency ❖ Make sure the child is warm. ❖ If no severe malnutrition: Insert an IV line and begin giving fluids rapidly following diarrhoea treatment plan C ❖ If severe malnutrition: Rehydrate orally. ❖ Proceed immediately to full assessment and treatment according to SAM guidelines



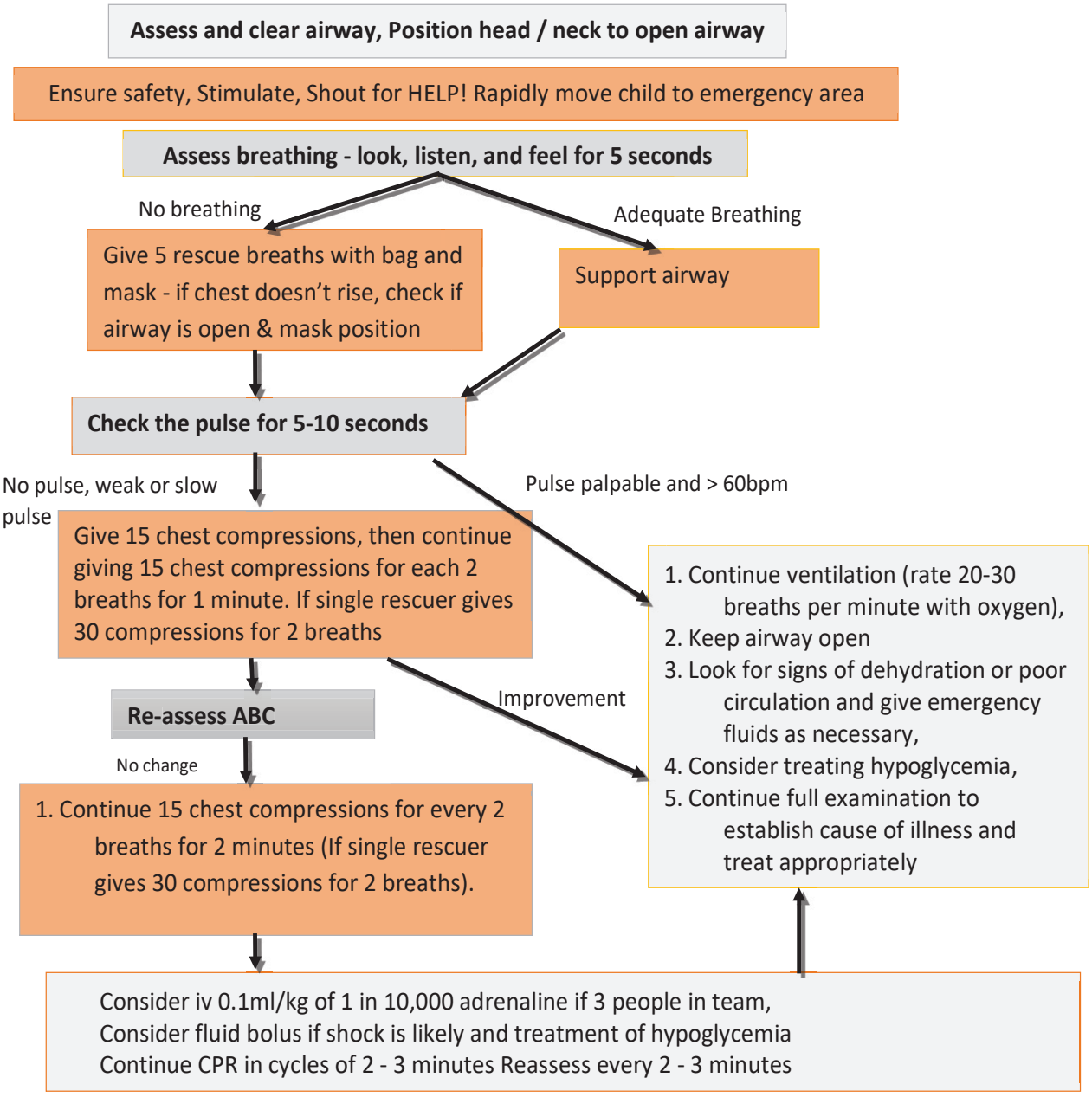
1.2 RESUSCITATION AND MANAGEMENT OF AIRWAY EMERGENCY

It is critical that healthcare providers be able to identify and treat infants and children in the pre-arrest, intra-arrest, and post arrest states. Differences in local healthcare organization and resource availability can lead to significant variation in practice. Paediatric life support guidelines like Emergency Triage and Treatment Plus (ETAT+), Paediatric Advanced Life Support (PALS) and others offer easy to use, unequivocal algorithm to help standardise care of critically ill children.

This chapters provides simple algorithms on how to resuscitate unresponsive child following ABCDE approach and how to manage airway emergencies, adapted from the Rwandan ETAT+

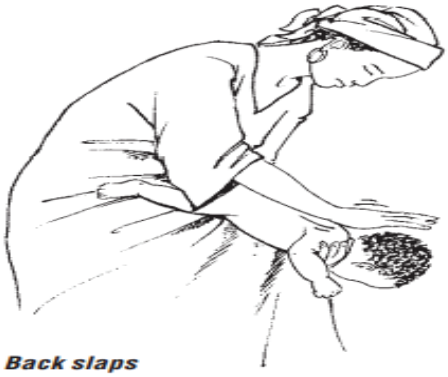
Basic Paediatric Protocol, 2020 version and WHO Hospital Care for children Pocket Book, second edition

Figure 1: ABC for infant / child basic life support



Adapted from Rwandan ETAT+, 2020 edition

Figure 2: How to manage a chocking infant



Back slaps

- Lay the infant on your arm or thigh in a head-down position.
- Give five blows to the middle of the infant's back with the heel of the hand.
- If obstruction persists, turn the infant over and give five chest thrusts with two fingers on the lower half of the sternum.

Chest thrusts

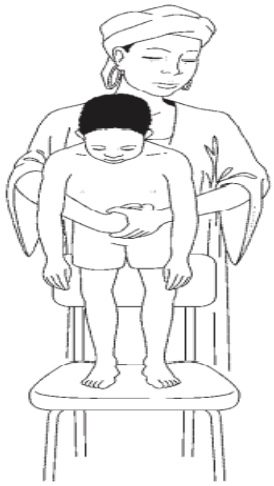
- If obstruction persists, check infant's mouth for any obstruction that can be removed.
- If necessary, repeat sequence with back slaps.

Figure 3: How to manage a chocking child (> 12 months old)

Back blows to clear airway obstruction in a choking child

Administer back blows to clear airway obstruction in a choking child.

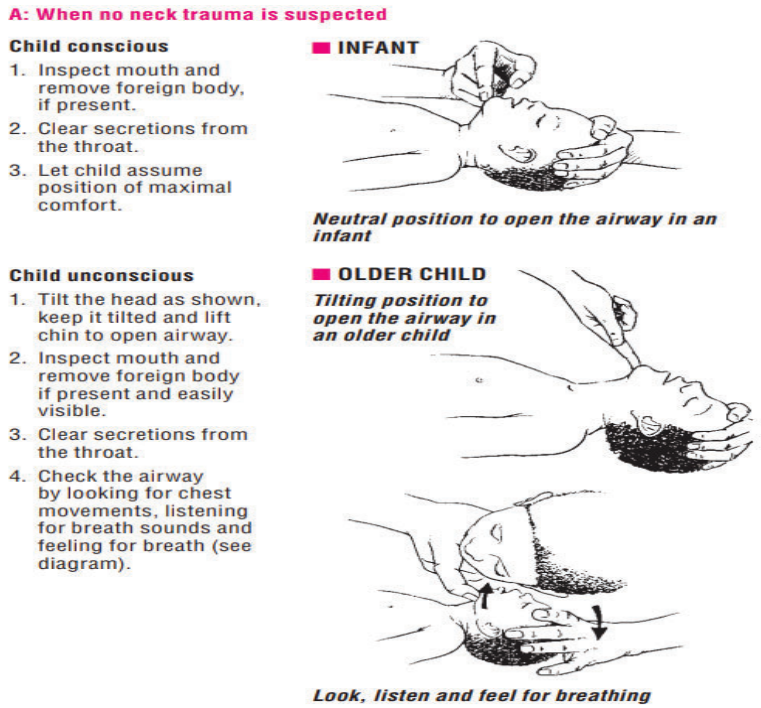
- Give five blows to the middle of the child's back with the heel of the hand, with the child sitting, kneeling or lying.
- If the obstruction persists, go behind the child and pass your arms around the child's body; form a fist with one hand immediately below the child's sternum; place the other hand over the fist and pull upwards into the abdomen (see diagram); repeat this Heimlich manoeuvre five times.
- If the obstruction persists, check the child's mouth for any obstruction that can be removed.
- If necessary, repeat this sequence with back blows.



Heimlich manoeuvre for a choking older child

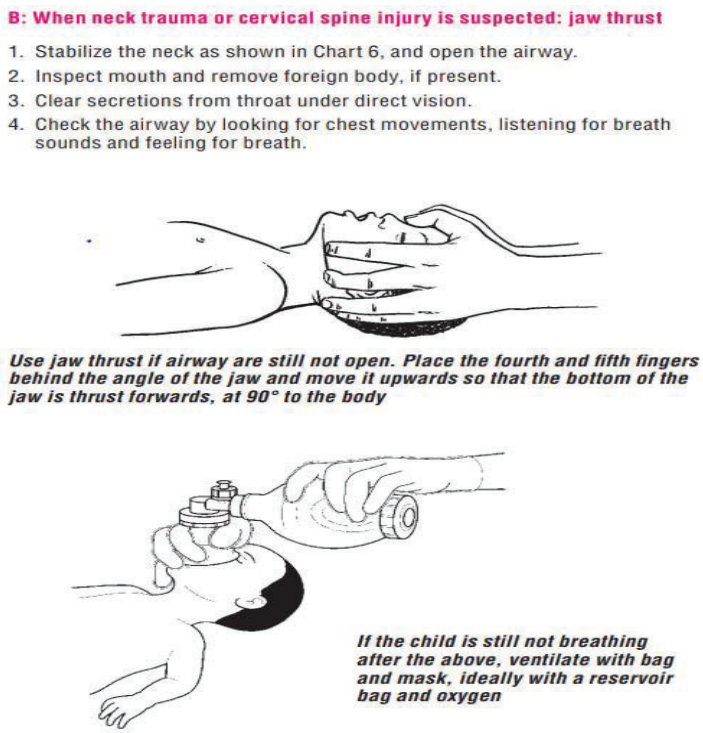
Adapted from WHO, Hospital Care for sick pocket book, second edition.

Figure 4: How to manage the child with obstructed breathing



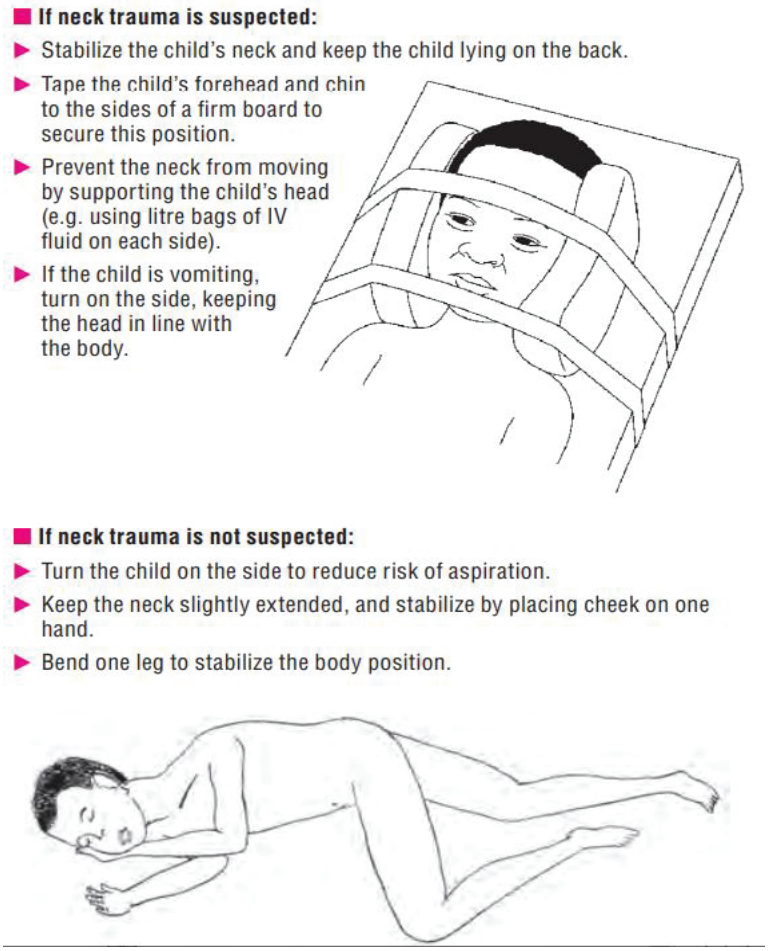
Adapted from WHO, Hospital Care for sick pocket book, second edition.

Figure 5: How to manage the child with obstructed breathing



Adapted from WHO, Hospital Care for sick, Pocket Book, second edition.

Figure 6: How to position an unconscious child



Adapted from WHO, Hospital Care for sick pocket book, second edition.

1.3 MANAGEMENT OF CHILD PRESENTING WITH SHOCK

Shock is a dynamic and unstable pathophysiologic state characterized by inadequate tissue perfusion. Although the effects of inadequate perfusion are reversible initially, prolonged oxygen deprivation leads to generalized cellular hypoxia and the disruption of critical biochemical processes, eventually resulting death.

History

- Acute or sudden onset
- Trauma
- Bleeding
- History of congenital or rheumatic heart disease
- History of diarrhoea
- Any febrile illness
- Known meningitis outbreak
- Fever
- Able to feed

Examination

- Consciousness level
- Any bleeding sites
- Cold or warm extremities
- Neck veins (elevated jugular venous pressure)
- Pulse volume and rate
- Blood pressure
- Liver size increased
- Petechiae
- Purpura

Table 2**:** Differential diagnosis in a child presenting with shock**.**

Children with shock are lethargic, have fast breathing, cold skin, prolonged capillary refill, fast weak pulse and may have low blood pressure as a late sign. To help make a specific diagnosis of the cause of shock, look for the signs below.

Diagnosis or underlying cause	In favour
Bleeding shock	– History of trauma – Bleeding site
Dengue shock syndrome	– Known dengue outbreak or season – History of high fever – Purpura
Cardiac shock	– History of heart disease or heart murmur – Enlarged neck veins and liver – Crepitations in both lung fields
Septic shock	– History of febrile illness – Very ill child – Skin may be warm but blood pressure low, or skin may be cold – Purpura may be present or history of meningococcal outbreak
Shock associated with severe dehydration	– History of profuse diarrhoea – Known cholera outbreak

Management

Physiological indicators that should be targeted during therapy include:

- Blood pressure (systolic pressure at least 5th percentile for age: 60 mmHg <1 month of age, 70 mmHg + [2 x age in years] in children 1 month to 10 years of age, 90 mmHg in children 10 years of age or older)
- Quality of central and peripheral pulses (strong, distal pulses equal to central pulses)
- Skin perfusion (warm, with capillary refill <2 seconds)
- Mental status (normal mental status)
- Urine output (≥1 mL/kg per hour, once effective circulating volume is restored)

Vascular access

Vascular access must be quickly obtained as soon as circulatory compromise is identified.
Peripheral intravenous access should be attempted initially.
Intraosseous cannulation should be considered if rapid intravenous access cannot be rapidly secured.

1.3.1 Hypovolemic shock

The management of hypovolemic shock focuses on fluid replacement and preventing ongoing fluid loss.

- Resuscitate with isotonic crystalloid (Normal saline or Ringers lactate) 20 mL/kg per bolus within 15 minutes, repeated as needed.
- Considerations for children who have not improved after receiving a total of 60 mL/kg over 30 to 60 minutes include:
    - The amount of fluid loss may have been underestimated (as with burn injury) or there may be significant ongoing fluid loss (i.e. from haemorrhage with blunt abdominal trauma or capillary leak with bowel obstruction).
    - Colloid is suggested for patients with capillary leak or hypoalbuminemia who have not improved after initial therapy with crystalloid solutions.
- Patients with haemorrhagic shock who have not improved should receive blood and require definitive treatment for the cause of haemorrhage
- In case of acute malnutrition, give IV Ringer's lactate solution with 5% dextrose 15 ml/kg over 1 hour. Then follow protocol for management of acute malnutrition

1.3.2 Septic shock

- Antipyretic therapy may reduce the metabolic requirements of children with fever.
- Children in septic shock typically require 20mls/kg within 15 minutes, may give up to 3 bolus (60 mL/kg) of an isotonic crystalloid solution for initial resuscitation depending on patient response.
- Children who have not improved after 60 mL/kg of isotonic crystalloid, should receive early vasoactive therapy in addition to maintenance fluid. The following vasoactive infusions should be added if there is no clinical improvement.
- Low dose dopamine (2 to 5 mcg/kg/min) for children who are normotensive, titrate to targeted BP if hypotensive and vasodilated to a maximum of 20mcg/kg/min.
- Epinephrine for children who are hypotensive and vasoconstricted despite maximum beta adrenergic doses of dopamine and/or norepinephrine.
- Consider early referral to higher level for critical care management if not able to give vasoactive therapy.

1.3.3 Anaphylactic shock

A history of allergies and/or the presence of stridor, wheezing, urticaria, or facial oedema suggest anaphylaxis.
Children with possible anaphylaxis should receive:

- Resuscitate with isotonic crystalloid (normal saline or ringers lactate) 20 mL/kg per bolus within 15 minutes, repeated as needed

- Intramuscular epinephrine (1:1,000), 0.01mg/kg, the dose may be given 2-3 times with 5-15 minutes interval or in case of emergency give 7.5-15<kg: 0.1mg, 15-<30kg: 0.15mg, >30kg: 0.3mg).
- Adjunct treatment
  - Promethazine 0.1mg/kg/dose or Intravenous or intramuscular diphenhydramine 1-2mg/kg (maximum 50mg)
  - Steroids: Hydrocortisone 5mg/kg single dose or maintenance depending on clinical response
  - Nebulization with salbutamol and saline or give aminophylline IV loading 5mg/kg infusion over 20 minutes
  - If hypotension, fluid boluses according to shock management described above.

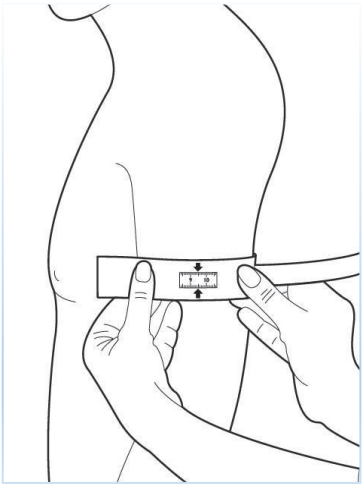
1.3.4 Cardiogenic shock

A history of heart disease, an abnormal cardiac examination, and/or worsening clinical condition with fluid resuscitation are suggestive of cardiogenic shock.

Management of cardiogenic shock is discussed under Cardiovascular diseases chapter 5

1.4 MANAGEMENT OF SEVERE ACUTE MALNUTRITION

Anthropometry (body measurement) quantifies malnutrition. In children, measurement of mid-upper arm circumference (MUAC) is the simplest. Weight and height measurements can be useful to detect wasting and stunting and individual monitoring over time e.g. growth velocity.



Mid upper arm circumference (MUAC)

MUAC is measured using a tape around the left upper arm. MUAC is quicker in sick patients so use MUAC in acute management.

Weight, Height and Age

- *Weight for height (W/H)**:*** Measure length (Lying) if aged <2 years to give weight for length.
  Low W/H (or W/L) = wasting and indicates acute malnutrition.
- *Weight for age (W/A):* Low W/A does not distinguish acute from chronic malnutrition. W/A is thus ***not used*** for diagnosis of acute malnutrition, but plotted over time, e.g. in MCH Passport

In the diagnosis of acute malnutrition, we use W/H ***expressed as Z scores***. Z

Visible Severe Wasting (VSW) it tends to identify only severest cases of SAM. It is better to use MUAC. ***Kwashiorkor = severe malnutrition at any age***

Table 3: Determination of severity of SAM using MUAC

Acute Malnutrition - Severity	MUAC cm	WHZ
None	>13.5	>-1
At Risk	12.5 to 13.4	-2 to -1
Moderate	11.5 to 12.4	-3 to -2
Severe	**<11.5**	**<-3**
	Kwashiorkor	

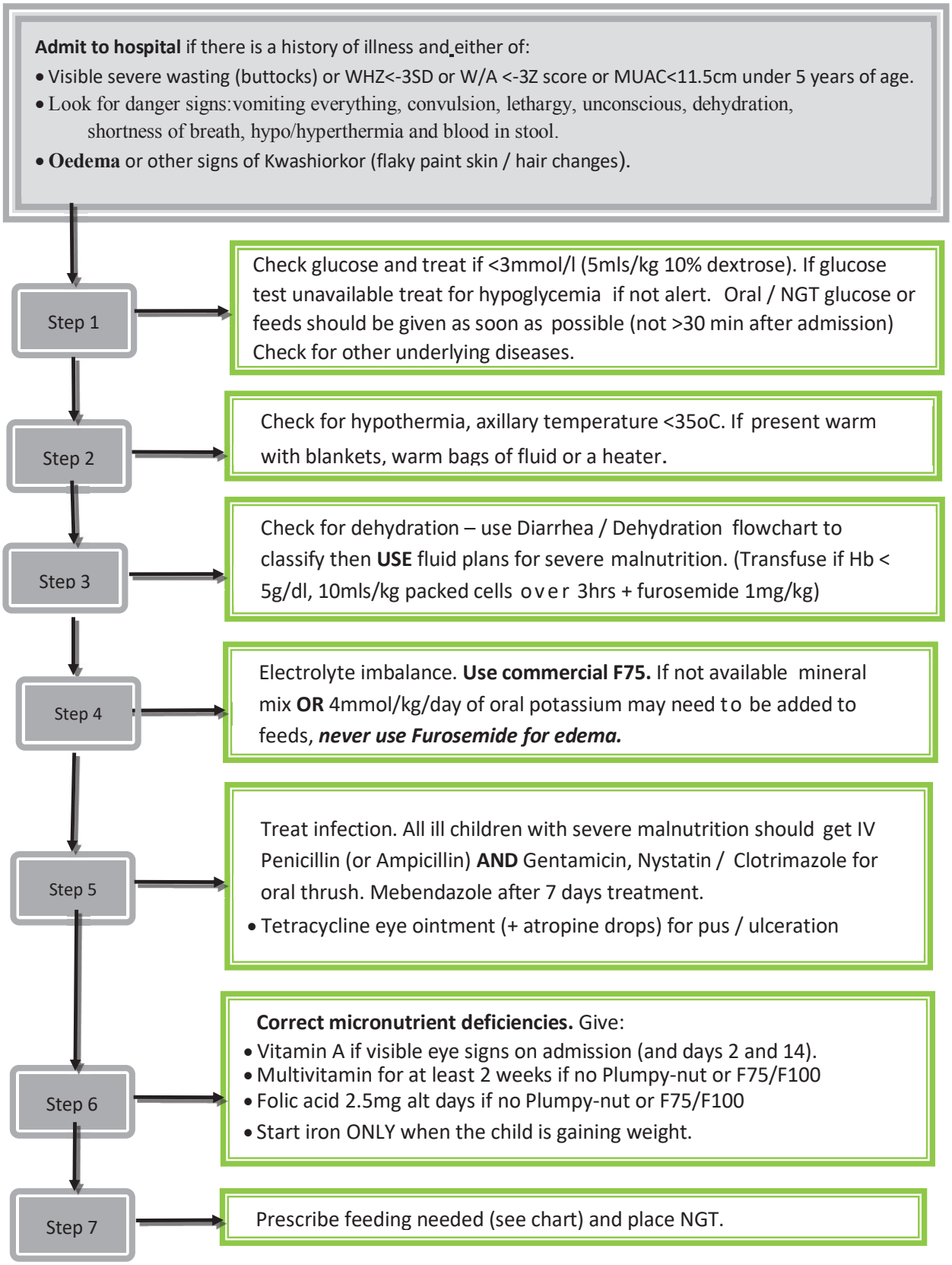
Adapted from Rwandan ETAT+, 2020 edition

SAM Management

Admit to hospital if there is a history of illness and either of:

- Visible severe wasting (buttocks) or WHZ<-3SD or W/A <-3Z score or MUAC<11.5cm under 5 years of age.
- Look for danger signs: vomiting everything, convulsion, lethargy, unconscious, dehydration, shortness of breath, hypo/hyperthermia and blood in stool.
- Pitting ***Oedema*** or other signs of Kwashiorkor (flaky paint skin / hair changes).

Figure 7: Symptomatic severe malnutrition. (Age 6 – 59 months).



Fluid management in severe malnutrition with diarrhoea

Shock:

- AVPU<A, absent, or weak pulse plus prolonged capillary refilling (>3s) plus cold periphery with temperature gradient
- 20 ml/kg over 2 hours of Ringer's Lactate (RL)/5% dextrose**.** – add 50mls 50% dextrose to 450mls Ringers (or 10% Dextrose/Half Strength Darrows if no Ringers).
- If severe anaemia start urgent blood transfusion not Ringers.

Not in shock or after treating shock

- If unable to give oral / NGT fluid because of very poor medical condition, use / continue with iv fluids at maintenance regimen of 4mls/kg/hour

***Able to introduce oral or NG fluids / feeds*:**

- **For 2 hours:** Give ReSoMal (Rehydration Solution for Malnutrition) at 10mls/kg/hour
- **Then:** Introduce first feed with F75 and alternate ReSoMal / F75 each hour at 7.5mls/kg/hour for 10 hours – can increase or decrease hourly fluid as tolerated between 5 – 10mls/kg/hour.
- At 12 hours switch to 3 hourly oral / NGT feeds with F75

Symptomatic severe malnutrition in infants < 6 months.

- Give the same general medical care as infants with severe acute malnutrition older than 6 months
- Prioritize establishing, or re-establishing, effective exclusive breastfeeding by the mother
- Can be discharged from all care when they:
  - Are breastfeeding effectively or feeding well with replacement feeds
  - Have adequate weight gain
  - Have a weight-for-length ≥–2 Z-scores of the WHO Child Growth Standards median.

Table 4: Weight based fluid volumes in SAM

	Shock		Oral / NGT ReSoMal	Emergency Maintenance
	20mls/kg		10mls/kg/hour	4mls/kg/hour
	Ringer's Lactate (RL) in 5% Dextrose		ReSoMal Oral / NGT **10mls/kg/hour** for up to 10 hours	RL/D 5% Dextrose iv Hourly until transfusion
	Iv			
	Shock = over 2 hours 80	**Drops/min if 20drops/ml giving set** *13*		
4.00			40	15
5.00	100	*17*	50	20
6.00	120	*20*	60	25
7.00	140	*23*	70	30
8.00	160	*27*	80	30
9.00	180	*30*	90	35
10.00	200	*33*	100	40
11.00	220	*37*	110	44
12.00	240	*40*	120	46
13.00	260	*43*	130	48
14.00	280	*47*	140	50
15.00	300	*50*	150	52

Adapted from Rwandan ETAT+, 2020 edition

1.5 MAGEMENT OF COMMON POISONING

Suspect poisoning in any unexplained illness in a previously healthy child or with suggestive history. Note that traditional medicines can be a source of poisoning.

Diagnosis

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

- Obtain full details of the poisoning agent, the amount ingested, the time of ingestion, attempt to identify the exact agent involved and ask to see the container, when relevant.
- Check for signs of burns in or around the mouth or of stridor (upper airway or laryngeal damage), which suggest ingestion of corrosives.
- Admit all children who have deliberately ingested iron, pesticides, Paracetamol or aspirin, narcotics or antidepressant drugs; and those who may have been given the drug or poison intentionally by another child or adult.
- 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 pulmonary oedema, which may take some hours to develop.
- A specific antidote if this is indicated

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.
- Gastric decontamination is most effective within 1 h of ingestion. After this time, there is usually little benefit, except for agents that delay gastric emptying.
- A decision to undertake gastric decontamination must weigh the likely benefits against the risks associated with aspiration.
- Gastric decontamination does not guarantee that all the substance has been removed, so the child may still be in danger.
- Contraindications to gastric decontamination are:
    - An unprotected airway in an unconscious child, except when the airway has been protected by intubation with an inflated tube.
    - Ingestion of corrosives or petroleum products
- Check the child for emergency signs and for hypoglycaemia; correct hypoglycemia if present or give dextrose bolus if not able to measure.
- Identify the specific agent and remove or adsorb it as soon as possible. Treatment is most effective if given, ideally within 1 h.
- If the child swallowed kerosene, petrol or petrol-based products (note that most pesticides are in petrol-based solvents); if the child's mouth and throat have been burnt (for example with bleach, toilet cleaner or battery acid), do not make the child vomit but give water or milk orally.
- If the child has swallowed other poisons, give activated charcoal, and do not induce vomiting

Activated charcoal

- Given by mouth or nasogastric tube at the doses shown in the below.
- If a nasogastric tube is used, be particularly careful that the tube is in the stomach and not in the airway or lungs.
- Mix the charcoal in 8–10 volumes 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.

Table 5: Amount of activated charcoal per dose

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

Gastric lavage

- Undertake gastric lavage only if staff have experience in the procedure
- If ingestion was less than 1 h previously and is life-threatening
- If the child did not ingest corrosives or petroleum derivatives
- 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 and ensure the tube is in the stomach.
- Perform lavage with 10 ml/kg of normal saline (0.9%). Ensure the volume of lavage fluid returned be approximate the amount of fluid given.
- Lavage should be continued until the recovered lavage solution is clear of particulate matter

Give general care

- Keep the child under observation for 4–24 h, depending on the poison swallowed.
- Keep unconscious children in the recovery position.
- Consider transferring the child to next higher level only when appropriate and when this can be done safely done.

Principles 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.
- Removed clothing and personal effects should be stored safely in a see-through ***plastic bag that can be sealed, for later cleansing or disposal.***

Eye contamination

- Rinse the eye for 10–15 min with clean running water or normal saline. Evert the eyelids and ensure that all surfaces are rinsed.
- Use of anaesthetic eye drops will assist with irrigation.
- When possible, the eye should be thoroughly examined by ophthalmologist for signs of corneal damage.
- If there is significant conjunctival or corneal damage, the child should urgently treated.

Principles for inhaled poisons management

- Remove the child from the source of exposure.
- 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 and urgent referral should be arranged.
- Follow-up plan

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.
    - Do not induce vomiting if the child has swallowed kerosene, petrol or petrol based products, if the child's mouth and throat have been burnt or if the child is drowsy.
    - If the child swallowed bleach or another corrosive, give milk or water to drink as soon as possible.
    - Take the child to a health facility as soon as possible, together with information about the substance concerned, e.g. the container, label, sample of tablets, berries.

Table 6: Common non-pharmaceutical products involved in household poisoning

Product	***Characteristics***	***Symptoms***	***Treatment***
Aftershave, alcohols, cologne, mouthwash, perfumes	Ethanol containing agents; perfumes contain up to 75 % to 95 %	CNS and respiratory depression, hypoglycaemia, acidosis	Clinical observation Administer oral or intravenous glucose in hypoglycemic children depending on severity Respiratory support as needed
Bleach	Household solutions contain approximately 3–10 % sodium hypochlorite or less commonly 3 % hydrogen peroxide; extremely unpalatable; unlikely to cause serious damage.	Nausea, vomiting, diarrhoea; Esophageal injury rarely occurs; Hypernatraemia, hyperchloremic, acidosis. External contamination may result in eye or skin irritation	Administer fluids; hospital admission of children at risk of developing esophageal injury Structured post discharge follow-up if there was injury
Dishwasher powders, liquids, tablets	Older or professional use products: Strongly alkaline; possible severe corrosive injury	Hypersalivation, drooling, vomiting, haematemesis, pain. Esophageal injury may occur in the absence of oral burns	Remaining products must be washed off; Administer oral fluids; supportive treatment Manage esophageal burns
Disinfectants and antiseptics	May contain a number of toxic constituents (chlorhexidine, hexylresorcinol, hydrogen peroxide, ichthammol, iodine, phenol, potassium permanganate); Usually they are found in very low quantities in diluted solutions	Irritation of the oral mucosa, and transient gastrointestinal upset, Aspiration pneumonia. Systemic toxicity: Acidosis, CNS depression, hepatic/renal damage depending on the substances involved	Administer fluids; Precise identification of the involved substance is essential. Assess and manage esophageal injury
Petroleum distillates(paraffin, kerosene, petrol, diesel, lubricating, engine oils)	-Low systemic toxicity	Aliphatic hydrocarbons: Chemical pneumonitis. Many aromatic and halogenated hydrocarbons may cause CNS depression, seizures, and cardiac arrhythmias	Clinical observation; Administer fluids; Chest X ray and supportive treatment in severe cases of chemical pneumonitis

Table 7: Common pharmaceuticals involved in unintentional poisoning in children

Drug	Characteristics	Symptoms	Treatment
Cough and decongestant preparations	Active ingredients include: Sympathomimetics, opioids, antihistamines and expectorants. The ingestion of several active ingredients in a single preparation can cause a confusing clinical picture and potentiate adverse effects	Dependent on the active ingredient: Hypertension, reflex bradycardia, arrhythmias, convulsions, respiratory depression, coma	Hospital admission dependent on type and amount of ingested substance, and severity of symptoms. Mainly treatment is supportive
Non-steroidal anti-inflammatory drugs (NSAIDs)	Ibuprofen accounts for 65-81 % of childhood NSAID exposures. Generally of low toxicity, but mefenamic acid may cause significant toxicity	Gastrointestinal upset, headache, dizziness, tinnitus, and visual disturbance. Hypotension, tachycardia, and hypothermia rarely occur. In large overdose electrolyte disturbances, metabolic acidosis CNS depression, convulsions	Symptomatic children require hospital admission. Oral fluids should be encouraged and dehydration corrected. Electrolytes, creatinine, and acid-base balance should be monitored. Diazepam is the treatment of choice for convulsions
Paracetamol (acetaminophen)	Toxic Paracetamol concentrations associated with the unintentional ingestion in children are extremely rare.	Nausea, vomiting, abdominal pain, signs and symptoms of hepatic dysfunction	If the dose ingested cannot be confirmed or is ≥ 150 mg / kg, measurement of blood Paracetamol concentration at least four hours following ingestion is indicated. -Then treatment with intravenous infusion of acetyl cysteine (150 mg / kg in 60 min, then 50 mg / kg in 4 h, followed by 100 mg / kg in 16 h) or oral (140 mg / kg loading dose followed by an additional 17 doses of 70 mg / kg every 4 h) -Assessment of electrolytes, creatinine, liver enzymes, and coagulation parameters is mandatory

Table 8: Pharmaceutical and non-pharmaceutical substances with a high potential for toxicity

Substance	Characteristics	Symptoms	Treatment
Antihistamines (H 1 and H 2 receptor antagonists)	H 1 antagonists: Anticholinergic, anti-serotonergic, and anti-adrenergic Properties. Cardiac toxicity mediated by myocardial sodium channel blockade. H 2 receptor antagonists rarely cause significant toxicity	CNS depression, nausea, emesis. Anticholinergic side effects in overdose (dry mouth, mydriasis, Hallucinations, convulsions). Cardiac dysrhythmias with prolongation of QRS and the QT interval, ventricular tachyarrhythmias, Torsades de pointes.	Clinical observation; Symptomatic children require hospital admission. ECG monitoring; Administer intravenous fluids in hypotensive children, avoid epinephrine because of possible paradoxical hypotension. Tachyarrhythmias with QRS widening: An initial bolus of 1 ml / kg of 8.4 % sodium bicarbonate. Further doses of sodium bicarbonate may be required to keep the arterial pH between 7.45 and 7.55, and QRS complex < 0.1 s. Consider lidocaine in ventricular tachycardia (VT). Administration of magnesium sulphate in children with Torsades de pointes dysrhythmia (15–30 mg / kg). Defibrillation is mandatory in children with pulseless VT or ventricular fibrillation. Benzodiazepines are given if convulsions or agitation occur
Iron	Highly toxic; may be contained in vitamin preparations; toxicity depends on the elemental iron content of the salt as the supplement	Early signs include vomiting, diarrhoea, abdominal pain, gastrointestinal haemorrhage; After apparent stabilization (6 – 24 h post ingestion), Mitochondrial toxicity may evolve resulting in shock, acidosis, coma, seizures, hepatic and renal failure.	If ingested dosage > 40 mg / kg hospital admission is required. Abdominal X-ray examination; Whole bowel-irrigation if undissolved iron tablets are visible; if tablets are confined to the stomach: repeated gastric lavage or endoscopic removal. Determination of serum iron level 4–6 h post-ingestion, repetition at 8 h in case of sustained release preparations; if serum levels exceeds 500 g / dl (90 mmol /

		Late sequelae are seen rarely and include gastrointestinal scarring and stricture formation (gastric outlet obstruction)	l) regardless of symptoms, and at 350 –500 g / dl (63 – 90 mmol / l) for symptomatic patients administer intravenous Deferoxamine 15 mg / kg / h. Intensive supportive care
Organophosphate (OP) and carbamate insecticides	Constituents of insecticides; acetyl Cholinesterase inhibition; stimulation of acetylcholine receptors throughout the body. Common poison in the developing world	Muscarinic effects: Increased secretions from salivary, lacrimal, bronchial, and gastrointestinal glands, and increased peristaltic activity, bronchoconstriction, bradycardia, hypotension, miosis, loss of visual acuity; urinary / faecal incontinence. Nicotinergic effects: Muscle stimulation followed by paralysis. - Direct CNS effects: Coma, convulsions, respiratory and cardio-circulatory failure.	Clinical observation of asymptomatic children; assessment of cholinesterase enzyme activity; supportive care in patients with mild symptoms; Atropine is given as an antidote (0.01- 0.02 mg / kg; second-line medication: Pralidoxime or obidoxime (reactivates inactivates acetylcholinesterase). - Intensive supportive care including mechanical ventilation, inotropes depending on clinical condition.
Selective serotonin reuptake inhibitors (SSRI)	SSRI usage has increased in recent years. Less toxic in overdose than tricyclic antidepressants	Emesis, agitation, tremor, nystagmus, drowsiness; convulsions, and dysrhythmias. Sinus tachycardia, bradycardia. QT prolongation is seen mainly with citalopram overdose. - Serotoninergic syndrome especially when congested with TCA, MAO inhibitors or other SSRIs	Clinical observation of asymptomatic patients; Supportive treatment. In case of cardiac dysrhythmias, see *tricyclic antidepressants (TCA)*

1.6 MANAGING COMMON CAUSES OF ENVENOMING

It is important to have some knowledge of the common poisonous animals, early recognition of clinically relevant envenoming or poisoning, and symptomatic and specific forms of treatment available.

1.6.1 Snake bite

- 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.

Diagnosis

- General signs include shock, vomiting and headache.
- Examine bite for signs such as local necrosis, bleeding or tender local lymph node enlargement.
- Specific signs depend on the venom and its effects, these include:
  - Shock
  - Local swelling that may gradually extend up the bitten limb
  - Bleeding: external from gums, wounds or sores; internal, especially intracranial.
  - Signs of neurotoxicity: respiratory difficulty or paralysis, ptosis, bulbar palsy (difficulty in swallowing and talking), limb weakness.
  - Signs of muscle breakdown: muscle pains and black urine
- It is important to check Hb and whenever possible, to assess coagulation profile.

Treatment

First aid

- Splint the limb to reduce movement and absorption of venom.
- If the bite is likely to have been by a snake with neurotoxic venom, apply a firm bandage to the affected limb, from fingers or toes to near the site of the bite.
- Clean the wound.
- Transport the child to a hospital that has anti-venom as soon as possible.
- If the snake has been killed, take it with the child to hospital.

Note: Avoid cutting the wound or applying a tourniquet.

Hospital care

- Treat shock, if present
- Paralysis of respiratory muscles can last for days and requires intubation and mechanical ventilation until respiratory function returns.
- Attention to carefully securing the endotracheal tube is important.
- Antivenom (refer to RMH, KFH,)
- If there are systemic or severe local signs (swelling of more than half the limb or severe necrosis), give Antivenom if available.
  - Give monovalent Antivenom if the species of snake is known.

- Give polyvalent antivenom if the species is not known.
- Follow the directions given on preparation of the antivenom. The dose for children is the same as that for adults.
- Dilute the antivenom in two to three volumes of 0.9% saline and give intravenously over 1 h. Give more slowly initially, and monitor closely for anaphylaxis or other serious adverse reactions
- If itching or an urticarial rash, restlessness, fever, cough or difficult breathing develop, then stop antivenom and give adrenaline at 0.15 ml of 1:1000 IM, Chlorphenamine at 0.25 mg/kg (see anaphylaxis treatment)
- When the child is stable, re-start antivenom infusion slowly.
- More antivenom should be given after 6 h if there is recurrence of blood clotting disorder or after 1–2 h if the patient is continuing to bleed briskly or has deteriorating neurotoxic or cardiovascular signs.

- Clotting function returns to normal only after clotting factors are produced by the liver.
- The response of abnormal neurological signs to antivenom is more variable and depends on the type of venom.
- Consider anticholinesterases, can reverse neurological signs in children bitten by some species of snake

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. Surgical care will include:
- Excision of dead tissue from wound
- Incision of fascial membranes (fasciotomy) to relieve pressure in limb compartments, if necessary
- Skin grafting, if there is extensive necrosis
- Tracheostomy (or endotracheal intubation) if the muscles involved are paralyzed

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 antitetanus prophylaxis.
- Antibiotic treatment is not required unless there is tissue necrosis at the wound site.
- Avoid IM injections.

1.6.2 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, they include:
  - 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.
- Check for low blood pressure or raised blood pressure and treat if there are signs of heart failure.

Treatment

- Transport to hospital as soon as possible.
- If there are signs of severe envenoming, give scorpion antivenom, if available (as above for snake antivenom infusion).
- Treat heart failure, if present.
- Consider use of Prazosin if there is pulmonary oedema.
- Give oral Paracetamol, oral or IM morphine according to severity of pain
- If very severe, infiltrate the site with 1% lignocaine, without Adrenaline

1.7 TRAUMA AND INJURIES

- Severe multiple injuries or major trauma are life-threatening problems that children may present with to hospital.
- Multiple organs and limbs may be affected, and the cumulative effects of these injuries may cause rapid deterioration of the child's condition.
- Management requires urgent recognition of the life-threatening injuries.
- Basic techniques of emergency triage and assessment are most critical in the first hour of the patient's arrival at hospital.
- When there is more than one life threatening state, simultaneous treatment of injuries is essential and requires effective teamwork.

Primary survey or initial assessment

Initial assessment

- The initial rapid assessment, also commonly referred to as 'the primary survey', should identify life-threatening injuries such as:
  - Airway obstruction
  - Chest injuries with breathing difficulty
  - Severe external or internal haemorrhage
  - Head and cervical spine injuries
  - Abdominal injuries.

The primary survey

- The primary survey should be systematic, if there is a risk of neck injury, avoid moving the neck and stabilize as appropriate.
- During the primary survey, any deterioration in the patient's clinical condition should be managed by reassessment from the start of the protocol; as a previously undiagnosed injury may become apparent.
- The systematic approach should comprise assessment of:
  - Airway patency
  - Breathing adequacy
  - Circulation and control of haemorrhage
  - Central nervous system (assess coma scale), cervical spine immobilization
  - Exposure of the whole body and looking for injuries.

All the key organ systems and body areas injured during the primary assessment, provide emergency treatment.

- Resuscitate the patient as appropriate
- Give oxygen by bag or mask if necessary
- Stop any haemorrhage
- Gain circulatory access in order to support the circulation by infusion of crystalloids or blood if necessary.
- Draw blood for Hb and group and cross-matching as you set up IV access.
- Document all procedures undertaken.

Secondary survey

- Conduct a secondary survey only when the patient's airway patency, breathing, circulation and consciousness are stable.
- Undertake a head-to-toe examination, noting particularly the following:
  - Head: scalp and ocular abnormalities, external ears and periorbital soft tissue injuries
  - Neck: penetrating wounds, subcutaneous emphysema, tracheal deviation and neck vein appearance
  - Neurological: brain function (level of consciousness, AVPU), spinal cord motor activity and sensation and reflex
  - Chest: clavicles and all ribs, breath sounds and heart sounds • Abdominal: penetrating abdominal wound requiring surgical exploration, blunt trauma and rectal examination when necessary
  - Pelvis and limbs: fractures, peripheral pulses, cuts, bruises and other minor injuries

Investigations

- After the child is stabilized and when indicated, investigations can be performed. In general, the following investigations may be useful, depending on the type of injury:
- X-rays: depending on the suspected injury (may include chest, lateral neck, pelvis, cervical spine, with all seven vertebrae, long bones and skull).

- Ultrasound scan: a scan of the abdomen may be useful in diagnosing internal haemorrhage or organ injury.

Treatment

- Once the child is stable, proceed with management, with emphasis on achieving and maintaining homeostasis, and, if necessary arrange transfer to an appropriate referral hospital.
- In the absence of head injury, give morphine 0.05–0.1 mg/kg IV for pain relief, followed by 0.01–0.02 mg/kg increments at 10-min intervals until an adequate response is achieved.
- Pain relief and patient reassurance should be provided during all stages of care.
- If there are signs of shock, give 20 ml/kg of normal saline, and re-assess (refer to shock management as above).
- If blood is required after haemorrhage, give initially 20 ml/kg of whole blood or 10 ml/kg of packed red cells.
- Manage hypoglycaemia
- Consult or refer to specific specialties for management of specific injuries.

References

1. Turner EL et al, (2016) A Review of Pediatric Critical Care in Resource Limited Settings: A Look at Past, Present, and Future Directions. Front. Pediatr. 4:5. doi: 10.3389/fped.2016
2. Kelly M and Scott L.W. Initial resuscitation and management of pediatric septic shock.Minerva Pediatr. 2015 April ; 67(2): 141–158.
3. WHO. Pocket Book of Hospital Care for Children, second edition, 2013.
4. Ministry of Health (MOH). Basic Paediatric Care, 2020 edition.

1.8 HYPONATRAEMIA

Definition

Hyponatraemia is defined as serum sodium <135 mmol/L, which result from either a deficit of sodium or an excess of free water. Hyponatraemia is among the most common electrolyte abnormalities in children. Drops in sodium level can lead to neurologic findings and in severe cases significant morbidity and mortality, especially in those with acute and rapid changes in plasma or serum sodium. Most children with Na >125 mmol/L are asymptomatic.

- Hyponatraemia and rapid fluid shifts can result in cerebral oedema causing neurological symptoms.
- If Na <125 mmol/L or if serum sodium has fallen rapidly vague symptoms such as nausea and malaise are more likely and may progress.
- If Na <120 mmol/L: headache, lethargy, obtundation and seizures may occur.
- Chronic hyponatraemia (developing >24 hours) may have more subtle features such as restlessness, weakness, fatigue or irritability (due to cerebral adaptation)

- Rapid correction of hyponatraemia can result in osmotic demyelination syndrome which manifests as irreversible neurologic features (dysarthria, confusion, obtundation and coma) which often present days after sodium correction.

Table 9: Classification and common causes of Hyponatraemia

Fluid Overloaded	Euvolaemic	Dehydrated

• **IV fluid administration in excess of the child's needs**
• Nephrotic syndrome
• Cirrhosis
• Heart Failure
• Acute/ Chronic Renal Failure
• Obstructive uropathy
	• **Administration of enteral hypotonic fluids** (including dilute formula, Oral Rehydration Solutions, excessive water intake)
	• Psychogenic Polydipsia
	• **Increased ADH secretion**
	  • **Pulmonary: pneumonia, bronchiolitis, mechanical ventilation**
	  • **CNS: infections, injury, tumour**
	  • **Post-operative, trauma, pain**
	  • Endocrine: Hypothyroid, low cortisol
	• Medications
	  • Chemotherapy (cyclophosphamide, vincristine, platinum based agents)
	  • Antiepileptics (valproate, carbamazepine, oxcarbazepine)
	  • Vasopressin
		• **GI losses and rehydration with free water**
		  • Gastroenteritis
		  • Secretory/osmotic diarrhoeas
		  • Ostomies
		• Skin losses (CF / burns)
		• Abdominal 3rd spacing
		• High rate fluid consumption post exercise
		• Hyperglycaemia
		• Renal Losses
		  • Thiazide Diuretic
		  • Cerebral salt wasting
		• Primary renal Tubular Disorders
		• Hypoaldosteronism
		• Metabolic alkalosis

Assessment

- History consistent with common causes for hyponatraemia
- History of fluid intake/losses
- Clinical assessment of the child's current hydration status
- Neurological status
- Laboratory evaluation; Plasma osmolality, Urine osmolality, Urine sodium, in addition to closely monitoring Urea, Creatinine and electrolyte.

Red Flags

- Nausea and vomiting
- Irritability
- Headache
- Decreased conscious state
- Seizures

Management

Investigations

- Investigations should include measurement of plasma osmolarity, urine osmolarity, and urine sodium.
- Urine osmolarity and plasma urea can differentiate the cause of the hyponatraemia.
  - Urine osmolarity >20mmol/L for dehydration, but <20mmol/L for water intoxication.

- Paired plasma and urinary osmolality are needed to diagnose SIADH.
- Urinary sodium should be checked, low urinary sodium suggests intravascular volume depletion.
- Blood sugar level (If hyperglycaemia present in addition to hyponatraemia suspect DKA)
- Consider blood gas if sick and able to do so.

