STANDARD TREATMENT GUIDELINES

AND

ESSENTIAL MEDICINES LIST

FOR

SOUTH AFRICA

HOSPITAL LEVEL

PAEDIATRICS

2017 EDITION

health
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Health
REPUBLIC OF SOUTH AFRICA

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Additionally, the updated Paediatric Standard Treatment Guidelines and Essential Medicines List will be added to the mobile application, "EML Clinical Guide". This mobile application can be downloaded on android, IOS and windows operating systems, from the relevant app stores.

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Note:
The information presented in these guidelines conforms to the current medical, nursing and pharmaceutical practice. Contributors and editors cannot be held responsible for errors, individual responses to drugs and other consequences.

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FOREWORD

"Children are our greatest treasure. They are our future."
— Nelson Mandela

Our children are our next generation, and as a vulnerable group, it is imperative that their health and wellbeing is a priority. To this end I am proud to present the fourth edition of the Paediatric Hospital Level Standard Treatment Guidelines (STGs) and Essential Medicines List (EML).

As we move to the era of National Health Insurance with an integrated health care system to service the needs of all, it is imperative that the health of our children is prioritised, to ensure the next generation is well taken care of.

I am happy to present the STG and EML in electronic format, now available on your cellphones. This makes access to information that you need to care for our patients much easier.

The latest edition of the Paediatric Hospital Level STGs and EML is a culmination of many efforts, and we are immensely grateful to all those who participated in the review process.

It is our hope that healthcare workers will continue to utilise the STGs and EML in their endeavors while caring for our young patients.

DR A MOTSOALEDI, MP
MINISTER OF HEALTH
DATE: 14/12/2017

INTRODUCTION

The National Department of Health (NDoH) is committed to ensuring an adequate and reliable supply of safe, cost-effective medicines of acceptable quality to all citizens of South Africa, and ensuring the rational use of these medicines by prescribers, dispensers and consumers. I am, therefore, pleased to introduce the fourth edition of the Paediatric Hospital Level Standard Treatment Guidelines (STGs) and Essential Medicines List (EML), a tool that can be used to achieve this goal.

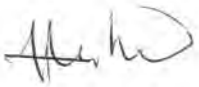
The STGs and EML development processes ensure for the selection of safe, effective and cost-effective medicines, and provide a framework for their use to ensure rational medicine use by healthcare professionals and patients.

With the move to the electronic mobile application platform, it is our hope that the most up-to-date information will be easily accessible to all healthcare professionals as they need it.

The review of the Paediatric Hospital Level STGs and EML has been the collective efforts of an Expert Review Committee, National Essential Medicine List Committee and external stakeholders involved in paediatric care.

I would like to take this opportunity to thank all those who participated and contributed to the review process, and continue to promote rational medicine use in their respective healthcare and teaching settings.

It is our hope that healthcare professionals will continue to make use of the STGs and EML in their efforts to provide the best possible care, and ensure that all the healthcare needs of our children are met.



MP MATSOSO
DIRECTOR-GENERAL: HEALTH
DATE: 22/01/2018

ACKNOWLEDGEMENTS

Without the continued dedication of the members of the Paediatric Expert Review Committee for the Hospital Level Essential Medicines List, this edition of the Standard Treatment Guidelines and Essential Medicines List would not have been possible. The quality of this edition was further enhanced by the contribution of many doctors, pharmacists, professional societies and other health care professionals. We are humbled by the willingness to participate in the consultative peer review process. We hope that, with renewed enthusiasm, future editions will benefit from your contributions.

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THE ESSENTIAL MEDICINES CONCEPT

The WHO describes Essential medicines as those that satisfy the priority health care needs of the population. Essential medicines are intended to be available within the context of functioning health systems at all times in adequate quantities, in the appropriate dosage forms, with assured quality and adequate information, and at a price the individual and the community can afford.

The concept of essential medicines is forward-looking. It incorporates the need to regularly update medicines selections to:

» reflect new therapeutic options and changing therapeutic needs;
» the need to ensure medicine quality; and
» the need for continued development of better medicines, medicines for emerging diseases, and medicines to meet changing resistance patterns.

Effective health care requires a judicious balance between preventive and curative services. A crucial and often deficient element in curative services is an adequate supply of appropriate medicines. In the health objectives of the National Drug Policy, the government of South Africa clearly outlines its commitment to ensuring availability and accessibility of medicines for all people. These are as follows:

» To ensure the availability and accessibility of essential medicines to all citizens.
» To ensure the safety, efficacy and quality of drugs.
» To ensure good prescribing and dispensing practices.
» To promote the rational use of drugs by prescribers, dispensers and patients through provision of the necessary training, education and information.
» To promote the concept of individual responsibility for health, preventive care and informed decision-making.

Achieving these objectives requires a comprehensive strategy that not only includes improved supply and distribution, but also appropriate and extensive human resource development. The implementation of an Essential Drugs Programme (EDP) forms an integral part of this strategy, with continued rationalisation of the variety of medicines available in the public sector as a first priority. The private sector is encouraged to use these guidelines and drug list wherever appropriate.