Prevention

- Special attention should be paid when prescribing fluids to children with conditions associated with increased ADH secretion
- Only give isotonic fluid (e.g.: 0.9% Saline or Ringers Lactate + 5% glucose) as maintenance fluids.
- Only give 1/2- 2/3 maintenance rate if child is euvolaemic
- Measure urea, creatinine and electrolyte at baseline, then monitor daily while on fluids
- Regular weights

Treatment

Overview: Appropriate treatment of paediatric hyponatraemia requires an understanding of the following:

- Etiology of hyponatraemia – Treatment choices may vary depending on the underlying condition.
- Child's effective circulating volume and hemodynamic stability.
- Identification and severity of symptoms, particularly neurologic findings determined by presence of seizures/ altered conscious state and fluid status.
- Duration of hyponatraemia – Since cerebral adaptation begins within a day of sustained hyponatraemia, it is safest to approach any hyponatraemia of more than 24 to 48 hours' duration as chronic in nature.
- In patients with chronic hyponatraemia, osmotic demyelination may develop when hyponatraemia is corrected too quickly.
- The need to readjust therapy based on data from ongoing monitoring of the patient's fluid status based on frequent clinical examinations and follow-up laboratory evaluation, including subsequent assessment of sodium levels
- The target rate of serum sodium correction is 6-8mmol/L in 24 hours (unless having seizures).

Asymptomatic hyponatraemia

- Active correction with or without 3% saline is not necessary and potentially harmful. Management will depend on volume status.
- Sodium deficit is a combination of the sodium loss in the isotonic fluid deficit (each kilogram of body weight represents one litre deficit of water and 140 mEq loss of sodium) and the loss of sodium in the remaining current hyponatraemic state, which is calculated as follows:

Hyponatraemic sodium deficit = Current total body water (TBW) x (desired plasma sodium - actual sodium)

- If normal or increased volume status:
  - Fluid restrict to 60% of maintenance fluid.
  - Do not give hypotonic fluids.
  - Review medications history and treat any stimuli to ADH secretion.
- If mild-moderate dehydration and Na≥130mmol/L:
  - Consider enteral rehydration with oral rehydration solution
  - Close monitoring of electrolytes, ongoing losses and fluid losses
  - Remember oral rehydration solution is hypotonic and may result in further fall in Na or failure to correct. If this occurs give 0.9% saline with 5 % glucose if appropriate intravenously.
- If severe dehydration or serum sodium <130mmol/L:
  - Administer 0.9% saline with glucose if appropriate
  - Measure serum sodium and electrolytes 4 hours after commencing/altering therapy and repeat every four hours until stable.

Note:

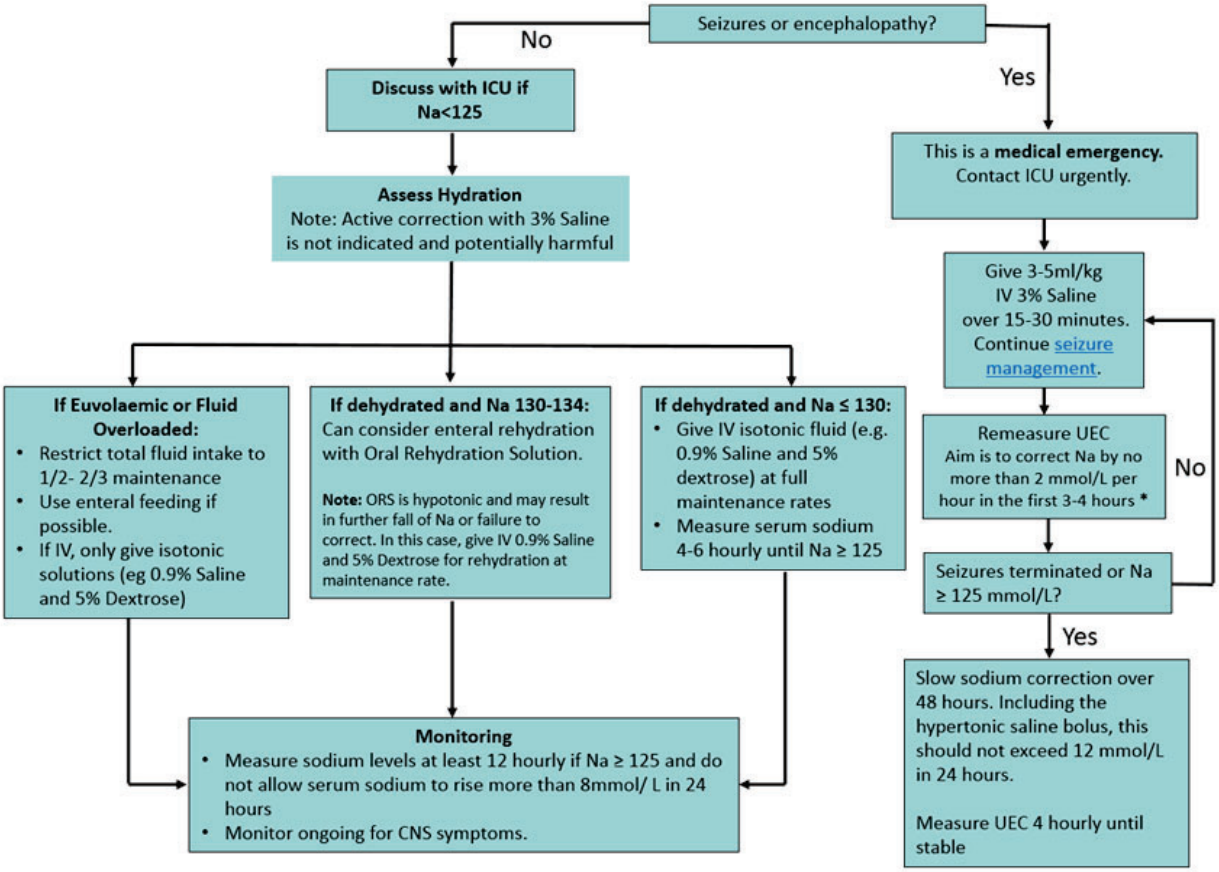
- Risk of morbidity from delayed treatment is greater than the risk of osmotic demyelination from overly rapid correction. Therefore, aggressive initial correction is indicated for the first 3-4 hours (or until symptoms resolve) at a rate not to exceed 2 mmol/L per hour

Symptomatic hyponatraemia

Hyponatraemic seizures may be refractory to anticonvulsants and sodium correction should not be delayed.

- 3% Saline should preferably be given via a central line
- Consider early consultation with higher level
- Consider early transfer when;
  - Sodium <125 mmol/L
  - The child has had CNS symptoms including seizures or altered conscious state

Figure 8: Simple summary of Hyponatraemia treatment



Reference

1. Jakub Zieg. Evaluation and management of hyponatraemia in children. Acta paediatrica (Oslo, Norway: 1992). Supplement · May 2014.
2. Michael J S and Avram Z T. Hyponatremia in children - UpToDate. Topic last updated: Nov 11, 2016.www.uptodate.com ©2018 UpToDate.

1.9 HYPERNATRAEMIA

Definition:

Hypernatraemia is defined as a serum sodium concentration of more >145 meq/L. It is characterized by a deficit of total body water (TBW) relative to total body sodium levels due to either loss of free water, or infrequently, the administration of hypertonic sodium solutions

Categories of hypernatraemia

- Mild hypernatraemia (146-149 mmol/L)
- Moderate hypernatraemia (150- 169 mmol/L)
- Severe hypernatraemia (≥ 170 mmol/L)

Causes

The following 3 mechanisms may lead to Hypernatraemia, alone or in concert:

- Pure water depletion (e.g., diabetes insipidus)
- Water depletion exceeding sodium depletion (e.g., diarrhoea)
- Sodium excess

Poorly managed Hypernatremia is associated with life threatening complications.
Diagnosis:

- Diagnosis is based on the history of risk factors supported by laboratory finding of serum sodium more than 145 mill equivalents per litre

Symptoms of Hypernatremia include;

- High pitched cry
- Restlessness
- Excessive crying
- Convulsions

Signs of Hypernatremia include

- Kussmal breathing and doughy feel if due to Hypernatraemic dehydration
- Lethargy
- Irritability/ Hyperreflexia
- Altered level of consciousness
- Jittery movements
- Increased muscle tone
- Convulsions

Physical examination:

- Evaluate the ABC (Airway, Breathing, Circulation)
- Evaluate the level of consciousness using AVPU
- Check vital parameters:
  - Respiratory rate
  - Oxygen saturation (normal range: ≥95% on room air)
  - Temperature,
  - Heart rate
- Evaluate the general condition:
  - General appearance
  - Weight
  - Mental status (e.g., irritability, apathy, or lethargy)
- Assessment of hydration status
  - Mucous membranes (e.g. moist or dry)
  - Anterior fontanelle (e.g., sunken)
  - Eyes (e.g., sunken eyes, decreased tears
  - Skin turgor

Investigations:

- ***Laboratory Studies***
  - Serum tests of sodium, osmolality, urea and creatinine levels
  - Urine tests of sodium concentration and osmolality
  - In cases of hypovolemic hypernatremia, extra renal losses show urine sodium levels of less than 20 mEq/L, and in cases of renal losses, urine sodium values are more than 20 mEq/L.
  - In euvolaemic hypernatremia, urine sodium data vary.
  - In hypervolemic hypernatremia, the urine sodium level is more than 20 mEq/L.
- ***Imaging Studies***
  - Imaging studies of the head should be considered in alert patients with severe hypernatremia to rule out a hypothalamic lesion affecting the thirst centre.
  - CT scans may help in diagnosing intracranial tumours, granulomatous diseases or other intracranial pathologies.

Management

- Treat shock as a priority
- Once circulating volume is restored, the rate of sodium correction should be slow, no more than 0.5 mmol/L/hour
- Severe hypernatraemia (≥170 mmol/L) is a medical emergency and should preferably managed in a tertiary centre with ICU

Mild hypernatraemia (146-149 mmol/L)

- Manage the underlying cause and repeat urea and electrolytes in 4-6 hours

Moderate hypernatraemia (150- 169 mmol/L)

General principles:

- Treatment is dependent on the underlying cause, water deficit
  - Restrict and record oral fluid intake as thirst can be excessive
- Cease any feed fortifications such as extra scoops of formula
- Monitor fluid status with urine output and repeated weights (weigh at least daily)
- Treat diabetes insipidus with endocrinology input
- Monitor neurological status closely

Treatment of moderate hypernatraemia due to water deficit

- Replace water deficit over 48 hours in addition to daily maintenance, with IV sodium chloride 0.9% and glucose 5%
- In addition, replace ongoing losses mL for mL (excluding urine) with IV sodium chloride 0.9%
  - **Total fluid requirement = maintenance + replacement of deficit + replacement of ongoing losses**
- The serum sodium concentration should be monitored frequently to avoid too-rapid correction of Hypernatremia.

- In cases of associated hyperglycaemia, 2.5% dextrose solution may be given. Insulin treatment is not recommended because the acute decrease in glucose, which lowers plasma osmolality, may precipitate cerebral oedema.
- Once the child is urinating, add 40mEq/L KCl to fluids to aid water absorption into cells.
- Calcium may be added if the patient has an associated low serum calcium level.
- Serum sodium levels should be monitored every 12 hours.
- If seizures occur:
  - consider venous sinus thrombosis or cerebral infarction
  - consider imaging with a contrast CT scan
  - contact ICU - may need hypertonic saline to slow a rapid decrease in sodium level

Severe hypernatraemia requires correction over several days, at a slower rate

In patients with diabetes insipidus:

- Monitor weight and urine output because clinically significant changes in sodium values are associated with changes in weight.
- Restrict sodium and protein intake.
- The patient should drink liberal amounts of water.

References

1. Kliegman et al, 2020, Nelson Textbook of Pediatrics; Electrolyte and Acid-Base Disorders, Elsevier, Philadelpia
2. National Institute for Health and Care Excellent, 2020 Intravenous fluid therapy in children and young people in hospital, viewed October 2020 https://www.nice.org.uk/guidance/ng29
3. Somers et al, 2020 Hypernatraemia in Children, UpToDate viewed October 2020

CHAPTER 2: RESPIRATORY DISEASES:

2.1 RHINITIS AND RHINOPHARYNGITIS (COMMON COLD)

Definition: Rhinitis and Rhinopharyngitis are very common viral infections of the nasal or pharyngeal mucosa, which occur with seasonal variations under 5 year olds (more frequent in cold and rainy seasons).

Causes:

- commonest virus: Rhinoviruses
- Other viruses: Coronaviruses, respiratory syncytial viruses, human Metapneumovirus, influenza viruses, para influenza viruses, adenoviruses, enteroviruses rarely
- Other causes include allergy (in case of recurrence), Iron deficiency, Passive tobacco smoke

Signs and symptoms:

- Nasal congestion
- Sore throat
- Sneezing
- Productive cough
- Fever sometimes
- Watery red eyes
- Headache

Note: Suspect allergic rhinitis in case of recurrent signs of rhinitis with itching of nose, eyes, ears and palate

Complications

- Otitis media
- Sinusitis (over 6-year-old age)
- Tonsillitis
- Exacerbation of asthma

Management

- No specific treatment
- Normal saline nasal, Nasal irrigation with 0.9% sodium chloride with large volumes or Nasal saline spray, 4 to 6 times/ day or when needed to clear the airway.
- Patients with fever give paracetamol as follow 10 to 15 mg/kg/dose 4-6 hourly (maximum dose 60mg/kg/day),
- Use Ibuprofen 5-10mg/kg 8hourly (Never in infants<6 months)
- Air humidification using nebulization with 0.9% sodium chloride may help open the airways, thin secretions, and loosen mucus in the lungs, making it easier to cough up or clear
- Ensure breast feeding and keep hydration
- Review within 72 hours if not improving or worsening breathing difficulty
- For children with allergic rhinitis only, give an antihistamine Second generation (Desloratidine, cetirizine,) for 7 days as follow:

Recommendation:

- Antibiotics are **not indicated** in viral rhinitis and rhinopharyngitis except in case of evident bacterial superinfection on Full blood count with leucocytosis
- Use cough mixtures are not recommended below 2 years

2.2 PNEUMONIA

Definition: Pneumonia is infection of the lung parenchyma characterized by inflammation and consolidation of lung tissue.

Causes:

Bacterial:

- Streptococcus pneumonia (most common at all ages)
- Chlamydia pneumonia
- Mycoplasma pneumonia (over 5 year old age)
- Chlamydia trachomatis (infant)
- Staphylococcus aureus
- Haemophilus influenza (in case of no vaccination)
- Pseudomonas aeruginosa (in immunocompromised patients)
- Klebsiella pneumonia …

Viral:

- Respiratory syncytial Virus
- Adenovirus
- Influenzae A and B
- Corona virus (Covid 19)
- Parainfluenzae types 1 and 3
- Metapneumovirus

Fungal:

- Cryptococcus Neoformans and Aspergillus species

Mycobacterial:

- Mycobacterium tuberculosis, Mycobacterium avium, Mycobacterium intracellulare

Parasites:

Pneumocystis Jirovecii (especially in HIV infected children below 1 year)

Signs and symptoms:

- Fever
- Cough
- Tachypnea
- Use of accessory muscles (Inter-costal, sub-costal recession, suprasternal recessions)
- Nasal flaring
- Grunting
- Paradoxical breathing
- Head nodding
- Crackles and wheezing on auscultation
- Bronchial breathing
- Cyanosis and respiratory fatigue (in severe case especially for infant)

Table 10: Clinical staging of pneumonia

Type	Signs	Symptoms
Very severe and severe pneumonia	• Cyanosis • Inability to drink/breastfeed • AVPU = V, P or U • Grunting • Head nodding (bobbing) • Lower chest indrawing • Nasal flaring	• History of cough or difficulty of breathing • Fever • Abdominal/chest pain (sometimes)
Pneumonia	Fast breathing Presence or absence of crackles	

Investigations:

- FBC
- Malaria test
- Chest x-ray
- Blood culture
- HIV test in severe Pneumonia, Suspected TB and malnutrition
- Rapid Covid 19 test
- Mantoux test and Sputum in case of suspected PTB

Complications of pneumonia:

- Pneumothorax
- Pleural effusion/pleuritis
- Pericardial effusion
- Sepsis/ Meningitis / Arthritis
- Empyema
- Respiratory failure
- Bronchiectasis
- Dehydration

Management:

Indications for admission of children with pneumonia:

- Age < 6 months
- Severe and very severe Pneumonia
- Inability to feed or dehydration
- AVPU < A
- Oxygen saturation below 90%
- Underlying chronic conditions like severe acute malnutrition, cardiac diseases, Immunocompromised state, Sickle cell anaemia etc
- When doubting home management
- Multiple lobe involvement
- Toxic appearance
- No response to appropriate oral antibiotic therapy

Table 11: Management summary of pneumonia

Type	*Management*	*Comments*
Very severe pneumonia Severe pneumonia	Hospitalization, Oxygen, Correct shock, hypoglycaemia and dehydration, Fluid maintenance **First line:** Ampicillin 200mg/kg/day Q6hr **Plus** Gentamycin IV 7.5mg/kg IV over 3-5 minutes Q24hr **OR** Cefotaxime 50mg/kg/dose Q8hr **(second line)** **Note:** If pneumonia due to staphylococcus is suspected give IVI Cloxacillin 200mg/kg/day in 4 doses and Gentamycin 7.5mg/kg. Use vancomycin as **second line** therapy if no response	Duration 10 days Switch to oral treatment with Amoxicillin 50mg/kg/day Q12hr if improvement in clinical symptoms if patient was on Ampicillin and Gentamycin Or Cefixime 4mg/kg /dose 12h for 7 days or Augmentin 50mg/kg/dose 12h if patient was on Cefotaxime Cloxacillin oral 25-50mg/kg/dose 8h if patient was on ivi Cloxacillin Use Azithromycin 10mg/kg / day once a day for 5 days or Erythromycin 50mg/kg 12hourly for 7 days if penicillin allergy
Non-severe Pneumonia	Amoxycillin 50mg/kg/day Q12hr	Duration 5 days

In case of persistent pneumonia (abnormal X-ray more than 30 days after treatment) the patient should be referred for investigations (CT scan, bronchoscopy) to exclude:

- Foreign body
- Tuberculosis
- Congenital malformation (adenomatosis)
- Immotile cilia syndrome

Likewise, in case of recurrent pneumonia, an underlying cause should be suspected and the child referred for further investigations.

Pleural effusion**:**

In case of pleural effusion, think of Staphylococcus aureus, streptococcus pneumonia, mycoplasma pneumonia, tuberculosis

Exclude Tuberculosis

Ultrasound to measure the volume of liquid and aspiration for culture, GeneXpert

Drainage of fluid is urgent to relieve the respiratory distress

Table 12: Pneumonia Treatment Failure Definitions

Treatment failure definition	Action
Any time. Progression of pneumonia to severe (development of cyanosis or inability to drink in a child with pneumonia without these signs on first contact.	**Admit child** • Change treatment from amoxicillin • to Ampicillin and gentamicin to cover for Gram negative pneumonia
Obvious cavitation on CXR	• Treat with Cloxacillin and Cefotaxime ivi for Staph. Aureus and Gram-negative pneumonia. • Investigate for TB
48 hours	
Severe pneumonia child getting worse, reassess thoroughly, get chest X ray if not already done (looking for empyema /effusion, Cavitation, Pneumothorax, and Foreign body).	• Switch to Ceftriaxone / Cefotaxime unless suspect Staphylococcal pneumonia then use Cloxacillin and Cefotaxime • Use vancomycin if patient not responding to Cloxacillin • Suspect PCP especially if <12 months, an HIV test must be done - treat for Pneumocystis if HIV positive. • Manage the underlying complication/cause • Transfer to Provincial or Referral H
After 1 week	
Persistent fever and respiratory distress.	❖ Consider TB, perform mantoux and follow TB treatment guidelines

2.3 WHEEZING CHILD:

Definition: A wheeze is a musical and continuous sound that originates from oscillations in narrowed airways. Wheezing is heard mostly in expiration as a result of critical airway obstruction.

Causes/ differential diagnosis:

- Bronchiolitis
- Asthma
- Oesophageal or Lower airway foreign bodies
- Aspiration syndrome (gastro-oesophageal reflux diseases)

2.3.1 Bronchiolitis

***Definition*:** Bronchiolitis is an inflammation of the small airways due to acute viral infection affecting children below 2 years of age. It occurs with seasonal variations and may lead to fatal respiratory distress. Recurrent episodes of wheeze associated with bronchiolitis may occur, and some of these children may develop asthma.

Causes

- Respiratory Syncytial Virus is the most common (>50% cases)
- Other agents: parainfluenza, adenovirus, Mycoplasma, and, occasionally, other viruses especially Human Metapneumovirus

Clinical signs

- *Mild Bronchiolitis*
  - Cough and fast breathing (tachypnoea).
- *Moderate Bronchiolitis*: As above plus one of the following:
  - Lower chest wall in-drawing;
  - Nasal flaring;
  - Grunting
- *Severe Bronchiolitis:* As above plus at least one of the following:
  - Central cyanosis, oxygen saturation < 90% in room air;
  - Inability to feed;
  - Convulsions, lethargy or decreased level of consciousness;
  - Severe respiratory distress (e.g. very severe chest wall in-drawing).
  - Silent chest on auscultation (corresponding to an intense bronchospasm)

Risk factors for severe bronchiolitis:

- Age less than 3 months
- Ex-preterm infants
- Chronic lung disease
- Congenital heart disease

Diagnosis: Is on clinical basis

- Prodrome of viral infection: irritability and rhinorrhoea.
- A wheeze that is slowly responsive or non-responsive to bronchodilators.
- Crepitations and signs of hyperinflation of the chest.
- Chest X-ray should be reserved for clinically severe or complicated cases
- Tachypnoea: age dependent:

Investigations

- FBC
- CRP
- Malaria test
- Covid 19 in suspected cases
- Random blood sugar
- Chest X-ray: (Not mandatory) show hyperinflated lungs with patchy atelectasis

Complications:

- Dehydration
- Bacterial secondary infection

- Apnoea especially in neonatal and infant period
- Atelectasis
- Respiratory failure
- ARDS

Management: In Bronchiolitis treatment is symptomatic

Outpatient management (mild bronchiolitis)

- Nasal irrigation with 0.9% NaCl before each feed
- Small, frequent feedings to reduce vomiting triggered by bouts of coughing.
- Increased fluids if fever and/or significant secretions are present.
- Treat fever with paracetamol 10-15mg/kg/dose 6 hourly
- Counsel the care giver and advise to come back if the child deteriorates or does not improve or not feeding well.

Admit all children with one of the following criteria to hospital:

  - Presence of any sign of severity
  - Pre-existing pathology (cardiac, Respiratory, malnutrition, HIV, etc.)
  - Associated acute pathology (viral gastro-enteritis, bacterial infection, etc.)
  - Age less than 3 months

Management of moderate to severe bronchiolitis

As for mild bronchiolitis **PLUS:**

- Administer high humidified oxygen
- Maintenance IV fluid
- Tube feeding when the respiratory distress improves
- In case of respiratory failure, use non-invasive nasal CPAP or mechanical ventilation

Indications for NCPAP

- Grunting
- Persistent hypoxemia on oxygen
- Persistent increased respiratory effort on oxygen

Transfer all cases if no NCPAP or no improvement on NCPAP

Recommendation:

- Antibiotic treatment is indicated for children with severe respiratory distress.
  - Ampicillin IVI: 200 mg/kg/day in 4 divided doses + Gentamycin 7.5mg/kg OD

Note: Treatment of bronchospasm:

Data does not support routine use of bronchodilators, steroids or antibiotics. If bronchodilators are to be used, closely monitor effect as it might worsen the respiratory distress. (Use Adrenaline (0.5-1ml of 1: 1000) or Salbutamol 0.15mg/kg)

Cough in Bronchiolitis may go up to 2 weeks and no need for intervention if no signs of respiratory distress

2.3.2 Asthma

***Definition*:** Asthma is a chronic inflammatory condition of the lung airways resulting in episodic airflow obstruction.

Asthma is characterized by variable respiratory symptoms such as wheeze, shortness of breath, chest tightness and cough, and variable expiratory airflow limitation. It is usually associated with airway inflammation

***Causes and triggers*:** unknown but the following factors have been identified:

- Allergens (e.g., house dust, perfumes, food, animal airs, mites),
- Medicines (e.g., propranolol and aspirin),
- Environmental (e.g., change of weather, pollutants), Infections (viral or bacterial),
- Emotions
- Family history (genetic factors),
- Gastroesophageal reflux

Clinical signs and symptoms

- Breathlessness
- Wheezing/ prolonged expiratory
- Cough (chronic nocturnal cough)
- Exercise induced cough
- Chest tightness
- Sputum production

Table 13: Normal rates of breathing in awake children**:**

< 2 months	< 60/min
2-12 months	< 50/min
1-5 years	< 40/min
6-8 years	< 30/min

Table 14: Guide to limits of normal pulse rate in children:

Infants	2-12 months	< 160/min
Preschool	1-2 years	< 120/min
School age	2-8 years	< 110/min

Table 15: Severity of Asthma Exacerbations

Parameter	Mild	Moderate	Severe	Respiratory arrest imminent
Breathless	Walking Can lie down	Talking Infant - softer, shorter cry; difficulty feeding Prefers sitting	At rest Infant stops feeding Hunched forward	
Talks in	Sentences	Phrases	Words	
Alertness	May be agitated	Usually agitated	Usually agitated	Drowsy or confused
Respiratory rate	Increased	Increased	Very Increased	
Accessory muscles and suprasternal retractions	Usually not	Usually	Usually	Paradoxical thoraco-abdominal movement
Wheeze	Moderate, often only expiratory	Loud	Usually loud	Absence of wheeze
Pulse/min.	<100	100 - 120	>120	Bradycardia
Pulsus paradoxus	Absent < 10 mm Hg	May be present 10 - 25 mm Hg	Often present> 25 mm Hg (adult) 20 - 40 mm Hg (children)	Absence suggests respiratory muscle fatigue
PEF after initial bronchodilator % predicted or % personal best	Over 80%	Approx. 60-80%	< 60% predicted or personal best or response lasts < 2 hrs	
SaO2% (on air)	>95%	91 - 95%	<90%	

Diagnosis:

Asthma is diagnosed on the basis of a patient's symptoms and medical history.
Presence of any of these signs and symptoms should increase the suspicion of asthma:

- Wheezing: high-pitched whistling sounds when breathing out-especially in children. A normal chest examination does not exclude asthma.)
- History of any of the following:
  - Cough, worse particularly at night
  - Recurrent wheeze
  - Recurrent difficulty in breathing
  - Recurrent chest tightness
- Symptoms occur or worsen at night, awakening the patient.
- Symptoms occur or worsen in a seasonal pattern.
- The patient also has eczema, hay fever, or a family history of asthma or atopic diseases.
- Symptoms occur or worsen in the presence of:
  - Strong emotional expression Animals with fur
  - Aerosol chemicals
  - Changes in temperature
  - Domestic dust mites
  - Drugs (aspirin, beta blockers)
  - Exercise
  - Pollen
  - Respiratory (viral) infections
  - Smoke
  - Respiratory infections (viruses, bacteria)
  - Allergen exposure (inhalant grass pollen, food, fungal spores, and occupational)
  - Inhaled respiratory irritants (including tobacco and cannabis smoke and cold, dry air)
  - Temperature and weather
  - Physical activity
  - Hormonal fluctuations
  - Medications(Aspirin, beta blockers)
  - Emotional factors (eg, anxiety, stress)
- Symptoms respond to anti-asthma therapy
- Patients colds "go to the chest" or take more than 10 days to clear up

Investigations:

- FBC + Malaria test for exclusion of super-infection
- Chest X-ray (where available for differential diagnosis and i
- Additional diagnostic tests:
  - Lung function to confirm diagnosis and assess severity (where available)
  - Peak expiratory flow rate can help diagnosis and follow up
  - Skin Prick Test where available to evaluate exposition to allergen

***Complication*:**

- Uncontrolled/poorly controlled asthma can lead to severe lung damage
- Severe asthma exacerbation can cause respiratory failure and death

Management:

- Asthma exacerbation (asthma attacks) are episodes of a progressive increase in shortness of breath, cough, wheezing or chest tightness or a combination of these symptoms.
- Asthma attacks require prompt treatment
- Categorize severity of attach and treat as per ETAT+ guidelines below

Very Severe Asthma and Respiratory arrest imminent

Any one with:

- Oxygen saturation <90%
- Central cyanosis
- Silent chest
- Inability to drink / breast feed
- AVPU= "V", "P" or "U" or
- Inability to talk/complete sentences
- Pulse rate >200 bpm (0-3 years) and >180 bpm (4-5yrs)

Immediate Management

ADMIT

- Oxygen
- Nebulize 2.5 mg salbutamol if not available inhaled salbutamol 100mcg 6 puffs with spacer and mask give every 20 minutes (3 doses in hour) if needed than continue every 1-3h as needed
- Start oral prednisolone at 1-2mg/kg for 3-5 days. Max dose of 20mg/day for < 2 years and 30mg/day for 2-5 years above 5 years Max dose 40mg/day.
- IVI Hydrocortisone 4mg/kg 8h for 3 doses then switch to Prednisolone **OR** Dexamethasone 0.5mg/kg once a day for 2 days if unable to take orally

Adjunct treatment:

- Ipratropium bromide (if available): nebulization increases effect of salbutamol or Combivent (Ipratropium bromide and albuterol sulphate)
- Adrenaline in case of anaphylaxis but not indicated for asthma attack (0.01mg/kg not exceed 0.5mg. 10µg/kg IM [then infusion 0.1µg/kg/min)]→not necessary
- Magnesium sulphate 25-50mg/kg as a single dose over 30 minutes (Maximum dose 2g)

Moderate to Severe asthmatic attack:

- Wheeze
- Lower chest wall indrawing

Immediate Management

- Oxygen if obvious use of accessory muscles, measure oxygen saturation.
- Salbutamol by nebulizer or
- Inhaler + spacer + mask repeated up to 10 puffs (every 20 min in first 1 hour) in 30min min (shake inhaler every 2 puffs)
- Start oral prednisolone at 1-2mg/kg for 3-5 days. Max dose of 20mg/day for < 2 years and 30mg/day for 2-5 years above 5 years Max dose 40mg/day.

Reassess after 30-60 min and reclassify severity – if now:

- Very severe

- Continue oxygen, 1-4 hourly salbutamol, early review, antibiotics as for very severe pneumonia
- Severe
  - 4 hourly salbutamol, antibiotics as for severe pneumonia
- Mild:
  - 4 hourly salbutamol, oral antibiotics if indicated aim for discharge in 24 h

Mild asthmatic attack:

- Wheeze PLUS
  - Fast breathing (RR 50 aged 2-11 months RR 40 aged 12-59 months)

Management of mild asthmatic attack

- Salbutamol by inhaler, spacer + mask
- Reassess respiratory rate after 20-30 minutes, if persistently elevated consider oral antibiotic if indicated
- Counsel caregiver on signs of deterioration and schedule review within 48 hours
- Give education on use of inhaler, spacer + mask
- Discharge on salbutamol inhaler 4-6 hourly for no more than 5 days

NOTE:

- In recurrence of asthma symptoms consider inhaled corticosteroid (ICS) therapy or adjust the doses if already on ICS and look out for other comorbidities
- Demonstrate metered dose inhaler (MDI) and spacer use to the caregiver before discharge
- Preferably use spacer with face masks for <3 years for 4-5 years use facemask or mouthpiece.
- Advise on regular follow up

Maintenance treatment: see tables below

Clinical initial check- up

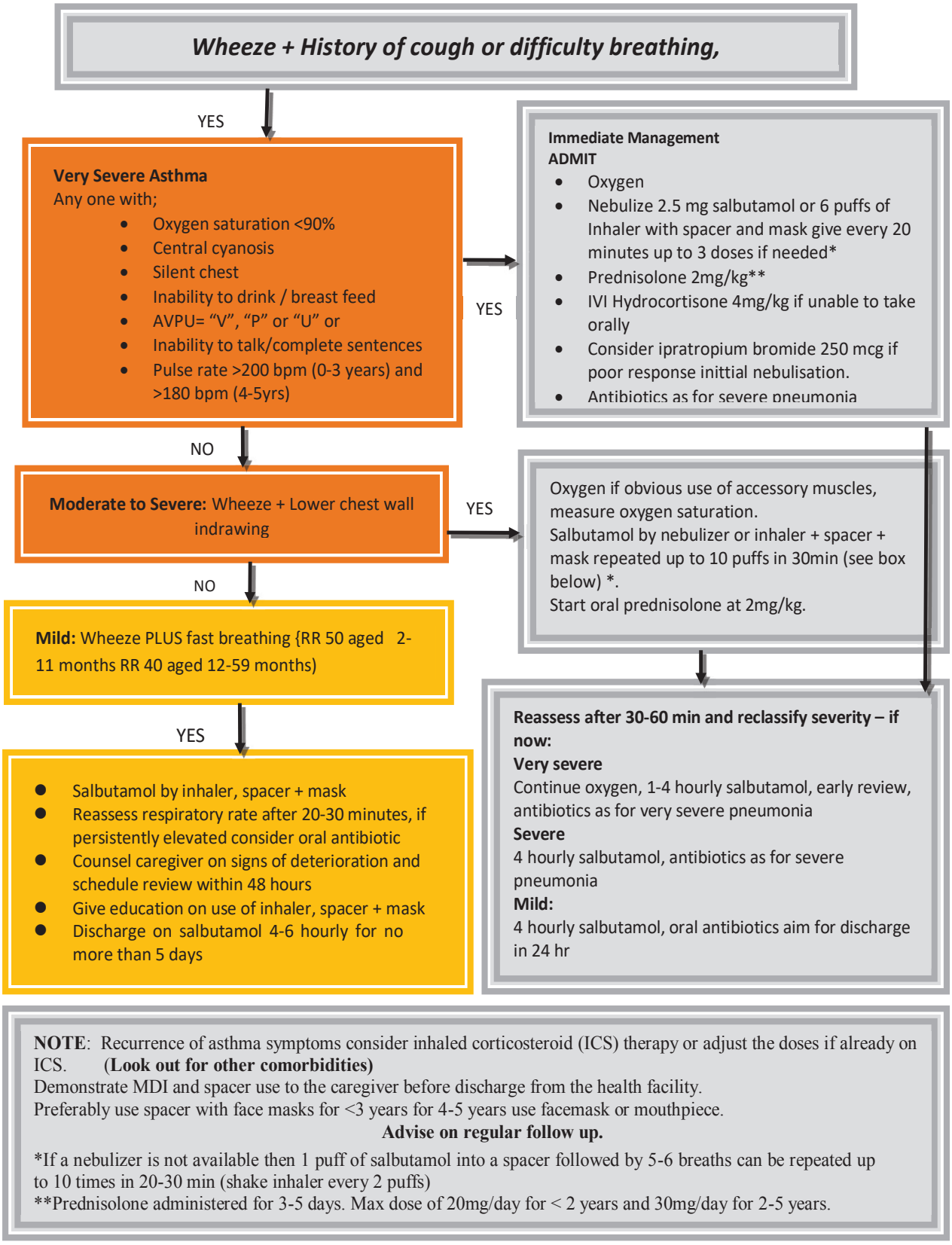
- Check risk factors
- Patient education: Discuss the management plan, importance of adherence to treatment
- Medication: inhaled corticosteroids. Example: start with Beclomethasone inhaled 50ug, 100ug 250µg, once to twice a day with inhalation chamber then step up or step down according to the evolution (close follow up after discharge)
- Low dose ICS plus long acting ß$_2$-agonist (Seretide 25/50, 25/125)
- Treatment of co-morbid conditions (Rhinitis, sinusitis, gastroesophageal reflux)

Table 16: Stepwise approach for maintenance treatment

Level of control	Treatment action
Controlled	Maintain and find lowest controlling step
Partially controlled	Consider stepping up to gain control
Uncontrolled	Step up until controlled
Exacerbation	Treat exacerbation and identify the cause

Step 1	Step 2	Step 3	Step 4	Step 5
Asthma education Environmental control. (If step-up treatment is being considered for poor symptom control, first check inhaler technique, check adherence, and confirm symptoms are due to asthma).				
As needed rapid acting $ß_2$-agonist	As needed rapid acting $ß_2$-agonist			
Controller option	Select one	Select one	To step 3 , select one or more	To step 4 Add either
	Low dose ICS (inhaled corticosteroid) Beclomethasone	Low dose ICS plus long acting $ß_2$-agonist (Seretide)	Medium or high dose ICS plus long acting $ß_2$-agonist	Oral glucocorticoids (lowest dose)
	Leukotriene modifier Montelukast	Medium or high dose ICS Low dose ICS plus leukotriene modifier		Anti IgE treatment
		Low dose ICS		

Figure 9: Algorithm for asthma management
(Adopted from MOH Basic Paediatric (ETAT +) guidelines 2020)



2.4 PERTUSSIS (WHOOPING COUGH)

Definition: this is a highly infectious form of bronchitis caused by Bordetella pertussis. It has become rare since vaccination but it is endemic with epidemics every 3-4 years. Particular attention to young infants (before complete vaccination) and unvaccinated.

Cause: Bordetella pertussis

Signs/symptoms:

After one week of Coryza (catarrhal phase), the child develops a characteristic paroxysmal cough followed by characteristic inspiratory whoop (paroxysmal phase, 3-6 weeks). Worse at night and occasional vomiting. During paroxysm, the face goes red or blue and mucus flows from nose and mouth. **May cause apnoea in young infants.** The symptoms gradually decrease and may persists for months (convalescent phase)

Diagnosis:

- Clinical symptoms and signs
- FBC: marked lymphocytosis (>15 109/l)
- Culture if available

Management:

- Admit to hospital if infant (risk of apnoea)
- Symptomatic treatment: O_2, gavage
- Erythromycine 15-20 mg/kg/dose Q8h for 14 days Or
- Azithromycin
    - Infants aged <6 months: 10 mg/kg/dose Q24h for 3 days.
    - Infants and children aged ≥6 months: 10 mg/kg (maximum: 500 mg) on day 1, followed by 5 mg/kg/dose Q24h (maximum: 250 mg) on day 2-5.

- Prophylaxis for close contact (same)

Counsel the parents on the prolonged duration of the cough which may go up to 3 months

CHAPTER 3: EAR NOSE AND THROAT CONDITIONS:

3.1 OTITIS EXTERNA

Definition

Inflammation of the external ear. Common precipitants of otitis externa are maceration, trauma of the ear canal or presence of a foreign body or dermatologic diseases (such as eczema, psoriasis).

Clinical features

May be one of the following:

- Diffuse: An infection of the ear canal, often due to Gram negative bacilli especially P Aeruginosa
    - Pain on chewing and movement of the tragus or pinna
    - Lining of the canal is inflamed or swollen with dry or moist debris with or without discharge.
    - If visible, the tympanic membrane is normal
- Furuncular: Usually caused by Staphylococcus aureus.
    - A painful localized swelling seen at the entrance to the ear canal

General measures

- Rule out chronic otitis media before treatment.
- Most cases recover after thorough cleansing and drying of the ear.
- Keep the ear clean and dry.
- Do not leave pieces of cotton wool, etc. in the ear.

Medical treatment

Diffuse

- Does not usually require an antibiotic.
- Clean and dry the ear using a dry cotton bud or a small piece of dry cotton wool.
    - Apply **ciprofloxacin** ear drops: 3 drops 12 hourly in the affected ear(s) for 7 days or Chloramphenicol ear drops or Gentamycin ear drops

Furuncular

- Cloxacillin, oral 25mg/kg/dose 6 hourly for 5 days.
- OR Cefadroxil 30mg/kg/day in 2 divided doses for 5 days
    - PLUS Apply **ciprofloxacin** ear drops: 3 drops 12 hourly in the affected ear(s) for 7 days or Chloramphenicol ear drops

    Note:

    Systems antibiotics are indicated in immune compromised and infections extending beyond the ear canal

    In suspected fungal infection use eardrops containing clotrimazole

    Manage pain with Paracetamol 10-15mg kg 8h

3.2 ACUTE OTITIS MEDIA

Definition: It is the inflammation of the middle ear cavities

Causes:

- Bacterial (Streptococcus pneumoniae, Haemophilus influenzae, Moraxella catarrhalis etc)
- Viral
- Predisposing factors include poor living conditions, immune suppression, adenoids, sinusitis, allergic rhinitis, tonsillitis, asthma etc

Signs/symptoms

- Fever
- Retroauricular pain
- Crying with ear scrubbing
- Gastro intestinal signs
- Otalgia
- Cervical lymphadenopathy
- Otorrhoea (if tympanic membrane perforated)
- Impaired hearing
- Redness of eardrum
- Sometimes bulging of the eardrum

Diagnosis:

- Clinical on otoscopy
- FBC and CRP if signs of sepsis

Complications:

- Secretory otitis media (glue ear)
- Chronic otitis media with perforation
- Acute mastoiditis sometimes with periosteal abscess
- Intracranial (meningitis, brain abscess, subdural abscess, etc)
- Facial paralysis
- Labyrinthitis
- Decreased hearing

Management:

- General measures: Elimination of risk factors
- Medical
- Surgical: Myringotomy if necessary

Treatment of first choice

- Amoxicillin, Po 30mg/kg/dose P.O. Q8h for 7-10 days
- When associated with rhinitis add Xylometazoline (Otrivin) 0.5% nose drops or simple argyrol drops 1% , 0.05% + Antihistamine
- Paracetamol 10-15mg/kg/dose Q6hr if high fever or pain

Second line treatment:

- Amoxyclav (Augmentin) 45mg/kg/dose P.O , Q12h for 7 -10 days; **OR**
- Cefadroxil (Oracefal): 15mg/kg/dose Q12h for 7 days
- Cefuroxime (Zinnat): 15mg/kg /dose Q12h for 7 days

- Azithromycin 10 mg/kg (maximum: 500 mg) on day 1, followed by 5 mg/kg/dose Q24h (maximum: 250 mg) on day 2-5.
- Erythromycin 20 mg/kg/dose Q8h for 10 days

Recommendations:

- Avoid getting in the inside of the wet ear
- Refer complicated cases to ENT surgeons

3.3 CHRONIC SUPPURATIVE OTITIS MEDIA:

Definition: It is a chronic inflammation of the middle ear with recurrent ear discharges or otorrhoea through a tympanic perforation for more than 2 weeks.

Predisposing risk factors:

- Inadequate management of otitis media
- Frequent upper respiratory tract infections
- Anatomic factor: Short Eustachian tube
- Poor living conditions, poor housing, hygiene and poor nutrition
- Immunosuppression (e.g. V infection)

Causes

- H. Influenza
- P. aeruginosa
- Pneumoniae
- Staphylococcus aureus
- Tuberculosis

Signs and symptoms:

- Recurrent pus ear discharge
- Large perforation of the eardrum on examination
- Progressive hypoacousia with Impaired hearing
- Buzzing (acouphene)
- History of recurrent otitis media
- Loss of transparency of tympanic membrane

Diagnosis:

- Clinical with and without Otoscopy

Investigations:

- Bacterial Cultures of pus discharge
- Search for predisposing factors

Complications :

- Subperiosteal abscesses
- Facial nerve palsy
- Lateral sinus thrombophlebitis
- Suppurative labyrinthitis
- Brain abscess
- Meningitis
- Mastoiditis

- Extradural and subdural Empyema
- Otitic hydrocephalus
- Hearing impairment
- Deafness

Management

Non-pharmacolocal management

- Dry mopping
- Aural toilet by ear drops (with Hydrogen peroxide or povidone iodine saline solutions)
- Avoid water getting the inside of the ear. E.g.: protect ears while bathing and no swimming until healed.

Pharmacological management

- Topical quinolones (Ciprofloxacin ear drops Q12h for 7 days)
- For complicated cases refer to ENT surgeon or if applies consider systemic treatment: Ceftazidime IV or IM 50mg/kg/dose Q8h (max:6gr/day) for 7 days
- In case of mastoiditis: Refer to ENT surgeon for possible mastoidectomy

Recommendations:

- Proper management of acute otitis media
- Refer to the ENT surgeon for further management

3.4 TONSILLITIS

Definition: It is an inflammation of the tonsils

Causes:

- Bacterial infection (Group A β-haemolytic streptococcal, staphylococcal...)
- Viral infection (Rhinoviruses, influenza...)
- Fungal infection

Signs/symptoms

- Difficult and painful swallowing (Dysphagia/odynophagia)
- Refusal of breastfeeding/feeding
- Fever, chills
- Headache
- Vomiting
- Sore throat - lasts longer than 48 hours and may be severe
- Enlarged and tender submandibular lymph nodes
- Swollen red tonsils with white spots, exudate

Diagnosis is clinical

- It is difficult to distinguish clinically between viral and bacterial tonsillitis

Investigations:

- Swab for laboratory analysis where possible
- Complete blood count
- Streptococcal screen ASOT/ASLO

Complications:

- Rheumatic heart disease
- Acute glomerulonephritis
- middle ear infections
- Peritonsilar abscess (quinsy)
- Abscess of the pharynx
- Sinusitis
- Septicaemia
- Bronchitis or pneumonia
- Airway obstruction

Management:

- Ensure enough fluids to avoid dehydration
- Medical treatment: antibiotics, analgesics, anti-inflammatory
- Surgery

Treatment of first choice:

- Amoxicillin 15-30 mg/kg/dose Q8h for 10 days
  OR
- Penicillin V tabs: 15mg/kg/dose Q12h for 10days

In case of allergy to penicillins use:

- Erythromycin 15-20mg/kg/dose Q8h for 10 days
- OR Azithromycin 10mg/kg/dose Q24h for 3 days
- If fever or pain, give Ibuprofen: 5-10mg/kg/dose Q8h (max 200mg/dose for <6years) or Paracetamol 10-15mg/kg Q6h, max 60mg/kg/day

If no response with the first choice,

- Amoxiclav (Augmentin) 15-20mg/kg/dose P.O , Q8h 7 -10 days;
  OR
- Cefuroxime (Zinnat): 15mg/kg /dose Q12h for 7 days

Recommendations:

- Systematically give Antibiotherapy for children > 3 years in order to prevent rheumatic heart disease
- Consider for ENT surgeon review for any of the following:
  - Chronic repetitive tonsillitis
  - Obstructive tonsils
  - Peritonsilar abscess
  - If no response or complication

3.5 ACUTE MASTOIDITIS:

- Definition: Acute mastoiditis is sudden onset bacterial infections of the mastoid bone
- Causes:
- Spread of pathogens causing acute otitis media to the mastoid bone
- Signs/symptoms
- Fever
- Pain, tenderness, discomfort and swelling behind the ear

- In some instances, the ear on the affected side seems pushed out and quite prominent. This is caused by a high concentration of pus in the mastoid
- Sometimes associated suppurative otitis media
- Tympanic membrane is usually perforated with otorrhoea
- Occasionally, pus breaks through the mastoid tip and forms an abscess in the neck (Bezold's abscess)
- Headache
- Hearing loss

Diagnosis: Clinical basis

- X-Ray of the mastoid bone

In selected cases,

- CT-scan of the middle ear, when indicated
- Culture of the pus from the mastoid bone
- Blood culture
- LP if signs of meningitis

Complications:

- Facial palsy
- Brain abscess
- Meningitis
- Neck abscess
- Extradural abscess
- Septicemia
- Subdural abscess

Management: Should be managed in collaboration with ENT surgeon

Treatment of first choice:

- Ceftriaxone iv 100mg/kg/dose Q24h for 14 days OR cefotaxime 200mg/kg/day in 4 divided doses 14 days + Vancomycin are the recommended treatment until culture and sensitivity results are available.
- If vancomycin is not available, consider Cloxacillin 200mg/kg/day in 4 divided doses for 14 days.

If 3rd **generation cephalosporin not available,**

- Amoxiclav IV, for 14 days and Gentamycin iv 5mg/kg/dose Q24h 5 days
- When anaerobic infection is suspected: Add metronidazole IV 15-20 mg/kg/dose Q8h and culture sensitivity where possible**.**
- If fever or pain, give Ibuprofen: 5-10mg/kg/dose Q8h (max 200mg for < 6 years) or Paracetamol 10-15mg/kg Q6h, max 60mg/kg/day.

Surgical (ENT surgeon review)

- Mastoidectomy
- Incision of abscess

3.6 EPISTAXIS

Definition: Epistaxis is nose bleeding

Causes:

- Local (trauma, inflammation, foreign bodies, tumours of the nose and rhinopharynx, chronic use of nasal steroids, intra nasal growth like polyps,..)
- Systemic (cardiovascular diseases, hematological diseases, liver diseases, kidney diseases, febrile illness)
- Upper respiratory disease (sinusitis, allergic rhinitis)
- Nasal masses
- Idiopathic (causes not known)

Signs/symptoms:

- Blood coming from the nose or the rhinopharynx
- History of recurrent nasal bleeding

Diagnosis:

- Clinical:
  - Exploratory clinical examination
  - ENT and general examination
  - Full blood count
- In complicated or recurrent cases,:
  - Do full blood count, clotting time, bleeding time, prothrombin time
  - Refer for ENT surgeon and pediatrician review
  - Other investigations should be requested based on general examination findings

Complications

- Hypovolemic shock
- Anaemia

Management:

Non-pharmaceutical treatment:

- Sit the patient up to avoid aspiration
- Cleaning of blood clots from the nose
- Direct pressure applied by pinching the soft fleshy part of the nose, apply for at least five minutes and up to 20 minutes.
- Application of cold compresses on the nose
- Room humidifier
- Nasal packing with ribbon gauze impregnated with topical ointments (Vaseline…) and remove it after 12-24 hours.

Pharmaceutical treatment:

- Application of a topical antibiotics ointment to the nasal mucosa has been shown to be an effective treatment for recurrent epistaxis (eg. tetracycline…)
- Topical vasoconstrictor: Xylometazoline spray (eg. Otrivin) 0.5mg/ml
- Cauterization of the bleeding site with silver nitrate or 20% of solution trichloracetic acid under topical anesthesia (ENT surgeon)
- Electro coagulation(ENT surgeon)
- If severe bleeding with shock/or anemia, immediate blood transfusion is recommended.

- Investigate and Treat the underlying cause.

Recommendations:

- In complicated or recurrent cases,:
  - Do full blood count, clotting time, bleeding time, prothrombin time
  - Refer for review by ENT surgeon and pediatrician

3.7 SINUSITIS

Definition: Sinusitis is the inflammation of one or more sinus cavities.

Causes:

- Rhinitis (most common cause)
- Trauma with open sinuses
- Bacterial infections (Bacteria : Pneumoniae, H. Influenza, Moraxella catarrhalis, staphylococcus Aureus, anaerobes)
- Viral
- Common predisposing factors include: allergic rhinitis, abscess and tooth extraction, chemical irritants, nasal polyp, deviation of nasal septum, perfumes or paint fumes, and changes in the weather

Signs/symptoms:

- Nonspecific complaints
- Purulent nasal discharge (unilateral or bilateral)
- Fever and cough
- Nasal obstruction and congestion
- Frontal headache and heaviness of the head exaggerated on bending the head
- Persistent symptoms of upper respiratory tract infection
- On clinical examination, pressure on frontal and maxillary sinuses causes pain
- Decreased sense of smell
- Periorbital oedema
- Anterior rhinoscopy shows pus coming through the middle meatus (by ENT)

Diagnosis:

- Clinical
- Investigations: (by specialists)
  - Paranasal X-ray (shows opacification with air-fluid level)
  - CT scan

Complications:

- Local: Osteomyelitis, orbital cellulitis, orbital abscess
- Descending infections: pharyngitis, tonsillitis, bronchitis, pneumonia
- Systemic: septicaemia, meningitis, brain abscess, thrombophlebitis of cavernous sinus, subdural empyema

Management:

- Medical treatment consists of nasal decongestants and antibiotics

Treatment of first choice:

- Amoxicillin, Po 30mg/kg/dose Q8h 7-10 days
- Paracetamol 10-15mg/kg/dose Q6hr OR Ibuprofen 5-10mg/kg 8h

Alternative treatment:

- Amoxicillin-clavulanate (Amoxiclav, Augmentin®) 30 mg/kg/dose PO, Q8h 7 -10 days
- Add Xylometazoline (Otrivin) 0.05% nose drops or simple Argyrol drops 1% , 0.05% for 5 days for children above 2 years

  OR
- Cefadroxil (Oracefal): 15mg/kg/dose Q12h for 7 days
- Cefuroxime (Zinnat): tabs 15mg/kg/dose Q12h for 7 days
- Azithromycin 10mg/kg/dose Q24h for 3 days
- Erythromycin 15-20 mg/kg/dose Q8h for 10 days
- Argyrol-ephedrine nasal drops 2% 3 drop x3/day/7 days

Recommendations:

- Do not use nasal decongestants taking a monoamine oxidase inhibitor in hypertensive patient

3.8 LARYNGOTRACHEOBRONCHITIS (Croup)

Definition: Inflammation of the vocal cords and structures inferior to the cords. It is the common cause of stridor in children aged between 6 months and 2 years leading to potentially life-threatening airway obstruction

Causes:

- Viral respiratory tract infection: Parainfluenza Virus Type 1 and 2, Rhinoviruses, Syncytial Viruses, adenoviruses, measles and herpes simplex….)

Signs and Symptoms: (Avoid looking at the throat)

- Progressive shortness of breath following upper respiratory tract infection in a previously well child, followed by a barking cough and stridor
- Stridor becomes softer as airway obstruction becomes more severe
- There may be a sore throat
- Mild fever may be present
- Erythema and oedema of larynx

The following features suggest a different diagnosis:

- Acute onset of obstruction without prodromal features (foreign body or angioneurotic oedema)
- Incomplete immunisation and a membrane in the upper airway (diphtheria),
- High fever, dysphagia, drooling or sitting position (epiglottitis, retropharyngeal abscess, bacterial tracheitis)
- Recurrent upper airways obstruction (laryngeal papilloma).

Assessment of severity of airway obstruction in LTB

- Grade 1: Inspiratory stridor
- Grade 2 : Inspiratory and Expiratory stridor and passive expiration
- Grade 3 : Inspiratory and Expiratory stridor + pulsus paradoxus and active expiration
- Grade 4 : cyanosis, apathy, marked retractions, impending cardiorespiratory arrest

Note: grade 3-4 are critical and need urgent attention

Diagnosis:

- Clinical signs as above
- Investigations:
  - FBC + CRP
  - AP Neck X-ray (not mandatory) which shows narrowing of the airways (steeple sign)

Management:

Leave child in carer's arms as much as possible (except if near respiratory arrest) as you manage the child

Supportive measures

- Humidified O2 therapy
- Monitor oxygen saturation, heart rate and respiratory rate
- Maintenance fluids and nutrition
- Avoid unnecessary stimulation
- Depending on severity, admit child to high care or intensive care ward (grade 3-4).

Medical treatment:

Grade 1 obstruction

- Nebulization with Adrenaline 1:1,000 (0.5mg/kg Max 2.5mg < 4 years and 5mg >5) single dose
- Dexamethasone, IV/IM, 0.6 mg/kg as a single dose (Max 16mg) OR
- Prednisone, oral, 1-2 mg/kg as a single dose (Max 30mg).
- Paracetamol for the fever 10-15mg/kg 8h

Note: Avoid steroids in patients with measles or herpes infection.

Grade 2 obstruction

- Nebulization with Adrenaline 1:1,000 (0.5mg/kg (Max 2.5mg < 4 years and 5mg >5) using oxygen, every 30 minutes until obstruction is abolished.
- Dexamethasone, IV/IM, 0.6 mg/kg as a single dose (Max 16mg) OR
- Prednisone, oral, 1-2 mg/kg as a single dose (Max 30mg).

Grade 3 obstruction

- As above:
- If improvement, treat as in grade 2 but reduce frequency of adrenaline (epinephrine) nebulization with time,
- If no improvement within 1 hour, intubate, under general anaesthesia
- If unable to intubate, bag and mask ventilate and refer urgently

Grade 4 obstruction

As above and:

- Continue steroids
- Continue with adrenaline (epinephrine) nebulization with 100% warm humidified oxygen
- Intubate, under general anaesthesia
- If unable to intubate, bag and mask ventilate and urgently consult ENT surgeon

For suspected herpes:

- Acyclovir IV, 10–15 mg/kg/dose 8 hourly for 5–7 days (or oral 20mg/kg 8h for 7 days Max 800mg per dose).

For suspected bacterial infection:

- Ampicillin, IV 25-50 mg/kg/dose 8 hourly for 5–10 days.

If bacterial tracheitis is suspected:

- Cloxacillin, IV, 50 mg/kg/dose 6 hourly for 7 days.

3.9 EPIGLOTTITIS

Definition: Acute epiglottitis is a life-threatening emergency due to respiratory obstruction. It is due to intense swelling of epiglottis and surrounding tissues with septic signs.
Cause: It is caused by Haemophilus influenza type b. Since systematic vaccination, this condition has become very rare.

Table 17: clinical Presentation of Croup and Epiglottitis

Signs/symptoms	Croup (laryngitis)	Epiglottitis
Onset	Over days	Over hours
Preceding Coryza	Yes	No
Cough	Severe, barking	Absent or slight
Able to drink	Yes	No
Drooling saliva	No	Yes
Appearance	Unwell	Toxic, very ill
Fever	<38,5°C	>38,5°C
Stridor	Harsh, rasping	Soft, whispering
Voice, cry	Hoarse	Muffled, reluctant to speak

Management:
Urgent hospital admission and treatment
Move the child only when ready for intubation under general anesthesia
Intubation by senior anesthetist, paediatrician and ENT preferably in theatre room
Urgent tracheostomy if intubation impossible
Antibiotic treatment:
Cefotaxime iv 50 mg/kg/dose Q8h for 7-10 days Or
Ceftriaxone iv 50mg/kg/dose Q12h for 7-10 days
PLUS Cloxacillin 200mg/kg/ day 6hourly or Vancomycin 20mg/kg/dose 12hourly

3.10 ALLERGIC RHINITIS

Definition: Recurrent inflammation of the mucous membranes of the nose and paranasal sinuses in response to an inhaled allergen e.g. pollen, house dust, grasses and animal hair. Overuse of nasal decongestants and viral infections may precipitate the symptoms
Signs/symptoms allergic rhinitis:

- Blocked stuffy nose/ Sensation of nasal obstruction
- Watery nasal discharge

- Frequent sneezing, often accompanied by nasopharyngeal itching and irritation
- Conjunctival itching and watering
- Oedematous pale nasal mucosa
- Swollen nasal turbinate
- Mouth breathing
- Snoring at night
- Dry cough
- Headache
- Asthenia
- Thick, sticky mucus (after 3-days)

Diagnosis: Based on clinical signs

Investigations: Not indicated in our setting. Skin Prick Test and spirometry to rule out associated Asthma and Eczema

Complications:

- Acute or chronic sinusitis.
- Otitis media.
- Sleep disturbance or apnoea.
- Dental problems (overbite): Caused by excessive breathing through the mouth.
- Palatal abnormalities.
- Eustachian tube dysfunction
- Sinusitis
- Pharyngitis
- Laryngobronchitis

Management:

- Avoid allergens
- There is no cure for allergic rhinitis; treatment is given for symptom relief
- Supportive care includes bed rest and drinking plenty of fluid

Treatment of first choice:

Desloratidine

- Children 6 months to 5 years of age: 2.5 ml (1.25 mg) once a day
- Children 5-12 years of age: 5 ml (2.5 mg) once a day
- Children ≥12 years and Adolescents: 5 mg once daily.
- Duration of treatment: 1 to 3 months.
- Avoiding the allergen
- If poorly controlled/severe: Corticosteroid aqueous nasal solution, e.g. Budesonide, 100 mcg, 1 spray into each nostril 12 hourly. OR Fluticasone nasal spray (Avamys) 27.5mcg 1 puff daily
- Refer all complicated cases to Paediatricians/ ENT

Alternative treatment in acute phase:

- 2-5 years : Chlorpheniramine tabs/syrup :1mg x3/day/1-3days;
- 6-11years: Chlorpheniramine tabs/syrup: 2mg x3/day/1-3days
- 12 years: Chlorpheniramine tabs/syrup: 4mg x3/day/1-3days
- Avoid local nasal decongestants as they have long term side effect

CHAPTER 4: GASTROINTESTINAL DISORDERS

4.1 ACUTE GASTROENTERITIS

Definition: Gastroenteritis is an inflammation of the stomach and intestines that causes diarrhoea, vomiting, nausea and other symptoms of digestive upset.
Diarrhoea is the passage of three or more loose or watery stools per day. It can be watery, bloody or containing mucus.

Causes:

- ***Viral gastroenteritis:*** Rotavirus and enterovirus), are the most likely cause of infectious diarrhoea in children under age 5
- ***Bacterial gastroenteritis*** **:** Campylobacter, Salmonella or E. coli
- ***Intestinal parasites*****:** Giardia lamblia,
- ***Others*** causes include life threatening conditions including intussusception; appendicitis…may be initiated by diarrhoea.

Signs/Symptoms:

- Diarrhoea
- Vomiting
- Abdominal pain
- Fever
- Dehydration

Table 18: Clinical evaluation of dehydration

Mild dehydration : 3 - 5% Plan A)	No signs of dehydration
Moderate dehydration : 6-9% (Plan B)	• Able to drink (drinks eagerly) plus 2 or more of: • Sunken Eyes • Skin pinch 1 - 2 secs • Restless / Irritable/Agitated
Severe dehydration : 10-15% (Plan C)	• Pulse weak or rapid and unable to drink plus: • Sunken Eyes • Skin pinch ≥ 2 secs? • Lethargic or decreased level of consciousness unconscious • Kussmal (acidotic) breathing

Complications:

- ***Hypovolemic shock*** (Tachycardia, cold hands, weak or absent pulse, capillary refill > 3 sec, not alert)
- ***Electrolytes imbalance***: severe hyponatraemia (<130mmol/L), severe hypernatraemia (>150mmol/L), severe hypokalaemia (<3mmol/L), severe hyperkaelemia (>5.5).

- ***Cerebral œdema*** (headache, convulsions, vomiting, nausea, weakness) due to rapid rehydration with hypotonic solutions. Common in hypernatraemia
- ***Intracerebral haemorrhage*** (due to severe dehydration in infants and young children)

Investigations:

- FBC, CRP, malaria test and blood culture if suspicion of bacterial blood stream.
- Electrolytes (Sodium and Potassium)
- Random blood sugar , Urea/creatinine if shock
- Stool exam: direct/culture (if blood or pus in stool)

Note: Qualitative evaluation of dehydration (according to sodium level)

- ***Isotonic dehydration:*** Na 130 to 150 mmol/L
- ***Hypertonic dehydration*****:** Na > 150 mmol/L
- ***Hypotonic dehydration*** **:** Na < 130 mmol/L

Management:

Admit the child: Absolute criteria of admission:

- Profuse diarrhoea (> 8 stools/24h) with vomiting
- Vomiting every feed
- Severe dehydration
- Failure of home oral rehydration
- If not sure of home care

Management of shock

If dehydration and shock without signs of malnutrition, give appropriate treatment as follow**:**

- Consider ABCD
- 20ml/kg of normal saline (NS) or Ringers Lactate (RL) as quickly as possible IV or IO in 15 minutes (see table below for estimation of required volume for 20ml/kg):
- Repeat the bolus of NS or RL 3-4 times if persistence of signs of shock
- Treat as severe dehydration after correction of shock

If dehydration and shock with signs of malnutrition

AVPU<A, absent or weak pulses, prolonged capillary refilling (>3s) and cold periphery with temperature gradient

- 15 ml/kg over 1 hours of Ringer's Lactate (RL)/5% dextrose. – add 50mls 50% dextrose to 450mls Ringers (or 10% Dextrose/HSD if no Ringers).
- If severe anaemia (Hb < 5) start urgent blood transfusion not Ringers.

Note: The current evidences suggest that in case of malnutrition complicated by hypovolemic shock, the number of fluid boluses shouldn't exceed 1 bolus. If shock persist, we have to consider other approaches including blood transfusion and use of vasopressors and referral to advanced level.

Table 19: Management of severe dehydration without malnutrition

If severe dehydration without shock (Plan C);

Normal Saline (If unavailable) Full Strength Ringer Lactate	**Age < 12 months**	**Age ≥ 12 months to 5 years**
Step 1	30 mls / kg over 1 hour	30 mls / kg over 30 mins
Step 2	70 mls / kg over 5 hours	70 mls / kg over 2.5 hours
Then re-assess child – if still signs of severe dehydration repeat step. If signs improving treat for moderate dehydration If no ivi line give ORS via NGT 120ml/kg over 6hour and continue looking ivi line		

If moderate dehydration (Plan B) without malnutrition

- Best treated with ORS 75ml/kg over 4 hours orally or through NGT
- Give RL 75ml/kg over 4 hours in case of uncontrolled /severe diarrhoea and/or vomiting

After 4 hours

- Reassess the child and classify the child for dehydration.
- Select the appropriate plan to continue treatment.
- Begin feeding the child in clinic.

Table 20: How to administer ORS

By bottle	Give 1/3 during 1st h, then 2/3 during 3 following hours. Example: 10 kg; dehydrated 7.5%. Should receive 75 ml/kg = 750 ml ORS in 4h Give 60 ml every 15 min during 1st hour Then 170 ml every hour for 3 hours
Spoon or syringe	Maybe effective if has severe vomiting Allows adequate volumes Example: 5 ml every 1 to 2 min → 300 to 150 ml in 1 hour
Nasogastric tube	vomiting +++ fatigue +++

NB ORS is

- Contra-indicated if ileus or decreased level of consciousness
- Able to correct the electrolyte imbalance (hypo and hypernatraemia)

If the mother must leave before completing treatment:

- Show her how to prepare ORS solution at home.
- Show her how much ORS to give to finish 4-hour treatment at home.
- Give her enough ORS packets to complete rehydration

Explain the 4 rules of home treatment

- Give extra fluid: Give to the child more to drink as he wants
- Give zinc supplements for 10–14 days:
  - Up to 6 months: 1/2 tablet (10 mg) per day, above 6 months 1 tablet (20 mg) daily
- Continue feeding: initial 4-hour rehydration period, breastfed children should continue to breastfeed frequently throughout
- When the child has to be returned to the health facility:
  - Drinking poorly or unable to drink or breastfeed
  - Becomes more sick
  - Develops fever
  - Has blood in the stool

If no dehydration (Plan A) without malnutrition

- Treat the child as an outpatient; give ORS 10ml/kg after each watery stool
- Counsel the mother on the 4 rules of home treatment:
  - Give extra fluid,
  - Give zinc supplements
  - Continue feeding
  - Give advice on when to return for review

Table 21: Different forms of dehydration with electrolyte imbalances

Type	Intervention (See details in chapter 1)	Comment
Hyponatremia (Na < 130mmol/L)	Na Deficit = 0.6 x W in kg x (Na^+_d - Na^+_m) during 4 hours W= weight d = desired sodium m = measured sodium	Do not correct too quickly to avoid CNS complications **Refer to chapter I Page 43 for details**
Hypernatremia (Na > 150mmol/L)	Slowly correct dehydration over 48 hours **Refer to chapter I Page 47 for details** **Total fluid requirement = maintenance + replacement of deficit + replacement of ongoing losses given over 48 hours**	Risk of convulsions/cerebral oedema in case of rapid correction
Hypokalemia	If Potassium**< 2.5 mmol**/L give KCl 30-40 mmol/L/24hours	Give KCl if urine output is adequate

Note: Dehydration with electrolyte imbalance should be managed in a high care setting

For management of dehydration with acute malnutrition refer to chapter 1.4 and National malnutrition protocol

4.2 PERSISTENT DIARRHOEA

Definition: Persistent diarrhoea is a diarrhoea, with no signs of dehydration and severe malnutrition, with or without blood, which begins acutely and lasts ≥ 14 days.

Table 22: Causes of persistent diarrhoea

Age	Aetiologies
Infancy	• Post gastroenteritis malabsorption syndrome • Cow's milk/soy protein intolerance • Secondary disaccharidase deficiencies
Childhood	• Secondary disaccharidase deficiencies • Giardiasis • Post gastroenteritis malabsorption syndrome • Celiac diseases • HIV • Malnutrition
Adolescence	• Irritable bowel syndrome • HIV • Inflammatory bowel disease

Complications:

- Dehydration
- Failure to thrive, malnutrition
- Immunosuppression
- Electrolyte imbalances

Investigations: will vary according to the suspected aetiology

- Stool examination:PH, White blood count, Fat, Ova, osmolality, Culture
- FBC, CRP, electrolytes, urea and creatinine
- Urine culture
- Barium study
- Small bowel biopsy
- Endoscopy: Sigmoidoscopy or colonoscopy with biopsy

Management:

- Oral rehydration
- Treat the cause

Step-wise empiric protocol for management of diarrhoea

Day 1−2

- Continue full-strength feeds with additional ORS as required.

Day 3−7

- Change to lactose-free feeds if not breastfed.
- Continue additional oral rehydration as required.
- If diarrhoea resolves, discharge, but continue with lactose-free feeds for 2 weeks.

Day 8−13

- Semi-elemental formula: sucrose- and lactose-free, protein hydrolysate, medium chain triglyceride.
- Continue additional ORS as required.

4.3 BLOODY DIARRHOEA (DYSENTRY)

Definition: Frequent (>3/day) passage of blood and/or mucus in the stools

Cause:

- Bacterial infections (e.g. Shigella, salmonella...)
- Parasitic infestations (e.g. amoebic dysentery)
- Milk allergy
- Chronic inflammatory bowel disease

Signs and symptoms:

- Sudden onset
- Abdominal cramps
- Peritonism urgency, fever and diarrhoea with blood and mucus in the stools
- Meningism and convulsions may occur
- Exclude intussusceptions which present as:
    - pain or abdominal tenderness
    - bile-stained vomitus
    - red currant jelly-like mucus

Investigations

- Stool culture to confirm diagnosis of Shigellosis
- Stool microscopy reveals many polymorphs and blood
- Immediate microscopy of warm stool to diagnose amoebic dysentery
- Abdominal ultrasound/ abdominal x-ray if intussusception is suspected

Management

- Bloody diarrhoea in infancy and childhood often indicates serious gastrointestinal disease
- Bacterial gastroenteritis is usually self-limiting—antibiotics are needed only in selected cases
- Children with severe bloody diarrhoea or signs of systemic illness need urgent specialist referral, as these symptoms may indicate a life threatening condition
- The WHO recommends treating all episodes of blood in the stools with antibiotics and to use Ciprofloxacin and Ceftriaxone as the first-line drugs.

Treatment:

Non-pharmacological treatment:

- Ensure adequate nutrition and hydration

Pharmacological treatment

- Fluid and electrolyte replacement (see Acute Diarrhoea)
- Ciprofloxacin, oral, 15 mg/kg/dose 12 hourly for 3 days

OR

- Ceftriaxone, IV, 50 mg/kg as a single daily dose for 5 days (if hospitalised or if unable to take oral antibiotics)
- Cefixime 8mg/kg per day for 5 days 0

Complications include:

- Dehydration
- Convulsions
- Shock
- Electrolyte imbalance
- Acidosis
- Rectal prolapse
- Renal failure
- Haemolytic uraemic syndrome

Recommendation:

- Refer patient to a paediatrician, if dysentery with complications, e.g. persistent shock, haemolytic uraemic syndrome or bloody diarrhoea beyond 3 days despite treatment
- Refer urgently if intussusception is suspected

4.4 AMOEBIASIS

Definition: Amoebiasis is a parasitic infection due to the intestinal protozoa Entamoeba histolytic.

Transmission is faecal-oral, by ingestion of amoebic cysts from food or water contaminated with faeces.

Usually, ingested cysts release non-pathogenic amoebae and 90% of carriers are asymptomatic.

In 10% of infected patients, pathogenic amoebae penetrate the mucous of the colon: this is the intestinal amoebiasis (amoebic dysentery). The clinical picture is similar to that of shigellosis, which is the principal cause of dysentery. Occasionally, the pathogenic amoebae migrate via the blood stream and form peripheral abscesses. Amoebic liver abscess is the most common form of extra-intestinal amoebiasis.

Clinical features

- Amoebic dysentery
  - Diarrhoea containing red blood and mucus
  - Abdominal pain, tenesmus
  - No fever or mild fever
  - Possibly signs of dehydration
- Amoebic liver abscess
  - Painful hepatomegaly; mild jaundice may be present
  - Anorexia, weight loss, nausea, vomiting
  - Intermittent fever, sweating, chills; change in overall condition

Laboratory

- Amoebic dysentery: identification of mobile trophozoites (E. histolytica) in fresh stool samples
- Amoebic liver abscess: Abdominal ultrasound and indirect haemoagglutination and ELISA

Treatment for Amoebic dysentery

Tinidazole PO

- Children: 50 mg/kg once daily for 3 days (max. 2 g daily)
- Adolescents: 2 g once daily for 3 days OR

Metronidazole PO

- Children: 15 mg/kg /dose 8hourly for 5 days
- Adolescents: 500 mg 3 times daily for 5 days

OR Entamizole (Diloxanide furoate +Metronidazole) 10 mg / kg every 8 h OR 250-750 mg 3-4 times / day for 5 days.

Note:

- If there is no laboratory, first line treatment for dysentery is for shigellosis
- Treat for amoebiasis if correct treatment for shigellosis has been ineffective
- The presence of cysts alone should not lead to the treatment of amoebiasis.
- Amoebiasis is confirmed with a parasitological stool examination: mobile trophozoites in fresh stool

4.5 CONSTIPATION

Definition: Constipation is an acute or chronic condition in which bowel movements occur less often than usual or consist of hard, dry stools that are painful or difficult to pass.

Causes:

- Lack of exercise
- Certain medicines
- Metabolic, endocrine, neurogenic and lower bowel abnormalities
- Psychogenic disorders
- Chronic use of enemas
- Not drinking enough water
- Diet that does not include an adequate amount of fiber-rich foods
- Anal fissure (a tear or crack in the lining of the anus)
- Hirschsprung disease
- Colon or rectal cancer
- Depression
- Hypercalcemia (abnormally high levels of calcium in the blood)
- Hypothyroidism (underactive thyroid gland)
- Illness requiring complete bed rest
- Irritable bowel syndrome
- Stress

Signs and Symptoms:

- A symptomatic bowel impaction
- Blood on the stools
- Changes in bowel patterns
- Abdominal pain, distension
- Encopresis

Diagnosis: clinical based

- Non-tender deformable faecal masses palpable on rectal examination

Investigations: Not always indicated

- Abdominal X-ray
- Barium enema - reveals blockage inside the intestine in particular cases
- Laboratory analysis of blood and stool samples for internal bleeding
- Sigmoidoscopy (examination of the sigmoid area of the colon with a flexible tube equipped with a magnifying lens), rarely indicated.

Complications:

- Bowel obstruction
- Chronic constipation
- Haemorrhoids
- Hernia
- Spastic colitis
- Laxative dependency

Treatment:

- Treatment involves 3 steps:
  - Initial clearance of stools
  - Prevent re-accumulation of hardened retained stool (Diet change with additional natural fibre from fruit, vegetables and bran).
  - Retraining of the gut to achieve regular toilet habits
- Management is long-term, and requires the active involvement of the parents

Pharmacological treatment:

- Enema twice daily for 3 days for faecal clearance if faecal loading
- Lactulose (Duphalac) for 1 week but if passes 3 stools/day stop it
- Bowel re-training
- Use of rectal medications e.g. Glycerine suppositories
- In refractory cases:
  - Lactulose, oral, twice daily (1 mL/kg up to maximum 60 mL daily).
    - < 1 year 2.5 mL
    - 1–6 years 5 mL
    - > 6 years 10 mL
  - Forlax (Polyethylene glycol 3350 powder) is generally given using a weight-based dosing as follow:
    - 0.4 to 0.8 g/kg per day; maximum 17 g daily for starting dose .Administer by mixing in water, juice, or soda (not milk),
      Note: the Sackets are in 4g and 10g
  - Sorbitol:
    - 1 -11 years: 1 mL/kg once or twice daily (maximum 30 mL daily)
    - 15 to 30 mL once or twice daily
  - Determine and treat the underlying cause

Recommendation:

- Refer patient to the specialist, if an organic cause e.g. constipation from birth in a breast-fed baby is suspected
- If faecal loading continues, maintenance therapy should be continued for months to years

4.5.1 Constipation-associated faecal incontinence: Encopresis

Definition: Encopresis also known as faecal soiling is the involuntary leakage of small amounts of soft or watery stool in a child with chronic constipation

Causes

- Psycho social precipitants
- Functional (Incorrect Diet, lack of exercise, poor fluid intake)
- Metabolic or Neurological Abnormalities
- Endocrine abnormalities (Hypothyroidism)
- Chronic use of Laxatives
- Obstructive lesions (Acquired and congenital defects)

Signs and symptoms:

- Abdominal pain
- Most of the times associated with encopresis
- Infrequent defecation
- Pain or strain on defecation
- Hard stool
- Feeling of incomplete evacuation (Tenesmus)

Investigations

- Abdominal x-ray in suspected obstructive lesions
- Thyroid function tests when indicated
- Stool analysis
- Barium Enema
- Investigate other functional lesions

Complications

- Anal Fissure, ulcers and prolapse
- Stasis syndrome with bacterial overgrowth

Management

Non-pharmacolocal management

- Rehydrate to increase faecal bulk and soften stool
- Education of patients/parents on Diet, exercise, etc.....
- Diet change with additional natural fibre from fruit and vegetables.
- Treatment involves 3 steps:
    - Initial clearance of stools
    - Prevent re-accumulation of hardened retained stool
    - Retraining of the gut to achieve regular toilet habits

Pharmacological management:

- Glycerine Suppositories 1 suppository /dose according to occurrence of symptoms OR
- Lactulose syrup <1 yr.: 5-10ml/24 hr PO OD; 1-6 Yrs 10-20 ml/24 hrs PO OD; 7-14 yrs 20-50ml/24 hrs PO OD OR
- Bisacodyl (Dulcolax) 0.3mg/kg/day PO OD maximum dose 30mg/24 hrs

Recommendation:

- Refer to a higher health facility in cases of inadequate response to therapy for further investigations
- If continued constipation therapy should be continued for months to years

4.6 UPPER GIT BLEEDING

Definition: Bleeding arising proximal to the ligament of Treitz in the distal duodenum commonly manifested by haematemesis and/or melena.

Causes

Neonates:

- False bleeding (maternal swallowed blood Vit K1 deficiency (Haemorrhagic disease of the newborn)
- Coagulopathy (infection, liver failure, coagulation disorder.
- Stress or gastric ulcer
- Haemangioma

Infants and toddlers:

- Mallory-Weiss syndrome
- Non-steroid anti-inflammatory drugs
- Oesophagitis
- Caustic ingestions, iron poisoning
- Oesophageal varices bleeding

Old children and adolescent:

- Mallory-Weiss
- Peptic ulcer/gastritis
- Rendu Osler syndrome
- Gastric polyps
- Oesophageal varices

Clinical manifestations:

- Hematemesis
- Melena
- Other signs according to the causative agent

Assessment:

History: The clinical history should include information concerning:

- The **time course of** the bleeding episode
- Estimated blood loss, and any associated symptoms.
- Gastrointestinal symptoms including dyspepsia, heartburn, abdominal pain, dysphagia, and weight loss. In infants, these features may be reflected in poor feeding and irritability.

The history should also include information about the following symptoms or signs which may provide clues to an underlying disorder:

- Recent onset of jaundice, easy bruising or change in stool colour, which may suggest underlying liver disease
- Recent or recurrent epistaxis, to investigate the possibility of a nasopharyngeal source of bleeding
- History of easy bruising or bleeding, which suggests a disorder of coagulation, platelet dysfunction, or thrombocytopenia
- Personal or family history or liver, kidney or heart disease, or coagulation disorders
- A drug history is important to assess potential contributions from medications that may induce ulceration (such as NSAIDs and corticosteroids); Tetracyclines, may cause a pill esophagitis
- If the patient has been taking drugs or has a cardiac condition that affects homeostatic responses (such as beta-adrenergic antagonists), because these may mask tachycardia associated with life-threatening hypovolemia and shock.

Physical examination: The physical examination should include the following elements:

- The skin for cutaneous signs of generalized vascular malformations/disorders (cutaneous haemangiomas. mucocutaneous telangiectasia)
- Evidence of portal hypertension, (splenomegaly, prominent abdominal and haemorrhoid vessels)
- Inspection of the nasopharynx
- Check for hemodynamic failure (signs of shock?)

Nasogastric tube:

- Sometimes used to confirm the diagnosis and determine if the bleeding is ongoing.
- The lavage will also remove particulate matter, fresh blood, and clots to facilitate endoscopy and decrease the risk of aspiration.

Differentials:

- Swallowed maternal blood during delivery or while nursing
- Ingested epistaxis – nasopharynx bleeding
- Certain foods e.g. red coloured juices

Investigations:

Depending on suspected cause and magnitude of the blood loss, laboratory assessment should include:

- FBC, cross-match blood in case transfusion is required , LFTs, blood urea nitrogen, serum creatinine , Coagulation tests
- Upper digestive endoscopy (diagnosis and interventional).

Management:

Main objectives:

- Relieve or treat haemorrhagic shock if present
- Stop bleeding
- Treat the causative agent

Emergency treatment

- ABC (include Blood transfusion if necessary)
- Insert a nasogastric tube for aspiration and an IV line (big enough for age).
- If the haemodynamic state is stable (pulse and blood pressure are normal):
  - Hydrate (Ringer lactate), monitor vitals, and keep NPO for 12 hours.
  - If there is no active haemorrhage, restart oral feeding after 12 hours
- Assess for possible causative agent and treat accordingly.
- If need of endoscopy, then refer to centre where it's available.

Most common causes according to age and treatment

- Neonates (Stress ulcers secondary to severe illness):
  - Cimetidine IV 5-20mg/kg divided in 2 doses
  - Omeprazole, PO 0.5–1 mg/kg, 12– 24 hourly
- Infants and toddlers (common cause is gastric ulcers and other causes can be evaluated after endoscopy)
  - Octreotide, IV bolus, 1–2 mcg then 1–5 mcg/kg/hour by infusion, initiated by the specialist in case of cases of variceal bleeding (difficult to control, to help control bleeding before endoscopy, or when endoscopy is unsuccessful, contraindicated, or unavailable)
  - Esomeprazole, PO
    - 1 month–2 years 2.5mg, 12 hourly
    - 2–6 years 5 mg, 12 hourly initiated by the Specialist for post bleed prophylactic management
- Old children and adolescent (common cause is gastric ulcers and other causes can be evaluated after endoscopy)
  - Omeprazole, PO < 20 kg: 10 mg QD >20 kg : 20 mg QD

Note: Endoscopy is recommended to be performed within 24 to 48 hours for infants and children presenting with upper GIT bleeding that is acute and severe, it can be performed for diagnosis and treatment (sclerotherapy in oesophageal variceal)

Alternative treatment:

- Propranolol oral, 2–8 mg/kg/24 hours in 3 divided doses (to reduce the pulse rate by 25%).Use for oesophageal varices only
- Surgical oversewing if endoscopy and sclerotherapy or banding have failed

Recommendations:

- Refer all cases to the specialist for appropriate diagnosis and treatment
- Refer all bleeding varices - after commencement of resuscitation and octreotide, if available

4.7 PEPTIC ULCER DISEASE

Definition: This refers to ulceration of gastric or duodenal mucosa that tends to be chronic and/or recurrent. Peptic ulcers may be primary (e.g. Helicobacter pylori related) or secondary, (e.g. stress related or associated with NSAID use).

Signs and Symptoms:

- Peptic ulcers may present with dyspeptic or other gastrointestinal symptoms or may be completely asymptomatic, sometimes until complications such as haemorrhage or perforation occur. The symptoms associated with peptic ulcers are not sensitive or specific and the differential diagnosis is broad.
- Most common: Ulcer-like or acid dyspepsia (burning pain; epigastric hunger-like pain; relief with food, antacids, and/or anti-secretory agents)
- Food-provoked dyspepsia or indigestion (postprandial epigastric discomfort and fullness, belching, early satiety, nausea, and occasional vomiting) : food-stimulated acid secretion persists for three to five hours; thus, classic DU symptoms occur two to five hours after meals
- Reflux-like dyspepsia

Cause:

- Stress related or associated with NSAID use).
- Helicobacter pylori (H. pylori) -In developing nations, the majority of children are infected with H. pylori before the age of 10

Diagnosis:

Clinical symptoms:

- Epigastric pain. Pain is often poorly localised in children, described as dull and aching and frequently does not respond to antacids
- Haematemesis or melena is a relatively common presentation in children (up to 50%).

Investigations

- Stool analysis for occult blood
- FBC
- For Helicobacter Pylori:
  - It is recommended that the initial diagnosis of H. pylori infection be based on positive histopathology plus positive rapid urease test, or positive culture.
  - A validated ELISA for detection of H. pylori antigen in stool is a reliable non-invasive test to determine whether H. pylorus has been eradicated.
  - **Tests based on the detection of antibodies (IgG, IgA) against H. pylori in serum, whole blood, urine and saliva are less reliable for use in the clinical setting.**

NB: specialists recommend: In children with refractory iron deficiency anaemia, where other causes have been ruled out, testing for H. pylori infection may be considered

Complications:

- The natural history of peptic ulcer ranges from resolution without intervention to development of complications : acute or Chronic blood loss or perforation
- Iron deficiency anaemia

Management:

- Avoid any foods that cause pain to the patient's (e.g. acid foods, cola drinks)
- Avoid gastric irritating drugs (NSAIDs)
- Give magnesium-based antacids or combined magnesium-aluminium

First line H pylori eradication regimens are:

- Triple therapy with a PPI + Amoxicillin + Clarithromycin;;
- **or** PPI + Amoxicillin + Imidazole

- **or** Bismuth salts + Amoxicillin + Imidazole;
- **or** Sequential Therapy Triple therapy for eradication of H. pylori by;
    - Omeprazole PO
        - 15-30 kg: 10 mg twice daily
        - >30 kg: 20 mg twice daily **Or**
    - cimetidine 20–40mg/kg/day
      +
    - Clarithromycin : 500mg BID (15mg/Kg/24 BID)
      +
    - Amoxicillin 1g twice daily
      Or
    - metronidazole 500 mg (15–20mg/kg/day) BD

Duration: 10 – 14 days,
A reliable non-invasive test for eradication is recommended at least 4 to 8 weeks following completion of therapy

Recommendations:

- Refer to a specialist, if there is severe haemorrhage
- Stabilize the patient before transfer
- Infuse IV fluids/blood to maintain normal volume/pulse
- Ensure continuous assessment of further blood loss (Persistent tachycardia, postural hypotension, continuing haematemesis)
- Definitive treatment/Eradication of H. pylori

4.8 GASTROESOPHAGEAL REFLUX

- **Definition:** GER is the passage of gastric contents into the esophagus with or without regurgitation and vomiting. GER is a normal physiologic process occurring several times per day in healthy infants, children, and adults. Most episodes of GER in healthy individuals last <3 minutes, occur in the postprandial period, and cause few or no symptoms. In contrast, Gastroesophageal reflux disease GERD is present when the reflux of gastric contents causes troublesome symptoms and/or complications.

Causes and risk factors:
The cause is still unclear

- Anatomical abnormalities such as a hiatal hernia
- Long term use of nasal gastric tube
- Diet that stimulates gastric acid production
- Neurologic impairment (NI), obesity, certain genetic syndromes, oesophageal atresia (EA), chronic lung diseases, and those with a history of premature birth

Diagnosis: Based on signs and symptoms**:**

- In infants and toddlers, there is no symptom or symptom complex that is diagnostic of GERD or predicts response to therapy. In older children and adolescents, as in

adult patients, history and physical examination may be sufficient to diagnose GERD if the symptoms are typical.

The following symptoms are suggestive of GERD:

- **In newborn:**
  - Recurrent vomiting, stridor, apnoea
- **In infant**:
  - Recurrent vomiting
  - Respiratory manifestations, (dry cough, recurrent wheeze or cough, chronic obstructive airway disease, recurrent aspiration pneumonia, stridor, apnoea
- **In children /adolescent:**
  - Heartburn, Epigastric or chest pain.
  - Respiratory manifestations: dry cough, recurrent wheeze or cough, chronic obstructive airway disease,

Complications:

- Dysphagia (difficulty in swallowing)
- Odynophagia (pain on swallowing)
- Weight loss
- Anaemia
- Esophagitis
- Aspiration pneumonia
- Barrett's oesophagus
- Abnormal posturing or opisthotonus (Sandifer syndrome)

Investigations: when GER is persisting despite basic management

- 24 hours oesophageal PH monitoring
- Endoscopy with biopsy to rule out esophagitis
- Barium X-rays for severity of oesophageal stenosis
- FBC look for anaemia

Management:

Non-pharmacological management

- Postural treatment: prone and lateral positions are associated with an increased incidence of sudden infant death syndrome (SIDS). The risk of SIDS outweighs the benefit of prone or lateral sleep position on GER; therefore, in most infants from birth to 12 months of age, supine positioning during sleep is recommended.
- Dietary measures such as thickened food – if not breastfeeding, frequent small volume of solid foods

Pharmacological management

Less Severe or Non-Erosive;

- Anti-acids for 1 week then review
  - Sodium alginate (Gaviscon Enfant)/antacid combination
  - 1-2 months 1.5 mls after each meal
  - 2-4 months 2mls after each meal
- Aluminium and Magnesium hydroxide (Maalox) Syrup 0.5 ml/kg/dose PO QID
- H2 Antagonists: Cimetidine IV/syrup/tab

- Neonates 5-20mg/kg/24 hr divided in 2 doses
- Infants 10-20 mg/kg/24hrs divided in 2 doses
- Children 20-40mg/kg/24hr divided in 2 doses

Severe or Erosive

- Esomeprazole, oral;
  - Neonate 0.5–1 mg/kg, 12– 24 hourly
  - Children 1- 16 years :
    -5 kg to <10 kg: 5 mg once daily
    - 10 kg to ≤20 kg: 10 mg once daily
    - >20 kg: 20 mg once daily

Alternate dosing: 1 mg/kg/dose once or twice daily; Higher doses may be necessary in children between 1-6 years**. ADD**

- Pro-Kinetics: Domperidone (Motilium) 0.1– 0.2 mg/kg/ dose 8hourly. Maximum 30mg/24hrs

Recommendation

- Refer to a higher level gastro-oesophageal reflux not responding to treatment
- Education Parents/guardians on patient diet
- Eat small, frequent meals

4.9 TROPICAL SPLENOMEGALY (HYPERREACTIVE MALARIOUS SPLENOMEGALY)

Definition: It is a massive enlargement of the spleen resulting from abnormal immune response to repeated attacks of malaria

Signs and symptoms:

- Chronic abdominal distension and pain.
- Weight loss
- Intermittent fever

Some patients present with Anaemia, generalized weakness, cough, dyspnea, epistaxis, headache, increased skin and respiratory infection

Diagnosis: is based on clinical signs

- Splenomegaly of at least 10cms
- Regression of the spleen by at least 40% by 6 months on antimalarial therapy.

Investigations:

- Blood smear
- Complete blood count (for Hb, Platelets)
- Serum levels of IgM (at least 2SD above normal limit)

Complications:

- Hypersplenism leading to anaemia, leukopenia and thrombocytopenia, bleeding
- Splenic lymphoma

Management:

Pharmacological treatment:

- Doxycycline tabs /day for 6 months
  - Children >8 years (<45 kg): 5 mg/kg/day OD
  - Children >8 years (>45 kg): treat as adults 100mg od

OR

- Mefloquine 5mg/kg weekly without exceeding 250mg/week of adult dose for 6 months

NB: Generally, splenectomy in the management of HMS is not recommended as mortality is high from sepsis and thrombocytosis **UNLESS** there is a splenic rupture.

4.10 HERPES GINGIVOSTOMATITIS

Definition.

Inflammation of the mouth structures with ulcers (which may be of various numbers and sizes), caused by Herpes simplex virus infection. The normal course of the disease is 7–10 days.

Diagnosis Based on clinical symptoms and signs

- General inflammation of the mouth with multiple small ulcers on the buccal mucosa, palate, anterior tonsillar pillars, tongue, inner lips and gingival margins.
- Fever, malaise and dysphagia.
- Tender, enlarged cervical lymph nodes.

Complications

- Dehydration
- Malnutrition

Management

General and supportive measures

- Maintain adequate nutrition and hydration by encouraging fluid and food intake – use foods and fluids that cause less pain ripe bananas, porridge, yoghurt, Milk.
- If oral nutrition cannot be maintained use oral/nasogastric and/or IV fluids, if necessary.

Medical treatment

- Chlorhexidine 0.2%, 10 mL as a mouthwash or gargle, 12 hourly. Do not swallow.
- For pain: Paracetamol, oral, 15 mg/kg/dose 6 hourly.

OR

- Ibuprofen, oral, 5–10 mg/kg/dose 6 hourly after meals.

If more than minor fever blisters:

- Acyclovir, oral
  - If > 1month to 1 year old: 20 mg/kg/dose 8hourly.
  - If > 1 year to 6 years old: 20 mg/kg/dose.
  - If > 6 years to 12 years old: 20mg/kg/dose.

If very severe infection, consider:

- Acyclovir, IV,5-10mg/kg/dose 8h

For very painful oral herpes in children > 2 years:

- Lidocaine (lignocaine) 2% gel applied every 3 to 4 hours. Apply a thin layer on the affected areas only. Do not exceed 3 mg/kg dose, i.e. maximum 0.15 mL/kg of 2% gel.

Referral

- Herpes gingivostomatitis not responding to therapy.
- Disseminating disease, especially if associated with encephalopathy or increasing liver span.

4.11 HERPANGINA IN CHILDREN

Definition

Herpangina is a viral infection that is manifested clinically as an acute febrile illness with small ulcerative or vesicular lesions in the posterior oropharynx and hard palate. It is mainly caused by Coxsackie viruses A and B, Enterovirus 71 and Echovirus. It affects commonly children 3-10 years. Adolescents and adults are less frequently affected. Newborns, immunocompromised, and pregnant patients can develop more severe disease.

Symptoms of Herpangina

Herpangina is characterized by

- Sudden onset of fever
- Sore throat,
- Headache,
- Anorexia, vomiting and
- Neck pain.
- Within 2 days after onset, greyish papules develop and become vesicles with erythematous base. They occur most frequently on the tonsillar pillars but also on the soft palate, tonsils, uvula, or tongue.

Diagnosis of Herpangina

- Diagnosis of Herpangina is based on symptoms and characteristic oral lesions
- Confirmatory testing is not usually required but can be done by isolating the virus from the lesions

Treatment of Herpangina

Herpangina is a self-limited illness, and the treatment is primarily supportive. The management can be described as general treatment, symptomatic treatment, and antiviral treatment.

General

- Patients should be isolated to prevent cross-infection.
- A healthy diet and adequate hydration; light, liquid, or semi-liquid foods with adequate calories and should avoid hot, spicy, and/or irritating foods.
- Oral care; patients rinse their mouths with normal saline after meals
- Younger children can have their mouths wiped with normal saline or salted

Symptomatic

- Antipyretics such as ibuprofen or Paracetamol.
- Adequate hydration.

Antiviral

- No specific antiviral drugs are currently available for the treatment of herpangina.

Differential diagnoses

1. Recurrent aphthous ulcers may appear similar but, unlike with herpangina, rarely occur in the pharynx and are not typically accompanied by systemic symptoms.
2. Herpetic stomatitis occurs sporadically and causes larger, more persistent, and more numerous ulcers throughout the oropharynx than herpangina.
3. Hand, foot, and mouth disease (HFMD) is a clinical syndrome characterized by an oral anathema and a macular, maculopapular, or vesicular rash of the hands and feet. HFMD is one of the most recognizable viral exanthemas in children and adults. Coxsackievirus A16 and enterovirus A71 are the serotypes most frequently associated with HFMD and are responsible for the majority of large outbreaks--

References

1. Mara Alves da Cruz Gouveia, Manuela Torres Camara Lins, Giselia Alves Pontes da Silva: Acute diarrhea with blood: diagnosis and drug treatment, Jornal de Pediatria, Volume 96, Supplement 1, 2020,
2. Bruzzese E, Giannattasio A, Guarino A. Antibiotic treatment of acute gastroenteritis in children. F1000Res. 2018 Feb 15;7:193. doi: 10.12688/f1000research.12328.1. PMID: 29511533; PMCID: PMC5814741.
3. https://www.uptodate.com/contents/image/print?imageKey=PEDS%2F63381
4. Pashankar DS, Bishop WP. Efficacy and optimal dose of daily polyethylene glycol 3350 for treatment of constipation and encopresis in children. J Pediatr 2001; 139:428.
5. Adapted from: Tabbers MM, Dilorenzo C, Berger MY, et al. Evaluation and Treatment of Functional Constipation in Infants and Children: Evidence-Based Recommendations From ESPGHAN and NASPGHAN. J Pediatr Gastroenterol Nutr 2014; 58:258.
6. https://www.ncbi.nlm.nih.gov/books/NBK507792/
7. Yao X, Bian LL, Lu WW, Li JX, Mao QY, Wang YP, Gao F, Wu X, Ye Q, Li XL, Zhu FC, Liang Z. Epidemiological and etiological characteristics of herpangina and hand foot mouth diseases in Jiangsu, China, 2013-2014. Hum Vaccin Immunother. 2017 Apr 03;13(4):823-830

CHAPTER 5: CARDIOVASCULAR DISEASES

Definition: Cardiovascular diseases (CVD) are the disorders of heart and blood vessels. Most cardiac diseases in young children are congenital, while those in older children may be acquired or congenital.

5.1 HEART FAILURE (CONGESTIVE CARDIAC FAILURE)

Definition: It is a clinical syndrome reflecting the inability of the myocardium to meet the oxygen and nutritional/ metabolic requirements of the body.

Causes:

In normal heart anatomy;

- Severe anaemia
- Infection/sepsis
- Acquired valvulopathies
- Volume overload
- Arrhythmia
- Cardiomyopathies/Myocarditis
- Hypertension
- Renal failure
- Hypothyroidism
- Kawasaki disease

In Congenital heart disease:

- Left to Right shunt (Ventricular Septal Defect, Patent Ductus Arteriosus…)
- Aortic Coarctation
- Aortic valvular stenosis
- Supra valvular aortic stenosis
- Mitral stenosis, mitral regurgitation
- Pulmonary veins stenosis
- Single ventricle

Signs and Symptoms:

- Cough
- Sweating
- Excessive weight gain/oedema
- Poor feeding/ failure to thrive
- Pallor
- Weak pulses
- Cold extremities
- Prolonged capillary refill > 3seconds
- Hypotension
- Tachycardia
- Gallop rhythm with or without heart murmur
- Tachypnea/dyspnoea
- Crepitations (in old children) / wheezing

- Hepatomegaly with or without increased jugular vein pressure
- Oliguria

Diagnosis: Based on the above clinical symptoms and signs

Investigations

- FBC, Electrolytes, Urea and Creatinine, Blood Gas if available.
- Chest X-ray
- ECG
- Echocardiogram

Management: Monitoring of vital signs: RR, HR, BP, O2 saturation, urine output is critical

Non-pharmacological treatment

- Oxygen therapy
- Semi- Sitting position (cardiac bed)
- Restrict fluids to 2/3 of maintenance (aim at urine output of 2ml/kg/h)
- Strict bed rest
- Low sodium diet
- Ensure adequate nutrition
- Recognize and treat the underlying conditions e.g. fluid overload, hypertension, infection

Pharmacological treatment

- Furosemide IV 1-4mg/kg divided in 2 doses (to be increased progressively)
  Then consult a paediatrician for further management
- Captopril 1-4mg/kg/day divided in 3 doses if normal creatinine (to be increased progressively, beware hypotension)
- Carvedilol for stable older children > 30 kg: initiate with 3.125mg BID, increase every 15 days if good tolerance. Maximum dose: 12.5mg BID
- Digoxin orally 0.01mg/kg/day (no loading dose!!)