The criteria for the selection of essential drugs for Primary Health Care in South Africa were based on the WHO guidelines for drawing up a national EDL. Essential medicines are selected with due regard to disease prevalence, evidence on efficacy and safety, and comparative cost.

The implementation of the concept of essential medicines is intended to be flexible and adaptable to many different situations. It remains a national responsibility to determine which medicines are regarded as essential.

HOW TO USE THIS BOOK

Principles

The National Drug Policy makes provision for an Essential Drugs Program (EDP), which is a key component in promoting rational medicines use.

Each treatment guideline in the Paediatric Hospital Level Standard Treatment Guidelines (STGs) and Essential Medicines List (EML) has been designed as a progression in care from the current Primary Health Care (PHC) STGs and EML. In addition, where a referral is recommended, the relevant medicines have either been reviewed and included in the tertiary level EML, or are in the process of being reviewed.

The STGs serve as a standard for practice, but do not replace sound clinical judgment. It is important to remember that the recommended treatments provided in this book are guidelines only, and are based on the assumption that prescribers are competent to handle patients with the relevant conditions presenting to their facilities.

All reasonable steps have been taken to align the STGs with Department of Health guidelines that were available at the time of review. A medicine is included or removed from the list using an evidence based medicine review of safety and effectiveness, followed by consideration of cost and other relevant practice factors.

The EML has been developed down to generic or International Non-propriety Name (INN) level. It is anticipated that each Province will review the EML and prevailing tenders to compile a formulary which:

» lists formulations and pack sizes that will facilitate care in alignment with the STG;
» selects the preferred member of the therapeutic class based on cost;
» Implements formulary restrictions consistent with the local environment; and
» provides information regarding the prices of medicines.

Therapeutic classes are designated in the "Medicine treatment" section of the STGs which provides a class of medicines followed by example such as, HMGCoA reductase inhibitors (statins) e.g. simvastatin. These therapeutic classes have been designated where none of the members of the class offers a significant benefit over the other registered members of the class. It is anticipated that by limiting the listing to a class there is increased competition and hence an improved chance of obtaining the best possible price in the tender process. In circumstances where you encounter such a class always, consult the local formulary to identify the example that has been approved for use in your facility.

The perspective adopted is that of a competent medical officer practicing in a public sector hospital. As such, the STGs serve as a standard for practice but do not replace sound clinical judgment.

Navigating the book

It is important that you become familiar with the contents and layout of the book in order to use the STGs effectively.

Where relevant this book is consistent with the Standard Treatment Guidelines for Primary Health Care, Integrated Management of Childhood Illness Strategy (IMCI) guidelines and other National Programme treatment guidelines.

The ICD-10 number, included with the conditions, refers to an international classification method used when describing certain diseases and conditions. A brief description and diagnostic criteria are included to assist the medical officer to make a diagnosis. These guidelines also make provision for referral of patients with more complex and uncommon conditions to facilities with the resources for further investigation and management. The dosing regimens provide the recommended doses used in usual circumstances however, the final dose should take into consideration capacity to eliminate the medicine, interactions and comorbid states.

It is important to remember that the recommended treatments provided in this book are guidelines only and are based on the assumption that prescribers are competent to handle patients' health conditions presented at their facilities.

The STGs are arranged into chapters according to the organ systems of the body. Conditions and medicines are cross-referenced in two separate indexes of the book. In some therapeutic areas that are not easily amenable to the development of a STG, the section is limited to a list of medicines.

The Paediatric Hospital Level STG and EML provides additional information regarding Patient Adherence in Chronic Conditions, Measuring Medication Level and Prescription Writing. The section on Patient Education in Chronic Conditions aims to assist health workers to improve patient adherence and health, generally.

Furthermore, to promote transparency, in this fourth edition, revisions are accompanied by the level of evidence that is cited and hyperlinked accordingly. All evidence is graded according to the Strength of Recommendation Taxonomy (SORT) (a patient-centered approach to grading evidence in the medical literature).

Finally, the guidelines make provision for referral of patients with more complex and uncommon conditions to facilities with the resources for further investigation and management.

Medicines Safety

Provincial and local Pharmaceutical and Therapeutics Committees (PTCs) should develop medicines safety systems to obtain information regarding medication errors, prevalence and importance of adverse medicine events, interactions and medicines quality. These systems should not only support the regulatory pharmacovigilance plan but should also provide pharmacoepidemiology data that will be required to inform future essential medicines decisions as well as local interventions that may be required to improve safety.

In accordance with the Medicines Control Council's guidance on reporting adverse drug reactions in South Africa, the medical officer with the support of the PTC should report the relevant adverse reactions to the National Adverse Drug Event Monitoring Centre (NADEMC). To facilitate reporting a copy of the form and guidance on its use has been provided at the back of the book.

Feedback

Comments that aim to improve these treatment guidelines will be appreciated. The submission form and guidelines for completing the form are included in the book. Motivations will only be accepted from the Provincial PTC.

MEASURING MEDICATION LEVELS

Potentially toxic medicines, medicines with narrow therapeutic indices and those with variable pharmacokinetics should be monitored to optimise dosing, obtain maximum therapeutic effect, limit toxicity and assess compliance.