Recommendation:

- If isolated Right sided heart failure: use furosemide (see dosage above) and aldactone 2mg/kg/day divided in 2 doses.
- Administration of carvedilol and aldactone should be discussed with the cardiologist.
- **Any patient with heart failure due to heart disease must be referred to the cardiologist**

5.2 CARDIOGENIC SHOCK

Definition: It is a dramatic syndrome characterized by inadequate circulatory provision of oxygen due to cardiac pump failure secondary to poor myocardial function, so that the metabolic demands of vital organs and tissues are not met. The patient is often a known case of heart disease with signs of heart failure but may be a new case with heart failure.

Signs and symptoms:

- Hypotension
- Tachycardia
- Gallop rhythm
- Hepatomegaly
- Crackles/wheezes
- Weak and fast pulses (or absent)
- Cold extremities/ pallor
- Capillary refill > 3 seconds
- Oliguria/anuria

Management:

Non-pharmacological management:

- Avoid excessive IV fluids, the patient is fluid overloaded in this case, give 2/3 of maintenance (aim at urine output of 2ml/kg/h)
- Oxygen therapy: 10-15l/min with mask and reservoir bag
- Semi- Sitting position (cardiac bed)
- Low sodium diet
- Strict bed rest
- Ensure adequate nutrition
- Correct hypoglycaemia with 5ml/kg IV of Dextrose 10%

Pharmaceutical treatment

- Dopamine IV 5-10 microgram/kg/min, may increase to 20 microgram/kg/min OR
- Dobutamine IV 2 to 20 microgram/kg/min
- If tissue perfusion and blood pressure do not improve satisfactorily on adequate fluid volume replacement and inotropic support, consider: Epinephrine (adrenaline), IV infusion, 0.01–1 mcg/kg/minute.
- Furosemide IV 2mg/kg/dose if adequate peripheral perfusion. Repeat the dose according to estimated fluid overload up to 8mg/kg/day. This is done after discussion with a cardiologist or paediatrician
- Correct arrhythmia if present with digoxin 0.04mg/kg/day in 3 divided doses(maintenance: 0.01mg/kg/day)
- **Monitor: Heart rate, Respiratory rate, BP, Urine output, Pulse Oximetry for oxygen saturation**

5.3 PULMONARY OEDEMA

Definition: Pulmonary oedema is accumulation of fluid in the alveoli due to an increase in pulmonary capillary venous pressure resulting from acute left ventricular failure**.**

Causes:

- Heart not removing fluid from lung circulation properly (cardiogenic pulmonary oedema)
- A direct injury to the lung parenchyma

Signs and symptoms:

- Breathlessness/ Respiratory distress
- Sweating
- Cyanosis (decreased oxygen saturation)
- Frothy blood-tinged sputum
- Rhonchi, and crepitations/wheezes

Diagnosis: Mainly clinical: history, symptoms and signs

Investigations:

- Chest x-ray shows loss of distinct vascular margins, Kerley B lines, diffuse haziness of lung fields, pleural effusion.
- ECG
- Echocardiography
- Blood Gas if possible

Management:

- Maintain patient in a semi sitting position
- Oxygen by facial mask with reservoir bag if available
- IV furosemide 2mg/kg/dose, maximum 8mg/kg/day.
- Inotropic support with dopamine or Dobutamine if signs of shock
- Transfer to paediatrician/cardiologist for further management.

5.4 CONGENITAL HEART DISEASES

Definition: Structural abnormalities of the heart or great vessels present at birth. They fall into 2 major groups: Acyanotic and cyanotic

5.4.1 Acyanotic Heart Diseases

Common lesions:

- Ventricular Septal Defect (VSD) most common congenital heart disease
- Patent ductus arteriosus (PDA)
- Atrio-ventricular septal defect (AVSD) or endocardial cushion defect (common in trisomy 21)
- Atrial septal defect (rarely causes heart failure)
- Coarctation of aorta

Signs and symptoms:

Each condition has specific clinical, radiological and ECG findings. Large left to right shunts present clinically with:

- Feeding difficulties (breast feeds and stops then starts again}
- Sweating during feeds.
- Failure to thrive
- Recurrent chest symptoms
- Tachypnoea and indrawing.
- Chest deformity: respiratory sulcus, precordial bulge.
- Tachycardia
- Heart murmur

- Gallop rhythm
- Hepatomegaly
- Increased jugular venous pressure.
- Chest X-ray: usually cardiomegaly with plethoric lung fields.

***Diagnosis*:** Based on clinical signs and symptoms

Investigations:

- Chest X-Ray
- ECG
- Echocardiogram
- Cardiac catheterization/angioscan in special cases.

Complications

- Failure to thrive
- Heart failure
- Recurrent chest infections
- Infective endocarditis
- Pulmonary vascular obstructive disease (pulmonary hypertension) which can lead to Eismenger syndrome

Management: Always discuss with a cardiologist

Treatment depends on the specific condition. Some congenital heart diseases can be treated with medication alone, while others require one or more surgeries.

- Furosemide, oral, 1mg/kg/dose 8-12 hourly.
- Spironolactone 1-3mg/kg/day in 12-24hours
- Captopril 1-3mg/kg/day (start with 1mg/kg)
- Pay special attention to nutrition/Increase calories in feeding
- Iron if Hb less than 10g/dl (preferably reach 15g/dl)
- Surgical repair generally before 1 year if possible

5.4.2 Cyanotic heart diseases:

Definition: Cyanotic heart disease is a heart defect, present at birth (congenital), that results in low blood oxygen levels (< 90 % even with oxygen).

Common lesions:

Decreased flow to the lungs (do not cause heart failure):

- Tetralogy of Fallot
- Pulmonary stenosis
- Pulmonary atresia

Increased flow to the lungs (cause heart failure and failure to thrive):

- Transposition of great vessels (TGA)
- Truncus arteriosus
- Single ventricle
- Tricuspid atresia

Tetralogy of Fallot:

Definition: Tetralogy of Fallot refers to a type of congenital heart defect comprising of:

- Large ventricular septal defect
- Pulmonary stenosis
- Overriding aorta
- Right ventricular hypertrophy

Signs and symptoms:

- Progressive cyanosis with pulmonary systolic murmur
- Digital clubbing occurs after long time
- Hallmark: Paroxysmal hyper cyanotic attacks (blue spells) with the following manifestations:
  - Hyperpnoea and restlessness
  - Increased cyanosis
  - Gasping respiration
  - Syncope or convulsions
  - Spontaneous squatting position is frequent (in older children)
  - Heart murmur disappears

Diagnosis: Clinical plus Echocardiography findings

Investigations:

- Chest x-ray
- Complete blood count (CBC)
- Echocardiogram
- Electrocardiogram (EKG)

Complications

- Delayed development/growth
- Polycythemia
- Hypercyanotic attack, sometimes associated with seizures and death
- Infective endocarditis
- Brain abscess

Management:

- Avoid dehydration and stress (treat early infections, quite environment)
- Propranolol 0.5-1mg/kg/dose every 6 hours to prevent Hypercyanotic attacks
- Iron 5mg/kg /day to prevent microcytosis
- Surgical repair, urgent as soon as spells begin.
- In case of Hypercyanotic attacks:
  - Squatting position (hold the infant with the legs flexed on the abdomen)
  - Oxygen 6l/min with mask
  - Propranolol IV 0.1 – 0.2 mg/kg slowly then continue oral maintenance to relax the infundibular spasms.
  - Normal saline 10-20ml/kg bolus over 30 minutes
  - Sodium bicarbonate 8.5% 1ml/kg to correct acidosis
  - Morphine 0.1mg/kg IV if persistent attacks (but risk of respiratory depression)
  - Diazepam 0.3mg/kg IV or 0.5mg PR if convulsing

5.4.3 Common causes of heart failure in Neonates

Below are the common causes of heart failure in neonates and their clinical presentation

Table 23: Common causes of heart failure in Neonates

Clinical manifestations	Likely lesions
Very poor pulses	• Hypoplastic Left Ventricle Syndrome • Critical aortic stenosis
Poor femoral pulses	• Coarctation of aorta
Bounding pulses	• Patent ductus arteriosus (PDA) • Truncus arteriosus • Severe anaemia

Recommendations:

- All children with cyanotic heart diseases who come with diarrhea and vomiting should be admitted for closer observation. Furosemide is contra-indicated
- All new born babies with suspected cyanotic heart disease should be referred to a cardiologist/tertiary hospital immediately.

5.5 ACQUIRED HEART DISEASES

5.5.1 Acute Rheumatic Fever

Definition: This is an acute, systemic connective tissue disease in children related to an immune reaction to untreated group A Beta haemolytic streptococcus infection of the upper respiratory tract .The initial attack of acute rheumatic fever occurs in most cases between the ages of 3 and 15 years. It is the autoimmune reaction which damages the heart valves leading to Rheumatic heart diseases

Cause: Auto-immune disease

Table 24: Revised Jones Criteria:

Major manifestations:	Minor manifestations:	Group A Strep(GAS) Infection:
Carditis	Fever	GAS on throat swab (culture)
Arthritis	Arthralgia	Raised Anti-streptolysin O titre (ASOT)
Sydenham's Chorea	Prolonged P-R interval on ECG	Raised Anti-deoxyribonuclease B (Anti-DNase B)
Erythema marginatum	Raised ESR or CRP	
Subcutaneous nodules		

Criteria for ARF diagnosis according to WHO

- The first episode of ARF can be confirmed if:
  - 2 MAJOR, **or** 1 MAJOR and 2 MINOR manifestations are present **plus** evidence of preceding Group A streptococcal infection.
- Recurrent ARF (with no RHD) can be confirmed if
  - 2 MAJOR, **or** 1 MAJOR and 2 MINOR manifestations are present **plus** evidence of preceding Group A streptococcal infection.
- Recurrent ARF (with existing RHD) can be confirmed if
  - 2 MINOR manifestations are present **plus** evidence of preceding Group A streptococcal infection.

Note:

- Chorea for which other causes have been excluded, provides adequate evidence of rheumatic fever without the other criteria for diagnosis being required.
- In children with rheumatic heart disease with fever, it is critical to differentiate recurrence of acute rheumatic fever from infective endocarditis (IE).
- For children with rheumatic heart disease, recurrence of some of the above criteria would suggest a recurrence of rheumatic fever but other causes such as IE should be excluded.

Diagnosis is made on clinical basis

Investigations

- Throat swab for culture (positive throat culture of group A Streptococcal infection)
- Raised ASOT/ASLO antibodies titre (Anti-streptolysin-0-titre – ASOT of 1:300)
- Anti-DNase B
- FBC/ ESR/CRP
- Chest x-ray – Features of cardiomegaly
- ECG
- Echocardiogram

Complications: Rheumatic heart disease

Management:

- The primary goal of treating an ARF attack is to eradicate streptococcal organisms and bacterial antigens from the pharyngeal region
- Persons with symptoms of ARF should be hospitalized to ensure accurate diagnosis, and to receive clinical care and education about preventing further episodes of ARF.
- The diagnosis should include an initial echocardiogram used to help identify and measure heart valvular damage.
- Long-term preventative management should be organized before discharge.
- All cases of ARF should receive:
  - A single injection of Benzathine penicillin G (Extencillin): Below 30kg give 600,000 units > 30kg give 1.2 mega units every 3-4 weeks. Dilute each vial with water for injection 8ml + Lignocaine 2% 2ml and give the appropriate dose .

  OR
  - Oral Penicillin (Pen V) 25–50mg/kg/day in divided 3 doses for 10 days (Erythromycin 30-50mg/kg/day divided in 3 doses if penicillin allergy)

Relief of symptoms

Arthritis and fever

- Aspirin 75–100mg/kg/day in 4–6 divided doses. Treatment continued until fever and joint inflammation are controlled and then gradually reduced over a 2-week period **OR**
- Prednisolone 1-2mg/kg/day OD for 2 weeks then taper for 2 weeks with good response
- Begin Aspirin in the 3rd week and continue until 8th week tapering in the final 2 weeks
- Add an antacid to reduce risk of gastric irritation e.g. Omeprazole 1mg/kg Max 20mg /day

Chorea

- Most mild-moderate cases do not need medication
- Provide calm and supportive environment (prevent accidental self-harm)

For severe cases:

- Carbamazepine per os:
  - <6 years: 10-20mg/kg/day divided in 3 doses,
  - 6-12 Years: 400-800mg/day divided in 3 doses,
  - >12 years: 200mg x 2/day
  - Valproic acid 20-30mg/kg/day divided in 2 doses
  - Duration: 2 weeks

Carditis

- Bed rest if in cardiac failure
- Anti-failure medication as above
- Anti-coagulation medication if atrial fibrillation is present

Management plan when the acute episode is controlled

- Administer the first dose of secondary prophylaxis
- Register the individual with the local health authority or RHD Programme;
- Provide disease education for the person with ARF and the family
  - Understanding of ARF and RHD and risks of ARF recurrence
  - Importance of regular secondary prophylaxis and medical review
  - Recognizing own signs and symptoms of ARF and RHD
  - Risks associated with future RHD (e.g. pregnancy, surgery and high level of aftercare)
  - Importance of dental health
- Include an ARF diagnosis alert on computer systems and/or medical files (if applicable);
- Refer to local health facility for ongoing management;
- Arrange dental review (and provide advice about endocarditis prevention);

Long-term Management

- Regular secondary prophylaxis (refer to 5.5 Table 6 Recommended Secondary Prophylaxis Regimen)
- Regular medical review

- Regular dental review
- Echocardiogram (if available) following each episode of ARF, and routine echocardiogram: every 2 years for children (sooner if there is evidence of cardiac symptoms)

Secondary prophylaxis

Aim**:**

- Prevents the occurrence of GAS infections which can lead to recurrent ARF
- Reduces the severity of RHD
- Helps prevent death from severe RHD.

Indications for Use

Secondary prophylaxis is indicated for people who have

- ARF confirmed by the Jones Criteria
- RHD confirmed on echocardiogram
- ARF or RHD not confirmed, but highly suspected.

Doses:

Benzathine Penicillin G IM every 4 weeks:

- 600,000 units for children <30kg
- 1,200,000 units for ALL people ≥30kg

Penicillin V if Benzathine Penicillin G IM injections not tolerated or contraindicated:
Dose: 250mg oral, twice-daily for ALL children.
Erythromycin if proven allergy to Penicillin: 250mg oral, twice-daily for ALL people.

Table 25: Recommended Secondary Prophylaxis Regimens

Disease Classification	Duration of Secondary Prophylaxis
ARF (No proven Carditis)	• Minimum of 5 years after last ARF, or • Until age 18 years (whichever is longer)
Mild-moderate RHD (or healed Carditis)	• Minimum 10 years after last ARF, or • Until age 25 years (whichever is longer)
Severe RHD and following **Cardiac Surgery** for RHD	• Continue medication for life

5.5.2 Rheumatic heart Diseases

Definition: It is an inflammatory damage of the heart valves, as a complication of acute rheumatic fever. The mitral valve is the most commonly involved valve, although any valve may be affected.

Types of valvular lesions;

- Mitral regurgitation/stenosis
- Aortic regurgitation/stenosis
- Tricuspid regurgitation

- Mixed regurgitation and stenosis
- Multivalvular heart diseases

Signs and symptoms:

- May be asymptomatic when minor lesions
- Heart murmurs over affected valve

Complications:

- Congestive cardiac failure with pulmonary oedema
- Bacterial endocarditis.

Diagnosis: on clinical basis

Investigations:

- Chest x-ray
- ECG
- Echocardiography

Management:

- Treat underlying complication, e.g., heart failure, pulmonary oedema
- Continue prophylaxis against recurrent rheumatic fever
- Ensure oral hygiene
- Endocarditis prophylaxis if dental procedures, urinary tract instrumentation, and GIT manipulations;
    - Above the diaphragm;
        - Amoxicillin 50mg/kg (Max 2gr) 1 hour before the procedure OR
        - Erythromycin 50mg/kg (max 1.5gr) – if allergic to penicillins
    - Below the diaphragm:
        - Ampicillin 50mg/kg IV or IM (max 2gr) with Gentamycin, 2mg/kg (max 120mg) 30minutes before the procedure then,
        - Amoxycillin per os 25mg/kg (max1gr) 6 hours after the procedure
- Ensure good follow up by cardiologist
- Never stop medications without consulting a Paediatrician/cardiologist

5.5.3 Infective endocarditis:

Definition: Infection of the endothelial surface of the heart. Suspect infective endocarditis in all children with persistent fever and underlying heart disease**.**

Cause/predisposing factors:

- Rheumatic valvular disease
- Congenital heart disease

Signs and symptom:

- Persistent low grade fever without an obvious underlying cause
- Fatigue, joint pain, new murmurs, clubbing, splenomegaly and haematuria

Table 26: Major and minor clinical criteria used in the modified Duke criteria for diagnosis of infective endocarditis (IE)

Major criteria	Minor criteria

• Positive blood culture:
  ○ typical micro-organisms from two separate blood cultures: S. viridans, including nutritional variant strains, S. bovis, *HACEK group, S. aureus, or
  ○ Enterococci, in the absence of a primary focus, or
  ○ persistently positive blood culture with a micro-organism consistent with IE
  ○ from blood cultures drawn > 12 hours apart, or
  ○ all 3 or a majority of 4 or more separate blood cultures, with the first and last drawn at least one hour apart, or
  ○ positive serology for Q fever,
  ○ Single positive blood culture for Coxiella burnetti or anti-phase 1 IgG antibody titre > 1:800.
• Evidence of endocardial involvement:
  ○ positive echocardiogram for IE (transoesophageal echocardiography is recommended for patients with prosthetic valves): oscillating intracardiac mass, on valve or supporting structures, or in the path of regurgitant jets, or on implanted
  ○ materials, in the absence of an alternative anatomic explanation, or
  ○ abscess, or
  ○ new partial dehiscence of prosthetic valve, or
  ○ New valvular regurgitation.
	• Predisposing heart condition or
	• IV drug use
	• Fever ≥ 38ºC.
	• Vascular phenomena:
	  ○ major arterial emboli,
	  ○ septic pulmonary infarcts,
	  ○ mycotic aneurysm,
	  ○ intracranial haemorrhage,
	  ○ conjunctival haemorrhages,
	  ○ Janeway lesions.
	• Immunologic phenomena:
	  ○ Osler's nodes,
	  ○ Roth spots,
	  ○ glomerulonephritis,
	  ○ Rheumatoid factor.
	• Microbiologic evidence:
	  ○ positive blood culture but not meeting major criterion, or
	  ○ Serologic evidence of active infection with organism consistent with IE.

Definite IE	Possible IE	Rejected

Pathological criteria
• Micro-organisms
  ○ by culture or histology in a vegetation, or in a vegetation that has embolised, **or**
  ○ in an intracardiac abscess, or lesions
• Vegetation or intracardiac abscess present – confirmed by histology showing active IE.
Clinical criteria – see Table above
• 2 major criteria,
• 1 major and 3 minor, or
• 5 minor.
	• At least one major and one minor criterion,
	or
	• 3 minor
		• Alternative diagnosis for manifestation of endocarditis, **or**
		• resolution of manifestations, with antibiotic therapy ≤ 4 days, **or**
		• No pathologic evidence of IE at surgery or autopsy, after antibiotic therapy for ≤ 4 days.

Limitations of the Duke Criteria in children

The clinical criteria rely heavily on relatively rare clinical features.

In contrast, common clinical features like splenomegaly, clubbing and haematuria have not been included.

Investigations:

- Blood cultures (at least 3 cultures) before antibiotics
- FBC /CRP/ESR
- Urine test strips – haematuria
- Echocardiography

Management:

Non-pharmacological management

- Bed rest/limit physical activity
- Ensure adequate nutrition
- Maintain haemoglobin > 10 g/dL
- Measures to reduce fever

Pharmacological management

- Paracetamol, oral, 20 mg/kg at once, then 10–15 mg/kg/dose, 6 hourly as required
- Antibiotics regimen: IV antibiotics are always given, based on culture and sensitivity results
  - Native valve endocarditis (NVE) due to Streptococci:
    - Benzylpenicillin (Penicillin G), IV, 300 000 units/kg/day divided in 4 doses for 4 weeks OR
    - Ceftriaxone 100mg/kg/day as single dose (maximum 2g) for 4 weeks PLUS
    - Gentamicin, IV, 3mg/kg/day divided in 3 doses (maximum 240mg/day) for 2wks

- Patients allergic to penicillin and cephalosporins: Vancomycin 40mg/kg/day divided in 3 doses (max 2g/day) for 4 weeks.

- NVE due to staphylococci
  - Cloxacillin 200mg/kg/day divided in 4 doses 6 for 4 weeks
    PLUS
  - Gentamicin 3mg/kg/day divided in 3 doses (maximum 240mg/day) for first 5 days .OR
  - Cloxacillin-resistant strains or allergy to penicillin: Vancomycin 40mg/kg/day divided in 3 doses (max 2g/day) for 6 weeks.

Note: All highly suspected cases of infective endocarditis must be referred to the cardiologist where blood cultures and proper management will be done.

5.6 CARDIOMYOPATHIES

Definition: Cardiomyopathies are diseases characterized by structural and functional abnormalities of the myocardium.

Classification: Classification based on the predominant structural and functional abnormalities:

- Dilated cardiomyopathy: primarily systolic dysfunction,
- Hypertrophic cardiomyopathy: primarily diastolic dysfunction,
- Restrictive cardiomyopathy: primarily diastolic but often combined with systolic dysfunction

5.6.1 Dilated cardiomyopathy:

Dilated cardiomyopathy refers to a group of conditions of diverse etiology in which both ventricles are dilated with reduced contractility

Causes:

- Infections (e.g. Viral+++, Rickettsia, Chagas disease…)
- Neuromuscular disorders (e.g. Duchenne dystrophy, Becker dystrophy, …)
- Endocrine, metabolic and nutritional (e.g. hyperthyroidism, beriberi, kwashiorkor…)
- Diseases of coronary arteries (e.g. Kawasaki, Aberrant Left Coronary Artery)
- Autoimmune diseases (e.g. Rheumatic Carditis, juvenile rheumatoid arthritis, systemic lupus erythematosus, dermatomyositis, systemic lupus erythematosus…)
- Drugs toxicity (e.g. doxorubicin, cyclophosphamide, IPECA…)
- Hematologic diseases (e.g. anaemia, Sickle cell anaemia, hypereosinophilic syndrome: Löffler syndrome)

Signs and symptoms: see signs of congestive heart failure

Diagnosis:

- ECG: prominent P wave, LV or RV hypertrophy, nonspecific T-wave abnormalities.
- Chest X-ray: cardiomegaly, pulmonary oedema
- Echocardiogram: confirm diagnosis and shows LA and LV dilation, poor contractility
- FBC, Urea and creatinine, Electrolytes (Na, K),
- Myocardial biopsy, PCR, genetic… according to the etiology

Management:

- Treatment: Refer to principles aand medications of congestive heart failure

5.6.2 Hypertrophic cardiomyopathy

Definition: Hypertrophic cardiomyopathy is a genetic disorder that is characterized by left ventricular hypertrophy unexplained by secondary causes and a non-dilated left ventricle with preserved or increased ejection fraction

Causes:

- Left ventricle obstruction (Coarctation of aorta, hypertension, aortic stenosis)
- Secondary (infants of diabetic mothers, corticosteroids in premature infants)
- Metabolic (Glycogen storage disease type II (Pompe disease)
- Familiar hypertrophic cardiomyopathy
- Syndromes (Beckwith - Weidman syndrome, Friedereich ataxia…)

Signs and Symptoms:

- Weakness
- Fatigue
- Dyspnoea on effort
- Palpitations
- Angina pectoris
- Dizziness and syncope
- Increased risk of sudden death

Diagnosis:

- ECG: LV hypertrophy
- Chest X-ray: Mild cardiomegaly
- Echocardiogram: LV hypertrophy, ventricular outflow tract gradient
- Doppler flow studies may demonstrate diastolic dysfunction before the development of hypertrophy.

Management:

- Prohibit competitive sports and strenuous physical activities
- Propranolol 0.5 -1mg/kg/day devised in 3 doses or atenolol
- Implantable cardioverter-defibrillator if documented arrhythmias or a history of unexplained syncope
- Open heart surgery for septal myotomy: rarely indicated

5.6.3 Restrictive cardiomyopathy

Definition: Restrictive cardiomyopathy (RCM) is a myocardial disease, characterized by impaired filling of the ventricles in the presence of normal wall thickness and systolic function.

Cause/Aetiologies:

- Idiopathic, Systemic disease (scleroderma, amyloidosis, or sarcoidosis)
- Mucopolysaccharidosis
- Hypereosinophilic syndrome; malignancies
- Radiation therapy

- Isolated non-compaction of the left ventricular myocardium

Signs and symptoms:

- Dyspnoea
- Oedema and ascites
- Hepatomegaly with increased venous pressure
- Pulmonary congestion

Diagnosis: clinical basis

Investigations

- ECG: Prominent P waves, ST segment depression, T-wave inversion
- Chest X-ray: mild to moderate cardiomegaly
- Echocardiogram: markedly enlarged atria and small to normal-sized ventricles with often preserved systolic function but highly abnormal diastolic function

Complications

- Arrhythmias
- Mitral regurgitation
- Progressive heart failure
- Tricuspid regurgitation

Management:

- Lasix 2mg/kg divided in 2 doses
- Aldactone 1-2mg/kg devised in 2 doses
- Antiarrhythmic agents / biventricular pacing are used as required
- Aspirin or warfarin in case of no compaction LV with an increased risk of mural thrombosis and stroke
- Cardiac transplantation where possible and indicated

5.6.4 Pericarditis/Pericardial Effusion:

Definition: Accumulation of fluid in the pericardial space, usually secondary to pericarditis..

Causes:

- Infection such as viral, bacterial (tuberculosis…)
- Inflammatory disorders, such as lupus
- Cancer that has spread (metastasized) to the pericardium
- Kidney failure with excessive blood levels of nitrogen
- Heart surgery (postpericardectomy syndrome).

Signs and symptoms:

- Pericardial tamponade:
- Chest pressure or pain and signs of congestive heart failure with sometimes shock.

Note: Many patients with pericardial effusion have no symptoms. The condition is often discovered on a chest x-ray or echocardiogram that was performed for another reason.

Diagnosis:

- Most patients present with a prolonged history of:
  - Low cardiac output,
  - Distended neck veins,
  - Muffled or diminished heart sounds.

- Patients with HIV may be asymptomatic and incidentally diagnosed on chest Xray.
- Often associated with TB.
- Acute septic pericarditis may occur in patients with septicemia

Investigations

- ECG
  - Small complexes tachycardia
  - Diffuse T wave changes
- Chest X-ray: "water bottle" heart, or triangular heart with smoothed out borders
- Echocardiogram
- Tuberculin skin test
- Diagnostic pericardiocentesis
  - in all patients with suspected bacterial or neoplastic pericarditis and patients whom diagnosis is not readily obtained
- Cell count and differential, culture, gram stain, PCR

Management

Non-pharmacological treatment

- Semi-sitting position if tamponade suspected
- Pericardiocentesis
  - preferably under ultrasound guidance
  - Performed by an experienced person
  - indicated in children with symptomatic pericardial effusion

Pharmacological treatment:

- If hypotensive, rapidly administer intravenous fluids 20ml/kg of Normal saline over 30min to 1 hour,
- If suspected TB pericarditis: standard anti TB treatment + steroids
- In case of purulent pericarditis: Cloxacillin, IV 50 mg/kg/dose 6 hourly for 3 – 4 weeks + ceftriaxone, IV, 100 mg/kg as a single daily dose, to adapt according to culture results.
- Treat heart Failure (See Section on heart failure)

Recommendation: All patients with pericardial effusion should be referred to a cardiologist

5.7 HYPERTENSION IN CHILDREN:

Definition: Hypertension is defined as systolic and/or diastolic blood pressure ≥ the 95th percentile for gender, age and height percentile on at least three consecutive occasions. A sustained blood pressure of > 115/80 is abnormal in children between 6 weeks and 6 years of age.

Hypertensive emergency/crisis acutely elevated BP (usually >95th percentile + 30mmHg for age and gender) with evidence of end-organ damage. It exists when CNS signs of hypertension appear such as encephalopathy, convulsions, retinal hemorrhages or blindness. Great care is required to reduce the blood pressure in a controlled manner to avoid potentially serious consequences of impaired auto-regulation of cerebral blood flow.

The presence of symptoms of end organ damage is more important than the absolute BP elevation.

Hypertensive urgency is defined as a significant elevation of blood pressure without accompanying end organ damage (usually >95th percentile + 30mmHg for age and gender). Patients are generally symptomatic with complaints of headache, blurred vision and nausea, despite the lack of end organ involvement

Accurate measurement of BP:

- Use the widest cuff that can be applied to the upper arm
- The cuff bladder must encircle at least 80% of the upper arm and should cover at least 75% of the distance between the elbow and the shoulder joints
- It is better to use a cuff that is slightly too large than one that is too small

Causes:

- Severe hypertension suggests renal disease
- Coarctation of aorta
- Rarely phaeochromocytoma
- Long term steroid therapy

Most common causes of secondary hypertension by age:

New born:

- Renal abnormalities
- Coarctation of the aorta
- Renal artery stenosis
- Renal artery or vein thrombosis

First year:

- Coarctation of the aorta
- Renal vascular disease
- Tumour
- Medications (steroids…)

1-6 years:

- Renal vascular diseases
- Renal parenchymal diseases (glomerulonephritis, haemolytic-uremic syndrome…)
- Coarctation of the aorta
- Medications
- Essential hypertension

6-15 years:

- Renal vascular diseases
- Renal parenchymal diseases (glomerulonephritis, haemolytic-uremic syndrome…)
- Essential hypertension
- Coarctation of the aorta
- Endocrine causes
- Nutritional causes (obesity)

Signs and symptoms:

- Headache
- Convulsions, coma and visual symptoms

- Oedema, haematuria, proteinuria
- Acute heart failure and pulmonary oedema
- Some children may be asymptomatic

Blood pressure in children correlates with body size and age.

Table 27: Blood pressure correlation with age in children

Age of child	95th Percentile of Systolic and Diastolic Blood Pressure	
	First 12 hours	First week
newborn prem	65/45 mmHg	80/50 mmHg
newborn fullterm	80/50 mmHg	100/70 mmHg
	Systolic mmHg	Diastolic mmHg
6 weeks–6 years	115	80
8 years	120	82
9 years	125	84
10 years	130	86
12 years	135	88
14 years	140	90

95th Percentile of systolic and diastolic BP correlated with Height

Height cm	Systolic mmHg	Diastolic mmHg
100	114	70
110	116	72
120	118	74
130	120	74
140	125	75
150	130	75
160	135 (131)	77
170	140 (133)	80
180	145 (135)	83

Diagnosis: Mainly Clinical

Symptoms and signs of any of the following systems:

- Central nervous
- Cardiovascular
- Respiratory
- Urogenital

Investigations:

- Urea, creatinine, electrolytes (Na+, K+),
- Fundoscopy
- ECG
- Echocardiogram
- Abdominal ultrasound (focused on kidneys).
- Others according to the suspected etiology

Management of acute hypertension (Hypertensive emergency and urgency)

Non-pharmacological treatment

- Admit patient to paediatric high dependence care unit
- Monitor BP every 10 minutes until stable – thereafter every 30 minutes for 24 hours
- Insert two peripheral intravenous drips
- Rest on cardiac bed
- Control fluid intake and output (restriction)
- Restrict dietary sodium

Pharmacological treatment: Do not combine drugs of the same class

- Labetalol IV Bolus: 0.2–1 mg/kg (max 40 mg) then infusion: 0.4–1 mg/kg/hr (max 3 mg/kg/hr) or repeat bolus every10 min.
  Or
- Hydralazine IV :0.1–0.2 mg/kg/dose IV/IM every 4-6 hours(max: 20mg/dose)
  Or
- Nifedipine , oral, 0.1-0.25mg/kg/dose (max: 10mg) sublingual (may repeat if needed every 4-6 hrs)
  Or
- Amlodipine, oral, 0.2 mg/kg/dose. May be repeated 6 hours later, thereafter every 12 hours.
- Furosemide, IV, 1–2 mg/kg as a bolus slowly over 5 minutes increase up to 8 mg/kg/day. If oliguric; Max 5mg/kg/day (in patient with underlying kidney disease, or volume overload: heart failure and pulmonary oedema).
- Refer the patient to a Paediatrician when the patient is stable

Recommendations:

- Rule out Increased intracranial pressure (ICP) before initiating therapy (consult a paediatrician/ neurologist in case of increased ICP)
- For acute or chronic hypertension blood pressure needs to be lowered cautiously
- Aim to reduce the SBP-by ≤**25%** in the **first 8 hours,** then gradual normalization over the next 24 - 48 hours
- Do not decrease BP to < 95th percentile in first 24 hours

Management of Chronic Hypertension

Non-pharmacological management:

- Introduce physical activity, diet management and weight reduction, if obese.
- Advise against smoking in teenager
- Follow up to monitor blood pressure and educate patient on hypertension
- If blood pressure decreases, continue with non-drug management and follow up
- If BP is increasing progressively, reinvestigate to exclude secondary causes or refer to the specialist
- If BP is stable but persistently > 95th percentile and secondary causes have been excluded, start drug treatment after failed non-drug management for 6 months
- Consider earlier initiation of drug treatment if positive family history for cardiovascular disease, essential hypertension or diabetes mellitus

Pharmacological management:

Table 28: Recommended medications and doses for patients with chronic Hypertension.

Drug	Dosage	Side effect/comment
First line: Hydrochlorothiazide	1-2mg/kg/day once daily (maximum 25mg/day).	Hypokalemia
Second line: Nifedipine (extended release) OR Amlodipine	0.3-1mg/kg/day divided in 1 or 2 doses 0.1mg/kg/day (maximum dose 10mg/day) once daily	Not well studied in children less than 6 years of age
Third line: Captopril OR Lisinopril	0.5 – 4mg/kg/day divided in 2 doses 0.07- 0.6mg/kg daily	• Hyperkalaemia • Check renal function and Serum-K periodically, • Not used in bilateral renal artery stenosis, contraindicated in renal failure • Can cause cough
Forth line: Atenolol	0.5-1mg/kg/day once daily (max up to 2mg/kg/day, do not exceed /100mg/day).	• Bradycardia
Furosemide (Lasix) if associated oedema or stage 4 chronic kidney disease. **Note:** Do not associate Furosemide with Hydrochlorothiazide	1-4mg/kg/day in 2 to 4 divided doses	• Hyponatraemia • Hypokalaemia

Table 29: Recommended Hypertension medications for patients with Renal Failure

For CKD 1-3 (GFR ≥30, creatinine <2x normal value for age	
First- line drug	Lisinopril
Second -line drug	Hydrochlorothiazide
Third- line drug	Amlodipine
Forth- line drug	Atenolol (use half of normal recommended dose)
For CKD 4 or 5 (GFR < 30, creatinine ≥2x normal value for age	
First-line drug	Furosemide
Second-line drug	Amlodipine
Third-line drug	Atenolol (use half of normal recommended dose).

Recommendations:

- Advise a change in lifestyle
- Institute and monitor a weight reduction programme for obese individuals
- Regular aerobic exercise is recommended in essential hypertension
- Dietary advice: Limit salt and saturated fat intake, increase dietary fibre intake (reduce salt intake to a maximum of one leveled tea spoon per day, all preparation included)
- All patients with hypertension and persistent proteinuria should be treated with an ACE inhibitor
- Always exclude bilateral renal artery stenosis before treating with an ACE inhibitor
- Renal function must be monitored when an ACE inhibitor is prescribed because it may cause a decline in GFR resulting in deterioration of renal function and hyperkalaemia
- Patients with hypertension due to a neuro-secretory tumour (phaeochromocytoma or neuroblastoma), should receive an α-blocker either as single drug or in combination with ß-adrenergic blocker
- For patients with persistent hypertension despite the use of first line drugs, a second/third drug should be added
- Specific classes of antihypertensive drugs should be used according to the underlying pathogenesis or illness
- For patients with predominantly fluid overload: use diuretics with/without ß-blocker

5.8 CARDIAC ARRHYTHMIAS IN CHILDREN:

Definition: Heart rate that is abnormally slow or fast for age or irregular.
There are three types of arrhythmias in children;

- Heart block
- Ventricular arrhythmias
- Paroxysmal atrial tachycardia

Table 30: Types of Arrhythmias, their causes and signs and symptoms

Type of Arrhythmia	cause	Signs and symptom
Heart block: A delay or complete block of the electrical impulse as it travels from the sinus node to the ventricles	• Idiopathic and familial • Electrolyte disturbances (hyperkalaemia), • Digoxin toxicity • Congenital heart disease, particularly transposition of the great arteries, and especially after surgery • Myocarditis • Post infective, for example in endocardial fibroelastosis or rheumatic fever	• Chest pressure or pain • Fainting, also known as syncope, or near-syncope • Fatigue • Light headedness or dizziness • Palpitations, which can be skipping, fluttering or pounding in the chest • Shortness of breath
Ventricular arrhythmias: A rapid heart rate, usually with a regular rhythm, originating from above the ventricles	• Heart attack • Cardiomyopathy • Heart failure • Heart surgery • Myocarditis • Valvular heart disease	• May be asymptomatic • Chest discomfort (angina) • Fainting (syncope) • Light-headedness or dizziness • Sensation of feeling the heart beat (palpitations) • Shortness of breath • Absent pulse • Loss of consciousness • Normal or low blood pressure • Rapid pulse
Paroxysmal atrial tachycardia: A rapid heart rate, usually with a regular rhythm, originating from above the ventricles.		• Palpitation • lightheadedness • Weakness • Shortness of breath • Chest pressure

Table 31: Normal heart rate/minute for age:

Age	Heart rate
Newborn	100–160
< 1 year	110–160
1–2 years	100–150
2–5 years	95–140
5–12 years	80–120
> 12 years	60–100

Table 32: Diagnosis is based on these clinical signs and symptoms:

Infants:

Color changes (pale, mottled)	Irregular pulse
Irritability	Tachycardia
Feeding difficulties	Bradycardia
Sweating	Signs of cardiac failure
Tachypnoea/Apnoeic spells	

Children:

Dizziness	Tachycardia
Palpitations	Bradycardia
Fatigue	Syncope
Chest Pain	Signs Of Cardiac Failure

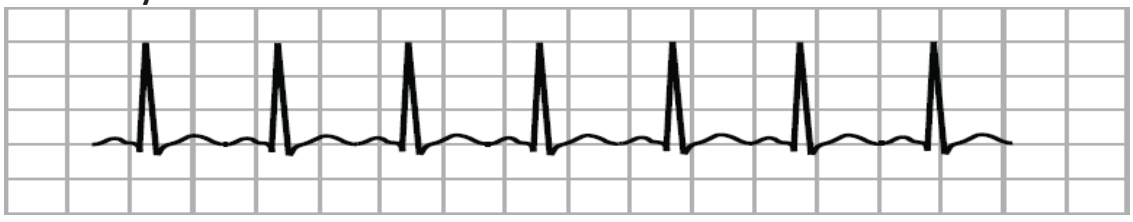
Note: All patients with arrhythmias should be referred to a cardiologist

Investigations

- ECG is essential for diagnosis, preferably a 12 lead ECG
- Echocardiogram
- Other according to the suspected etiology.

5.8.1 Tachyarrhythmias:

Sinus tachycardia



ECG Criteria

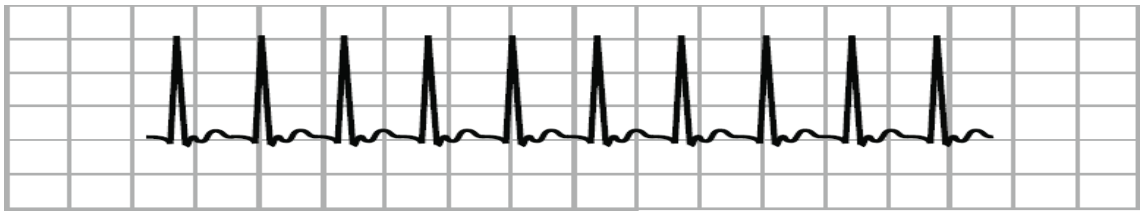
Rate: > upper limit for age

P wave: present and normal

Rhythm: regular

QRS: normal

Supraventricular Tachycardia

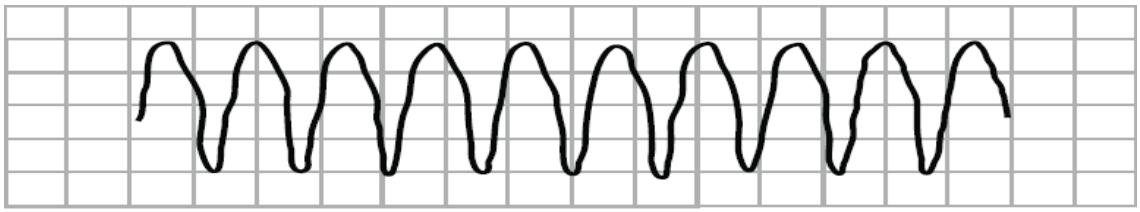


ECG Criteria

Rate: usually > 200 beats per minute **P wave:** abnormal

Rhythm: regular **QRS:** narrowed

Ventricular Tachycardia



ECG Criteria

Rate: generally 100–220 beats per minute **P wave:** mostly not seen

Rhythm: generally regular **QRS:** abnormal, large with QRS > 120 millisecond

Management

Non-pharmacological treatment

- Sinus tachycardia usually requires management of the underlying condition
- ABC of resuscitation
- Admit to high care or intensive care unit
- Monitor ECG, Oxygen saturation, Blood pressure, Haemoglobin, Heart rate, Acid–base status and blood gases, Respiratory rate, Maintain adequate nutrition and hydration, Treat pyrexia

Pharmacological management:

Emergency treatment

Narrow Complex Tachycardia (supraventricular tachycardia):

Stable patient: Attempt vagal stimulation

- Place icebag on face, or
- Infants: immerse face in ice-cold water for a few seconds
- Older children: try a Valsalva manoeuvre, e.g. asks the patient to blow through a straw.
- Place NGT if other means are not available
- **Note: Eye-ball pressure and carotid massage is contraindicated in children.**

- In consultation with a paediatrician or Cardiologist: Adenosine, IV, 0.1 mg/kg initially, increasing in increments of 0.05 mg/kg to 0.25 mg/kg. Follow with a rapid flush of at least 5 ml Normal saline.

Unstable patient: Heart failure / shocked

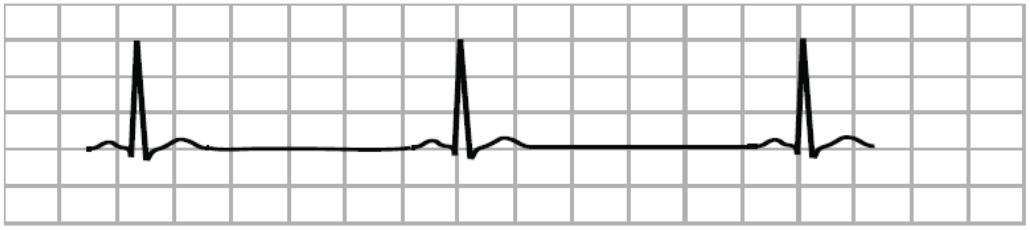
- DC synchronised cardioversion in increments of 0.5–1–2 J/kg
- Empty the stomach before cardioversion is attempted
- Amiodarone, IV, 5 mg/kg slowly over 20 minutes (NEVER as a rapid infusion)

5.8.2 Bradyarrhythmias

Causes:

- Hypoxia
- Hypothermia
- Head injuries and increased intracranial pressure
- Toxins and drug overdose
- Post-operative
- Congenital excessive vagal stimulation
- Electrolyte disturbances (Hypo- or hyperkalaemia, Hypocalcaemia)

Sinus Bradycardia

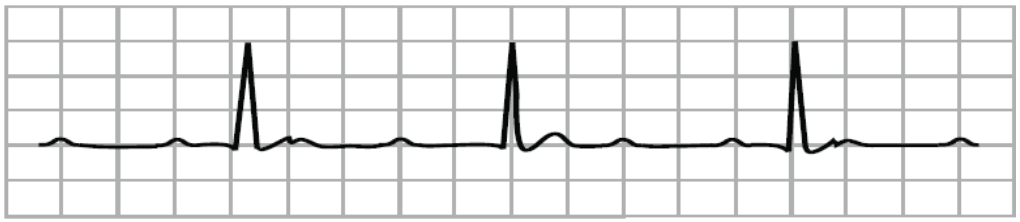


ECG Criteria

Rate: < lower limit for age **P wave:** present, all look the same

Rhythm: regular **QRS:** normal, 80–120 millisecond

Heart Block (Complete)



ECG Criteria

Rate: low, usually < 60 beats per minute **P wave:** independent P waves

QRS's with no relationship between the two (AV dissociation)

Management

- If syncope and Heart rate - below 50/min:
- Start i.v. Isuprel (Isoprenaline) 0. 05 – 0. 4 microgram/kg/min.

OR

- Dobutamine (Dobutrex) 2 - 20 microgram/kg/min
- Insert pacemaker if ineffective

References:

1. Larry M. Baddour at al. Infective Endocarditis. Diagnosis, Antimicrobial Therapy, and Management of Complications. A Statement for Healthcare Professionals From the Committee on Rheumatic Fever, Endocarditis, and Kawasaki Disease, Council on Cardiovascular Disease in the Young, and the Councils on Clinical Cardiology, Stroke, and Cardiovascular Surgery and Anesthesia, American Heart Association. Circulation. 2005;111:e394-e434
2. Guidelines on Prevention, Diagnosis and Treatment of Infective Endocarditis Executive Summary. The Task Force on Infective Endocarditis of the European Society of Cardiology. European Heart Journal (2004) 25, 267–276.
3. Gene Buhkman. The PIH guide to Chronic Care Integration for Endemic Communicable Diseases. Rwanda Edition, 2011
4. http://www.uptodate.com
5. GREGORY B. LUMA et al. Hypertension in Children and Adolescents. American Family Physician. May 1, 2006 .Volume 73, Number 9
6. Brian W. McCrindle. Assessment and Management of Hypertension in Children and Adolescent. Nature Reviews cardiology 2010.

CHAPTER 6: GENITOURINARY SYSTEMS

6 .1 URINARY TRACT INFECTION (UTI)

Definition

UTI is significant bacteriuria of a clinically relevant uropathogen in a symptomatic patient.
It is classified as:

- Uncomplicated UTI (Cystitis), which is the inflammation and infection of the bladder to the bladder and urethra OR
- Complicated urinary tract infection (Pyelonephritis), an infection of the urinary tract involving the renal parenchyma

6.1.1 Acute cystitis

- Affects mainly girls from 2 years of age and there are no associated urological anomalies
- Escherichia coli is the causative pathogen in at least 70% of cases. Other pathogens include Proteus mirabilis, Enterococcus sp, and Klebsiella sp

Clinical features

Signs and symptoms are related to the age of the child and often non-specific.

- Burning sensation/pain on urination, urinary urgency and frequency; in children: crying when passing urine; involuntary loss of urine, cloudy urine and lower abdominal discomfort. PLUS
- No fever (or mild fever), no flank pain; no systemic signs and symptoms in children.

It is essential to rule out pyelonephritis

The symptom 'burning pain on urination' alone is insufficient to make the diagnosis.

Laboratory

Urine dipstick test**:**

- Perform dipstick analysis for nitrites (which indicate the presence of enterobacteria) and leukocytes (which indicate an inflammation) in the urine.
- If dipstick analysis is negative for both nitrites and leukocytes, a urinary infection is unlikely.
- If dipstick analysis is positive for nitrites and/or leukocytes, a urinary infection is likely.
- Microscopy/culture: when a dipstick analysis is positive, it is recommended to carry out urine microscopy/culture in order to confirm the infection and identify the causative pathogen, particularly in children and pregnant women.
- When urine microscopy is not feasible, an empirical antibiotherapy should be administered to patients with typical signs of cystitis and positive dipstick urinalysis (leucocytes and/or nitrites).

Treatment

Cystitis in girls 2 years and above:

- Cefixime PO: 8 mg/kg once daily for 3 days Or
- Amoxicillin/clavulanic acid PO 25 mg/kg 2 times daily for 3 days

6.1.2 Acute pyelonephritis

- Pyelonephritis is more common in females.
- May be associated with underlying congenital anomalies of the kidneys and urinary tract.
- It may result in significant short-term morbidity, including septicaemic shock and acute renal failure, especially in infants.
- Permanent renal damage may occur in children who have recurring episodes of pyelonephritis.
- The pathogens causing pyelonephritis are the same as those causing cystitis above
- Pyelonephritis is potentially severe, especially in neonates and infants.
- Management depends on the presence of signs of severity or complications or risk of complications.

Clinical features

Neonates and infant

- Symptoms are not specific: fever, lethargy, irritability, poor oral intake, vomiting, loose stools and jaundice. Palpation of the lower abdomen may show abdominal tenderness.
- The absence of fever does not rule out the diagnosis. On the other hand, fever with no obvious cause– may be the only manifestation.
- Neonates may present with fever or hypothermia, altered general condition, altered conscious state, pale/grey colour, shock etc.
- In practice, a urinary tract infection should be suspected in children with unexplained fever or septic syndrome with no obvious focus of infection.

Older children

- Signs of cystitis (burning pain on urination and urinary urgency and frequency, etc.
- Fever > 38 °C
- Flank pain or abdominal tenderness
- Nausea and/or vomiting are common.

Laboratory: As for cystitis above Plus

- Full Blood count, where possible Urine culture, blood urea and creatinine levels
- Renal and bladder ultrasound where possible in:
  - Children < 2 years of age with a first febrile UTI
  - Children of any age with recurrent febrile UTIs
  - Children of any age with a UTI who have a family history of renal or urologic disease, poor growth, or hypertension
  - Children who do not respond as expected to appropriate antimicrobial therapy

Treatment

Criteria for hospital admission:

- Patients at risk of complications: Neonates, infants and children with immunodeficiency
- Patients with complicated pyelonephritis: urinary tract obstruction, renal abscess,
- Patients with signs of severe infection: sepsis and septic shock, dehydration or vomiting

Neonates

Ampicillin slow IV (3 minutes) for 7 to 10 days

- Neonates 0 to 7 days (< 2 kg): 50 mg/kg every 12 hours
- Neonates 0 to 7 days (≥ 2 kg): 50 mg/kg every 8 hours
- Neonates 8 days to < 1 month: 50 mg/kg every 8 hours

PLUS Gentamicin slow IV for 5 days

- Neonates 0 to 7 days (< 2 kg): 3 mg/kg once daily
- Neonates 0 to 7 days (≥ 2 kg): 5 mg/kg once daily
- Neonates 8 days to < 1 month: 5 mg/kg once daily

Or

Cefotaxime slow IV for 7 to 10 days

- Neonates 0 to 7 days (< 2 kg): 50 mg/kg every 12 hours
- Neonates 0 to 7 days (≥ 2 kg): 50 mg/kg every 8 hours
- Neonates 8 days to < 1 month: 50 mg/kg every 8 hours

Children one month and over

- Ceftriaxone IM or slow ivi 50 mg/kg once daily until the child's condition improves then change to oral route to complete 10 days of treatment with:
- Amoxicillin/clavulanic acid PO
  - Children < 40 kg: 25 mg/kg 2 times daily
  - Children ≥ 40 kg: 2 tablets of 500/62.5 mg 2 times daily

Uncomplicated pyelonephritis

- Ceftriaxone IM: 1 g single dose or Gentamicin IM: 5 mg/kg single dose
  PLUS Ciprofloxacin PO: 15-20mg/kg/dose 2 times daily for 7 days

  Or
- Cefixime PO:8mg/kg/day in2 divided doses for 10 to 14 days

Pyelonephritis with criteria for hospital admission

- Ampicillin slow IV 50mg/kg (Max 2g) every 6 hours for at least 3 days PLUS
- Gentamicin IM: 5 mg/kg once daily for 3 days then change to Amoxicillin/clavulanic acid PO (or another antibiotic depending on the antibiotic susceptibility test) to complete 10 to 14 days of treatment

  Or
- Ceftriaxone IV 1 g once daily for at least 3 days PLUS Gentamicin IM: 5 mg/kg once daily for 3 days in the event of sepsis then change to amoxicillin/clavulanic acid PO (or another antibiotic depending on the antibiotic susceptibility test) to complete 10 to 14 days of treatment

6.2 ACUTE KIDNEY INJURY (ACUTE RENAL FAILURE)

Definition

Acute kidney injury (AKI) is a syndrome characterized by a rapid decline in glomerular filtration rate and retention of fluid and nitrogenous waste products.

AKI is classified as prerenal, renal and postrenal failure. In neonates exclude congenital abnormality of the urinary tract

Clinical presentation

- Oliguria is the most common manifestation, i.e.:
  - Neonates: output < 1 mL/kg/hour.
  - Older children: output ≤ 0.3 mL/kg/hour.
- Prerenal: shock and dehydration.
- Postrenal: exclude obstruction, e.g. palpable bladder.
- Intrinsic kidney disease: oedema, volume overload, hypertension.
- Signs of underlying infection/septicaemia, e.g. fever, skin rash, etc.

Investigations

- Full blood count
- Serum urea, creatinine, electrolytes, calcium and phosphate (Look for typical biochemistry complications: hyperkalaemic metabolic acidosis, hyponatraemia, hypocalcaemia, hyperphosphataemia)
- Urine macroscopic appearance: brownish with acute tubular necrosis.
- Urine microscopy: red blood cell casts, leukocyte, hyaline and granular casts.
- Urine culture to exclude pyelonephritis.
- Ultrasound of kidneys and bladder.

Management

Non-pharmacological

- Treat the underlying cause.
- Monitor fluid intake and output, blood pressure.
- Weigh daily.
- Nutritional support: High-energy diet. Give supplementary nasogastric feeds, if required.
- Restrict salt, potassium and phosphate intake.
- Avoid nephrotoxic or renally excreted medicines, e.g. NSAIDs, aminoglycosides, vancomycin, cough and cold mixtures, radiocontrast drugs.
- Fluid management:
  - Depends on volume status, urine output and extra-renal losses.
  - Never use a potassium-containing solution in an anuric patient.
  - Only use parenteral fluids if oral intake is not possible
  - Fluid balance is critical. Assess at least every 12 hours to make appropriate changes to fluid prescription.
  - Fluid management is done according to fluid status
- Insensible water loss is calculated as:
  - Neonates and young babies: 30-40 mL/kg/day
  - Older children: 25 mL/kg/day (400 mL/m2/day)
- Pulmonary oedema plus oliguria/anuria.
- Hydrated anuric patient without extra-renal fluid losses: Oral fluid to replace insensible water losses only.
- Normally hydrated plus oliguria: Oral fluid intake to replace insensible water loss plus urine output of previous 24 hours.

- Dehydrated, oliguric and ongoing extra-renal fluid losses:
- Replace fluid losses with an appropriate solution which mirrors losses e.g.:
  - For diarrhoea: ½ Darrows/dextrose 5%, IV or oral rehydration solution;
  - For vomiting/gastric fluid losses: sodium chloride 0.9%/dextrose 5%.
- Normally hydrated plus normal urine output: Give normal fluid intake.
- Polyuria, (urine output > 4 mL/kg/hour): which usually occurs during the recovery (diuretic) phase of acute tubular necrosis: Replace fluid and electrolyte losses with ½ Darrows/dextrose 5%, IV. Volume to replace is equal to urine output of preceding 12 hours.

Management of Hyperkalaemia

- Monitor ECG for signs of hyperkalaemia.
- Discontinue all sources of intake of potassium.
- Treat when serum potassium ≥6.5 mmol/L.
- Monitor response to treatment and adjust accordingly.
  - Calcium gluconate 10 %, IV, 0.5mL/kg/dose slowly over 3–5 minutes.
  - Salbutamol, solution, 2.5–5 mg/dose, nebulize over 20 minutes. OR
- Sodium bicarbonate 4.2%, IV, 4 mL/kg administered over 4 hours.
  - Do not mix calcium and sodium bicarbonate-containing solutions.
- Check Potassium level, if still no improvement
- Dextrose 10%, IV, 5 mL/kg over 20 minutes with/without insulin, soluble, 0.1units/kg depending on the blood glucose level.
  - If insulin is used -monitor for hypoglycaemia hourly.
- Sodium polystyrene sulphonate (Kayexelate), oral/rectal, 1 g/kg in dextrose water.
- If hyperkalaemia persists despite above treatment refer the patient urgently for dialysis.

Other complications

Metabolic acidosis: serum pH ≤ 7.1

- Sodium bicarbonate 4.2 %, IV, 4 mL/kg administered over 2–4 hours.

Infection

- Avoid nephrotoxic antibiotics.

Pulmonary oedema, volume overload and hypertension

- Do not give fluid to anuric patients with pulmonary oedema.
- Intubate and initiate positive pressure ventilation as necessary.
- Furosemide, IV, 2–5 mg/kg administered over 5 minutes. Maximum daily dose: 8 mg/kg/24 hours.
- Morphine, IV, 0.1 mg/kg. Repeat after 4 hours, if required.
- Oxygen, 100%, 2–3 L/minute by nasal cannula.

Note: Pulmonary oedema is an indication for dialysis in non-responsive cases.

Referral

- All children with AKI should be managed by a paediatrician hospital

6.3 POST STREPTOCOCCAL GLOMERULONEPHRITIS

Definition

Acute post-streptococcal glomerulonephritis (PSGN) is a disorder of the kidneys caused by an immunological response of the kidney to nephritogenic strains of streptococci. It develops one to three weeks after a streptococcal throat or skin infection. Immune complexes are deposited in the glomerular basement membrane and/or mesangial of the glomeruli.

Clinical features

- Occurs predominantly in children 3–12 years old.
- Presents 1–3 weeks after streptococcal pharyngitis or skin infection (impetigo).
- Characteristic features include:
  - Facial or generalized oedema,
  - Painless macroscopic haematuria (smoky or tea coloured urine),
  - Oliguria, and
  - Hypertension.

Special investigations to confirm APSGN

Urine analysis

- Macroscopic appearance smoky, brown, bloody
- Urine test strips 1+ to 3+ haematuria; ± trace to 2+ proteinuria
- Microscopic examination dysmorphic red blood cells; red blood cell and granular casts

Blood investigations

- Streptococcus serology
  - ASOT/ASLO or Anti-DNAseB titre positive in the absence of prior antibiotic treatment
- Serum biochemistry
  - Serum electrolytes: Dilutional hyponatraemia, hyperkalaemic metabolic acidosis is common
  - Urea & creatinine mildly elevated in the acute phase
- Full blood count: Dilutional anaemia; Platelets normal count is normal

Management of PSGN

Non-pharmacological measures

- Bed rest is necessary in children with severe hypertension or pulmonary oedema.
- Monitor fluid balance and prescribe fluid on a daily basis:
  - Weigh daily and record fluid intake and output strictly.
  - Allowed fluid intake should be calculated based on previous day's urine output and insensible losses.
  - In small children, fluid balance is best monitored with regular weighing.
  - Never use a potassium-containing solution in an anuric patient.
  - Do not use parenteral fluids if oral intake is possible.
- Ensure daily fluid calculations using insensible losses and previous day's output. Fluid management according to fluid status:

- Pulmonary oedema plus oliguria/anuria: give only insensible loss
- Hydrated anuric patient without extra-renal fluid losses: Oral fluid to replace insensible water losses only.
- Normally hydrated plus oliguria: Oral fluid intake to replace insensible water loss and urine output of previous 24 hours.
- Normally hydrated plus normal urine output: Give normal fluid intake.

Insensible water loss is calculated as:

- Neonates and young babies: 30 - 40 mL/kg/day
- Older children: 25 mL/kg/day (400 mL/m2/day)
- Dietary measures:
  - Restrict sodium intake in all patients.
  - Restrict potassium intake until result of serum electrolytes is available.
  - Restrict protein intake to 0.5 g/kg/day.

Pharmacological measures

Eradication of streptococci

- Phenoxymethylpenicillin, oral, 50 mg/kg/24 hours in 4 divided doses (6 hourly) for 10 days. **OR**

If unable to take oral medication:

- Benzathine benzylpenicillin IM, 30 000 units/kg/dose, 2 doses given 5 days apart. Maximum dose: 1.2 million units.

For severe penicillin allergy:

For patients with a penicillin allergy, recommended regimens include narrow-spectrum cephalosporins (Cefixime, Cefadroxil), Clindamycin, Azithromycin, and Clarithromycin.

Hypertension

Hypertension usually develops acutely due to fluid overload

Management for acute hypertensive emergency/crisis due to post streptococcal glomerulonephritis:

- Furosemide, IV, 1–2 mg/kg/dose.

If oliguric:

- Furosemide, IV, 5 mg/kg/dose.
  - Administer IV bolus slowly over 5 minutes due to risk of ototoxicity.

AND

- Labetalol, IV, 0.2–1.0 mg/kg/dose as a bolus.
  - Maximum bolus dose: 40 mg.
  - Continue infusion: 0.25–3.0 mg/kg/hour.
  - Monitor blood pressure frequently (every 30 minutes).
  - Taper infusion rate up or down according to response.

If Volume overloaded

- Furosemide, slow IV, 2 mg/kg/dose.
  - Maximum dose: 5 mg/kg/dose.
  - Maximum cumulative daily dose: 8 mg/kg/24 hours

If Pulmonary oedema:

- Morphine, IV, 0.1 mg/kg/dose.
  - Repeat after 4 hours if required.
- Oxygen, 100%, 2–3 L/minute by nasal cannula.

Referral

Refer as soon as possible all patients to tertiary hospital if:

- Anuric patient with acute volume overload and unresponsive to furosemide.
- Uncontrolled hypertension.
- Oliguric and progressive renal failure.
- Cardiac failure or pulmonary oedema not responding to treatment.
- Macroscopic haematuria persisting for more than 4 weeks or persistent proteinuria.
- Persistent renal failure after initial recovery
- Persistent hypertension

6.4 NEPHROTIC SYNDROME*:*

Definition: The nephrotic syndrome is caused by renal diseases that increase the permeability across the glomerular filtration barrier.

- A massive filtration of macromolecular across glomerular capillary wall due to functional abnormalities of glomerular podocytes
- Associated with (heavy) proteinuria with peripheral oedema, Hypoalbuminaemia, and hyperlipidemia

Clinical signs and symptoms:

Nonspecific symptoms:

- Fatigue and lethargy
- Loss of appetite, nausea and vomiting, abdominal pain, diarrhea
- Body weight increase, urine output decrease
- Foamy urine, a result of excess protein in your urine.

Oedema:

Massive urinary protein loss leads to hypoalbuminemia, which causes a decrease in the plasma oncotic pressure and transudation of fluid from the intravascular compartment to the interstitial space.

Pitting edema in different degree:

- Local edema: face, periorbital area, in lower extremities, scrotal, labial
- Generalized oedema (anasarca):),back, sacral
- Ascites, pleural effusion

Aetiology of Nephrotic Syndrome

Primary (idiopathic):90%

- Minimal changer Nephrotic syndrome (MCNS): most common 85%
- Focal segmental glomerulosclerosis (FSGN) : it accounts 10% - 15%
- Membranous nephropathy (MN): it accounts 4%
- Others glomerolopathies:
  - Mesangioproliferative glomerulonephritis (MPGN)
  - Lupus nephritis
  - IgA nephropathy

Secondary: 10%

- Infections: HBV, HIV, Syphilis, Malaria, toxoplasmosis, syphilis,
- Drugs (gold, mercury, NSAID, Interferon, heroin, lithium penicillamine)
- Connective tissue disorders (SLE)
- Metabolic disease (Diabetes Mellitus)
- Malignancies (Hodgkin's lymphoma, leukemia)
- Genetic disease (sickle cell disease, congenital Nephrotic Syndrome)

Differential Diagnosis

- Malnutrition
- Congestive Heart Failure
- Acute post-streptococcal glomerulonephritis
- Liver Failure

Diagnostic investigations:

- Urinary protein concentration(24hrs urine) - >50mg/kg/24hours
- Urine Dipstick: 3+ or 4+
- Serum albumin < 2.5mg/dl or 25 g/l
- Hyper-cholesterol:>5.7mmol/l
- Urine Protein Creatinine ratio (uPCR) > 2 is Nephrotic. ()uPCR Compares favorably with 24 hr urine protein

Additional investigations:

- Urine protein-on test strips(dip-stick)
- FBC, abdominal U/S,CXR
- Serum urea, electrolytes, creatinine, albumin
- Complement levels-C3,C4
- Urine microscopy and culture
- HB antigen, Hepatitis C antibody & HIV serology
- Screen for TB before starting steroids

Treatment:

- Normal Protein diet
- NaCl restriction
- Avoid saturated fat
- Antibiotics if infection is suspected

Symptomatic treatment:

- *Hypovolemia* - when symptomatic (cold extremities, low BP), requires plasma infusion (20ml/kg) or 20% albumin (1g/kg)
- *Diuretics* – only in case of anasarca & after correction of hypovolaemia (furosemide +/- albumin for 3 days)
- *Hypertension* – Beta blocks or calcium channel antagonist, ACE preferred if hypertension sustained.

Steroid therapy:

- Give prednisolone as a single dose in the morning with food.
- If prednisolone causes gastric irritation, give an anti-acid e.g Omeprazole mg/kg bid for the duration of treatment.
- Oral prednisolone 2mg/kg//day OR 60mg/m2/d for 4wks (max 60mg).
- Then 1.5mg/kg/day OR 40mg/m2 on alternate days/4wks.
- Reduce dose to0.5mg/k/day OR 10mg/m2/wk/4wks then stop

Remission:

- practically defined as negative or trace urine (urine protein Or; urine protein creatinine ration)uPCR of < 0.2; Or 24 urine protein < 150 mg, all for 3 consecutive days
- The long initial course of prednisolone (> 4 weeks) is associated with long remissions

Recommendations:

- If no improvement despite steroid therapy, refer to Nephrologists for probable kidney biopsy and further management in these following conditions:
  - Age >10 years
  - Hypertension
  - Macroscopic haematuria
  - Impaired renal function
  - Decreased C3/C4 complementary value
  - Failure to respond after 1 month of daily steroid therapy
- Penicillin prophylaxis
  - Children with NS are increased risk of infection especially capsulated organism e.g. pneumococcus. Penicillin V should be given while there is proteinuria and discontinued when then the child goes into remission.
  - Dose:
    - under 5years 125mg bid
    - 5 years and above 250mg bid
- Pneumococcal vaccination is recommended for children with NS.
- Consider giving during remission or 2 weeks before steroids (applies for all live vaccines).

Response to treatment

- Most children with NS will respond to treatment within 2-4 wks.
- A remission is defined as 3 consecutive days or more, of trace or negative urine protein on dipstick.
- If proteinuria persist beyond the first 4wks of steroids, refer for renal biopsy.

References

1. Shulman ST, Bisno AL, Clegg HW, Gerber MA, Kaplan EL, Lee G, et al. Clinical practice guideline for the diagnosis and management of group A streptococcal pharyngitis: 2012 update by the Infectious Diseases Society of Americaexternal icon. Clin Infect Dis. 2012;55(10):1279–82.
2. Shulman ST, Bisno AL, Clegg HW, Gerber MA, Kaplan EL, Lee G, et al. Erratum to clinical practice guideline for the diagnosis and management of group A streptococcal pharyngitis: 2012 update by the Infectious Diseases Society of Americaexternal icon . Clin Infect Dis. 2014;58(10):1496.
3. Committee on Infectious Diseases. Group A streptococcal infectionsexternal icon. In Kimberlin DW, Brady MT, Jackson MA, Long SS, editors. 31st ed. Red Book: 2018 Report of the Committee on Infectious Diseases. Elk Grove Village (IL): American Academy of Pediatrics; 2018:748–62.
4. Acute poststreptococcal glomerulonephritis: the most common acute glomerulonephritis. Pediatr Rev. 2015; 36(1):3-12; quiz 13 (ISSN: 1526-3347)
5. The Nephrotic Syndrome**:** Roberto Gordillo and Adrian Spitzer. Pediatrics in Review 2009;30;94. DOI: 10.1542/pir.30-3-94

CHAPTER 7: DERMATOLOGY

7.1 ECZEMA

Definition: Eczema, also known as dermatitis, is a syndrome characterized by superficial inflammation of the epidermis and itching.

It is an inflammatory itchy skin condition characterized by:

- Vesicles, weeping and crusting during the acute stage.
- Scaling and lichenification during the chronic stage.

Types:

- ***Atopic Dermatitis***: Chronic disease that affects the skin and often occurs together with asthma, dermatitis, rhinitis and Conjunctivitis.
- ***Contact Dermatitis***: Acute or chronic inflammation caused by allergens or irritants
- ***Napkin*** (Or Diaper area) dermatitis

Diagnostic criteria: Based on clinical history and signs

- Family history of allergies.
- Reaction after exposure to allergens.
- Typical distribution: face, flexures of knees and elbows, and creases of neck

Signs and Symptoms:

- Pruritus (constant symptom)
- And any of the following:
  - Blisters
  - Exudates and Erosions
  - Crusting/Excoriations
  - Xerosis
  - Erythroderma

Complications

- Secondary infection (bacterial, viral, fungal, etc)
- Post inflammatory Hypo or Hyper pigmentation
- Lichenification

Investigations

- Full blood count (Increase of Eosinophils is common)
- Identification of allergens (Prick Skin Test or Patch test not practical in our setting

Management

General and supportive measures

- Avoidance measures: use neutral soaps and rinse clothes properly after wash.
- Keep fingernails short to prevent scratching.
- Wrap with dressings soaked in sodium chloride 0.9%.
- Avoid sunlight and recommend use of sunscreen

For atopic dermatitis:

Non-pharmacological management

- Patient education
- Recommend Emollient to restore cutaneous barrier
- Aqueous cream: Apply > 2 times/day
- Emulsifying Ointment: apply > 2 times/day

Pharmacological management

- Local Treatment:
  - Antiseptic – Exudative lesions, Potassium permanganate diluted at 1/10,000 (500mg Tablet in 5 liters)
  - Antibiotics – Impetiginized lesions, Fucidine 2% 1 application/day/5 days.
  - Topical steroids: According to topography and thickness of the lesion
  - No long term topical steroid treatment (local side effects and gradual loss of efficiency). Prefer short courses

  First choice:
    - Betamethasone dipropionate (Diprosone, Diprolene) Cream/Ointment 2 applications/day for 3-4 days, then 1 application/day for 3 days, then 1 application every 2 days/week for 2 weeks

  Alternatives: According to the severity of the lesions and location:
    - Betamethasone valerate (Betneval) Cream/Ointment 2 applications/day for 3-4 days, then 1 application/day for 3 days, then 1 application every 2 days/week for 2 weeks **OR**
    - Methylprednisolone (Advantan) Cream/Ointment 1 application/day/3-4days then every 2 days/week for 1 week **OR**
    - Hydrocortisone Cream/Ointment 2 applications/day for 3-4 days, then 1 application/day for 3 days then 1 application every 2 days/week for 2 weeks

Side effects of topical steroids;

  - Skin atrophy
  - Skin Bleaching

- Systemic treatment:
  - Antihistamine for relief of the itching

    For children 2 years and older:
    - Cetirizine, Desloratidine/ Ebastine oral, as a single dose.
    - Children 2 - 6 years: 5 mg.
    - Children 6-12 years: 10 mg.
    - For children less than 2 years: Chlorphenamine, oral, 0.1mg/kg/dose as a single dose at night. (Maximum 4mg).
    - Combined Phototherapy UVAB in erythrodermic atopic dermatitis

Recommendation

- Short duration of topical steroids whenever possible (Stop topical steroids as soon as skin lesions disappear)
- Encourage use of emollient
- Avoid medicated soap
- Other eczema, consider topical steroids as indicated in atopic dermatitis above

7.2 BACTERIAL INFECTIONS (IMPETIGO)

Definition: A contagious intra-epidermal infection caused by streptococcus or staphylococcus and presenting as bullous lesions which rupture and crust. It comprises two types:

Non-Bullous Impetigo:

- More common form and is a superficial infection of the skin that appears first as a discrete papullovesicular lesion surrounded by a localized area of redness.
- The vesicle become rapidly purulent and covered with crust.
- The lesions may occur anywhere but is more common on the face and extremities.
- There is usually no fever nor systemic signs.
- Also occurs in traumatized skin that forms vesicles or pustules initially and rapidly develops crust.

Bullous Impetigo:

- Less common and occur most often in neonates and young infants on a previously healthy skin.
- It is characterized by transparent bullae usually < 3cm diameter. The distribution involves the face buttocks trunk and perineum. Staphylococcus aureus usually responsible.

Signs and symptoms:

Non-Bullous Impetigo

- Honey coloured crusters
- Lymphadenopathy
- Bullous Impetigo
- Flaccid and purulent bullous

Complications:

- Ulcerations
- Septicaemia
- Staphylococcal scaled skin syndrome (SSSS)

Investigations:

- Diagnosis is Clinical based on history and physical examination
- Swab for bacterial culture and sensitivity test

Management:

General measures

- Good personal and household hygiene to avoid spread of the infection and to reduce carriage of organisms.
- Trim finger nails.
- Wash and soak sores in soapy water to soften and remove crusts.
- Continue with general measures until the sores are completely healed.

Local Treatment:

- Antibiotics: Fucidic acid ointment (Fucidine 2%) 2 applications/day for 7 days
- Disinfectant with antiseptic solution;
- Potassium Permanganate diluted at 1/10,000 (500mg in 5 litres) OR

- Chlorhexidine solution (dermobacter) 2 applications/ Day for 7-10 da

Systemic treatment: Diffuse lesions

Children ≤ 7 years of age

- Cloxacillin : <40 kg: 12.5-25 mg/kg/day PO divided q6hr.

Severe infection: 50-100 mg/kg/day PO divided q6hr:

≥40 kg: 125-500 mg PO q6hr

Penicillin allergy:

Children ≤ 18 kg

Erythromycin, oral, 10–15 mg/kg/dose 6 hourly for 5 days.

Children > 18–35 kg (able to take tablets)

- Azithromycin, oral, 250 mg daily for 3 days.

Children > 35 kg and adults

- Azithromycin, oral, 500 mg daily for 3 days. If impetigo has improved, but has not completely cured, give a 2nd 5-day course of antibiotics.

Referral

- No improvement after second course of antibiotics.
- Presence of blood in urine test or clinical features of glomerulonephritis.

Recommendation:

- Follow-up is important to ensure complete clearing of lesions

7.3 CELLULITIS

Definition

A diffuse, spreading, acute infection within skin and soft tissues, commonly caused by streptococci and staphylococci**.**

- It is characterised by: oedema, redness, increased local temperature and no suppuration
- Frequently associated with lymphangitis and regional lymph node involvement.
- Commonly occurs on the lower legs, but may occur elsewhere.
- May follow minor trauma.
- There may be significant systemic manifestations of infection:
- Fever, tachycardia, hypotension, chills and delirium/altered mental state

Management

General measures

- Elevate the affected limb to reduce swelling and discomfort.

Medication

- Cloxacillin <40 kg: 12.5-25 mg/kg/day PO divided q6hr Severe infection: 50-100 mg/kg/day PO divided q6hr: ≥40 kg: 125-500 mg PO q6hr

Penicillin allergy:

Children ≤ 18 kg

- Erythromycin, oral, 10–15 mg/kg/dose 6 hourly for 5 days.

Children > 18–35 kg (able to take tablets)

- Azithromycin, oral, 250 mg daily for 3 days.

Children > 35 kg and adults

Azithromycin, oral, 500 mg daily for 3 days.

Severe cases: Refer for parenteral antibiotics.

Referral

Urgent

- Children who have significant pain, swelling or loss of function (to exclude osteomyelitis).
- Necrosis.
- Extensive cellulitis.
- Recurrent cellulitis associated with underlying conditions, e.g. lymphoedema.
- Cellulitis with systemic manifestations, e.g. confusion, hypotension.
- Poorly controlled diabetic patients.
- Involvement of the hand, face and scalp.

Non-urgent

- Inadequate response to initial antibiotic treatment

7.4 STAPHYLOCOCCAL SCALDED SKIN SYNDROME

Definition

Blistering skin condition that presents like scalded skin.

General and supportive measures

- Appropriate wound care.

Medication

- Cloxacillin, IV, 50 mg/kg/dose 6 hourly for 5 days.
- Neonates
  - Week 1–2 of age: administer 12 hourly.
  - Week 2–4 of age: administer 8 hourly.

7.5 STEVEN-JOHNSON SYNDROME (SJS)/TOXIC EPIDERMAL NECROSIS (TEN)

Definition

Life-threatening, acute hypersensitivity reaction with systemic upset, epidermal necrosis, and mucous membrane involvement.

TEN and SJS are different ends of the same spectrum: in TEN epidermal necrosis involves >30% of body surface area, while in SJS the involvement is <10%.

This condition is usually due to medication, e.g. sulphonamides, Nonnucleoside reverse transcriptase inhibitors (especially Nevirapine), Mebendazole, antiepileptics (phenytoin, Phenobarbitone, carbamazepine, lamotrigine), Allopurinol, laxatives (phenolphthalein).

Complications include:

- Dehydration, electrolyte disturbances and shock,
- Hypoalbuminaemia,
- Hypo and more commonly hyperthermia,
- High output cardiac failure,(resting cardiac output greater than 8 L/min)
- Secondary infection and sepsis; and
- Adhesions and scarring.

Diagnostic criteria

- Cutaneous lesions may start as a dusky red macular rash, progressing to confluence with epidermal necrosis and large flaccid blisters which rupture, leaving large areas of denuded skin. Mucous membrane erosions are common and multi- organ involvement may be present

General and supportive measure

- May require care in high or intensive care unit.
- Examine daily for systemic involvement, infection and ocular lesions.
- If infection is suspected, send blood and skin lesion specimens for culture and sensitivity before initiating antibiotic therapy.
- Do not puncture bullae or vesicles.
- Cool compresses and wet dressings.
- Regular supervised oral, genital and eye care to prevent adhesions and scarring.
- Encourage oral fluids, to prevent adhesions.
- Maintain fluid balance. Beware of shock.
- Nasogastric feeds if unable to eat, IV alimentation if enteral feeds are not possible.
- Stop all potentially causative medicines.

Medications

- These patients require effective pain control especially during change of dressing
- Skin hygiene, daily cleansing and bland, non-adherent dressings as needed.
- Do not use silver sulfadiazine if Stevens - Johnson syndrome is thought to be due to Cotrimoxazole or other sulphonamide.
- Empiric antibiotic therapy

For secondary infections

- Use IV antibiotics if the oral route cannot be used.
  - Cloxacillin, IV, 50 mg/kg/dose 6 hourly. **OR**
  - Cephalexin, oral, 6.25–12.5 mg/kg/dose 6 hourly.
- Reconsider choice of antibiotic when the results of cultures become available or the child does not improve.

For oral lesions:

- Chlorhexidine 0.2%, 15 mL as a mouthwash.
  - Use as needed.
  - Do not swallow.

Note: The use of systemic corticosteroids is not recommended.

Referral

- All cases with signs of respiratory distress
- Discuss with a specialist, if considering re-initiation of medicine treatment

7.6 ACNE

Definition

Acne is a skin disease characterized by pimples on the face, chest, and back. It occurs when the pores of the skin become clogged with oil, dead skin cells and bacteria, caused by

changes in skin structures consisting of a hair follicle and its associated sebaceous gland. It can present in inflammatory or noninflammatory forms.
Acne is most common during adolescence but may continue into adulthood. For most people, acne improves over time and tends to disappear in the early twenties. The most common sites for acne vulgaris are the forehead, cheeks, nose, and chin; the chest and back may sometimes be involved.

Causes and aggravating factors

- Sebum overproduction during puberty
- Altered hormonal status in adolescence with increased androgens in males
- Increased androgenic properties of progesterone in premenstrual females or those taking progesterone-containing contraceptives
- Some medicines (e.g., steroids) and cosmetics
- Family history
- Infection by Propionibacterium, mainly P. acnes

Signs and symptoms

Acne can be categorised as mild, moderate, and severe.

Mild

- Open and closed comedones (i.e. whiteheads and blackheads)
- Some papules and pustules (pimples), commonly on face, chest, back and shoulders

Moderate

- More frequent papules and pustules
- Mild scarring

Severe

- All of the above plus nodular abscesses
- Leads to more extensive scarring that may be keloidal in some cases

Management objectives

- Alleviate symptoms by reducing the number and severity of lesion
- Limit duration and recurrence
- Decrease sebaceous gland activity
- Decrease bacterial infection and inflammation
- Minimise cosmetic disfigurement and psychological suffering

Nonpharmacological management

Advise patients to:

- Avoid squeezing pimples because doing so may increase the risk of scarring
- Avoid excessive use of cosmetics and use only water-based products
- Wash face with mild soap and water 3 times/day; minimise scrubbing
- Get some sun (sunshine is helpful), but avoid sunburn
- Shave as lightly and as infrequently as possible.

Pharmacological management

For mild acne:

- Start with topical benzoyl peroxide cream or lotion 5%, once daily (use overnight).

- Treatment should be assessed after 4 weeks and, if beneficial, should be continued for at least 4–6 months.
- If no satisfactory response with benzoyl peroxide, use topical antibiotics or a combined preparation:
    - Erythromycin lotion or solution 1.5% or 2% applied twice daily to the affected area OR
    - Benzoyl peroxide 5%/erythromycin 3% gel applied twice daily to the affected area.

For moderate acne:

- Use topical treatment as for mild acne.
- If poor response to topical treatment, give oral antibiotics for at least 3 months:
    - Erythromycin 250 mg twice a day for 4 weeks OR
    - Doxycycline 100 mg once daily; can be taken with food or milk

Severe acne

- Use the topical treatment as for mild acne.
- Give also
    - Tetracycline 250-1,000 mg/day
    - Erythromycin 250–1,000 mg/day
- Duration of treatment depends on response. It may require 6 months to a year.
- Topical retinoid, e.g. Tretinoin cream/gel 0.05%, topical, applied sparingly once daily at bedtime until substantial improvement. Avoid contact with eyes and mucous membranes.

Referral

- All mild and moderate acne with poor response after 3 months of treatment
- All severe cases of acne
- Psychologically disturbed or depressed patient.
- Young females with premenstrual flare or with clinical signs of hyperandrogenism for consideration of oral contraceptives.

7.7 FUNGAL INFECTIONS:

Dermatophytes:

Definition: Fungal infection often seen as Tinea or Ringworm with clinical entities/forms depending on the anatomic site and etiologic agents involved. It is of two types;

- Tinea Capitis: Fungal Infections of the Scalp or head and often found in children.
- Tinea Corporis: Fungal infection of the glabrous skin (Hairless part of the body)

Table 33: Signs and symptoms of Dermatophytes:

Type	Clinical forms (Causative Agent)	Signs and symptoms
Tinea Capitis	Microsporic Tinea (Microsporum spp)	• Large patches/ plaques • Hair Fracture at few millimetres above surface of scalp (No alopecia)
	Tricophytic Tinea (Tricophyton Spp)	• Multiple small patches • Hair Fracture at the scalp giving black dots aspect
	Inflammatory Tinea/kerion (Microsporum spp and Tricophyton Spp)	• Severe Inflammatory reaction with deep abscess causing hair loss with permanent alopecia after healing
		• Yellow cup shaped crusts known as scotula • Hair is eliminated leading to permanent alopecia.
	Favus (Tricophyton schonleini)	Raised borders with Central normal skin, ring itself is red with dryness and scaling (Circinate lesions)
Tinea Corporis	All spp	• Itching • Skin rash • Small area of red, raised spots and pimples • Rash which slowly becomes ring-shaped, with a red-coloured, raised border and a clearer centre • The border of rash may look scaly • Rash may occur on the arms, legs, face, or other exposed body areas

Diagnosis:

- Clinical based on history and physical examination

Investigations:

- Looking at a skin scraping of the rash under the microscope using a potassium hydroxide (KOH)test
- Skin biopsy for histological exams

Table 34: Management Dermatophytes:

Types	Therapeutic options
Tinea capitis	• Topical treatment (always combined to systemic treatment).
	• Ketoconazole (Nizoral) shampooing, 3times/week apply to moist hair after shower, and then wash off after 15 minutes OR **Systemic treatment: First** choice: • Whitefield ointment , apply BID • Griseofulvin (tabs 125mg,250mg, 500mg): 20 mg/kg/ day , 6 to 8 weeks taken once daily with fatty meal **Alternatives:** • Fluconazole (Flucazol syrup 50mg/ml) 6 mg/kg/day, 6 to 8weeks once a day. • If inflammatory Tinea: add systemic antibiotics to antifungal above mentioned
Tinea Corporis	**Local treatment:** • Miconazole nitrate 2% cream, 2 applications/day for 15 days OR • Clotrimazole cream, 2 applications/ day for 10 days. OR • Ketoconazole cream, 2 applications/ day for 10 days. **Systemic treatment(≥3 lesions):** First choice: • Griseofulvin 20 mg/kg/ day, 3-4 weeks taken with fatty meals. Alternative: • Fluconazole (Flucazol suspension, 50mg/ml) 6 mg/kg/day, 6 to 8weeks once a day.

Recommendation:

- Avoid sharing combs and towels to prevent Tinea capitis

7. 8 PARASITIC INFECTIONS

Scabies:

Definition:

Scabies is a contagious skin condition caused by a tiny mite (Sarcoptes scabei). It burrows into the outer layer of the skin and deposits its eggs there. It spreads easily through person-to-person contact. It is particularly problematic in areas of poor sanitation and overcrowding.

Signs and symptoms

- Nocturnal intense pruritus
- Lesion distribution:
- Interdigital web spaces.
- Around the nipples.
- Genital region.
- Lesion characteristics:
  - Papules, pustules or excoriations.
  - The pathognomonic sign: intradermal tunnel called scabietic “burrow”

Diagnosis

- Based on clinical history and physical examination.
  - The history particularly itching of recent onset, and careful scrutiny of hands and wrists will usually establish the diagnosis.

Investigation:

- Microscopic identification of skin scrapings

Complications:

- Secondary skin infection
- Sepsis

Management objectives

- Prevent re-infection or further spread of the disease
- Relieve the itching

Non-pharmacological management

- All close family and skin-to-skin contacts must be treated at the same time to prevent re-infection, even if symptoms are not evident.
- The patient should be advised to wash, boil, dry in the sun, and iron all clothing, bedding, and bed linens after each use.
- The mattress, pillows, and chair cushions must be placed in the sun for at least 3 consecutive days.
- Advise the patient to keep his or her nails short and clean.
- Instruct the patient to dry his or her skin thoroughly after bathing and to put on clean clothes.
- The whole house should be cleaned and disinfected with a disinfectant spray.

Pharmacological management

- Use benzyl benzoate lotion 25%.
    - Adults and children >6 years: full strength 25% solution
    - Children <6 years: 12% solution (dilute 25% solution 1 part solution: 1 part water
    - Infants: 1:3 dilution
    - Apply benzyl benzoate lotion to the entire body, excluding the face and nipple area of breastfeeding women, for 3 consecutive evenings.
    - Leave on overnight and wash off the next day.
    - Attention should be paid to the toes, fingers, genital area and areas where the rash is seen.
    - A scrub bath must be taken before and after the 3 days of application.
    - Repeat the treatment after 10 days.
- Itching may persist for some weeks after completing the treatment. This can be relieved by taking Chlorpheniramine
    - Give Chlorpheniramine (4 mg tablets; 2 mg/5 ml syrup) PO every 4–6 hours daily.
        - Adults: One 4 mg tablet 4–6 times/day, not to exceed 24 mg/day
        - Children
            - 2–5 years: 1 mg (. teaspoon) syrup 4–6 times/day, not to exceed 6 mg/ day
            - 6–12 years: 2 mg (. tablet or 5 mL—1 teaspoon—syrup) 4–6 times/ day, not to exceed 12 mg/day
- Note: Itching usually starts to abate after 1 week and the rash after 3 weeks.

Referral

- If there are signs of treatment resistance, refer the patient to the specialist.

CHAPTER 8: INFECTIOUS DISEASES:

8.1 MALARIA

Definition: Malaria is a febrile caused by a protozoan parasite which invades the red blood cells and is transmitted by mosquitoes. The 4 species infecting humans consistently are Plasmodium falciparum, Plasmodium vivax, Plasmodium ovale, and Plasmodium malariae. In Rwanda, the main species is Falciparum (98%) and the main cause of severe malaria. There 3 forms of malaria:

Simple Malaria

- Axillary temperature ≥37.5 °C or history of fever in the last 24 hours with or without the following signs: headache, weakness, chills, loss of appetite, stiffness, and muscular pains
- Laboratory confirmation using either a blood smear or a rapid test is compulsory in all cases without exception**.**

Simple malaria with minor digestive symptoms

- Characterized by signs of simple malaria with vomiting that prevents oral medication with or without associated moderate diarrhoea.
- The confirmation of Plasmodium by either blood smear or rapid test is compulsory without any exception.

Severe malaria

- **All severe malaria cases must be admitted to hospital.**
- It is characterized by positive parasitaemia due to Plasmodium falciparum, accompanied by one or more of the following signs of severity or danger in the absence of an identified alternative cause:
    - Inability to drink or suckle;
    - Prostration; Generalized weakness with inability to sit, stand or walk without support
    - Vomiting every feed
    - Convulsions (≥ 2 convulsions in 24 hours);
    - Lethargy and unconsciousness.
    - Respiratory distress syndrome/Pulmonary oedema
    - Metabolic acidosis
    - Hypoglycaemia <2.2mmol/L or < 40mg/dl
    - Renal impairment
    - Significant bleeding from any site
    - Signs of shock
    - Hyperparasitaemia of Falciparum> 10%
- Severe malaria is a medical emergency. Delay in diagnosis and inappropriate treatment, leads to rapid worsening of the situation.
- The keys to effective management are early **recognition, assessment and appropriate antimalarial and supportive therapy.**

Management of different forms of malaria:
Management of simple malaria;
First line treatment:

- Artemisinin combination therapy (ACT): Artemether 20 mg and Lumefantrine 120 mg (COARTEM®), taken preferably during meals twice a day for 3 days
- Schematic diagram of COARTEM dosing according to the body weight of the patient

Table 35: Dosage of COARTEM

Category of body weight of the patient in kg	**Type of blister administered**	**Number of tablets of** COARTEM **per dose**					
		Day 1		**Day 2**		**Day 3**	
		First dose	**8 hours after first dose**	**24 hours after first dose**	**36 hours after first dose**	**48 hours after first dose**	**60 hours after first dose**
5 kg ≤ weight < 14 kg	6*1 (5-15 kg)	1	1	1	1	1	1
15 kg ≤ weight < 24 kg	6*2 (15-25kg)	2	2	2	2	2	2
25 kg ≤ weight < 34 kg	6*3 (25-35 kg)	3	3	3	3	3	3
≥ 35 kg	6*4 (> 35 kg)	4	4	4	4	4	4

Important instructions to follow:

- Respect the dose prescribed by the health provider;
- Artemether-lumefantrine is contraindicated in:
  - During first trimester pregnancy
  - In cases of allergy to one of the two drugs in the combination
  - In severe liver or renal disease
- In infants<5kg, use same dose as for infant with 5kg as was described in the schema above.
- If there is no improvement after 48 hours of treatment with Artemether-Lumefantrine, verify if the patient took the drugs correctly, re-examine the patient carefully and do another peripheral blood smear, and if the test is positive, admit for Artesunate injection or refer the patient to the specialist.
- If the peripheral blood smear is negative, exclude and treat other causes of illness and/or refer the patient.

Recommendation:
Monotherap**y** using artemisinine derivatives is not allowed for the management of simple malaria in Rwanda.

Management of simple malaria with minor digestive symptom:
Artesunat**e** IV: 2.4 mg/kg body weight as a single dose on admission (time= 0) then at 12 hour, then daily thereafter.

- If the patient's condition improves, change to oral Artemether-lumefantrine twice a day for three consecutive days.
- If the patient's condition does not improve within 24 hours of treatment, refer the patient for specialized care

Note: Preparation: Artesunate will be diluted in 1 ml 5% sodium bicarbonate (provided in the package), and then further diluted with 5% dextrose or 0.9% normal saline to a total volume of 6 ml, giving a final concentration of 10 mg/ml.

Supportive treatment:
In case of diarrhoea and/or vomiting;

- Evaluate and monitor the hydration status of the patient
- Rehydrate the child with ORS or other available liquids, encourage breast feeding and other modes of feeding and if necessary use a nasogastric tube
- Anti-emetics should be avoided as necessary
- In case of fever, give oral Paracetamol 15 mg/ kg per dose every 6-8hrs until fever is controlled.

Management of severe malaria;

Recommendations:

- Treatment must be initiated based on malaria positive blood smear or rapid diagnostic test results
- Meanwhile, other investigations to determine severity and prognosis should be undertaken
- The management of severe malaria must be done in either district hospital or referral hospital (private or public).

Pre-transfer treatment at the health centre:

- It is indicated to administer antimalarial treatment only after obtaining a positive blood smear or positive rapid diagnostic test
- While preparing for the transfer of the patient, urgently administer IV Artesunate or IV (IV infusion) if there is a contraindication to artemisinine derivatives and depending on the general condition of the patient (weak pulse or not, dehydration or none), the health centre staff will administer;
    - Artesunate 2,4 mg /kg IV/IM (3mg/kg for patients below 20kg) as a single dose before transferring the patient
    - Rectal artesunate:
        - 6-36 months: 100mg suppository
        - 37- 72 months: 200mg (=2x 100mg suppository)

Recommendation:

- Give parenteral antimalarial in the treatment of severe malaria for a minimum of 24h, once started (irrespective of the patient's ability to tolerate oral medication earlier), and, thereafter, complete treatment by giving a complete course of artemether plus lumefantrine orally.
- For cerebral malaria, administer the first dose of antibiotics;
    - Cefotaxime 50mg/kg/dose body weight four times a day **or**
    - Ceftriaxone 50 mg/kg/dose body weight twice daily.
- In case of hypovolaemia (rapid breathing, coma or systolic BP < 80 mm Hg), start with normal saline infusion in a dose of 20 ml/kg to run within 15 minutes to move the patient out of shock.
- For malnourished children (kwashiorkor or marasmus), give the loading dose of artesunate and if there is shock, manage according to the protocol
- If an intravenous line is not possible, use intramuscular artemether

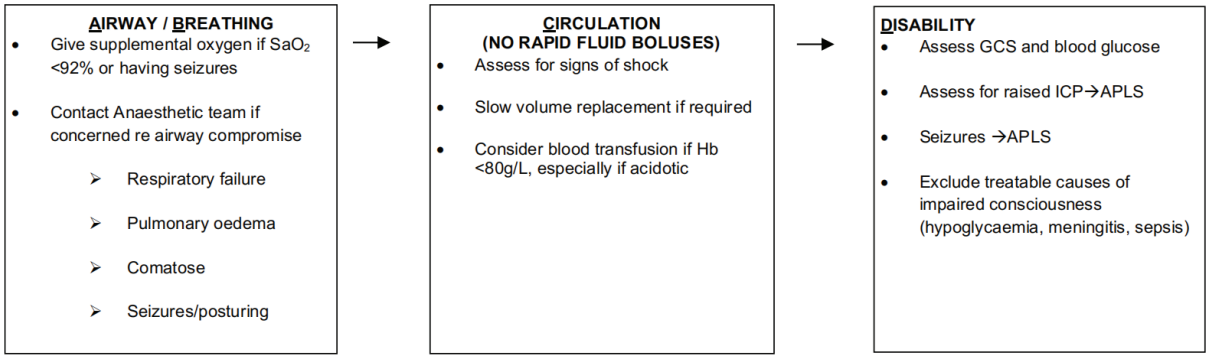
Supportive treatment:

- If the temperature is ≥38°C;
    - Do tepid sponging

- Give Paracetamol 15 mg /kg body weight by oral route or suppository and injectable forms

- To prevent hypoglycemia (characterized by reduced level of consciousness, severe weakness);
  - Give 2.5ml/kg body weight of 10% glucose bolus or if not available 1 ml/kg of 50% glucose diluted in 4ml of water for injection Or
  - Administer water with 10% sugar per mouth or with nasogastric tube, at a rate of 5 ml/kg (Preparation of 10% sugar/water: take 100 ml of boiled clean water and add 10 g of sugar or 2 coffee spoons

Figure 10: Treatment of the severe malaria in the hospital;



Then initiate antimalarial immediately;

- 20kg and above: 2.4mg/kg IV injection at 0, 12 and 24 hours then daily
- Less than 20kg: 3mg/kg IV injection at 0, 12 and 24 hours then daily

Table 37: Immediate clinical management of severe manifestations and complications of P. falciparum malaria

Manifestation or complication	Immediate management
Coma (Cerebral malaria)	Maintain airway, place patient on his or her side, exclude other treatable causes of coma (e.g. hypoglycaemia, bacterial meningitis); avoid harmful ancillary treatments, intubate if necessary.
Hyperpyrexia	Administer tepid sponging, fanning, a cooling blanket and Paracetamol.
Convulsions	Maintain airways; treat promptly with intravenous or rectal diazepam 0.5 mg/kg body weight Intra-rectal; If convulsions persist, give Phenobarbital 10-15 mg/kg IVI/IM; Check blood glucose.
Hypoglycaemia	Check blood glucose, correct hypoglycaemia and maintain with glucose-containing infusion. Although hypoglycaemia is defined as glucose < 2.2 mmol/L, the threshold for intervention is < 3 mmol/L for children < 5 years and < 2.2 mmol/L for older children and adults.
Severe anaemia	Transfuse with packed cells 10ml/kg or screened fresh whole blood 20ml/kg
Acute pulmonary oedema	Prop patient up at an angle of 45°, give oxygen, give a diuretic, stop intravenous fluids, intubate and add positive end-expiratory pressure or continuous positive airway pressure in life-threatening hypoxaemia.
Acute kidney injury	Exclude pre-renal causes, check fluid balance and urinary sodium; if in established renal failure, refer for haemodialysis/peritoneal dialysis.
Spontaneous bleeding and coagulopathy	Transfuse with screened fresh whole blood (cryoprecipitate, fresh frozen plasma and platelets, if available); give vitamin K injection.
Metabolic acidosis	Exclude or treat hypoglycaemia, hypovolaemia and septicaemia. If severe do haemodialysis.
Shock	Suspect septicaemia, take blood for cultures; give parenteral broad-spectrum antibiotics, correct haemodynamic disturbances.

Reference

1. (World Health Organization 2015). Guidelines for the Treatment of Malaria. 3rd edition.
2. WHO Guidelines for malaria. Geneva: World Health Organization; 2021. License: CC BY-NC-SA 3.0 IGO.
3. Rectal versus Intravenous Quinine for the Treatment of Childhood Cerebral Malaria in Kampala, Uganda: A Randomized, Double-Blind Clinical Trial Jane Achan, Justus Byarugaba, Hubert Barennes, James K. Tumwine Clinical Infectious Diseases, Volume 45, Issue 11, 1 December 2007, Pages 1446–1452, https://doi.org/10.1086/522972

8.2 MENINGITIS

Introduction

Meningitis is a severe, life-threatening infection of the central nervous system that requires immediate medical attention. Even with appropriate treatment, morbidity and mortality can be substantial. It is essential for clinicians to recognize the clinical signs and symptoms of meningitis and understand its management and prevention.

Causes:

- Bacteria (H. Influenzae, streptococcus pneumoniae, meningococcus…)
- Viruses (Herpes group…)
- Fungi (Cryptococcus Neoformans)
- Protozoa (toxoplasma gondii…)

Note:

- Haemophilus Influenza and Streptococci are common causes in infants while Neisseria meningitides is responsible for epidemics in older children …)
- Mycobacterium tuberculosis, Fungal and protozoa infections are more common in immunocompromised children like in HIV/AIDS and malnutrition

Signs and symptoms:

In younger infants

- Nonspecific features e.g. vomiting, restlessness, irritability and poor feeding
- Convulsions and bulging fontanel are more reliable signs in this age group

In older children

- Headaches
- Fever
- Convulsions
- Stiffness of the neck

Diagnosis:

- Based on symptoms and signs
- Investigations (for confirmation)

Investigations

- Lumber puncture and laboratory analysis of cerebral spinal fluid (cytology to be analyzed within 1 hour after sampling)
- Pressure of the CSF
- FBC, serum glucose (taken at the time of CSF sampling), electrolytes (Na and K)
- Blood culture

Interpretation of the CSF results:

Either Bedside examination:

- Looks cloudy in bottle (turbid) when not blood stained
- Laboratory examination with one or more of:
  - White cell count more than $10x10^6$/l and differentials (Neutrophils and Lymphocytes)
  - CSF protein more than
  - CSF glucose

- Gram positive diplococci or gram negative coco bacilli
  - If one is positive : definitive meningitis
  - If all lab results negative but one of the following (coma, stiff neck, bulging fontanel and LP looks clear : probable meningitis
  - If all of the clinical signs mentioned above, and CSF not done: possible meningitis

Table 38: Cerebral Spinal Fluid (CSF) parameters

	Viral meningitis	Bacterial meningitis
WBC count	Typically 10 to 500 cells/microL	Typically>1000 cells/microL, but can be lower, particularly early in the course
differential	Mononuclear predominance	Neutrophil predominance
Glucose	Normal or slightly reduced	Usually< 60% of serum value
protein	Normal to slightly elevated Usually <150 mg/dl	Typically 100 to 500 mg/dl

Complications:

- Convulsions
- Brain oedema
- Coma
- Syndrome of inappropriate ADH secretion
- Brain abscess
- Cranial nerve palsies
- Hydrocephalus
- Epilepsy
- Hearing, vison impairment
- Cerebral palsy

Management:

General supporting measures:

- Admit in high dependence/critical unit or where the patient can have close monitoring
- Follow ABCD guidelines for unconscious patient
- Correct hypoglycemia if present
- Give maintenance fluids IV (normotonic fluids)
- Stop convulsions with diazepam 0.5mg/kg intra rectal or IV 0.3mg /kg or a loading dose of Phenobarbital 10-15mg/kg IV(slowly over 15 min), followed by a maintenance dose od 5mg/kg/dose 24hrly.
- Feeding by NGT with milk, soup and porridge once stabilized (24hrs without clinical seizures with GCS is >8) (then, stop IV fluids)

Antibiotics:

- Definitive meningitis : Cefotaxime 50 mg/kg/dose IV 6 hourly for 14 - 21days or Ceftriaxone 50mg/kg/dose 12 hourly for 14 - 21 days.
- If gram stain positive, adjust and treat for 14 days if gram positives or 21 days if gram negatives.
- Probable meningitis : Same as definitive meningitis
- Possible meningitis: Same as definitive meningitis

Dexamethasone

- Reduces the risk of hearing loss in patients with H. influenzae or S. pneumoniae.
  - Given with or before the first dose of antibiotics except in neonates
  - Children > 1 month: 0.15 mg/kg (max. 10 mg) every 6 hours for 2 to 3 days
  - Monitor;
    - Vital signs (temperature, RR, HR, level of consciousness, diuresis)
    - Strict fluid input and output balance
- If suspected viral meningoencephalitis; Add Acyclovir IV 10-15 mg/kg/dose 8 hourly for 2-3 weeks or Acyclovir tabs: 20mg/kg/dose 6hrly for 2-3 weeks
- If tuberculous meningitis, fungal and protozoal meningitis treatment refer to the respective treatment services
- Raised intracranial pressure or cerebral oedema (Must be managed in HDU/ICU)
  - Elevate head of bed ± 30°.
  - Maintain PaCO2 at 30–35 mmHg; intubate and ventilate if necessary.
  - Avoid fluid overload.
  - Mannitol, IV, 250 mg/kg administered over 30–60 minutes.
  - Dexamethasone, IV, 0.5 mg/kg 12 hourly.(if not already on dexamethasone)

Contraindications to performing LP:

- Signs of ICP (papilledema)
- Focal neurological signs (strabismus, focal convulsions, unequal pupils…)
- Coagulopathy or low platelets (<50.000/ul)
- Haemodynamic and respiratory instability
- Glasgow coma scale less than 8/15 or Blantyre scale <3
- Skin infection over the site of lumbar puncture

8.3 TETANUS

Definition: Tetanus is an acute spastic paralytic illness caused by tetanospasmin, the neurotoxin produced by Clostridium tetani. The toxin prevents neurotransmitter release from spinal inhibitory neurons. It occurs in several clinical forms including generalized, localized and neonatal disease.

Cause:

- Clostridia tetani

Signs and symptoms:

- Trismus (lock jaw)
- Opisthotonus (Rigid arching of back muscles)
- Dysphagia

- Laryngospasm
- Autonomic nervous system instability with hypertension, tachycardia and dysrhythmias

Diagnosis:

The diagnosis is made on clinical grounds.

- Unimmunized/incompletely immunised child.
- History of wound/trauma or unhygienic care of umbilical cord/stump.
- Trismus/False smile
- Stiffness of the neck, back and abdominal muscles.
- Pharyngospasm, laryngospasm, dysphagia, inability to suck, chew and swallow which severely compromises feeding and eating activities.
- Spontaneous muscle contractions/spasms or muscle contractions/ spasms triggered by minimal stimuli such as touch, sound, light or movement.
- No involvement of sensorium, i.e. consciousness is not disturbed.
- Autonomic nervous system instability with hypertension, tachycardia and dysrhythmias

Complications

- Asphyxia and Brain damage due to hypoxia spasms
- Inability to suck, chew and swallow leading to dehydration.
- Heart failure from arrhythmias
- Pneumonia, Laryngospasms, Respiratory failure
- Fractures
- malnutrition

Investigations:

- No specific lab test is available to determine the diagnosis of tetanus
- Other tests done to rule out meningitis, rabies, strychnine poisoning e.t.

Management:

Non-Drug Treatment

- Transfer to a higher level where there is an intensive care unit/high dependency unit, in a tertially hospital
- Oxygen to prevent hypoxia and ventilatory support if needed
- Monitor:
  - Temperature
  - Respiration
  - Heart rate
  - Blood gases
  - SaO2
  - blood pressure
  - blood glucose
  - electrolytes
  - acid–base status
- Protect the patient from all unnecessary sensory and other stimuli (admit in a quiet, dark room)
- Ensure adequate hydration and nutrition
- Wound care and debridement/umbilical cord care
- Educate parents/caregivers regarding prevention of tetanus by vaccination

Pharmacological

- Tetanus immunoglobulin, IM, 500–2 000 IU as a single dose
- Eliminate toxin production
  - Benzylpenicillin (Penicillin G), IV, 50000IU/kg/day (Neonate 12hourly and in older children 6hourly)
  - Metronidazole for 7-10 days

Neonates less than 7 days old:

Weight	Dosage
<1.2 kg	7.5mg/kg/ i.v 48 hours
1.2-2 kg	7.5mg/kg ivi 0.d
> 2kg	15mg/kg/day 12 hourly

Neonates 7 days and older

Weight	Dosage
<1.2kg	7.5mg/kg 48 hourly
1.2-2 kg	15mg/kg/day 12 hourly
>2kg	30mg/kg/day 12 hourly

Infants (above 28 days and children Metronidazole 10mg/kg/dose IV 8 hourly

- Diazepam, IV, 0.1–0.2 mg/kg/dose 4–6 hourly, titrated according to response. Do not exceed dose of 10 mg/dose unless admitted in an ICU.
- Alternating with chlorpromazine 0.5 mg/kg 6 hourly PO (NGT)

After recovery from tetanus, patients should be actively immunised as the disease does not confer immunity

NB: Don't remove the NGT from the child until at least one week seizure free.

Prevention of tetanus

Minor Wounds:

- Children with clean minor wounds do not require tetanus immunoglobulin or antibiotics
- Tetanus vaccine should be given, except in fully immunised patients who have received a booster within the past 5 years

For more severe wounds

- If child with penetrating wound is fully not immunised give tetanus immunoglobulin
  - < 5 years 75 IU
  - 5–10 years 125 IU
  - > 10 years 250 IU
  - Tetanus toxoid vaccine (TT), IM, 0.5 mL
  - phenoxymethylpenicillin, oral, 12.5 mg/kg/dose 6 hourly for 7 days

OR

  - Erythromycin, oral, 6.25–12.5 mg/kg/dose, 6 hourly for 7 days (if allergic to penicillins)

Recommendation:

- Refer all cases of tetanus to intensive care /High dependency unit

8.4 HEPATITIS

Definition: It is an acute inflammation of the liver with varying degrees of hepatocellular necrosis. The most commonly known are hepatitis A, B and less commonly C, D and E viruses.

8.4.1 Hepatitis A

Cause:

- Hepatitis A RNA(virus)
- Vaccination does exist but provided in developed countries
- HAV is spread via the faecal-oral route

Symptoms and signs:

- Abrupt onset with nonspecific symptoms, such as fever, malaise, anorexia, vomiting, nausea, abdominal pain or discomfort, and diarrhoea.
- Jaundice occurs one week after onset of symptoms, along with choluria (bilirubin in the urine) and mild hepatomegaly.
- Young children are asymptomatic; Symptomatic 30 percent of infected children younger than six years, jaundice usually lasts for less than two weeks. Conjugated bilirubin and aminotransferases return to normal within two to three months
- In contrast, older children and adults with HAV infection are usually symptomatic for several weeks. Approximately 70 percent are jaundiced, and 80 percent have hepatomegaly. Symptoms last for a longer time
- The most common extrahepatic manifestations include an evanescent rash (11 percent) and arthralgia (14 percent). and less common extrahepatic manifestations include vasculitis, arthritis, optic neuritis, transverse myelitis, encephalitis, and bone marrow suppression

Complications:

- Acute liver failure is rare in developed countries , but account for 60% of liver failure in Latin America
- Death

Diagnosis: Made based on clinical symptoms and signs

Investigations

- Liver Function tests
- Anti-HAV IgM in a patient with the typical clinical presentation
- Serological tests for Hepatitis A (exclude Hep B and C)

Management:

- improved sanitary conditions, adherence to sanitary practices, hand washing +++ (virus may survive for up to four hours on the fingertips)
- No specific treatment for Hepatitis A
- Bed rest may be recommended but does not alter the course of the illness
- Human immunoglobulin prophylaxis for those who had contact
- Isolate patient of Hepatitis A for 7–10 after the onset of jaundice

Patients rarely require hospitalization except for those who develop fulminant hepatic failure.

8.4.2 Hepatitis B

Cause:

- Hepatitis B DNA virus (HBV)
- Perinatal transmission is the most common cause of chronic infection
- Infants born to women with HBV infection (HBeAg positive or negative) should be tested for hepatitis B at 9-18 months even if vaccinated (at least 5% develop chronic HBV)
- All pregnant women should be screened for HBV infection

Symptoms and signs:

Infection with HBV is associated with characteristic changes in the serum levels of hepatitis B antigens and antibodies. These markers are used to define different clinical states

Acute hepatitis

- Acute HBV infection in children ranges from asymptomatic infection to fulminant hepatitis.
- Constitutional symptoms, anorexia, nausea, jaundice and right-upper-quadrant discomfort.
- The symptoms and jaundice generally disappear after one to three months, but some patients have prolonged fatigue even after normalization of serum aminotransferase concentrations. Older children and adolescents have mild constitutional symptoms during acute HBV infection.

Chronic hepatitis

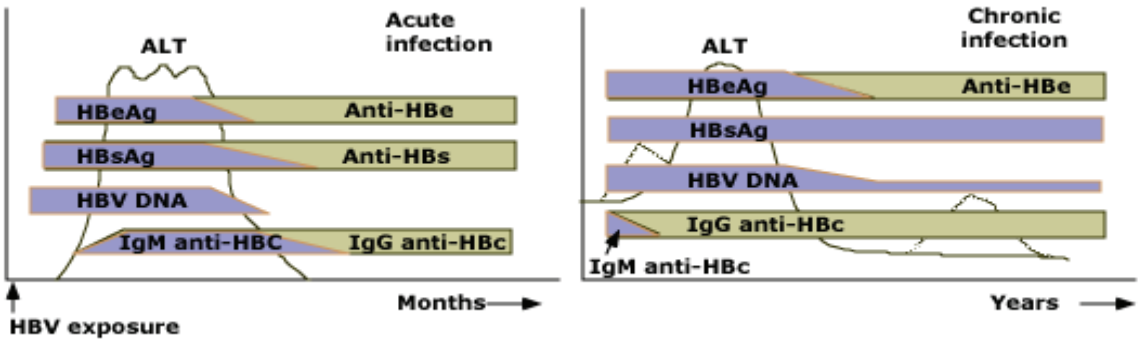
- Commonly asymptomatic and grow and develop normally.
- Vague right upper quadrant discomfort and fatigue, loss of appetite, jaundice.
- Extrahepatic manifestations including polyarteritis nodosa and glomerulonephropathy.

Diagnosis:

- Based on persistence of HBsAg for more than six months; IgG anti-HBc is positive, while IgM anti-HBc is negative
- Some carriers have large numbers of HBV in their serum and liver without symptoms or signs and without antibodies in their serum.

Investigations

- Serologic responses to HBV infection



- *Left panel:* Acute infection:
  - HBeAg (hepatitis B e antigen), HBsAg (hepatitis B surface antigen), and HBV DNA beginning in the preclinical phase.
  - IgM anti-HBc (hepatitis B core antigen) appears early in the clinical phase; the combination of this antibody and HBs Ag makes the diagnosis of acute infection.
  - Recovery: normalization of the serum ALT, the disappearance of HBV DNA, HBeAg to anti-HBe seroconversion, and subsequently HBsAg to anti-HBs seroconversion and switch from IgM to IgG anti-HBc. Then previous HBV infection is characterized by anti-HBs and IgG anti-HBc.
- *Right panel*: Chronic infection:
  - Persistence of HBsAg for more than six months after acute infection
  - Persistence of HBeAg (for a variable period), HBsAg, and HBV DNA in the circulation
  - Anti-HBs is not seen.
- *Other tests*
  - Liver Function tests (Prothrombin time, Bleeding time)
  - Glycaemia if severe
  - HBV tests (refer to figure)
  - Blood ammonia
  - Urea and electrolytes in cases of liver failure
  - FBC to determine severity of anaemia

Complications:

- Chronic Liver Disease: In children born from infected mother 76 percent of them are HBeAg positive at 10 years of age. The frequency of spontaneous seroconversion increases during puberty (Cirrhosis)
- Liver failure (hepatic encephalopathy)
- Portal hypertension (GIT bleeding, hematemesis and melena stools)
- Hepatorenal syndrome /reduced glomerular filtration rate.
- Liver cancer

Management:

General measures:

- Counseling of the patient about alcohol use in adolescents and family, surveillance for disease progression and development of complications,
- Regular monitoring of liver function every 3 months
- Patients who are in the inactive carrier phase of hepatitis B infection (i.e., HBsAg positive, HBeAg negative, anti HBe positive, persistently normal ALT/AST levels, serum HBV DNA <10(5) copies/mL) should undergo monitoring of liver biochemical function every 6 to 12 months.

Prevention:

- Immunization for adults
- Immunization for children

- Immunization for exposed neonates (from mother to child transmission): eg IM Engerix 0.5ml preferably within 12 hours of birth but can be given until 72 hrs of life.
- Immunoglobulin for babies born to mothers with HepB: 0,5 ml IM (within 12 hours)

Selection of patients for treatment:

- Treatment is generally considered in patients with HBV DNA positive chronic hepatitis who are in the immune active phase (usually defined as ALT >2 x ULN and HBV DNA >20,000 IU/mL or 10(5) copies/mL, for at least six months)
- Children with ALT values greater than 10 times the upper limit of normal but with concomitant low HBV DNA levels may be in the process of spontaneous seroconversion, and may not require treatment. These patients should be observed for several months with serial serologic testing.
- If there is evidence of hepatic decompensating, such as jaundice or coagulopathy, treatment should be initiated earlier
- Several other considerations may be relevant to treatment decisions (co-infected with HCV, HIV or HDV)

Choice of treatment:

- Lamivudine, TDF and interferon (IFN), are licensed for use in children, Adefovir approved for use in those over 12 years of age.
- IFN alfa as the first-line treatment for the patients with serum ALT more than twice the upper limit of normal, have positive HBeAg, who are committed to adhering to the treatment, and have no comorbid diseases that might be exacerbated by an immunostimulatory agent.
- If the patient does not respond to IFN alfa (defined by detectable HBV DNA and elevated serum ALT six months after completion of the course of IFN alfa), a nucleoside/nucleotide analog such as lamivudine or Adefovir can be used – this shall be considered as primary treatment if IFN alpha not available

Note:

- All children who are Hep B and C positive should be referred to the Hospital
- Hepatitis Clinic for management and follow-up according to national guideline

8.4.3 Acute liver failure (ALF).

Definition: Acute liver failure is the rapid deterioration of liver function due to massive necrosis of liver cells resulting into coagulopathy and alteration in the mental status of a previously healthy individual. It is a complex, uncommon illness which can rapidly progress to multisystem organ failure and death. ALF is defined as:

- Biochemical evidence of acute liver injury in a child with no known evidence of chronic liver disease along with at least one of the following
- INR > 1.5, not corrected with vitamin K supplementation, with encephalopathy
- INR > 2.0, not corrected with vitamin K supplementation, without encephalopathy.

Causes:

- Hepatotoxicity due to drugs like Paracetamol
- Viral (hepatitis, cytomegalovirus, hemorrhagic fever viruses, herpes simplex virus)

- Autoimmune hepatitis
- Miscellaneous causes
- Poisons e.g. Mushrooms

Signs and symptoms:

- Malaise
- Vomiting
- Anorexia
- Stupor/Encephalopathy
- Foetor hepaticus
- Bleeding tendency
- Ascites
- Jaundice often present but not always
- Ascites

Diagnosis:

Based on the above clinical signs and symptoms

Investigations:

- Liver function tests: AST, ALT, GGT, alkaline phosphatase, fractionated bilirubin, albumin, total protein - Raised or low liver enzymes, low serum albumin, raised bilirubin
- BUN, creatinine, blood glucose, calcium, magnesium and phosphorus
- Coagulation factors and profile: PT-INR, aPTT, , factors V, VII, VII- Elevated INR and prolonged prothrombin time
- Fibrinogen low levels
- Complete blood count with platelets and differential
- Urea-creatinine and electrolytes
- Ammonium levels if available
- Viral for hepatitis A, B, C, D, E, non-A, non-B viral hepatitis, EBV, CMV, etc.
- Tests specific for suspect cause of liver injury

Imaging and liver biopsy

- Ultrasound liver with Doppler study
- Liver biopsy as indicated

Management:

Non-pharmacological treatment:

- Transfer where there is high care or intensive care unit
- Monitor blood pressure, urine output, heart rate, neurological state, respiration, gastrointestinal bleeding, haematocrit, blood glucose (3 hourly if comatose), acid–base status, liver and renal functions, coagulation (INR), electrolytes: sodium, potassium, calcium and phosphate
- Maintain hydration
- Aim to reduce ammonia production by the gut and optimize renal excretion for patients with encephalopathy
- Withdraw protein completely initially followed by restricted intake if level of consciousness improves, i.e. 0.5–1 g/kg/24 hours

- Stop medium chain triglyceride supplements but maintain an adequate energy intake
- Stop sedatives, diuretics and hepatotoxic drugs, if possible

Pharmacological treatment:

- Lactulose, oral, 1 g/kg/dose 4–8 hourly via nasogastric tube, then adjust dose to produce frequent soft stools daily (to reduce intestinal protein absorption)

OR

- Polyethylene glycol solution with sodium sulphate and electrolytes, oral/via nasogastric tube, 10–25 mL/kg/hour over 6 hours. Follow with lactulose.
- Neomycin, oral, 12.5 mg/kg/dose 6 hourly for 5 days
- Mannitol, IV, 250 mg/kg administered over 30–60 minutes (if cerebral Oedema with serum osmolality < 320)
- Fresh frozen plasma, IV, 20 mL/kg over 2 hours (pre-operative)
- Vitamin K1, IV/oral, 2.5–10 mg daily never gives IM
  - Monitor response to vitamin K1 with INR and PTT
- Platelet transfusion (if platelet count < 10 x 10^3/L or if < 50 and with active bleeding
- Cimetidine, IV/oral 10 mg/kg/day 12 hourly
  OR
- Omeprazole, oral initiated by the specialist;
  - Neonate 1–2 mg/kg, 12– 24 hourly
  - 1 month–2 years 5 mg, 12 hourly
  - 2–6 years 10 mg, 12 hourly
  - 7–12 years 20 mg, 12 hourly

  AND/OR
- Sucralfate, oral, 250–500 mg 6 hourly
- Dextrose 10%, IV bolus 2,5 mL/kg (for patient with hypoglycaemia)
- Ringers lactate with dextrose 5%, IV, 60–80mL/kg/day, ensure a minimum of 3–6 mmol/kg/day of potassium
- Avoid diuretics
- Packed red cells, 10 mL/kg over 3 hours if haemoglobin < 7 g/dL For anaemia
- For sedation, if essential;
  - Midazolam, IV, 0.1 mg/kg Amelioration of liver injury, especially in idiopathic/toxin cases
  - Ampicillin, IV, 25 mg/kg/dose, 6 hourly + Cefotaxime, IV, 25–50 mg/kg/dose, 6–8 hourly + Nystatin 100 000 units/mL, oral, 0.5 mL after each feed. Keep nystatin in contact with affected area for as long as possible

Recommendation:

- All cases of liver failure should be managed in a referral /Tertially hospital

8.5 SEPTICAEMIA

Definition: Septicemia is a systemic inflammatory response (SIRS) to suspected or proven infection.

Sepsis is a major cause of hospital admission, morbidity, and mortality in children. The elements of optimal septic management include: recognition of changes in clinical condition and vital signs, such as fever, tachycardia, and changes in peripheral perfusion, which should raise concern for sepsis; initial stabilization of airway, breathing, and circulation; timely administration of empiric antimicrobial therapy; use of fluid boluses and vasoactive medications is critical for early stabilization and setting stage for eventual treatment.

Causes:

- Bacterial: (Streptococcus pneumoniae, Haemophilus influenzae type b, Neisseria meningitides, group A streptococcus, S. aureus, Salmonella)
- Viral infection: (influenza, enteroviruses, hemorrhagic fever group, HSV, RSV)
- Encephalitis: (arboviruses, enteroviruses, HSV)
- Vaccine reaction (pertussis, influenza, measles)
- Toxin-mediated reaction (toxic shock, staphylococcal scalded skin syndrome)

Clinical evaluation:

- Assess Airway, Breathing (RR, signs of respiratory distress and pulse oximetry),
- Circulation (HR, BP, Skin for signs of dehydration, JVP)
- SIRS a is systemic inflammatory response with at least two of the following four criteria, one of which must be abnormal temperature or leucocyte count:
    - Core temperature of < 36ºC or > 38.5ºC,
    - Tachycardia,
    - Tachypnoea,
    - Increased WBC (>12,000/mm3) or decreased (<4000/mm3) PLUS, one of the following:
        - Cardiovascular dysfunction,
        - Acute respiratory distress syndrome, or
        - ≥ 2 other organ dysfunctions
- Identify source of infection e.g pneumonia, abdominal abscess, meningitis e.t.c
- Assess organ function e.g. CNS (LOC, focal signs) , Renal function for urinary output

Diagnosis: Based on signs and symptoms complemented by laboratory investigations

Clinical

On examination, look for the following:

- Fever with or without obvious focus of infection
- Blood film for malaria is negative
- No stiff neck or other specific signs of meningitis (or a lumbar puncture for meningitis is negative)
- Signs of systemic upset (e.g. inability to drink or breastfeed, convulsions, lethargy or vomiting everything)
- Purpura may be present.
- Always fully undress the child and examine carefully for signs of local infection before deciding that no cause can be found.

Laboratory evaluation

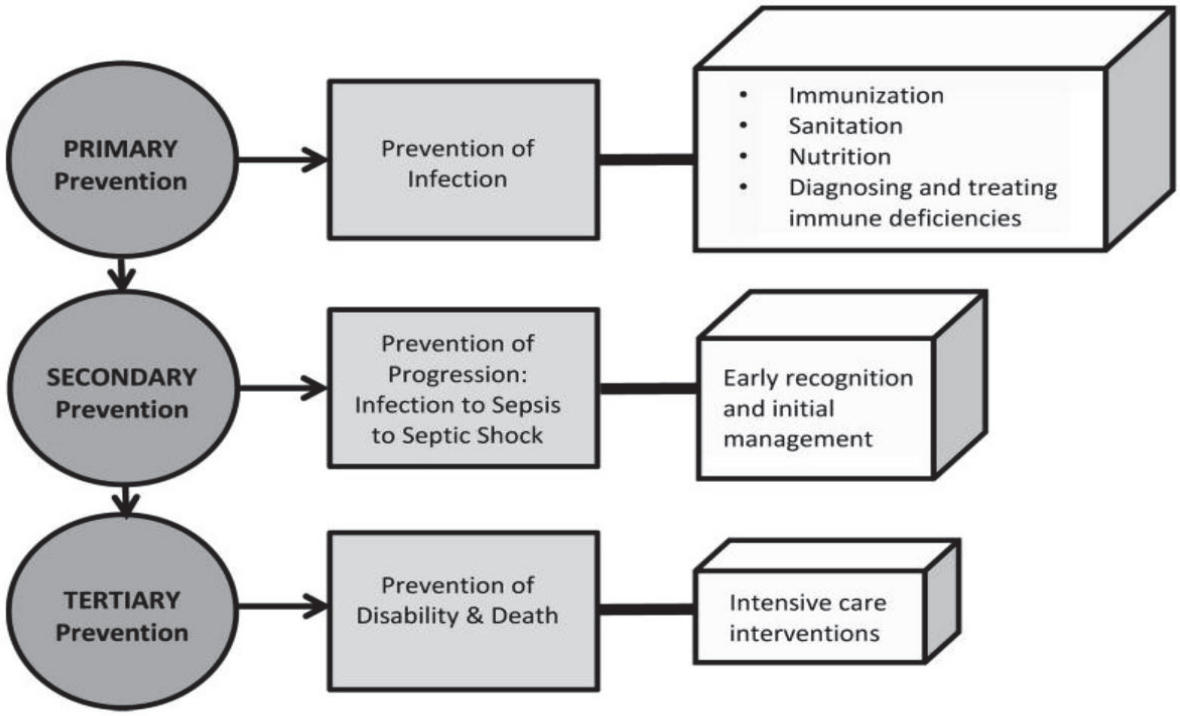
- Identify SIRS; CBC and White-cell differential
- Identify source of infection; Blood, urine, CSF, sputum culture and sensitivity analysis, Chest radiography and ultrasonography when indicated.
- Assess organ function;
  - Renal function: Electrolytes, BUN, creatinine.
  - Hepatic function: Bilirubin, AST, alkaline phosphatase
  - Coagulation: INR, PTT, platelets

Complications:

- Convulsions
- Confusion or coma
- Dehydration
- Multi-organ failure
- Disseminated intravascular coagulation(with bleeding episodes)
- Pneumonia
- Septic shock; which is the main cause of death

Prevention

Figure 11: Prevention of infection



Management:

- Assess for Airway, Breathing, Circulation, and Dehydration followed by appropriate management.
- Treat the source of sepsis e.g abscess, peritonitis.

- First choice treatment
  - Neonates: Cefotaxime, IV, 50mg/kg/dose 12 hrly (for <2 kg or <35weeks); 50mg/kg/ dose 8hrly (for term<7 days) and 50mg/kg/dose 6hrly (for term>7 days)
  - Children > 1 month: Ceftriaxone, IV, 50 mg/kg/dose, 12 hourly.

Alternative:

  - Give IV ampicillin at 50 mg/kg every 6 h plus IV gentamicin 7.5 mg/kg once a day for 7–10 days
- If staphylococcal infection is suspected use Cloxacillin, IV, 50 mg/kg/dose 6 hourly for at least 14 days, (longer courses often required).

Monitoring

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

Recommendation:

- Immunization with the conjugate H. influenzae type b and S. pneumoniae vaccines is for all infants.

N.B Use of Corticosteroids in patients with sepsis has adverse effects like hyperglycemia and immunosuppression thus leading to nosocomial infection and impaired wound healing. Studies reveal that early use of short-course, high-dose corticosteroids does not improve survival in severe sepsis.

8.6 SEPTIC ARTHRITIS

Definition: Septic arthritis is defined as an acute articular suppurative infection caused by pyogenic microorganisms. It may occur as a result of haematogenous seeding of the synovium during transient periods of bacteraemia and often part of a generalised septicaemia which may involve more than one joint.

Causes

Table 39: Causes of Septic Arthritis in different age groups

Neonates	S.aureus, Group B. Streptococci, E. coli, fungi
Infants/children	S.aureus, H. influenzae, Group A Streptococci, S. pneumonia
Children - Sexually active	N. gonorrhoea
Chronic septic arthritis	Brucella, tuberculosis, atypical mycobacteria, fungi and other uncommon organisms

Risk factors:

- Trauma
- Rheumatoid arthritis or osteoarthritis
- Sickle cell disease
- Skin infections
- Sexual activity
- Immune deficiency (HIV, etc.)

Symptoms and signs:

- Fever, local pain, loss of function and toxic/septic looking child.
- In neonates and infants signs and symptoms may be nonspecific and subtle (not well remarked)
  - Malaise, irritability, feeding problems and pseudoparalysis
- Local tenderness, warmth, swelling at a joint with restriction of passive and active movement.
- Poor weight gain

Old infants and children:

- Acute onset of pain, warm, and swollen joint
- Usually monarticular and affecting large weight-bearing joints (knee, shoulder or hip)

Complications:

- Sepsis
- Osteomyelitis
- Destruction of articular cartilage, permanently damagee to the joint
- Secondary infectious site (bacterial endocarditis, brain abscess, etc.)

Investigations:

- Joint ultrasonography
- Aspiration of pus under ultrasound guidance for microscopy, Gram stain, culture and sensitivity.(Done by a specialist/orthopedic surgeon)
- FBC and CRP
- X-ray
- Blood and/or pus culture and sensitivity before starting antibiotic treatment
- Scintigraphy where available
- MRI

Management:

Non- pharmacological management:

- Emergency surgical drainage of pus from infected joints

Pharmacological management:

Antibiotics: Minimum duration of therapy is 4–6 weeks.

Neonates:

- Cloxacillin IV:
  - 1st -2nd week of life: 50 mg/kg/dose 12 hourly,
  - 3rd – 4th week of life: 50mg/kg/dose 8 hourly
  - > 4 weeks of life 50mg/kg/dose 6 hourly + Cefotaxime, IV, 50 mg/kg/dose (preterm 12 hourly, 1st week of life 8 hourly and > 2 weeks 6 hourly)

Infants and children:

- Cloxacillin IV 50mg/kg/dose, 6 hourly PLUS Cefotaxime IV 25–50mg/kg/dose, 6 hourly
- Do arthrocentesis and culture to treat appropriately to sensitivities

Antipyretics and anti-inflammatories:

- Ibuprofen, oral, 10–15 mg/kg/dose, 6 hourly (>6 months)

- Ensure adequate pain management in addition to anti-inflammatory with addition of paracetamol 10-15mg/kg/dose q 6hrly to ibuprofen.

Recommendations:

- Penicillin antibiotic given for up to 6 weeks, with the first 2 weeks administered intravenously followed by a switch to oral treatment if an oral option exists and clinical signs, symptoms, and inflammatory markers are settling
- IV antibiotics regimen is adjusted based on the results of culture and sensitivity testing

Alternative:

- Vancomycin 50mg/kg/day divided in 3 doses. Maximum dose is 1g/dose

8.7 ACUTE OSTEITIS/OSTEOMYELITIS

Definition

Osteitis is inflammation of the bone while osteomyelitis is an infection of the bone.

Most cases of bone infection result from haematogenous deposition of organisms in the bone marrow after a transient bacteraemia episode. Osteomyelitis most commonly begins in the metaphyses of long bones which are highly vascular. The spread of infection through the epiphysis can result in septic arthritis.

Causes:

- Neonates: S. aureus, Group B Streptococci, Gram negative (E. coli).
- Infants/children: S. aureus, H. influenzae, Group A Streptococci, S. pneumoniae.
- Traumatic direct infection: P. aeruginosa (penetrating foot wounds).
- Co-existing medical conditions e.g. diabetes, HIV, leucopoenia: M. tuberculosis, fungi.
- Sickle cell disease: Salmonella, pneumococcus.

Diagnostic criteria

Clinical

- Local pain and tenderness, loss of function, general toxicity and fever.
- If lower extremities are involved (development of a limp or refusal to bear weight).
- In neonates, early signs may be subtle or non-specific, e.g. irritability, feeding problems and pseudoparalysis.
- Investigate for multi-organ disease, e.g. endocarditis, pericarditis and pneumonia.

Investigations

- Full blood count (raised white cell count)
- CRP raised
- Aspiration of pus for microscopy, Gram stain, culture and sensitivity.
- Blood culture
- X-ray after 2 weeks.
- MRI.
- Bone scan (Tc99) if available.

General Management

- Immobilize affected limb in position of function.
- Supportive and symptomatic care.

Medications

- Minimum duration of therapy: 4–6 weeks.
- Initiate IV antibiotic treatment immediately as diagnosis is made and blood and pus specimens have been collected.
- Adjust antibiotic therapy based on culture results or if response to antibiotic treatment is unsatisfactory.
- Where a single agent has been found to be sensitive, continue treatment on that single agent.
- Continue with IV antibiotics until there is evidence of good clinical response and laboratory markers of infection improve. Once clinical improvement and inflammatory markers have normalized, patients can be switched to oral antibiotic therapy.
- Ongoing fever suggests an un drained focus of pus.

Neonates:

- Cloxacillin, IV, 50 mg/kg/dose
  - If 1st week of life: 12 hourly.
  - If 2nd–4th week of life: 8 hourly.
  - If > 4 weeks old: 6 hourly.

PLUS

- Cefotaxime, IV, 50 mg/kg/dose.
  - Preterm (or<2kg): 12 hourly.
  - If 1st week of life: 8 hourly.
  - If > 1 weeks old: 6 hourly.

Infants and children:

- Cloxacillin, IV, 50 mg/kg/dose 6 hourly.
  PLUS
- Ceftriaxone, IV, 50 mg/kg/dose 12 hourly.

Special Circumstances

- If MRSA, replace Cloxacillin with vancomycin.
  - Vancomycin IV, 15 mg/kg/dose administered over 1 hour given 8 hourly (Monitor renal function)
- Penetrating foot bone injuries: replace cefotaxime with ceftazidime plus an aminoglycoside:
  - Ceftazidime, IV, 50 mg/kg/dose 6 hourly.
    PLUS
  - Gentamicin, IV, 6 mg/kg once daily.

Oral antibiotics

- Can transition to oral therapy once there is sustained clinical improvement, resolution of fever, normal white cell count and CRP 4-6 weeks of treatment.
- Cloxacillin oral, 25-50mg/kg/dose, 6 hourly (max dose: 2 gr/dose).

Referral: Refer or discuss all cases with an orthopaedic surgeon

References

1. James A. Russell. Management of Sepsis: N Engl J Med 2006; 355:1699-1713
2. WHO: POCKET BOOK OF Hospital care for children
3. Dellinger RP, Carlet JM, Masur H, et al. Surviving Sepsis Campaign guidelines for management of severe sepsis and septic shock. Crit Care Med 2004; 32:858-73.
4. Rivers E, Nguyen B, Havstad S, et al. Early goal-directed therapy in the treatment of severe sepsis and septic shock. N Engl J Med 2001; 345:1368-77.
5. Meduri GU, Headley AS, Golden E, et al. Effect of prolonged methylprednisolone therapy in unresolving acute respiratory distress syndrome: a randomized con-trolled trial. JAMA 1998; 280:159-65.
6. Steinberg KP, Hudson LD, Goodman RB, et al. Efficacy and safety of corticosteroids for persistent acute respiratory distress syndrome. N Engl J Med 2006;354:1671-84.

8.8 SALMONELLA INFECTIONS (TYPHOID FEVER)

Definition: Typhoid fever is a systemic infection with the bacterium Salmonella enterica serotype typhi and parathyphi. There are 3 distinct salmonellosis syndromes: nontyphoidal Salmonella (NTS) gastroenteritis, NTS extra intestinal disease, and typhoidal Salmonella (TS) enteric fever. TS are the cause of enteric (typhoid and paratyphoid) fever, a systemic disease with significant mortality and morbidity in developing countries.

Causes and risk factors

- Both Salmonella enterica serotypes Typhi and Paratyphi are exclusive human reservoirs and fecal-oral transmission.
- More than 95% of all transmission occurs through food, especially eggs.
- Water contaminated by faeces from an infected person carries the disease.
- Symptoms are most severe in infants, immunocompromised and those with other comorbidities
- Immune compromised patients are frequently affected and have recurrences

Signs and symptoms

Initial signs and symptoms:

- Prolonged or high fever (≥38.8) in plateau, with profuse sweating, in a previously healthy individual, lasting>1 week; the person may become delirious and possible convulsions
- A slower pulse rate than expected with the level of fever (pulse and temperature dissociation)
- Dull frontal headache, chills, malaise or myalgias.
- Poorly localized abdominal pain, constipation, anorexia, nausea and diarrhoea later in the illness; may be accompanied by frank bleeding.
- A coated tongue, abdomen tenderness and hepatosplenomegaly are common findings
- Jaundice may occur

Signs of complications

- Intestinal perforation—abdominal tenderness, with sudden increase in pulse rate and hypotension
- Altered mental status

NB: there is no typhoid fever without fever or hypothermia in infants !!!

Diagnosis:

On examination, key diagnostic features of typhoid are:

- Fever with no obvious focus of infection
- No stiff neck or other specific signs of meningitis, or a lumbar puncture for meningitis is negative (note: children with typhoid can occasionally have a stiff neck
- Signs of systemic upset, e.g. inability to drink or breastfeed, convulsions, lethargy, disorientation/confusion, or vomiting everything.
- Rose spots on the abdominal wall in light-skinned children
- Hepatosplenomegaly, tense and distended abdomen.

Note:

- Typhoid fever can present atypically in young infants as an acute febrile illness with shock and hypothermia.
- The differential diagnosis is broad and includes malaria, amoebiasis, dengue fever, leishmaniasis, and other causes of bacterial gastroenteritis

Laboratory evaluation

- FBC (may show leukocytosis or leucopenia, thrombocytopenia, severe anaemia follows intestinal bleeding)
- Blood culture (Gold standard) will isolate the bacteria during the first 2 weeks of illness.
- Stool culture will isolate the bacteria during the later period of illness.
- Plain X-rays of abdomen in erect position will show gas under the diaphragm if there is gut perforation

Note:

- Serologic tests such as the Widal test have limited clinical utility in endemic areas because positive results may represent previous infection. Positive serology alone shall never be a base for treatment of typhoid fever.

Complications:

- **GIT:** gastrointestinal bleeding, intestinal perforation, abdominal mass due to abscess formation
- **CVS:** Asymptomatic electrocardiographic changes, Myocarditis, Shock
- **CNS:** Encephalopathy, Delirium, Psychotic behaviour, Meningitis, Impairment of coordination.
- **Haematologic:** Anaemia, Disseminated intravascular coagulation
- **Respiratory**: Bronchitis, Pneumonia (Salmonella enterica serotype typhi, Streptococcus pneumoniae)
- **Others**: Focal abscess, Pharyngitis, Relapse and Chronic carriage

- Chronic carriers frequently have high serum antibody titers against the Vi antigen, which is a clinically useful test for rapid identification of such patients

Management:

Management objectives:

- Control the fever with paracetamol (or Ibuprofen as a second option)
- Prevent dehydration and correct it if present
- Prevent the spread of the disease in the community

Nonpharmacological management

- Encourage adequate oral fluids or initiate IV infusion.
- Ensure appropriate nutrition.
- Tepid sponging with lukewarm water (32-35oC) to reduce the fever.
- Isolate the patient
- Identify and treat all carriers

Pharmacological

- Paracetamol at 10-15mg/kg/dose every 6-8hrs to control fever (or Ibuprofen 5-10mg/kg/dose 8 hrly)
- Rectal/IV Diazepam if there are convulsions (or IV Phenobarbitone if indicated)
- Blood transfusion in case of severe bleeding
- Ciprofloxacin iv 10mg/kg/dose (max400mg) 12 hourly or 15mg/kg (max500mg) orally 12 hourly for 7-10 days OR
- Ceftriaxone 50 mg/kg 12 hourly IV for 7-14 days OR
- Cefotaxime 50 mg/kg IV 6 hourly for 7-14days OR
- Cefixime 20 mg/kg/day 12 hourly for 10-14 days (high dose specific to typhoid fever)

Follow up review: check for the following:

- Efficacy of treatment: fever
- Perforation (abdominal pain, tenderness,)
- Myocarditis (heart rate, gallop rhythm)

8.9 VARICELLA ZOSTER VIRUS (CHICKEN POX, VZV)

Definition

An acute, highly contagious, viral disease caused by varicella-zoster virus.

It spreads by infective droplets or fluid from vesicles. One attack confers permanent immunity. Varicella is contagious from about 2 days before the onset of the rash until all lesions crusted.

Re-activation of the virus may appear later as herpes zoster or shingles (in children, consider immunosuppression if this occurs). Incubation period is 2–3 weeks.

Complications are more common in immunocompromised patients and include:

- Secondary skin infection,
- Pneumonia,
- Necrotizing fasciitis,
- Encephalitis,

- Haemorrhagic varicella lesions with evidence of disseminated, intravascular coagulation.
- Two important bacteria causing complications are Staphylococcus aureus and Streptococcus pyogenes

Diagnostic criteria

Clinical

- Mild headache, fever and malaise.
- Characteristic rash.
- The lesions progress from macules to vesicles in 24–48 hours.
- Successive crops appear every few days.
- The vesicles, each on an erythematous base, are superficial, tense 'teardrops' filled with clear fluid that dries to form fine crusts.
- The rash is more profuse on the trunk and sparse at the periphery of extremities.
- At the height of eruption, all stages (macules, papules, vesicles and crusts) are present at the same time.
- The rash lasts 8–10 days and heals without scarring, unless secondarily infected.
- Mucous membranes may be involved.
- Pruritus may be severe.
- Patients are contagious from 1–2 days before onset of the rash until crusting of lesions

Management

- Isolate the patient.
- Maintain adequate hydration.

Medications

- Antiviral therapy
- Indicated for immunocompetent patients with complicated varicella and for all immunocompromised patients.
- Initiate as early as possible, preferably within 24 hours of the appearance of the rash.
- Neonates, immunocompromised patients and all cases with severe chickenpox (not encephalitis)
- Acyclovir, oral, 20 mg/kg/dose 6 hourly for 7 days. Maximum dose: 800 mg/dose.
- In severe cases or in cases where oral medicine cannot be given: Acyclovir, IV, 8 hourly administered over 1 hour for 7 days
    - If 0 – 12 years: 20 mg/kg/dose 8 hourly.
    - If > 12 years: 10 mg/kg/dose 8 hourly

For mild pruritus:

- Calamine lotion, topical, applied 8 hourly.

For severe pruritus:

- Give Desloratidine for 7 days as follow:
    - Children 1 through 5 years of age: 2.5 ml (1.25 mg) once a day
    - Children 6 through 11 years of age: 5 ml (2.5 mg) once a day

OR

- Over 2 years: Cetirizine, oral, 2.5-5 mg 12-24 hourly.

Secondary skin infection

- Cephalexin, oral, 12.5 mg/kg/dose, 6 hourly for 5 days.
- Prophylaxis: Post exposure prophylaxis must be given to:
  - Neonates whose mothers develop varicella from 5 days before delivery to 2 days after delivery:
  - Varicella-zoster immunoglobulin, IM, 1 mL (100 units) given within 96 hours of exposure.
  - If varicella-zoster immunoglobulin is not available: Acyclovir, oral, 20 mg/kg/dose 6 hourly for 10 days.
  - Note: In neonates, prophylaxis may not prevent disease.

Infants and children > 28 days

- Immunocompromised children exposed to varicella:
  - Acyclovir, oral, 20 mg/kg/dose 8 hourly for 10 days given in the second week after exposure.
- Hospitalised immunocompetent children exposed to varicella (to limit spread).
  - Acyclovir, oral, 20 mg/kg/dose 8 hourly for 10 days given in the second week after exposure.

Referral: All patients with complications.

8.10 MUMPS

***Definition*:** A viral infection primarily involving the salivary glands.

Incubation period: 14–21 days.

Signs and symptoms:

- Fever.
- Pain on opening the mouth or eating.
- About two days later a tender swelling appears below the ears at the angle of the jaw often first on one side and later on the other.
- The swelling disappears in about 10 days.

General measures

- Bed rest during febrile period.
- Advise on oral hygiene.
- Recommend plenty of fluids and soft food during acute stage.
- Patient is infectious from 3 days before parotid swelling to 7 days after it started.
- Isolate until swelling subsides.
- Children may return to school 1 week after initial swelling.

Medication

Children

- Paracetamol, oral, 10–15 mg/kg/dose 6 hourly when required.

Referral

- Abdominal pain (to exclude pancreatitis).
- Painful swollen testes (orchitis).
- Suspected meningoencephalitis.

Reference

1. Bula-Rudas FJ, Rathore MH, Maraqa NF. Salmonella Infections in Childhood. Adv Pediatr. 2015 Aug;62(1):29-58. doi: 10.1016/j.yapd.2015.04.005. PMID: 26205108.
2. Christenson JC. Salmonella Infections. Pediatr Rev. 2013;34(9):375–38324000341
3. Bhutta ZA. In: Kliegman RM, Stanton B, St. Geme J, Behrman RE, Schor NF, eds. Salmonella. Nelson Textbook of Pediatrics. Vol 1. 20th ed. Milwaukee, WI: Medical College of Wisconsin; 2016:1382–1393
4. American Academy of Pediatrics. In: Kimberlin DW, Brady MT, Jackson MA, Long SS, eds. Salmonella Infections. Red Book: 2015 Report of the Committee on Infectious Diseases. 30th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2015:695–701

CHAPTER 9: ENDOCRINE SYSTEM CONDITIONS

9.1 DIABETES MELLITUS

Definition: Diabetes mellitus is disorder of absolute or relative insulin deficiency that results in increased blood glucose and disruption of energy storage and metabolism. Diabetes Mellitus is generally divided into two classifications: Type 1 Diabetes Mellitus and Type 2 Diabetes Mellitus.

Type 1 Diabetes Mellitus: This results from the auto-immune destruction of the pancreatic beta cells that leads to absolute insulin deficiency. Type I diabetes accounts for approximately 2/3 of the new diagnosis of diabetes in patients $\leq$ 19 years old. There is a component of genetic susceptibility and close relatives of patients with type I DM are at higher risk of developing the disease.

Type 2 Diabetes Mellitus: This is secondary to varying degrees of insulin resistance and insulin deficiency and is related to both genetic and environmental influences including predisposing medications such as steroids and some ARVs. It is the most common type of diabetes mellitus in adults.

Neonatal diabetes: It is due to specific gene defect and may be permanent or transient. Many cases of neonatal diabetes were previously assumed to require insulin but, in fact, with modern genetic testing, such children even many years later can be successfully-and better- treated with sulfonylurea oral tablets instead of insulin. It is defined as persistent hyperglycaemia occurring in the first months of life that lasts more than 2 weeks The majority of affected infants are small for gestational age and present with weight loss, volume depletions, hyperglycaemia and glycosuria with or without ketonuria and ketoacidosis.

Signs and Symptoms:

History of:

- Polyuria: This occurs when the serum glucose concentration rises above 180 mg/dl exceeding the renal threshold for glucose and leads to increased urinary glucose excretion and a subsequent osmotic diuresis. This may present as nocturia, bedwetting, or daytime incontinence in a previously toilet trained child, or heavy diapers.
- Polydipsia: This is secondary to increased thirst from increased serum osmolality and dehydration.
- Rapid/ acidotic breathing
- Polyphagia: This is due to an increased appetite that occurs initially secondary to loss of calories from glycosuria. This symptoms is not always present.
- Weight loss: This is due to hypovolemia and increased catabolism.
- Weakness/Lethargy with ultimate progression to coma: This is secondary to hypovolemia and electrolyte disturbances including progressive acidosis.
- Visual disturbances: This is secondary to osmotic changes in the lens.
- Altered level of consciousness

- Further history to exclude other co-existing autoimmune disease such as hypothyroidism, vitiligo, rheumatoid arthritis, etc., and to further ask about family history of endocrinopathies or autoimmune diseases

Physical examination:

- Full general and systemic examination (should include the assessment of injection sites to rule out lipohyperdystrophy, thyroid enlargement, pus collection etc)
- Fundoscopy: to rule out diabetic retinopathy by ophthalmologist.
- Foot examination: for features of diabetic neuropathy and diabetic wounds

Diagnosis:

Clinical: The diagnosis should be suspected based on the signs and symptoms described above. Any of the above signs or symptoms should prompt further investigations.

Investigations:

- Blood sugar: Diagnostic criteria for diabetes mellitus:
  - Symptoms of DM plus random plasma glucose ≥200 mg/dl (11.1 mmol/L) OR
  - Fasting plasma glucose ≥126 mg/dl (7.0 mmol/L). Fasting is defined as no oral intake for at least 8 hours.
    OR
  - Two-hour plasma glucose ≥200 mg/dl during an oral glucose tolerance test (OGTT) as described by the WHO.
    OR
  - HgA1C > 6.5 percent. This laboratory should be performed in a certified laboratory with an assay standardized to the diabetes control and complications trial (DCCT) (not used for diagnosis in the paediatric population).
- Additional studies to evaluate severity and complications of the disease:
  - Blood gas if concern for diabetic ketoacidosis (where) available.
  - Electrolytes
  - Renal function tests (urea and creatinine) to evaluate for diabetic nephropathy and dehydration.
  - Urine analysis to check for glycosuria, ketones, and protein
  - HbA1c: to assess response to therapy.
  - Lipid profile
  - Thyroid-stimulating hormone (TSH): This should be performed in type 1 diabetics as autoimmune diseases may occur together.

Note Symptoms + Random BS or symptoms + Fasting BS or Symptoms + OGTT should be enough. HbA1C is used instead to assess compliance on subsequent visits.

Complications:

Short-term complications:

- Diabetic ketoacidosis (DKA): Occurs more frequently in type I diabetes mellitus, but may occur in some forms of type II diabetes mellitus.
- Hyperosmolar hyperglycaemic state (HHS): Occurs in type II diabetes mellitus.

- Insulin resistance secondary to hyperglycaemia: This occurs in both type I and type II diabetes mellitus.
- Infections due to immunosuppression and commonly include oral candidiasis and urinary tract infections.
- Death: Patients presenting with DKA or HHS have a high mortality rate.

Long Term complications:

- Vascular complications including both microangiopathy and macroangiopathy:
    - Nephropathy
    - Retinopathy
    - Neuropathy
    - Cardiovascular disease
    - Hypertension
- Dyslipidaemia
- Growth retardation or obesity depending on the insulin therapy. Patients may also have delayed puberty secondary to poor growth.
- Psychiatric disorders including depression related to their chronic disease.

Management:

***General objectives*:**

- Maintain normal glycaemia with insulin therapy or oral medications (in type II diabetes mellitus) to prevent both the signs and symptoms of uncontrolled hyperglycaemia and the complications mentioned above.

Non-pharmaceutical management

- Assess A-B-C-D (Airway, Breathing, Circulation, Disability)
- If patient has signs or symptoms of diabetic ketoacidosis (DKA) or hyperosmolar hyperglycaemic state, this is an emergency and treatment must be initiated immediately.
- The patient and the family should be counselled on the cause and the treatment of diabetes and its management. The patient and the family should be taught how to monitor blood glucose, record the test results, administer and adjust insulin doses based on blood glucose values and food intake.
- They family should be counselled on the complications of diabetes mellitus and how to manage them. In particular, they should know the signs and symptoms of acute hypoglycaemia and its management. They should also understand the importance of maintaining normoglycemia to avoid long-term complications. They should be instructed on how to manage acute illnesses in the context of diabetes mellitus, for example how to manage their insulin dose if they are unable to tolerate oral intake.
- Diet modification is important in both type I and type II diabetes mellitus. A nutritionist should be involved in providing individualized recommendations.

Pharmaceutical management

- The majority of children with diabetes mellitus have type I diabetes and may present with diabetic ketoacidosis (DKA). The management of DKA is detailed below.

- Diabetes Mellitus Type I: Children with Diabetes Mellitus Type I require insulin therapy. The patient is insulin dependent and while the insulin therapy may be adjusted based on the clinical condition and blood glucose results, the insulin therapy should NEVER be stopped completely as this could result in the development of DKA and death.

9.1.1 Diabetic Ketoacidosis

***Definition*:** DKA is the increase in the serum concentration of ketones greater than 5 mEq/L (Urine ketones on dipstick ++, a blood glucose level greater than 200 mg/dL and a blood pH less than 7.3.

Other features include: Ketonaemia, ketonuria and low serum bicarbonate level <18 mEq/L.

Causes:

- Previously undiagnosed diabetes
- Interruption of insulin therapy
- Underlying infection and intercurrent illness
- Poor management of DM type 1
- Stress
- Medication like corticosteroids

Signs and Symptoms:

The signs and symptoms of DKA can develop suddenly and include:

- Polydipsia
- Polyuria
- Nausea and vomiting
- Abdominal pain
- Weakness or fatigue
- Rapid deep breathing
- Fruity-scented breath
- Confusion or drowsiness
- Hot, dry skin
- Blurred vision

Suspect DKA even if the blood glucose is normal in a child with known diabetes and any of the following:

- Nausea or vomiting
- Abdominal pain
- Hyperventilation
- Dehydration
- Reduced level of consciousness

Investigations:

- Blood glucose
- Urine dipsticks for glucose and ketones
- Blood urea and electrolytes
- Malaria
- Full blood count
- Blood and urine cultures

Management:

DKA treatment goals

- Management of A,B, C
- Admission to HDU/ICU if possible for close monitoring
- Correct dehydration with intravenous fluids
- Correct hyperglycaemia with insulin and iv fluids
- Correct acidosis and reverse ketosis
- Monitor for complications of DKA (cerebral oedema).
- Correct electrolyte imbalances, especially potassium loss
- Restore blood glucose to near normal.
- Identify and treat any precipitating event.

Fluid requirements

- Fluids for resuscitation in shock:
  - Sodium chloride 0.9%, IV, 10–20 mL/kg over 10–30 minutes.
  - Repeat if shock persists.
- Fluid requirements after resuscitation
  - Fluid requirement = deficit + maintenance
  - Calculate deficit = estimated 10% dehydration x body weight (e.g. 10kg with 10% dehydration 10 x 100 = 1000mL)
  - Calculate maintenance (mL): use the Holliday–Segar formula (max wt.75kg :
    - ≤1 year: 120 mL/kg/24 hours
    - All children older than 1 year; it is the sum of the following:
      - First 10 kg body weight: 100 mL/kg/24 hours
      - Second 10 kg body weight: 50 mL/kg/24 hours
      - Additional weight > 20 kg body weight: 20 ml/kg/24 hour
- Add the deficit to 48 hour maintenance and replace this volume evenly over 48 hours, initially with sodium chloride 0.9%.
  Example 6 year old with 24kg
  Deficit after resuscitation is 50 x 24 = 1200ml
  Maintenance (100 x 10) + (10 x 50+ (4 x20) = 1580ml/24hour
  Maintenance in 48 hours = 1580 x 2 = 3160ml
  Deficit + maintenance = 3160+1200 = 4360
  Rehydration will be 4360/48 = 91ml/hour
- When blood glucose falls to < 15 mmol/L change the infusion to a dextrose containing maintenance fluid, e.g. dextrose 5% in sodium chloride 0.45%.
- Assess hydration status at least every 3 hours

Table 40: Alternative Rehydration plan:

AGE	1st hour	Next 7 hours	Next 16hours
< 1 yr	20 ml/kg	15 ml/kg	7 ml/kg
1 - 7 yrs	20 ml/kg	10 ml/kg	5 ml/kg
8 – 14 yrs	20 ml/kg	9 ml/kg	5 ml/kg
> 15 yrs	20 ml/kg	8 ml/kg	4 ml/kg

Emergency Insulin Therapy:

- Delay insulin until serum K+ is > 3,5 mmol/l
- Insulin should only be started after 30-60 minutes of fluid therapy, provided shock has been treated.
- Use regular Insulin short-acting (Actrapid or Humulin R), IV, 0.1 unit/kg, hourly
- If the rate of blood glucose fall exceeds 5 mmol/ L/hour or the blood glucose falls to 14 mmol/L:
  - Add a dextrose-containing fluid.
  - Do not stop the insulin while dextrose is being infused.
- If the blood glucose falls below 4 mmol/L:
  - Give a bolus of 2 mL/kg of dextrose 10% and increase the concentration of dextrose in the infusion.
- If glucose fall is inadequate, ie. a fall of < 4 mmol/l/hr - double the dose of insulin
- If glucose fall is excessive, ie a fall of > 5,5 mmol/l/hr - halve the dose of insulin
- Continue with IV insulin until:
  - Base deficit is < 5 or bicarbonate is ≥15 mmol/L,
  - There is no ketonuria,
  - Blood glucose is ≤10 mmol/L.
- If blood glucose stable and urine ketones negative, then start standard insulin regimen

Potassium (K+):

- If hyperkalaemia (serum K+ or ECG) withhold potassium supplementation
- If serum K+ is normal or low and patient is passing urine: Start K+ supplementation immediately
- K+ replacement will be necessary in all cases (even with initial hyperkalaemia)

Table 41: Required potassium supplement as KCL added to each litre of ivi fluids

Serum Potassium	Required potassium supplement as KCL added to each litre of ivi fluids
<3,0 mmol/l	40 mmol
3,0 - 4,0 mmol/l	30 mmol
4,1 - 5,0 mmol/l	20 mmol
5,1 - 6,0 mmol/l	10 mmol
6,0 mmol/l	None

Changing from intravenous to subcutaneous insulin

- When oral fluids are tolerated, reduce intravenous fluids.
- Subcutaneous insulin can be started once the child is well hydrated and able to tolerate a normal diet

Transitional insulin therapy (Sliding Scale):

Monitor Blood Glucose 4–hourly and give the corresponding amount of Soluble/Regular insulin subcutaneously

Table 42: Transitional insulin therapy (Sliding Scale):

Blood Glucose Result	Amount of Soluble/Regular Insulin to be given
Less than 6 mmol/L	No Insulin
6.1 – 9.0 mmol/L	0.06 units/kg body weight
9.1 – 12.0 mmol/L	0.09 units/kg body weight
12.1–15.0 mmol/L	0.12 units/kg body weight
15.1–18.0 mmol/L	0.15 units/kg body weight

Sliding scale is considered when the patient is;

- Out of coma and no acidosis
- Continue the sliding scale, making appropriate adjustments to the doses of insulin, until the patient is eating normally and the urine is free of ketones. This may take on average between 12 – 24 hours.

Maintenance insulin therapy:

- Determine dose on normal requirement: for those known diabetic patients, continue with the same dose before DKA if blood sugars were maintained within normal range. For those newly diagnosed, start with a low dose (ex 0.4u/kg/day), to be adjusted according to blood sugar readings; the aim being to maintain them within acceptable range for the age.
- 2 Injections regimen:
    - Administer subcutaneously in the form of 50% intermediate acting insulin (NPH or Lente) and 50% rapid insulin. Total dose divided in 2 doses:
        - 2/3 before breakfast (1/3 rapid insulin and 2/3 intermediate acting insulin)
        - Remaining 1/3 before the evening meal (1/3 Rapid insulin and 2/3 intermediate acting insulin)

    OR
- 4 Injections regimen (Prandial regimen):Total dose divided in 4 doses:
    - 50% of long acting insulin at bed time
    - 50% of rapid acting insulin dived in 3 doses – 20% before breakfast, 20% before lunch and 10% before dinner

Treatment of intercurrent infection:

- Start empiric antibiotics on suspicion of infection until culture results are available: Cefotaxime 100mg/kg/day/7days

Recommendation:

- Regular follow-up of all diabetics is important to assess their blood sugar control
- Dietary education
- Physical activity
- Diabetes education
- Keep urine free of ketones

9.1.2 Hypoglycaemia

Definition*:* Blood glucose levels below the lower limit of the normal range (blood glucose < 4mmol/L or 70mg/dl).

Causes/Risk factors:
Individuals with diabetes

- Excessive dose of anti−diabetic medication
- Omitted or inadequate amount of food
- Unaccustomed physical over activity
- Alcohol intake

Note: 2.2mmol/L and 3mmol/L are considered for non-diabetic patients.

Table 43: Signs and symptoms:

- Dizziness
- Blurred vision
- Headaches
- Palpitation
- irritability and abnormal behaviour
- Sweating
- Tremors
- Tachycardia
- Confusion
- Unconsciousness
- Convulsions

Note: Patients with frequent hypoglycaemic episodes develop hypoglycaemia unawareness, where the symptoms above do not occur despite a dangerously low blood sugar level.

Nocturnal hypoglycaemia

Nightmares and headaches may be suggestive of nocturnal hypoglycaemia.
Blood glucose concentrations fall to their lowest levels between 02h00 and 04h00.
Grading of severity:
Mild (Grade 1)

- Child or adolescent is aware of, responds to and self-treats the hypoglycaemia.
- Children < 6 years of age can rarely be classified as grade 1 because they are unable to help themselves.

Moderate (Grade 2)

- Child or adolescent cannot respond to hypoglycaemia and requires help from someone else, but oral treatment is successful.

Severe (Grade 3)

- Child or adolescent is semiconscious or unconscious with or without convulsions and may require parenteral therapy with glucagon or intravenous glucose.

Diagnosis: is made on clinical signs and investigations
Investigations:

- Blood glucose

Management:
Outside the hospital
Mild or moderate hypoglycaemia:

- Glucose, oral, 5–15 g or 1-3 level teaspoons of sugar (depending on child's age) in a small amount of water.
- Wait 10–15 minutes.

- If blood glucose has not risen to 6-8 mmol/L, repeat above.
- As symptoms improve, the next meal or oral complex carbohydrate should be taken, e.g. fruit, bread, cereal, milk, etc.

Severe hypoglycaemia

- Glucagon, IM/SC, 0.1–0.2 mg/10 kg body weight.
  - If < 12 years of age: 0.5 mg.
  - If > 12 years of age: 1.0 mg.
- If glucagon is not available:
  - A teaspoon of sugar moistened with water placed under the tongue, every 20 minutes until patient awakes

In hospital

- 10% Glucose, IV, 2−4 ml/kg 1 to 3 minutes followed by 5−10% Glucose, IV, according to total daily fluid requirement until the patient is able to eat normally (Dextrose 50% 1 mL + water for injection 4 mL = 5 mL 10% dextrose solution).
- If IV dextrose cannot be given; give glucagon, IM/SC, 0.1–0.2 mg/10 kg body wt
  - If < 12 years of age: 0.5 mg.
  - If > 12 years of age: 1.0 mg.

Recommendation

- Monitor blood glucose every 15-30 minutes until stable, then repeat 1–2 hourly.
- Keep blood glucose between 6 and 8 mmol/L

Referral

- Recurrent episodes of hypoglycaemia.

9.1.3 Guidelines for management of diabetics on sick days

Definition

Illness associated with fever tends to raise blood glucose because of higher levels of stress hormones, gluconeogenesis and insulin resistance.

Illness associated with vomiting and/or diarrhoea may lower blood glucose, with the possibility of hypoglycaemia and the development of starvation ketones.

Diagnostic criteria

- Unstable blood glucose measurements as a result of illness, stress or starvation.
- Increased insulin requirements are induced by a catabolic state and stress.
- Ketonuria may also indicate the following:
  - In the presence of hyperglycaemia, it is indicative of severe insulin deficiency and calls for urgent therapy to prevent progression into ketoacidosis;
  - In the presence of low blood glucose levels, it is indicative of a starvation state or is the result of a counter-regulatory response to hypoglycaemia.

General and supportive measures

- Monitor glucose more frequently.
- Test urine for ketones.
- Ensure adequate intake of calories and fluids on sick days to prevent ketogenesis. If insufficient calories are consumed, ketones will appear in the urine without

hyperglycaemia. In this circumstance encourage the patient to eat whatever he/she feels like.

- Treat underlying intercurrent illness.

Special circumstances:

Gastroenteritis:

- If hypoglycaemia occurs especially with gastroenteritis, and there is mild ketonuria, ensure that the child takes regular frequent amounts of carbohydrate, using oral rehydration solution or intravenous fluids.

Loss of appetite:

- Replace meals with easily digestible food and sugar-containing fluids.

Vomiting:

- If the patient has difficulty eating or keeping food down and the blood glucose is < 10 mmol/L, encourage the patient to take sugar containing liquids. Give small volumes. Some glucose will be absorbed. If there is no vomiting, increase the amount of liquid.

Medications

Insulin therapy

- Insulin must be given every day. Insulin injections should not be omitted because of sickness and/or vomiting. If vomiting occurs, IV fluids may be needed to avoid hypoglycaemia
- During an infection, the daily requirement of insulin may rise by up to 25%.

Moderate urine ketones

- The extra dose of insulin is usually 10–20% of the total daily dose given as short acting insulin every three hours.
- If the blood glucose drops < 8.3 mmol/L, it may be necessary to sip regular juice or other sugar-containing drinks. This is done to raise the blood glucose before giving the next insulin injection.

Large amount of urine ketones

- Give 20% of the total daily insulin dose.
- Repeat as above if necessary.

Extra fluids

In addition to taking extra insulin, extra fluids, e.g. water and fruit juices are important to prevent acidosis. These fluids replace the fluids lost in the urine and prevent dehydration.

Referral

In a child with inter-current illness **urgent** specialist advice must be obtained when:

- Patient is unable to carry out the advice regarding sick days;
- The diagnosis is unclear
- Vomiting is persistent, particularly in young children;
- Blood glucose continues to rise despite increased insulin;
- Hypoglycaemia is severe;
- Ketonuria is heavy or persistent;
- The child is becoming exhausted, confused, hyperventilating, dehydrated or has severe abdominal pain.

9.2 HYPOCALCAEMIA IN CHILDREN

Definition

The adjusted serum calcium levels below the normal ranges (calcium is 2.2 - 2.6mmol/L). Symptoms of hypocalcaemia, such as muscle cramps, paraesthesia, tetany and carpopedal spasm, typically develop when serum adjusted calcium falls below 1.9mmol/L. However, this threshold varies and symptoms also depend on the rate of fall.

The main causes of hypocalcaemia in children are:

- Vitamin D deficiency
- Calcium deficiency
- Magnesium deficiency
- Reduced parathyroid hormone production or resistance,
- Impaired renal function.

Diagnosis: Based on clinical signs and symptoms

Signs and symptoms of tetany include:

- Paraesthesia
- Weakness
- Lethargy
- Cramps
- Laryngospasm
- Seizures
- Positive Trousseau's sign
- Carpopedal spasm
- positive Chvostek's sign
- Prolonged QT interval on the ECG.

Investigations

- Calcium
- Albumin
- Phosphate
- Kidney function
- Magnesium
- 25 Hydroxyvitamin D (25OHD).
- Parathyroid hormone (PTH)

Medication

Acute hypocalcaemia

- Calcium gluconate 10%, IV, 1–2 mL/kg administered over 5–10 minutes, 6–8 hourly. Maximum dose: 10 mL.
- ECG monitoring is advised.

If hypomagnesaemic:

- Magnesium sulphate 50%, IV/IM, 0.2 mL/kg every 12–24 hours.

Chronic therapy

- Long-c therapy depends on the cause.
- Manage hypophosphataemia or hyperphosphatemia, depending on the cause of hypocalcaemia, before long-term calcium is initiated.
- Elemental calcium oral, 50 mg/kg/day until normal calcium level is achieved (given with meals).
- Maintenance dose: 30 mg/kg/day
- If vitamin D deficient:
  - Vitamin D, oral:
    - Under 6 months 2500 IU/day
    - 6 months -12 years 5 000 IU/day
    - 12 - 18 years 10 000 IU/day
- For hypoparathyroidism and Pseudohypoparathyroidism:
  - Calcitriol, oral, 0.01–0.04 mcg/kg/day. **OR**
  - Alfacalcidol, oral, 0.05 mcg/kg/day.
    - If < 20 kg: 0.05 mcg/kg/day.
    - If > 20kg: 1 mcg/day.

9.3 RICKETS

Definition

Failure to calcify osteoid tissue in a growing child, usually due to deficiency of vitamin D, its active metabolites, calcium, phosphorus or other rare causes. This leads to bone deformity. Occurs in ex-premature babies during infancy and in children with developmental disability, on anticonvulsants or not exposed to sunlight, vegan diets. In older children it is caused by renal tubulopathy and other rare conditions.

Diagnosis

Clinical signs

- Bowing of long bones knock-knees, widening of metaphyses and cranial frontal bossing.
- Muscular hypotonia
- Craniotabes
- Rachitic rosary along costochondral junctions
- Harrison groove due weakened ribs pulled by muscles also produce flaring over the diaphragm
- Kyphoscoliosis in older children
- Greenstick fractures
- Failure to thrive
- Occasionally convulsions or tetany due to hypocalcaemia.

Causes of rickets

- Nutritional deficiency still the most common causes of rickets.
- Prolonged and exclusive breast feeding without vitamin D supplementation with minimal sunlight exposure.
- Intestinal malabsorption of fat
- Liver or kidney disease

Investigations:

- FBC
- Urea & Electrolytes, Creatinine
- Bone profile (Ca, Mg, Phosphate, Alkaline phosphatase): Low to normal Calcium, Low phosphorus, High alkaline phosphatase, high PTH, low 25-Hydroxyvitamin D, Low to high 1-25 hydroxyl-vitamin D
- 25-OH Vitamin D levels (combined vitamin D2 and D3 (where possible)
- X-ray of affected (long bones, spine, knees, wrists, ankles):
  - Anterior view of the knee is the best site to study also the wrist and ankle
  - Widening and cupping of the metaphyses,
  - Fraying of metaphysis
  - Epiphyseal plate is widened and irregular
  - Osteopenia

General and supportive measures

- Prevent vitamin D deficiency.
- Exposure to sunlight, at least 3 hours a week.

Note: Breast milk does not contain adequate vitamin D to prevent deficiency.

- Ensure adequate sunlight exposure of infant or provide vitamin D until weaning.
- Normal vitamin D-containing diet for lactating mothers.

Medications

Prophylaxis

- For premature babies:
  - Vitamin D, oral, 400 IU, once daily.
- Infants who are exclusively breastfed: :
  - Vitamin D, oral, 400 IU once daily.

Treatment of active rickets

- Treat only after confirmation of active rickets on x–ray.
- Cholecalciferol IMI (Stoss therapy): < 1 year: 150,000IU ever3monthly; > 1 year: 300,000IU every 3 month. OR
- Vitamin D, oral, 5 000 IU once daily, in addition to milk in the diet.
- Add Elemental calcium 500mg OD for 1 month or more depending on severity and response to treatment.
- Labs and imaging required after 1 month and 3 months of treatment.
- Repeat X–ray after 6–8 weeks.
  - If no radiological improvement, further investigation is required.
  - If healing occurs, continue for 3 months. Confirm complete healing and adequate diet for the future.

Note: Children with low levels of Calcium should have both calcium and Vit D. This intervention shows a complete recovery within 3 months of supplementation. We need to insist on compliance since it is the reason number of non-response to treatment.

CHAPTER 10: MUSCULOSKELETAL CONDITIONS

10.1 JUVENILE IDIOPATHIC ARTHRITIS:

Definition: juvenile idiopathic arthritis is a chronic non-suppurative inflammatory condition of the synovium. Occurs in different forms

- **Systemic onset arthritis** (still's disease), occur at any age (mostly at 2–4 years old)
- **Polyarticular onset arthritis**, typically involves five or more joints, usually small joints
- **Pauciarticular onset arthritis**, commonest type of juvenile rheumatoid arthritis (50 %), less than five joints affected

Systemic onset arthritis:
Symptoms & signs:

- Arthritis in one or more joints.
- Plus 2 weeks of daily fever.
- With one of the following:
  - Erythematous macular rash, or
  - Serositis, i.e. pericarditis and pleuritis, or
  - Hepatosplenomegaly, or
  - Generalized lymphadenopathy

Polyarticular onset arthritis:
Signs and symptoms:

- Affects ≥ 5 joints in the first 6 months
- Involves large and small joints
- Rheumatoid factor either positive or negative
- Aggressive form of diseases with chronic course persisting into adulthood

Pauciarticular onset arthritis:
Signs and symptoms:

- Involves the large joints.(wrists, knees, ankles or elbows)
- Often asymmetrical distribution
- ≤ 4 joints are involved
- Associated with an increased risk of Iridocyclitis/uveitis

Diagnosis

- Based on clinical signs

Investigations

- FBC, differential: Anemia and Leukocytosis
  ESR and CRP may be elevated
- Rheumatoid factor
- X–ray of affected joints
- Anti-nuclear antibodies (ANA)

Complications

- Leg length discrepancy
- Scoliosis
- Contractures
- Iridocyclitis/uveitis
- Osteopenia
- Osteoporosis
- Permanent joint damage
- Persistent arthritis leading to significant disability
- Psychosocial factors, such as anxiety and school absenteeism

Management:

Non-pharmaceutical management

- Occupational and physiotherapy are essential
- Education of the patient and their families

Pharmaceutical management

- First choice: Brufen 5-10 mg/kg/dose x 3/day
- Alternative: Prednisone p.o. 2 mg/kg as a single daily dose for 1–2 weeks, continue with 0.3–0.5 mg/kg/day as single dose for 3 months
- If arthritis not controlled;
- Give methotrexate p.o, 0.3 mg/kg/week as a single dose on an empty stomach, increase at monthly intervals up to 1 mg/kg/week until there is satisfactory response, maximum dose is 25 mg/week + folic acid 5mg daily for methotrexate treatment.

Recommendation

- Refer patient for pediatrician/rheumatology specialist consultation and adequate management (methotrexate treatment)
- Ophthalmology consultation to rule out uveitis

CHAPTER 11: HAEMATOLOGICAL CONDITIONS

11.1 ANAEMIA

Definition:

Anaemia is defined as a reduction in red blood cell (RBC) mass or blood haemoglobin (Hb) concentration < 2 SD below mean for age, gender, race, and developmental stage.

Haemoglobin level reference ranges

- 0-2 weeks: 14-20 g/dL
- 2-6 months: 10-17 g/dL
- 6 months-1 year: 10-14 g/dL
- 1-6 years: 11-14 g/dL
- 6-18 years: 11.7-15.5 g/dL

Causes of anaemia

- Physiologic anaemia which occurs at approximately six to nine weeks of age. Erythropoiesis decreases dramatically after birth as result of increased tissue oxygenation and a reduced production of erythropoietin.
- Decreased production of red blood cells:
  - Iron deficiency, nutritional deficiencies (folic acid, vitamin B12, vitamin A)
  - Depressed bone marrow function, certain infections (HIV, EBV), renal failure; drug-induced etc.
- Loss of red blood cells
  - Acute or chronic haemorrhage that may be occult or obvious after trauma
  - In adolescent girls, heavy menstrual cycles are a common cause of anaemia
- Increased destruction of red blood cells (haemolysis)
  - Parasitic (malaria), bacterial and viral (HIV) infections
  - Haemoglobinopathies (sickle cell disease, thalassemia)
  - Reaction to certain drugs (co-trimoxazole, etc.)

In tropical settings, the causes of anaemia are often interlinked.

Clinical symptoms and signs

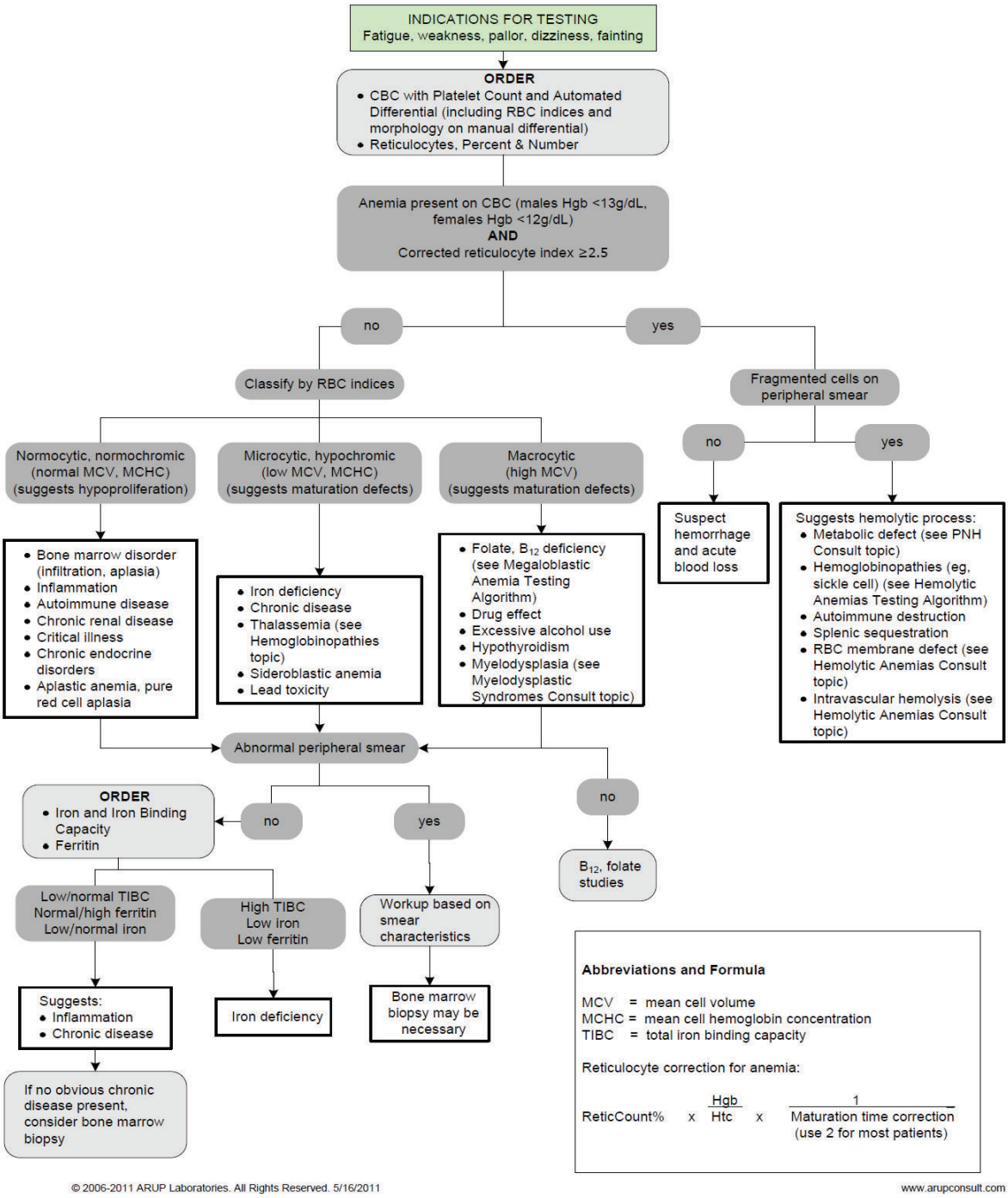
- Dizziness, fainting
- Headache, lethargy
- Shortness of breath on exertion (exercise intolerance)
- Visual disturbances
- Poor growth
- Confusion, decreased mental activity
- Mood or sleep disturbances
- Pale mucous membranes, palms and nail beds
- Rapid heartbeat or palpitations
- Dyspnoea, tachypnea
- Signs of heart failure if severe anaemia

- Other signs of severe anaemia include: Heart murmur, sweating, thirst, cold extremities, oedema in the lower limbs and shock
- Pica: intense craving for nonfood items; pica in young children may manifest as craving dirt, rocks, and paper.
- Some signs may indicate the likely cause of the anaemia:
  - Cheilosis (cracking of the corners of the mouth) and glossitis (nutritional deficiency)
  - Jaundice, hepatosplenomegaly, dark coloured urine (haemolysis)
  - Melena, haematuria, etc. (bleeding.)

Classification of anaemia

- Anaemia is classified according to physiologic process (decreased production, increased destruction or blood loss).
- In practice, classifying anaemia according MCV is a useful approach to assessing the common causes of anaemia in children

Figure 12: Algorithm for classification of anaemia



Investigations

Investigate according to clinical situation

- FBC, reticulocyte count and peripheral blood smear examination
- Blood film for malaria parasites/RDT
- Blood urea and serum creatinine
- Stool examination for eggs of hookworm, ova, parasites and occult blood,

Other tests that can be done at a tertiary level depending on the clinical presentation

- Sickling test/ Hemoglobin electrophoresis
- Analysis for nutritional deficiencies
- Bone marrow aspiration to assess the decreased production of red cells
- Coombs direct and indirect (in cases of haemolytic anaemia)
- Iron studies (Fe, Ferritin, TIBC, transferrin % saturation)

Reticulocytes

- Reticulocytes are circulating immature RBC. Reticulocyte count helps to categorize the anaemia into hypo-or hyper-proliferative type. Normal 0.5-1.5%

Hypoprolifearative:

- Decreased reticulocytes
- Bone marrow unable to produce the required number of RBC's
- Lack of essential substance (iron, B12, folate) or Bone marrow infiltration such as in leukemia , Aplastic anaemia

Hyperproliferative:

- Increased reticulocytes
- Cause of anaemia outside marrow
  - Hemolytic anaemia
  - Haemorrhage
  - Post anaemia treatment
- Decreased survival of RBCs
- Marrow normal and responds adequately by increasing the output

Corrected reticulocyte count (CRC) calculations:

- CRC = Reticulocyte % x (Patients' Hematocrit/Normal hematocrit per age). A CRC >1.5 suggests increased red blood cells production as a result of haemolysis and blood loss.

Management

- Obtain a detailed history from the patient or care givers
- Examine the anaemic patient carefully and perform the appropriate investigations with a goal of:
  - Confirming that the patient is anaemic
  - Establishing the type of anaemia
  - Determining the cause of the anaemia
  - Determining whether or not there are complications arising from the anaemia, the cause of the anaemia or both
  - Treat or correct the underlying cause
  - Always investigate cause of anaemia before initiating treatment
  - In an emergency, take all blood samples before treatment

Therapeutic objectives:

- Treat underlying cause of anaemia
- In sickle cell disease patients restore haemoglobin to steady state level
- In iron deficiency replenish iron stores after correction of anaemia (continue to treat for 2-3 months)

Non-Pharmaceutical management:

- Advise on a balanced diet especially iron-rich foods such as liver; beef kidneys; molasses; meat; sardines; eggs, fish; fresh green leafy vegetables..
- Malaria prevention
- Encourage exclusive breastfeeding until 6 months, then supplementation with iron rich food.
- Discourage use of cow's milk before 12 months and excessive intake of cow's milk.

Pharmaceutical management:

For iron deficiency anaemia:

  - Elemental Iron 4-6 mg/kg/day in 1 or 2 doses daily until the MCV has reached the normal range.
  - Continue for 2-3 months after normalization of MCV to replenish the iron stores.
  - Side effects of iron therapy: Diarrhoea, abdominal discomfort, constipation, or black stools

- If anaemia is due to hookworms
  - Albendazole:
    - Children 1-2 years of age 200 mg as a single dose
    - Children over 2 years of age 400 mg as a single dose
  - Or Mebendazole 100 mg orally 12h x 3 days.
- Vitamin B12 deficiency:
  - Hydroxycobalamin injection IM or IV, subcutaneous: Initially 50-100 mcg/day for first 3 days then once weekly until the deficiency is corrected and then once per month. Maintenance dose 30-50 mcg/month. Lifelong treatment may be required.
- Severe anaemia with signs of cardiac failure will need treatment of the heart failure in addition to blood transfusion.
  - Transfusion with packed cells. Look for signs of decompensation before deciding to transfuse and look for these signs during transfusion.
  - Transfuse the patient if Hb < 5 g/dl and decompensation signs are present:
    - Packed cells: 10-15 ml/kg body weight slowly over 4 hours. A transfusion rate of 2.5ml/kg/hour usually avoids circulatory overload. Patients deemed to be at risk for volume overload can be transfused at slower rate 1ml/kg/hour.
    - To calculate the volume needed to increase Hb: Volume of packed red cells = (desired Hb – actual Hb) x weight x 0.4
  - Furosemide 1mg/kg IV should be given at the beginning of transfusion:
    - If signs of heart failure or severely malnourished children
  - Make sure the CORRECT bag of blood is given and never transfuse blood that has been out of the refrigerator for more than 2 hours.
  - Make baseline recordings of temperature, respiratory rate and pulse rate, then observe patient closely every 15 minutes for transfusion reactions
  - In case of acute malnutrition: Hb < 4g/dl Transfusion: Hb 4g/dl or packed cell volume 12% Give 10ml/kg packed cells over 4hrs ONLY during the first 48hrs after admission. No food for 3 to 5 hrs after. Then manage according to acute malnutrition protocol

Referral:

- Refer all patients with anaemia related to poor diet to a nutritionist or a health centre for nutritional follow-up
- Refer all patients with recurrent anaemia or with anaemia of unknown cause to a Pediatrician

11.2 SICKLE CELL ANAEMIA

Definition: Chronic haemolytic anaemia characterized by sickle shaped red blood cells as a result of mutation in the β chain of Hemoglobin

Cause:

- Homozygous inheritance of mutated HbS (amino acid valine is substituted for glutamic acid in the position 6 of the β−chain)

Signs and symptoms:

- Impaired growth and development
- Anaemia and mild jaundice
- Hepatosplenomegaly (in younger children)
- Bone pain (especially long bones in children)
- Pain and swelling of the hands and feet (hand - foot syndrome) in children between 6 months and 3 years old.
- Arthralgia with fever
- Severe abdominal pain with vomiting
- Acute chest syndromes (sudden onset of fever, cough, chest pain, tachypnea leukocytosis and pulmonary infiltrates on x−ray): Must be aggressively treated may be fatal
- Tower shaped (“frontal and parietal bossing”) skull

Investigations:

- Full blood count
- Peripheral blood smear
- Sickling test (Test d’Emmel)
- Hb electrophoresis

Complications:

- Infections (especially from encapsulated organism such as Streptococcus pneumoniae:
  - Osteomyelitis (Streptococcus pneumonia and Salmonella)
  - Meningitis
- Aplastic crisis (commonly due to Parvovirus B19 infection)
- Stroke (infarctive) with hemiparesis and convulsions
- Gangrene (vaso-occlusive)
- Pulmonary hypertension
- Acute chest syndrome (sudden onset of fever, cough, chest pain, tachypnea leukocytosis and pulmonary infiltrates on X-ray): Must be aggressively treated as may be fatal

- Gall bladder stones +/- cholecystitis
- Splenic sequestration (in 5 first years of life): onset of life threatening anaemia with rapidly enlarging spleen and high reticulocyte counts
- Avascular necrosis of the femoral head is common
- Occlusion of major intracranial vessels may lead to hemiplegia
- Cranial nerve palsies and other neurological deficits
- Priapism

Management:

Management aims at 4 types of crisis

- Thrombotic (vasoocclusive, painful or infarctive),
- Aplastic
- Hyperhaemolytic due to Hypersplenism
- Acute splenic sequestration

Non-pharmacological treatment:

- IV or oral fluids 2L/m^2/day
- Oxygen if in respiratory distress

Pharmaceutical treatment:

- Analgesics (WHO Step wise pain management)
  - Paracetamol 10-15mg/kg/dose orally every 4-6 hours associated with Ibuprofen 5-10mg/kg/dose every 6-8 hours
  - Codeine 0.5-1mg/kg/dose every 6 hours (for children above 12 years)
  - Pethidine 0.5–2mg/kg 4hrly)
  - Morphine (titrate to effect) PO: 0.2-0.5 mg/kg/dose every 4-6 hours, IV, IM, SC: 0.1-0.2 mg/kg/dose every 2-4 hours
- If patient has an infection treat according to the bacteria, the site and the severity of the infection
- Aggressively search for cause of infection (blood and urine cultures, chest X ray) and start empiric antibiotic treatment if child has fever
- Blood Transfusion: Transfusion should be reserved for the following circumstances:
  - Urgently for sudden, severe anaemia due to acute splenic sequestration, parvovirus B19 infection, or hyperhaemolytic crises.
  - Transfusion is indicated in the following situations:
    - Acute infarctive stroke
    - Severe acute chest syndrome
    - Multiorgan failure syndrome
    - Perioperative.
    - Recurrent priapism that does not resolve after adequate hydration and analgesia

Additional treatment:

- Give supplementary folic acid (5 mg oral daily) but AVOID iron supplement unless there is signs of iron deficiency (risk of hemochromatosis).

- Hydroxyurea should be given to patients with more than 3 crises per year. Start at a dose of 15 mg/kg PO daily; monitor blood count very 2 weeks and titrate by 5mg/kg every 8 to 12 weeks until mild myelosuppression (ANC 2,000 to 4,000/mm^2) is achieved to a maximum daily dose of 35mg/kg. A clinical response to treatment may take 3-6 months; a 6-month trial of the maximum tolerated dose is recommended prior to considering discontinuation due to treatment failure. For children who have a clinical response, long-term hydroxyurea therapy is indicated.
- Homozygous should be vaccinated: Immunizations are cornerstone of infection prevention in SCD. Children with SCD should receive all routinely recommended childhood vaccines including those against Streptococcus pneumoniae, Hepatitis B, Pneumococcal, Neisseria meningitis and Haemophilus influenza type B.

Recommendation:

- Education of patient on sickle cell disease and crisis to avoid complications
  - Should drink much water daily
  - Avoid getting cold (dress with warm clothes in cold weather)
- Sickle cell screening before marriage for suspected carriers and genetic counseling if possible
- Heterozygote carriers should have family members screened for sickle cell disease

11.3 IDIOPATHIC THROMBOCYTOPENIC PURPURA

Definition

Immune thrombocytopenia purpura (ITP) is an immunologically mediated bleeding disorder in which autoantibodies against platelet antigens cause premature platelet destruction that leads to thrombocytopenia.
Children often develop ITP after a viral infection and may recover fully without treatment.

History:

- A previously healthy child who has sudden onset of generalized petechial rash, bruising and/or purpura skin rash.
- A history of a preceding viral infection 1–4 weeks before the onset of thrombocytopenia
- Acute bleeding from the gums and mucous membranes

Clinical manifestations:

- Findings on physical examination are normal, other than the finding of petechiae and purpura.
- Splenomegaly or pallor are rare.
- Fewer than 1% of patients have intracranial hemorrhage
- The severity of bleeding in ITP is based on symptoms and signs, but not on platelet count
- *Symptoms can be categorized as:*

- No symptoms (identified on routine blood tests showing severe thrombocytopenia)
- Mild symptoms: bruising and petechiae, occasional minor epistaxis, very little interference with daily living
- Moderate: more severe skin and mucosal lesions, more troublesome epistaxis and menorrhagia
- Severe: bleeding episodes—menorrhagia, epistaxis, melena—requiring transfusion or hospitalization, symptoms interfering seriously with the quality of life

Diagnosis:

- Diagnosis is based on the history, physical examination, full blood count with leukocyte differential, and examination of the peripheral smear

Laboratory:

- FBC with differential (should not show any anaemia (unless significant bleeding) or anomaly of WBC count) - Profound thrombocytopenia (platelet count $<10 \times 10^9$/L).
- Peripheral blood film examination (will show large or giant platelets with evidence of true thrombocytopenia without platelet aggregation features)
- Viral tests including HIV etc
- Additional investigations are done as clinically indicated
- Bone marrow biopsy is only indicated if the patient has other cytopenias, suspicious findings on the peripheral smear, or other clinical features associated with bone marrow failure syndrome

Differential diagnosis: ITP is a diagnosis of exclusion

- Active infection: on going viral infections such as infectious mononucleosis (EBV), CMV, HIV-1 etc.
- Active bacterial infections
- Leukemia
- Autoimmune haemolytic anaemia (AIHA)
- Systemic autoimmune disease such as lupus erythematosus (SLE)
- Wiskott-Aldrich syndrome (WAS)) must be considered in young males found to have low platelet counts, particularly if there is a history of eczema and recurrent infection.
- Drug exposure
- Haemolytic uremic syndrome (HUS)
- Inherited disorders causing thrombocytopenia

Management

The goal of therapy is to reduce the risk for bleeding so that patients can live a normal life
The decision to treat a child should be based on the clinical symptoms and not the platelet count.

Table 44: Management according to risk category

Risk category	Symptoms	Management
Low	• Many petechiae or large bruises • Painless oral/palatal petechiae or purpura. • Dry blood clots in the nostril/nares	• Observation as 0utpatient without medical • treatment (unless significant psychosocial or • safety concerns) • Repeat FBC and review in 1 week • Provide family education (activity restriction especially contact sport and avoidance of • antiplatelet and coagulation medications)
Moderate	• Epistaxis >5 minutes • Haematuria • Haematochezia • Painful oral purpura • Significant menorrhagia	• Admission to hospital • Discuss with Paediatrician/Paed Haematologist • Transfuse with Platelets only for life threatening bleeding: (as bolus 10-30 ml/kg, generally followed by a continuous infusion otherwise not effective as rapidly destroyed). Platelet count should be assessed immediately following the bolus (i.e., 15 minutes after) as trial to stop bleeding. • Prednisolone 4 mg/kg/day (max 60 mg) for 4–7 days, followed by rapid tapering down. • If poor response or rapid platelet rise is required e.g. before surgery: IVIG 0.8–1.0 g/kg/day for 1–3 days • Anti-D immune globulin (Anti-D) can be used in Rh positive patients, direct antiglobulin test (DAT) negative patients at a dose of 50-75 microgram/kg as single dose. • Additional treatments: ○ Epistaxis: oral tranexamic acid 25 mg/kg (max 1.5 g), ENT consult where possible ○ Heavy menstrual bleeding: tranexamic acid (must not be used if haematuria is present)
Severe Life-threatening	• Suspected internal haemorrhage (brain, lung, muscle, joint, etc.) OR • Mucosal bleeding that requires immediate intervention	• Urgent transfer to a tertiary hospital after stabilization • Combination IVIG 0.8–1 g/kg and pulse IV Methylprednisolone 15–30 mg/kg (max 1 g) daily for 3 days • Platelet transfusion 20 mL/kg, continuous if required IV tranexamic acid 15 mg/kg • Urgent surgical intervention or referral depending on site of bleeding

Splenectomy in ITP

- Splenectomy removes the primary site of platelet clearance and autoantibody production and offers the highest rate of durable response (50% to 70%) compared with other ITP therapies
- It should be reserved for 1 of 2 circumstances:
  - The older child (> 4 yrs.) with severe ITP that has lasted >1 yr. (chronic ITP) and whose symptoms are not easily controlled with steroids and IVIGs is a candidate for splenectomy.
  - Splenectomy must also be considered when life-threatening haemorrhage (intracranial haemorrhage) complicates acute ITP, if the platelet count cannot be corrected rapidly with transfusion of platelets and administration of IVIG and corticosteroids.

Family education

- On the illness/diagnosis
- Restrict activities to minimise the risk of head injury
  - Avoid contact sports (e.g. Rugby, Soccer)
  - Limit activities that have a risk for traumatic injury (e.g. Bicycle riding)
- Avoid anti-platelet, non-steroidal and anticoagulant medications.
- Avoid intramuscular injections
- Monitor for significant bleeding symptoms and go immediately to the emergency department if they occur
- Monitor for signs of ICH and go immediately to the emergency department if head injury or severe headache
- Consider discharge when family understands the condition, management, activity restrictions, follow-up plan and when to go to the emergency department

General transfusion policy management:

Red blood cells:

In children and adolescent:

- Low Hb and symptomatic anaemia
- Asymptomatic but Hb <5 g/dl
- Fever and Hb <8.0 g/dl
- Hb <8.0 g/dL in the perioperative period
- Serious infection and Hb <10.0 g/dl
- Postpone blood transfusion at diagnosis if WBC >100x10^9/l (Leukaemia is likely and high risk of increased viscosity).
- In infants within the first 4 months of life:
  - Hb <10 g/dL and major surgery
  - Hb < 10 g/dL and pulmonary disease

Platelets:

- Asymptomatic but platelets. <10.0x10^9/L
- Symptomatic (petechiae, fever from serious mucositis) and platelet <20.0x10^9/l
- Before LP if platelets <30.0x109/l or DIC or high WCC.
- Before surgical procedure if platelets <50.0x109/l

Reference

Hume: Clinical Practice of Transfusion Medicine Petz LD et al (eds) 3rd edition. New York, Churchhill Livingstone 1996: 705 – 732.

Table 45: Management of transfusion reactions

Severity	Signs	Transfusion	Treatment
Mild	Itchy rash	Slow rate	• Promethazine 0.125mg/Kg (Max 25mg) • Continue if stable after 30minutes
Moderate	Severe rash Fever Rigor Tachycardia	**Stop**	• Promethazine 0.125mg/Kg (Max 25mg) • Hydrocortisone 4mg/kg IV (max 100mg) • Nebulize with salbutamol if wheezing • If stable restart with new blood
Severe	Shock Haemolysis Bleeding Collapse	**Stop**	• Maintain airway and give oxygen • Normal saline bolus 20ml/kg • Adrenaline 1:1000 at 0.01 mg/kg (Max 0.3mg) every 2-5 minutes IM. In refractory cases, drip (0.1 mcg/kg/min) • Promethazine 0.125mg/Kg (Max 25mg) • Hydrocortisone 4mg/kg IV (max 100mg) • Nebulize with salbutamol if wheezing • Consider and treat for sepsis • Preferably observe in high dependency unit

CHAPTER 12: CENTRAL NERVOUS SYSTEM

12.1 CONVULSIONS

(For neonatal convulsions refer to neonatal protocol)

Definition:

A convulsions is an involuntary change in movement, attention or level of awareness that is sustained or repetitive and occurs as a result of abnormal and excessive neuronal discharges within the brain.

Convulsive Seizures are one of the most common medical problems affecting children, and epilepsy is the most common chronic neurological condition in children, yet the rate of misdiagnosis of seizures in children is at least around 25%.Therefore, obtaining a detailed clinical history, verbal description of seizure and often careful mimicking of event by the wetness are critical for accurate diagnosis of seizures.

Signs & symptoms of convulsions

- Shaking of body; can be generalised or focal
- Unresponsive, eyes rolling back, biting tongue or frothing of mouth
- Seizures that impair awareness are followed by a post-ictal period in which the patient is sleepy and confused
- Following seizure activity, patients may also have transient focal weakness (Toddy paresis) or language difficult.

Convulsions are classified as focal (Partial), generalised and unknown onset by the International League against Epilepsy (ILAE), 2017.

Generalised seizures may be:

- Tonic-clonic,
- Absence (typical or atypical),
- Clonic,
- Tonic or atonic,
- Myoclonic

Focal seizures (partial seizures):

- Affect one part of the body but may progress to generalised tonic-clonic seizures and this is known as secondary generalisation.
- Partial seizure can also be further categorised as; simple partial seizure (consciousness retained) or complex partial (consciousness impaired).

Causes

- Febrile convulsions
- Malaria
- Meningitis/Encephalitis
- Hypoglycaemia
- Hyponatraemia/ Hypernatraemia/Hypocalcaemia
- Epilepsy and epileptic syndromes
- Poisoning
- Head injury, hypoxic injury
- Rare congenital metabolic disorders

Diagnosis

- Diagnosis of seizure relies primarily on accurate description of the event by the witness.
- Take detailed developmental (milestones), medical and family history
- Conduct thorough physical and neurological examination including looking for skin signs of neurocutaneous syndromes

Investigation

- Bedside blood sugar level
- Malaria slide or Rapid Diagnostic Test (RDT)
- Full Blood count, CRP and taking appropriate cultures if infectious cause is suspected
- Urea, Creatinine, sodium, potassium and calcium (where possible)
- Consider lumbar puncture:
    - If signs of meningitis (fever, neck stiffness, bulging fontanelle or irritability)
- DON'T do a lumbar puncture if the child is not haemodynamically and respiratory stable or there are signs of raised intracranial pressure (unequal or unresponsive pupils, papilloedema, abnormal breathing), GCS <8/15, focal neurologic signs.
- Consider referral for an EEG if recurrent un provoked seizures (no fever and above investigations are normal)
- Refer for MRI if seizure predominantly of focal onset and suspicion of underlying CNS anomaly

Management

During seizure management

- Airway and Breathing: Clear airway; place child on side, protect from trauma, loosen clothing and suction secretions
- Make sure child is breathing; if not, call for help and start giving breaths using bag and mask
- Monitor rrespiratory rate, blood pressure, temperature and oxygen saturation promptly correct or support any abnormality.
- Provide oxygen by nasal cannula or mask to optimize oxygenation.
- Check blood sugar level & treat for hypoglycemia if blood glucose level is;
- < 2.5 mmol per litre (mmol/l) (45 milligrams per decilitre [mg/dl]) in a well-nourished child, or < 3 mmol/l (55 mg/dl) in a malnourished child.
- Give 5mls/kg dextrose 10% solution by rapid IV infusion. Another bolus of 5 ml/kg of 10% glucose solution can be repeated after 30 min if the glucose level remains low.
- Consider maintenance IV solutions with dextrose in unconscious children
- If generalized seizure lasts more than 5 minutes, use diazepam to stop it:
    - Diazepam
        - Infants and Children 6 months to 5 years: Rectal: 0.5 mg/kg rectally without exceeding 10 mg
        - Children 6 to 11 years: Rectal: 0.3 mg/kg.
        - Children ≥12 years and Adolescents: Rectal: 0.2 mg/kg.
    - In all cases if seizure continues, repeat dose once after 10 minutes.
    - Monitor respiratory rate.

- If still having seizure after 20 minutes after the second dose;
  - IV Phenobarbitone (loading 20mg/kg over 15 mins, max 1g) OR
  - IV phenytoin (loading dose 20mg/kg in Normal saline over 60 mins)
  - If seizure continues after Phenobarbitone/Phenytoin, treat as status epilepticus.

12.2 FEBRILE SEIZURES

Definition

Seizures occurring in children between the ages of 6 months and 6 years associated with a fever in absence of evidence of intracranial infection, hypoglycemia, acute electrolyte imbalance or defined cause for the seizure. Febrile seizures can be simple or complex febrile seizures.

Simple febrile seizures:

- Are generalised tonic-clonic seizures
- Are self-limiting, usually less than 5 minutes and always less than 15 minutes
- Cause no neurological deficit after the convulsion
- Have a good prognosis and very rarely develop into epilepsy
- Consist of only one seizure during the febrile illness which needs no specific treatment
- There is often a family history of febrile seizures.

Complex febrile seizures:

Febrile seizures with one or more of the following:

- Last longer than 15 minutes
- Are recurrent within the same febrile illness or within 24 hours
- Have a focal (partial) onset
- Have post-ictal, focal neurological abnormalities.
- Anticonvulsant treatment are usually required to interrupt seizure activity

Risk factors for recurrent febrile seizures include:

- Seizure disorder in a first degree relative,
- Onset before 12 months of age

Diagnostic criteria

Clinical

- Exclude intracranial, extracranial and biochemical causes of fever or seizure.
- Signs of meningism are unreliable in children < 2 years of age.
- Investigate and treat children empirically for meningitis if suspected.

Investigations

- Bedside blood sugar level
- Malaria slide or Rapid Diagnostic Test (RDT)
- Full Blood count
- Urea, Creatinine, sodium, potassium and calcium (where possible)
- Lumbar puncture is indicated in:
  - All children with clinical features of possible meningitis,
  - Children where meningitis cannot be excluded, e.g. < 1 year of age or those who have received a course of antibiotics prior to the event.

Note: In children > 1 year of age, where a focus of extracranial infection is present and intracranial infection such as meningitis has been excluded clinically, no further investigation is required.

Neuroimaging

- Based on clinical findings, investigate complex febrile seizures for possible underlying conditions such as meningitis, focal brain lesions, cerebral malaria and epilepsy.
- All children with complex febrile seizures and persistent lethargy require Brain CT scan.

Note: An EEG is of no value in simple febrile seizures, but consider it in recurrent complex febrile seizures.

General and supportive measures

- Reassure parents and caregivers.
- Educate parents and caregivers regarding the first aid management of seizures.

Management of febrile illness

- Treat fever with Paracetamol, oral, 15 mg/kg/dose 6 hourly or Ibuprofen 10mg/kg every 8hrs.
- If convulsion last more than 5 minutes: Infants and children 6 months to 5 years:
  - Rectal Diazepam 0.5 mg/kg without exceeding 10 mg or 0.3mg/kg IV/IO
  - Lorazepam 0.1mg/kg

Note:

For children with recurrent complex febrile seizures, discuss the treatment options with a Paediatrician.

- Only 2 doses of diazepam or lorazepam should be given 10 minutes apart if febrile seizures persist

12.3 EPILEPSY

Definition:

Epilepsy is a condition characterized by recurrent seizures associated with abnormal paroxysmal neuronal discharges. When seizures are recurrent, persistent or associated with a syndrome, then the child may be diagnosed with epilepsy.

The International League Against Epilepsy (ILAE) set criteria to define epilepsy as; 1) 2 or more unprovoked seizures occurring more than 24 hours apart or 2) 1 unprovoked or reflex seizure with a probability of recurrent seizures of at least 60% or higher over the subsequent 10 years or 3) diagnosis of an epilepsy syndrome.

Causes:

- Idiopathic/genetic (70-80%)
- Secondary causes:
  - Cerebral dysgenesis or malformation
  - Cerebral damage like hypoxic ischaemic encephalopathy (HIE), intraventricular haemorrhage or ischemia, head injury, infections
  - Cerebral tumours
  - Neurodegenerative disorders

Types of epilepsy and their clinical presentation

Infantile spasms (West's Syndrome)

Clinical Signs/Symptoms:

- Onset is during the first year of age
- Epileptic spasms (flexion and extension) associated with hypsarrhythmia on the EEG
- Child appears to stare, with a sudden flexion of the trunk and head, limbs either flung in or out but held in a tonic spasm for a few seconds
- Red appearance in the face and may cry out
- Developmental regression (70-90% develop intellectual disability, often severe)
- MRI may show structural abnormality
- Where available genetic and metabolic testing should be done if MRI normal
- Discuss with paediatrician management of infantile spasm or refer for proper diagnosis and management.

Generalized epilepsy with febrile seizures

Clinical Signs/Symptoms:

- Febrile convulsions which persist beyond 6 years
- Often family history of febrile convulsions
- Occasionally associated with afebrile convulsions

Primary generalized absence seizure of childhood (Petit mal)

Clinical Signs/Symptoms:

- Onset 4 - 6 years of age
- Short spells of motor arrest of maximum 15 seconds duration with little or no associated movements and no post-ictal effect
- Seizure activity may occur multiple times in a day
- EEG may show normal background or occipital intermittent rhythmic delta waves.
- Development is normal but children has high rates of learning disorders and ADHD
- Many children will remit and stop anti-seizure in late childhood

Benign Rolandic epilepsy with centrotemporal spikes

Clinical Signs/Symptoms

- Onset usually between 6–10 years but can occur before 6 years of age
- Sleep related events of hemi-facial clonic spasm
- Inability to speak with retained awareness
- Usually resolves by late adolescence

Severe Myoclonic Epilepsy of Infancy

Clinical Signs/Symptoms:

- Occur in children under 1 year of age
- Recurrent clusters of febrile convulsions, severe neuro-regression and other non-febrile seizures by 2-3 years of age
- Drug resistant seizures
- Early mortality common due to profound impairment

Lennox-Gastaut syndrome

Clinical Signs/Symptoms:

- Onset between 2 - 3 years of age
- Combination of generalized tonic clonic seizures, atypical absences, myoclonic seizures, atonic drop attacks and occasionally complex partial seizures
- Behavioral problems and neuro-regression, with most children in moderate to severe developmental delay
- EEG shows diffuse high amplitude background slowing with frontal predominant, slow spike wave.
- Epilepsy does not remit and remain drug resistant

Note: Infantile spasms, Severe Myoclonic Epilepsy of Infancy and Lennox-Gastaut syndrome are regarded as malignant forms of epilepsy and are associated with neuro-regression and behavioral problems

Complications:

- Status Epilepticus
- Trauma secondary to loss of consciousness during seizures
- Mild to severe mental retardation

Diagnosis:

- Detailed clinical history and physical examination
- Thorough family and medical history

Investigations:

- Blood work up : Full Blood count, blood sugar, malaria test, Urea, Creatinine, sodium, potassium and calcium depending on the type of epilepsy
- Electroencephalogram (EEG)
- CT/MRI scan of the brain
- Consider metabolic and genetic testing when feasible

Management

Non-Pharmaceutical

Acute management:

- Manage Airway-Breathing-Circulation-Disability and continue to monitor throughout the seizures
- If patient is unable to protect airway or poor ventilation, consider use of an oral airway, bag-mask ventilation and/or intubation
- Administer oxygen to maintain SaO2 of ≥ 95%
- Place patient on side at 20 – 30° head up to prevent aspiration
- Monitor heart rate, respiratory rate, blood pressure, oxygen saturation (SaO2), neurological status, fluid balance
- Monitor laboratory values including blood glucose, electrolytes, if available blood gases toxicology screen and if indicated anticonvulsant blood levels
- Control fever with Paracetamol with or without tepid sponging
- Administer oxygen to maintain SaO2 of ≥ 95%
- If unable to protect airway or poor ventilation, consider use of an oral airway, bag-mask ventilation and/or intubation
- Admit to pediatric ward or to intensive care unit if indicated

Medical management

- Pharmacological treatment in children <1 month of age: *Please refer to neonatology protocols 3rd Edition June 2019 for management of convulsions in children <1 month of age.
- Monotherapy is preferred and must be optimised but combination therapy may be necessary. Combination therapy should be initiated by or in close consultation with a pediatric specialist or neurologist. Drug levels are rarely indicated unless there is concern about toxicity or compliance.

For acute generalized tonic clonic seizures in children > 1 month of age:

- Diazepam rectal 0.5 mg/kg once OR IV 0.2-0.3mg/kg once
- Repeat after 10 minutes same dose only once
- Monitor airway and breathing closely

Alternative Medications (in the absence of diazepam):

- Lorazepam IV 0.05- 0.1 mg/kg once, may repeat in 5 minutes for a total of 3 doses
- Clonazepam IV 0.1 -0.15 mg/kg loading dose by slow IV injection
- For refractory status epilepticus: Midazolam IV 0.1-0.3 mg/kg bolus followed by a continuous infusion starting at 1ug/kg/minute. The infusion can be titrated upwards every 5 minutes as needed.

If persistent seizure activity after benzodiazepines, start:

- Phenobarbital 15-20 mg/kg IV or by NG tube loading dose over 15minutes, may use a dextrose containing solution. If no response after 30 minutes, may repeat a 10 mg/kg IV loading dose, give a maximum dose of 40mg/kg/in 24hrs.
- Phenytoin 15-20 mg/kg IV infused over 30 minutes in Normal saline
- If seizures persist after loading dose of either Phenobarbital or Phenytoin, manage as status epilepticus below and arrange to transfer to a centre with high dependency unit/ intensive care unit
- Monitor for bradycardia, arrhythmias, and hypotension and pause the infusion if they occur and restart at 2/3 of the initial loading dose.

Ongoing seizure control: Children with epilepsy require maintenance anticonvulsants

Table 46: Maintenance medicine treatment choices for different types of epileptic seizures.

Type of epilepsy	First line treatment	Second line treatment
Generalised tonic and/or clonic	• Valproate **OR** • Phenobarbitone (< 6 months old)	• Lamotrigine
Focal seizures	• Carbamazepine	• Lamotrigine • Topiramate
Infantile epileptic spasms	• Stabilize then consult paediatric neurologist	
Myoclonic	• Stabilize then consult paediatric neurologist	
Lennox-Gastaut syndrome	• Stabilize then consult paediatric neurologist	

Maintenance medicine treatment dosage

- Valproate, oral, 5 mg/kg/dose (starting dose), 8–12 hourly.
  - Increase by 5 mg/kg weekly to 15–20 mg/kg/day given 8–12 hourly over 4 weeks.
  - Maximum total daily dose: 40 mg/kg/day.
  - Exclude liver dysfunction prior to initiating therapy (at least ALT),
  - Monitor at least clinically for hepatotoxicity.
- Carbamazepine, oral, 5 mg/kg/dose (starting dose), 8-12 hourly.
  - Increase slowly by 0.2 mg/kg at 2 weekly intervals to 5–10 mg/kg/dose 8–12 hourly.
  - Usual maintenance total daily dose: 10–20 mg/kg/day.
  - Maximum total daily dose: 20 mg/kg/day.
  - Dosage intervals: syrup 8 hourly, tablets 12 hourly.
  - Exacerbates myoclonic seizures and absence seizures..
- Phenobarbitone, oral, 2.5–5 mg/kg/dose as single dose at night.
  - May be used in children under six months of age.
  - Is not recommended as maintenance therapy for children older than 2 years due to undesirable side effects such as sedation, behaviour disturbances, hyperkinesia and dependence, except in situations where there is poor adherence to other drugs.
  - Exacerbates absence seizures

Note:

- Patients not responding to these medications should be referred to a referral hospital for possible use of second line drugs like Lamotrigine and Topiramate
- Avoid prescribing carbamazepine, phenobarbital, and phenytoin for patients
- receiving NNRTIs or PIs, as there are serious interactions involved

Referral

- All cases of suspected infantile spasms or myoclonic seizures.
- If there is concern for a secondary cause of epilepsy requiring further evaluation (examples include brain tumors, tuberous sclerosis, brain abscess, cysticercosis, etc.). This is particularly true in partial seizures where there may be a focal neurological problem.
- Seizures that are not controlled on first-line medications within 1 month.
- Seizures associated with neuro-regression.
- Mixed seizure types within one patient.

12.4 CONVULSIVE STATUS EPILEPTICUS

Definition

Status epilepticus is a generalized epileptic seizure lasting 5 or more minutes, or the presence of two or more seizures without recovering consciousness within 30 min, or a focal seizure that persists for >10 min, or with altered consciousness lasting for 60 min or more.

Causes:

Epilepsy syndromes may present first as status epilepticus or status epilepticus may occur with inadequate anti-epileptic drug levels.

- CNS infection
- Hypoxic ischemic insult
- Traumatic brain injury
- Cerebrovascular accidents
- Metabolic disease including severe hypoglycemia and inborn errors of metabolism
- Electrolyte imbalance
- Intoxication
- Cancer including primary brain tumors and metastatic disease
- Epilepsy and epileptic syndromes

Signs and Symptoms

- Seizure lasting > 5 minutes or repetitive seizure activity without return to baseline consciousness.

Diagnosis

- Clinical evaluation

Investigations

- Blood work up : Full Blood count, blood sugar, malaria test, Urea, Creatinine, sodium, potassium and calcium depending on the type of epilepsy
- Lumbar puncture if infectious cause is suspected.
- Electroencephalogram (EEG), more precisely video EEG when available.
- CT/MRI of the brain

Complications:

- Hypoxic ischaemic damage to brain, myocardium and muscles
- Cerebral oedema
- Long term neurologic morbidity including persistent seizures or encephalopathy
- Respiratory depression or failure due to neurologic status or aspiration
- Blood pressure disturbances including severe hypotension or severe hypertension
- Hyperthermia
- Metabolic derangement including hypoglycemia, alterations in sodium, and acidosis
- Inappropriate antidiuretic hormone (ADH) secretion
- Renal failure
- Death

Non-pharmaceutical

Acute Management:

- Carefully evaluate vital signs as convulsions may cause alterations in blood pressure or interfere with breathing resulting in a decrease in oxygen saturation levels
- Manage Airway-Breathing-Circulation-Disability and continue to monitor throughout seizures
- Place patient on side at 20–30° head up to prevent aspiration
- Monitor heart rate, respiratory rate, blood pressure, oxygen saturation (SaO2), neurological status, fluid balance every 15 minutes or as frequently as possible

- Monitor laboratory values including blood glucose, electrolytes, blood gases, toxicology screen and if indicated anticonvulsant blood levels
- Control fever with Paracetamol
- Administer oxygen to maintain SaO2 of ≥ 95%
- If unable to protect airway or poor ventilation, consider use of an oral airway, bag-mask ventilation and/or intubation
- Admission to intensive care if possible

Pharmacological treatment of status epilepticus

  - Diazepam
    - Infants and Children 6 months to 5 years: Rectal: 0.5 mg/kg rectally without exceeding 10 mg
    - Children 6 to 11 years: Rectal: 0.3 mg/kg.
    - Children ≥12 years and Adolescents: Rectal: 0.2 mg/kg.
  - In all cases if seizure continues, repeat dose once after 10 minutes.
  - Monitor respiratory rate.
- If still fitting after 20 minutes
  - IV Phenobarbitone (loading 20mg/kg over 15 mins, max 1g) OR
  - IV phenytoin (loading dose 20mg/kg in Normal saline over 60 mins)
  - If seizure continues after Phenobarbitone, load with Phenytoin or if it persists after Phenytoin loading dose, load with Phenobarbitone If seizures continue despite the above, transfer to ICU for Endotracheal intubation and thiopental infusion

It is important to continue to address and manage the following:

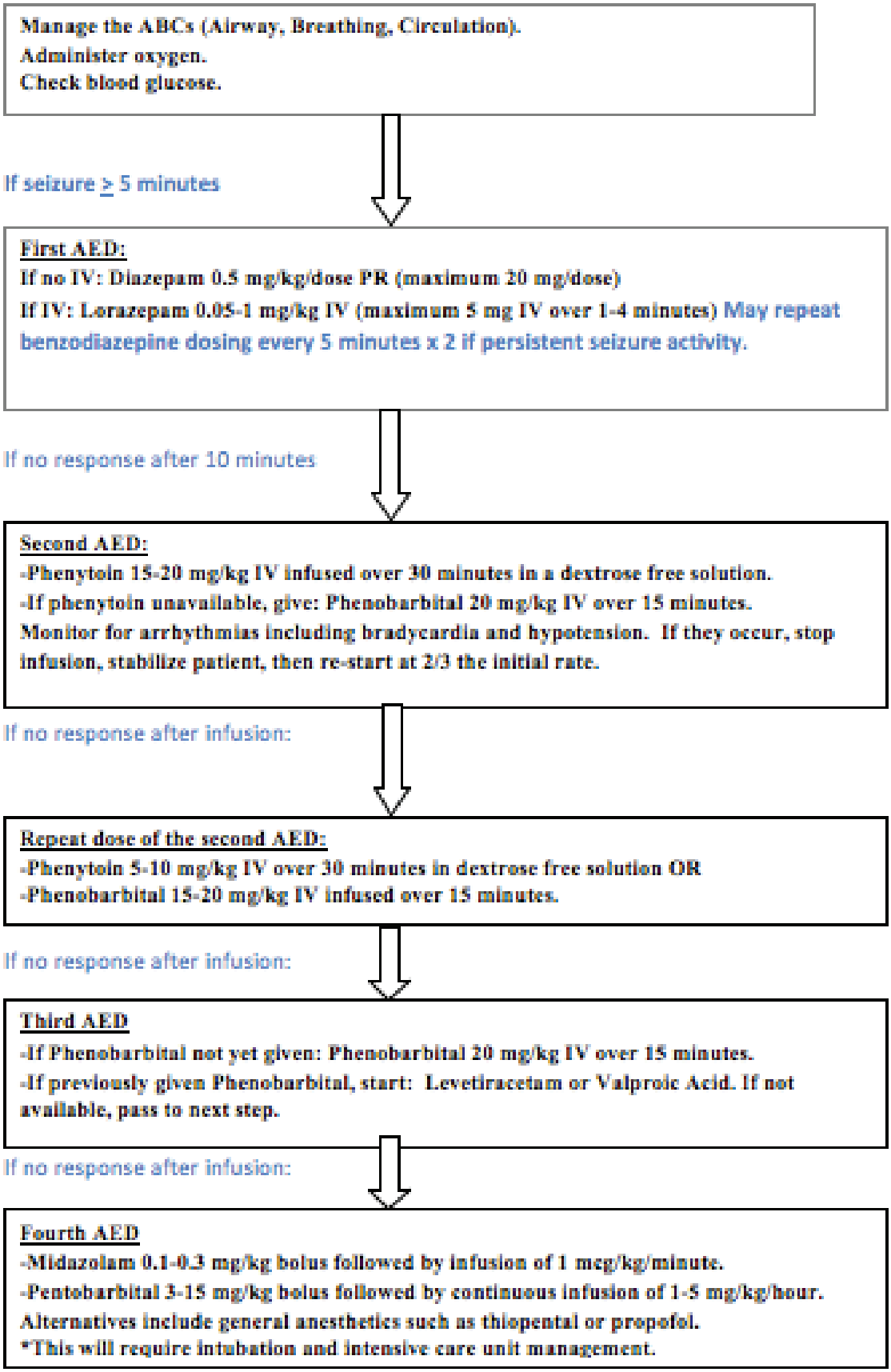
- ABCs
- Hypoxia: Administer oxygen, oral airway, bag-mask ventilation or intubation.
- Haemodynamic: Assess for shock or hypertension and manage accordingly.
- Hyperthermia: Treat with paracetamol 10-15 mg/kg orally or rectally every 4-6 hours as required.
- Hypoglycemia: Treat with IV dextrose solution.
- Electrolyte imbalance: Assess aetiology and manage accordingly.
- If cerebral oedema and normal renal function, consider mannitol IV 0.5-1 gram/kg administered over 30–60 minutes.
- If there is a known space-occupying lesion, consider dexamethasone IV 1-2 mg/kg IV as a single dose then 1-1.5 mg/kg/day divided into 4 doses after discussion with a neurosurgeon

Recommendations

- Once status epilepticus is resolved, consider maintenance therapy with an appropriate anti-epileptic drug depending on the aetiology of seizure.

Referral to a specialist is always appropriate in the case of status epilepticus. If possible, control seizures and stabilize the patient before referral. If status epilepticus has resolved, further work-up by a neurologist may be indicated

Figure 13: A flowchart showing medical management of Status Epilepticus:



12.5 CEREBRAL PALSY

Definition

Cerebral palsy is a group of non-progressive clinical syndromes due to brain abnormalities from a variety of causes that is characterized by motor and postural dysfunction of varying severity. Though it is not progressive, the appearance of the brain lesions and the clinical manifestations may change over time as the brain matures.

Common Causes:

- The etiology of the disorder is unknown in most the cases.
- Perinatal complications leading to perinatal hypoxia (toxemia, placenta previa, abruptio placentae, etc.)
- Congenital infections (TORCH)
- Teratogenic substances
- Congenital abnormalities including brain malformations and hereditary disorders
- Prematurity with intracranial hemorrhage
- Cerebral trauma
- Infections (Bacterial sepsis, meningitis, herpes)
- Metabolic disturbances (kernicterus, severe prolonged hypoglycemia, Reye's syndrome)
- Intoxication

Clinical Signs/Symptoms:

Findings are consistent with a specific CNS lesion and commonly include:

- Spastic syndromes : diplegia, hemiplegia, or quadriplegia
- Dyskinetic syndromes : athetosis, chorea or dystonia
- Ataxic syndromes
- Atonic syndromes
- Abnormal persistence or absence of infantile reflexes

Associated Disorders & Complications may include:

- Cognitive impairments. Intellectual disability, learning problems and perceptual difficulties are common. There is a wide range of intellectual ability and children with severe physical disabilities may have normal intelligence
- Psychiatric disorders : Behavioral, emotional or psychiatric disorders
- Epilepsy: This occurs in 45% of patients with CP and the onset is generally in the first 2 years of life.
- Gastro-oesophageal reflux can result in oesophagitis or gastritis, causing pain, poor appetite and aspiration.
- Speech, swallowing, vision and hearing problems
- Constipation
- Drooling (poor saliva control).
- Incontinence. Children may be late in achieving bowel and bladder control because of cognitive deficits or lack of opportunity to access toileting facilities because of physical disability or inability to communicate. Some children have detrusor over activity causing urgency, frequency and incontinence.

- Growth failure: This is generally due to poor nutrition.
- Pulmonary disease: This is usually due to chronic aspiration and chronic pulmonary disease is a leading cause of death in patients with CP.
- Orthopedic disease: This includes hip and foot deformities and spinal curvatures. Patients may have chronic back, neck, and joint pain.
- Osteopenia: This is multifactorial related to poor nutrition, lack of motility and chronic medication use.
- Visual problems e.g. strabismus, refractive errors, visual field defects and cortical visual impairment
- Hearing deficits

Diagnosis:

- Based on history and clinical examination of the patient.

Investigations:

- Neuro-imaging including brain ultrasound, CT or MRI
- Lumbar puncture if indicated
- Basic lab-work to exclude other abnormalities (liver and renal function tests)
- Genetic screening depending on the clinical and family history
- Metabolic screening depending on the clinical and family history and basic lab work
- EEG
- Audiogram and visual evaluation to exclude correctable hearing or vision loss
- X-rays if indicated

Common reasons to come to hospital

- Respiratory problems particularly pneumonia
- Uncontrolled seizures / status epilepticus
- Unexplained irritability - consider acute infections, oesophagitis, dental disease, hip subluxation, pathological fracture.

Management:

Management involves a team approach with health professionals and teachers. Input from the family is paramount

- Pharmacologic management of seizures (see above)
- Multidisciplinary services to address and promote social and emotional development, communication, education, nutrition, mobility and maximal independence and normal appearance.
    - Physical, occupational, and speech language therapy as necessary
    - Social services provided in a variety of context to aid in the coordination of care.
    - Nutritional assessment and support for those with dysphagia and/or poor growth
    - Mobility aids including crutches, walkers, or wheelchairs as needed
    - Surgical procedures to correct spasticity, contractures, scoliosis, or hip disorders
- Pharmacologic management of spasticity:
    - Botulinum toxin injections: Must be done by trained provider.
    - Dantrolene oral 0.5 mg/kg/dose once daily for 7 days, then increase to 1.5 mg/kg divided 3 times/day for 7 days, then increase to 3 mg/kg/day divided 3

times/day for 7 days, then increase to 6 mg/kg/day divided 3 times/day. Do not exceed 400 mg/day.

- Benzodiazepines: Dose varies based on medication. Diazepam may be used: If 5 years: <8.5 kg: 0.5-1 mg at bedtime; 8.5-15 kg: 1-2 mg at bedtime; >5 years: 1.25 mg given 3 times per day up to 5 mg given 4 times per day.
- Baclofen oral: <2 years: 10-20 mg divided every 3 times per day, titrate dose every 3 days in increments of 5-15 mg/day to a maximum of 40 mg daily; 2-7 years: 20-30 mg/day divided 3 times per day, titrate dose every 3 days in increments of 5-15 mg/day to a maximum of 60 mg/day, >8 years: 30-40 mg/day divided every 8 hours, titrate dose every 3 days in increments of 5-15 mg/day to a maximum of 120 mg/day.
- Intrathecal baclofen: Requires neurosurgical intervention to place pump to deliver medication. The benefits and complications should be discussed in detail with the neurosurgeon.

References:

1. Hadjiloizou and Bourgeois. Antiepileptic drug treatment in Children. Expert Rev Neurotherapeutics 2007. Updated to 2011.
2. Loddenkemper, T., & Goodkin, H. (2011). Treatment of Pediatric Status Epilepticus. In H. S. Singer (Ed.), Pediatric Neurology. In Current Treatment Options in Neurology. Springer Science + Business Media. DOI 10.1007/s11940-011-0148-3
3. Miller, G. Clinical Features of Cerebral Palsy. In: UpToDate., Patterson, MC (Ed), UpToDate, Waltham, MA.
4. Miller, G. Epidemiology and Etiology of Cerebral Palsy. In UpToDate., Patterson, MC (Ed), UpToDate, Waltham, MA.
5. Miller, G., Management and Prognosis of Cerebral Palsy. In UpToDate., Patterson, MC (Ed), UpToDate, Waltham, MA.
6. Miller, G., Diagnosis of Cerebral Palsy. In UpToDate., Patterson, MC (Ed), UpToDate, Waltham, MA.
7. Pocket Book of Hospital Care for Children. World Health Organization (2005). Geneva, Switzerland: WHO Press.
8. Wilfong, A., Management of status epilepticus in children. In UpToDate., Nordii, D (Ed), UpToDate, Waltham, MA.
9. Wilfong, A., Clinical features of status epilepticus in children. In UpToDate., Nordii, D (Ed), UpToDate, Waltham, MA.
10. Wilfong, A. Treatment of seizures and epileptic syndromes in children. In UpToDate., Nordii, D (Ed), UpToDate, Waltham, MA.

CHAPTER 13: ADOLESCENT HEALTH

13.1 INTRODUCTION

World Health Organization defines “adolescents” as those ages 10–19. It is a transitional stage of physical and psychological development that occurs during the period from puberty to legal adulthood

- Adolescents engage in unsafe activities that reflect the processes of adolescent development, including experimentation and exploration that may involve drugs and alcohol, tobacco, sexual activity, and other risk taking behaviors that affect their physical and mental health.
- These problems are often rooted in behaviours that are diagnosed not with a laboratory test or a physical examination but through open communication between the physician and the adolescent.
- It is critical to establish rapport and build trust with adolescent, or else they will not feel comfortable discussing sensitive health concerns.
- Assurances of confidentiality increase the number of adolescents who will discuss sensitive information about sexuality, sexual abuse, substance misuse, and mental health and those who are willing to seek future health care.

13.2 INTERACTION WITH ADOLSCENTS

Elements of successful interaction with adolescents

- Adolescents need a good listener with respect
- They don’t want to be judged
- They need privacy and confidentiality
- They want an atmosphere to let them talk and ask more questions
- Always remember the uniqueness of each adolescent during an interview and on examination
- It is not always about treating sickness, it is also about keeping them healthy and the pursue of healthy living style

13.3 ADOLESCENT ASSESSMENT

- Assessment of adolescents must be comprehensive and individualized, it must cover psychosocial, physical and tailored laboratory investigation.
- Introduce yourself to the family and indicate you are there to attend/discuss their concerns.
- Explore issues that concern the teen - not only those concerns of the parents. The adolescent's comments must be treated seriously. .
- A psychosocial assessment tool has been developed to assess issues at home, education, activities, drugs, sexuality, suicide or depression, and safety (HEADSSS). This assessment tool can be tailored to the individual adolescent’s needs.
- The "HEADSSS" mnemonic reminds clinicians about the psychosocial factors that influence the physical and emotional wellbeing of teenagers. This is a helpful screening tool for identifying potential problems and risk factors.

Table 47: Assessing issues of home, education, activities, drugs, sex, suicide or depression, and safety

Issue	Sample question
Home	• How do you get along with the people you live with? • How much time do you spend at home? • Can you go to your parents with problems? • Have you ever run away from home?
Education	• What class are you in? • What grades are you earning? Have they changed? • What are your best and your worst classes? Why? • Have you ever failed any classes or academic year? • Do you ever miss classes?
Activities	• What activities are you involved in during and after school? • Are you active in sports? Do you exercise? • Who do you go to with problems?
Drugs	• Do you smoke cigarettes? Have you ever smoked one? • Have you ever tasted alcohol? When? What kind and how often? • What drugs have you tried? Have you ever injected drugs or steroids? • When? How often do you use them? How did you pay for the drugs?
Sexual activity or sexual identity	• Are you sexually active? • Have you ever had sex unwillingly? • How many sexual partners have you had before? • Have you ever been pregnant? • Have you ever had an infection resulting from sex? • Do you use condoms or another form of contraception or sexually transmitted disease (STD) prevention? (use specific names for STDs). • Have you ever traded sex for money, drugs, clothes, or a place to stay? • Have you ever been tested for the human immunodeficiency virus, or HIV? Do you • Think it would be a good idea to be tested?
Suicide or depression	• How do you feel today on a scale of 0 to 10 (0 being very sad and 10 being very happy)? • Have you ever felt less than 5? • What made you feel that way? • Did you ever think about hurting yourself, that life wasn't worth living, or hope that when you went to sleep you wouldn't wake up again?
Safety	• Has anyone ever hurt you or intentionally destroyed something you value? • Do you ever feel unsafe at home, school, or at work or play? • How do you and your parents resolve conflicts? Have you ever been hit, pushed, or shoved? • Has anyone ever touched you in a private place against your will?

13.4 PHYSICAL EXAMINATION

- Conduct complete health exam to identify any health problems and provide needed treatment. This has increased the public health interest in health promotion, early detection and preventive health care for adolescents
- Explain to the adolescent about the examination, check if he/she prefers their parent or someone else in the room for support.
- Physical examination should be systemic, to minimize the patient's anxiety about the examination, begin by touching a neutral area before examining the genitalia or other private parts of the teen.
- Explain your examination findings, offer a chance for adolescent to ask questions and make sure the adolescent understands what it is his/her health problem.

13.5 COMMUNICATING THE DIAGNOSIS, OPTIONS AND TREATMENT

Once the adolescent is examined and a diagnose identified, it is important to inform the client about the finding, the options and necessary treatments in a way that she/he understands them and can deal with them. Therefore, clarify beforehand if an accompanying person should return into the room.

- When you talk demonstrate your esteem and empathy to the young client through your speech and your body language and be open for questions at any time.
- Inform the patient about the diagnosis and explain its implications for their health and life
- Use language and concepts that they are likely to understand.
- Information about the different treatment options can help clients to choose the one that matches their preferences and circumstances.
- This will furthermore increase the likelihood that they will adhere to the treatment and its effectiveness.
- Periodically assess their understanding (e.g. by asking them to say in their own words what they understand about the issue)
- Respond to questions any time.
- Help the client to decide/choose their preferred treatment or course of action.
- Respect their choice even if it is not the one you would have wanted them to make.
- When providing medication, explain why they need to take it, when and how.

Table 48: Prevention and intervention measures

Condition	Background	Interventions
Alcohol and drug abuse	• Most adolescents experiment with alcohol. • Alcohol and drugs can lead to or be a symbol of emotional problems. • Adolescents are twice as likely as adults to drive under the influence of alcohol • Screening tests for drug use are of questionable value in the care of adolescents and may not locally be available.	• Deliver preventive messages at every routine visit. • Ask about alcohol drug use without parents or guardians present. • Ask questions nonjudgmentally about substances used, frequency of used, and quantity of use as well as setting in which such use occurs. • Reinforce that if teens do drink or use drugs, that they take preventive steps such as not driving while under the influence. • Look for signs of substance abuse, such as aggressive behavior, recent change in personal appearance, personality changes, cutting classes, changes in school performance. • Where possible and indicated, referral for substance abuse counseling and treatment.
Dental diseases	• Dental and periodontal diseases are common and present long term risks. • Dental conditions can be disabling, disfiguring, and costly. • Dental caries, gingivitis, and periodontal disease, although primarily occurring in later life, are preventable.	• Provide counseling through discussion and printed material. • Pay particular attention to high risk patients, such as those with diseases such as diabetes and smokers • Counsel teens on preventive oral hygiene, including brushing with fluoride toothpaste, flossing, and limiting dietary intake of sugar. • Encourage teens to be seen regularly by a dental care provider.
Injuries	• Accidents and unintentional injuries are the leading cause of death in adolescents, including motor vehicle accidents, head injuries and drownings. • Safe practices substantially reduce injuries including seatbelts, helmets (for use on motorcycles or bicycles	• Promoting behavior change. • Discuss injury prevention at each visit to target in depth discussions to high-risk areas. • Have printed information available. • Encourage teens to learn to swim or at least learn about water safety. • Encourage teens to learn CPR and/or appropriate basic safety skills.

	• Alcohol and substance misuse often play a key role	
Tobacco use	• Most smokers begin to smoke as teenagers. • Once a teen begins to smoke, he or she is likely to continue. • Smoking often occurs in the context of other risky behaviors. • Prevention programs have been effective in reducing smoking up to 4 years following the counseling.	• Clinic and staff should regularly ask about smoking use. • Effective strategies include stickers on the chart, adding smoking to list of vital signs, and direct questioning. • When patients do not use tobacco, provide positive reinforcement. • Enroll a teen who smokes in a smoking cessation program.
Sexual activity	• Teens are sexually active, and many will become pregnant. • Teen pregnancy poses significant problems, both physical and mental. • In teens who delay seeking effective prenatal care, pregnancies are at a particularly high risk. • Progesterone with condoms and oral contraceptives with condoms are equally effective if used as directed, and are well tolerated by teenage women. • Hormonal contraception (either medroxyprogesterone acetate or oral contraceptive pills) is safe and effective.	• Begin discussion about pregnancy with teens well before they become sexually curious. • Regularly discuss sexuality, the prevention of sexually transmitted diseases, sexual orientation. • Adolescent women should be told about the risks and benefits of emergency contraception. • Condoms should be available, and staff should feel comfortable showing adolescents how to use them.

References

1. Chun TH et al. Evaluation and Management of Children and Adolescents with Acute Mental Health or Behavioral Problems. Part I: Common Clinical Challenges of Patients with Mental Health and/or Behavioral Emergencies. Pediatrics. 2016;138(3):e20161570
2. Michael S Wilkes. A primary care approach to adolescent health care: West J Med 2000; 172:177–182.
3. Powers ME, Takagishi J, AAP Ccommittee on adolescence, AAP council on early childhood. Care of Adolescent Parents and Their Children. Pediatrics. 2021; 147(5):e2021050919.
4. WHO, setting WHO directions. Caring for Children and adolescents with mental disorders. Geneva, 2003.

CHAPTER 14: CHILDHOOD AND ADOLESCENT OBSESITY

14.1 INTRODUCTION

Childhood obesity is a growing global health problem. There are few evidence-based studies specifically addressing the treatment of childhood obesity, thus the management and treatment of the child with obesity is left to the practitioner to use clinical judgment and persuasion to modify the family's dietary and lifestyle habits.

- The main risk factor for a child to be overweight or obese is an unbalance between energy intake and energetic expenditure
- Epigenetics is thought to play a large role in the precipitous rise in obesity over the past 30 years.
- Children are at increased risk for obesity if their parents have obesity: there is a 30% chance of obesity if one parent has obesity and a 90% chance if both parents have obesity.
- Obesity in childhood is associated with a maternal preconception BMI (body mass index) ≥30 kg/m2, excessive gestational weight gain, and gestational diabetes mellitus
- Infants who are small for gestational age due to tobacco abuse or insufficient maternal weight gain are also at risk for obesity and metabolic disease in childhood.

Practitioners often do not have the competence nor know where to turn to find guidance on managing the raising number of children who presents for medical care either with obesity that coexist with other medical problems or because of obesity.

14.2 INITIAL ASSESSMENT

Assess Risk:

Family or Personal History of:

- Medical and family history is crucial for assessing obese youths, because obesity and associated comorbidities may be asymptomatic/subclinical but have familial tendencies.
- Cardiovascular disease, dyslipidemia, obesity, diabetes, hypertension, sleep apnea premature CVD events/deaths (such as heart attacks or strokes); and infertility, Polycystic ovary syndrome PCOS (in women)
- Assess the presence of polyuria/polydipsia, blurry vision, and fungal vaginitis/discharge in girls, and unexplained weight loss, all of which could be indicative of hyperglycemia
- Assess for presence of frequent unexplained headaches, which raise the possibility of hypertension
- Obtain careful history for psychiatric disorders, children and adolescents who are overweight or obese are more likely to suffer from mental health disorders than their normal weight counterparts
- Detailed history of second-generation antipsychotics use, such as clozapine, risperidone, olanzapine, and quetiapine, because of their association with weight gain

Assess Dietary Behaviours

It is important to estimate the type and quantity of food and beverage average daily intake, the frequency of eating (at home or out of home), and the frequency and type of snacks (among other dietary issues)

- Excessive sweetened beverages
- Minimal fruit and vegetable consumption
- Frequency of eating out versus family meals
- Lack of daily breakfast, skipped meals
- Inappropriate portion sizes
- Snacking habits

Assess Physical Activity Behaviors

- Obtain a history of sedentary behaviors; daily activity patterns, amount of moderate exercise, snacking, amount of screen time (TV, computer, video games, etc.)

Assess Attitudes

- Assess perception of weight/Body image, readiness/Barriers to change.

14.3 PHYSICAL ASSESSMENT AND OBESITY DIAGNOSIS

- Measure Weight, Height, Wrist circumference, use body mass index (BMI) and the Centers for Disease Control and Prevention (CDC) normative BMI percentiles to diagnose overweight or obesity in children and adolescents ≥2 years of age.
- Normal weight-BMI between the 5^{th} and < 84^{th} percentile for age and sex
- Diagnosing a child or adolescent >2 years of age as overweight if the BMI is ≥85th percentile but,<95th percentile for age and sex, as obese if the BMI is ≥95th percentile, and as extremely obese if the BMI is ≥120% of the 95th percentile or ≥35 kg/m2 whichever is lower.
- Suggest calculating, plotting, and reviewing a child's or adolescent's BMI percentile at least annually during well-child and/or sick-child visits.
- For children ,<2 years of age be diagnosed as obese if the sex-specific weight for recumbent length is ≥97.7th percentile on the World Health Organization (WHO) charts.
- Blood pressure should be carefully measured using a proper-sized cuff; hypertension is defined as systolic or diastolic blood pressure ≥95^{th} percentile for children 1 to 13 years and ≥130/80 for adolescent 13 years or older on at least 3 occasions.
- HEENT exam may provide clues to the etiologies of obesity and/or comorbidities
- Examination of skin and hair is useful in evaluating signs of endocrine etiologies and or complications
- Abdominal exam to look for signs of gallbladder disease and nonalcoholic fatty liver disease
- Musculoskeletal (look for evidence of slipped capital femoral epiphysis or Blount disease

- Routine laboratory evaluations for endocrine etiologies of pediatric obesity are not mandatory unless the patient's stature and/or height velocity are attenuated (assessed in relationship to genetic/familial potential and pubertal stage).
- Children or adolescents with a BMI of ≥85th percentile must be evaluated for potential comorbidities

Genetic obesity syndromes

- Consider genetic testing in patients with extreme early onset obesity (before 5 years of age) and that have clinical features of genetic obesity syndromes (in particular extreme hyperphagia) and/or a family history of extreme obesity.
- Approximately 7% of patients with extreme pediatric obesity may have rare chromosomal abnormalities and/or highly penetrant genetic mutations that drive their obesity
- Appropriately counsel and advise for families and parents where genetic testing is feasible, genetic diagnosis can provide information that helps health care providers appropriately manage the child's or adolescent's health and possibly lessen the social stigma.

Endocrine and syndromic disorder

- The distinguishing feature of endocrine causes of obesity, such as growth hormone (GH) deficiency, hypothyroidism, or Cushing syndrome, is that stature and height velocity are decreased, whereas a normal or increased growth rate generally excludes endocrine causes.
- However, Albright hereditary osteodystrophy/pseudohypoparathyroidism, although associated with short stature in adolescence, may be associated with increased growth velocity in the first 2 to 3 years of life.
- Paediatric overweight/obesity is also associated with earlier breast development, pubarche, and menarche in girls, and advanced skeletal development in boys that will lead to increased growth rate.
- Thus, clinicians should not test for endocrine causes of obesity unless the patient is short relative to genetic potential and has decreased growth velocity against the backdrop of continued weight gain.

14.4 OBESITY RELATED CONDITIONS

- Paediatric overweight and obesity is associated with substantial comorbidities, greater the severity of obesity, the higher the risks of cardiometabolic risk factors, particularly among boys.
- Clinicians should carefully examine medical and family history and laboratory assessments of children and adolescents who are overweight or obese to identify comorbidities early and initiate appropriate management
- The following conditions are associated with obesity and should be considered for further work-up. Additional lab tests may be warranted if indicted by the patient's clinical condition.

Table 49: Obesity related conditions

Dermatologic: Acanthosis nigricans Hirsutism Intertrigo	**Endocrine:** Polycystic ovarian syndrome (PCOS) Precocious puberty Pre-diabetes: Impaired fasting glucose and/or impaired glucose tolerance as demonstrated during a GTT Premature adrenarche Type 2 Diabetes **Cardiovascular** Hypertension Dyslipidemia Premature atherosclerotic cardiovascular disease Alterations in cardiac structure and function	**Gastrointestinal:** Cholelithiasis Constipation GERD Nonalcoholic fatty liver disease or steatohepatitis **Neurologic:** Pseudotumor cerebri	**Orthopedic:** Blount's Disease Slipped capital femoral epiphysis (SCFE) **Pulmonary:** Asthma Obstructive sleep apnea Obesity hypoventilation syndrome **Psychological/Behavioral Health:** Anxiety Binge eating disorder Depression Teasing/bullying **Renal:** Impaired kidney function

Laboratory Screening and Tests

- It is important to identify adiposity-related complications and screening for comorbidities because of their high prevalence and their association with morbidity and mortality.
- The 2007 Expert Committee recommends a fasting glucose and fasting lipid profile along with ALT and AST.
- Additionally, Endocrine Society recommends using A1C, fasting glucose or oral glucose tolerance to test for diabetes or pre-diabetes.
- For patient convenience, non-fasting screening lab tests can be performed and taking fasting samples if there is suspicion.
- Clinical judgment and availability of testing should be used to help determine the timing of follow up of abnormal labs.
- Currently, there are no guidelines on when to start laboratory testing for patients with obesity. Based upon the patient's health risk, some experts recommend start screening patients at 2 years of age.

Note: Consider Fasting Lipid Profile age ≥ 2 years, additional hepatic function and fasting glucose should be considered at age ≥ 10 years. Clinical judgment may dictate additional labs in the younger child with higher risk.

Table 50: Plasma Glucose criteria

Plasma Glucose	Normal	Impaired	Diabetes
Fasting	<100	100-125	≥ 126
Oral gtt 2h PG	<140	140-199	≥ 200
Random			≥ 200 + symptoms

Abnormal values may warrant referral or consultation with Endocrinology specialist

Table 51: Cholesterol level interpretation

Category	Total Cholesterol *(mg/dL)*	LDL *(mg/dL)*	HDL *(mg/dL)*
Acceptable	<170	<110	>40
Borderline	170-199	110-129	
Abnormal	≥ 200	≥ 130	<40

Abnormal values may warrant referral or consultation with Cardiology or lipid specialist.

Table 52: Triglyceride age and sex normal ranges

	Normal mg/dL	
Age (y)	Male	Female
8-9	25-90	30-115
10-11	30-105	35-130
12-15	35-130	40-125
16-19	40-145	40-125

Abnormal values may warrant referral or consultation with Cardiology
Note: AST and ALT values will vary by laboratory, refer to local lab for normal values. Abnormal values may warrant referral or consultation with a gastroenterology specialist.

14.5 PREVENTION OF OBESITY

Prescribe and support healthy eating habits such as:

- Avoiding the consumption of calorie-dense, nutrient-poor foods (e.g., sugar-sweetened beverages, sports drinks, fruit drinks, most “fast foods” or those with added table sugar, high-fat or high sodium processed foods, and calorie-dense snacks)

- Encouraging the consumption of whole fruits rather than fruit juices.
- Encourage children and adolescents to engage in at least 20 minutes, optimally 60 minutes, of vigorous physical activity at least 5 days per week to improve metabolic health and reduce the likelihood of developing obesity.
- Fostering healthy sleep patterns in children and adolescents to decrease the likelihood of developing obesity due to changes in caloric intake and metabolism related to disordered sleep.
- Discuss balancing unavoidable technology related screen time (TV, video games etc) in children and adolescents with increased opportunities for physical activity.
- Clinicians should assess family function and make appropriate referrals to address family stressors that lead to the development of obesity.
- Encourage using school-based programs and community engagement in pediatric obesity prevention.
- Promote and encourage breast-feeding in infants based on numerous health benefits and WHO exclusive breast-feeding for six months and continue breast feeding with appropriate complementary feeds for at least two years.

14.6 MANAGEMENT OF OBESITY

Lifestyle: general considerations

- Paediatricians must prescribe and support intensive, age-appropriate, culturally sensitive, family-centered lifestyle modifications (dietary, physical activity, behavioral) to promote a decrease in BMI.
- Encourage and support healthy eating habits in accordance with the following guidelines of the American Academy of Pediatrics.
- Decrease consumption of fast foods
- Decrease consumption of added table sugar and elimination of sugar-sweetened beverages
- Decrease consumption of high-fat, high sodium, or processed foods
- Encourage consumption of whole fruit rather than fruit juices
- Food portion control education appropriate for age.
- Reduce saturated dietary fat intake for children and adolescents >2 years of age
- Recommend increased intake of dietary fiber, fruits, and vegetables
- Timely, regular meals, and avoiding constant “grazing” during the day, especially after school and after supper
- Recognize eating cues in the child’s or adolescent’s environment, such as boredom, stress, loneliness, or screen time
- Recommend reduction of inactivity and also a minimum of 20 minutes of moderate to vigorous physical activity daily, with a goal of 60 minutes, all in the context of a calorie-controlled diet.
- Encourage and support patients to limit nonacademic screen time to 1 to 2 hours per day and decrease other sedentary behaviors, such as digital activities.