Routine measurement is rarely warranted, but rather should be tailored to answering a specific clinical question, and is of most value in medicines with a narrow therapeutic index or where there is considerable individual variation in pharmacokinetics.

Aminoglycosides

Peak levels will be adequate if dosing is adequate. Trough levels taken immediately before the next dose are valuable in identifying potential toxicity before it manifests as deafness or renal impairment. Aminoglycosides are contraindicated in renal impairment.

Anti-epileptics

Levels may be helpful to confirm poor adherence or to confirm a clinical suspicion of toxicity. Routine measurement in patients with well controlled seizures and no clinical evidence of toxicity is not appropriate. Individual levels may be difficult to interpret – if in doubt, seek assistance from a clinical pharmacokineticist.

Therapeutic Drug Level Monitoring

Guidance on therapeutic drug level monitoring has been added to this edition of the Paediatric STGs and EML in certain indications requiring vancomycin and gentamycin.

PRESCRIPTION WRITING

Medicines should be prescribed only when they are necessary for treatments following clear diagnosis. Not all patients or conditions need prescriptions for medicine. In certain conditions simple advice and general and supportive measures may be more suitable. In all cases, carefully consider the expected benefit of a prescribed medication against potential risks.

All prescriptions should:

- be written legibly in ink by the prescriber with the full name and
- address of the patient, and signed with the date on the prescription form;
- specify the age and, in the case of children, weight of the patient;
- signature of prescriber and practice/prescriber number;
- have contact details of the prescriber e.g.name and telephone number.

In all **prescription writing the following should be noted:**

» The name of the medicine or preparation should be written in full using the generic name.
» No abbreviations should be used, due to the risk of misinterpretation.
» Avoid the Greek mu (μ): write mcg as an abbreviation for micrograms.
» Avoid unnecessary use of decimal points and only use where decimal points are unavoidable. A zero should be written in front of the decimal point where there is no other figure, e.g. 2 mg not 2.0 mg or 0.5 mL and not .5 mL.
» Frequency: Avoid Greek and Roman frequency abbreviations that cause considerable confusion (qid, qod, tds, tid, etc.). Instead, either state the frequency in terms of hours (e.g. 8 hourly) or times per day in numerals (e.g. 3 times daily).
» State the treatment regimen in full:
  - o medicine name and strength,
  - o route,
  - o dose or dosage,
  - o dose frequency,
  - o duration of treatment,

  e.g. amoxicillin, oral, 250 mg 8 hourly for 5 days.
» In the case of 'as required', a minimum dose interval should be specified, e.g. every 4 hours as required.
» Most monthly outpatient scripts for chronic medication are for 28 days; check that the patient will be able to access a repeat before the 28 days are completed.
» After writing a script, check that the dose, dose units, route, frequency, and duration for each item is stated. Consider whether the number of items is too great to be practical for the patient, and check that there are no redundant items or potentially important drug interactions. Check that the script is dated and that the patient's name and folder number are on the prescription form. Only then sign the script, and provide some other way for the pharmacy staff to identify you if there are problems (print your name, use a stamp, or use your institution issued prescriber number).

A GUIDE TO PATIENT ADHERENCE IN CHRONIC CONDITIONS

Achieving health goals for chronic conditions such as asthma, diabetes, HIV and AIDS, epilepsy, hypertension, mental health disorders and TB requires attention to:

» Adherence to long term pharmacotherapy-incomplete or non-adherence can lead to failure of an otherwise sound pharmacotherapeutic regimen.
» Organisation of health care services, which includes consideration of access to medicines and continuity of care

Patient Adherence

Adherence is the extent to which a person's behavior - taking medication, following a diet and/or executing lifestyle changes, corresponds with agreed recommendations from a health care provider.

Poor adherence results in less than optimal management and control of the illness and is often the primary reason for suboptimal clinical benefit. It can result in medical and psychosocial complications of disease, reduced quality of life of patients, and wasted health care resources.

Poor adherence can fall into one of the following patterns where the patient:

» takes the medication very rarely (once a week or once a month);
» alternates between long periods of taking and not taking their medication e.g. after a seizure or BP reading:
» skips entire days of medication;
» skips doses of the medication;
» skips one type of medication:
» takes the medication several hours late:
» does not stick to the eating or drinking requirements of the medication:
» adheres to a purposely modified regimen; and
» adheres to an unknowingly incorrect regimen.

Adherence should be assessed on a regular basis. Although there is no gold standard, the current consensus is that a multi method approach that includes self-report be adopted such as that below.

Barriers that contribute toward poor adherence.

BARRIER	RECOMMENDED SUPPORT
Life style » It is often difficult to take multiple medications. » A busy schedule makes it difficult to remember to take the medication.	» Create a treatment plan with information on how and when to take the medications. » Use reminders such as cues that form part of the daily routine.
Attitudes and beliefs » The condition is misunderstood or denied. » Treatment may not seem to be necessary. » May have low expectations about treatment.	» Remind patients that they have a long-term illness that requires their involvement. » Use change techniques such as motivational interviewing. » Identify goals to demonstrate improvement/stabilisation.
Social and economic » May lack support at home or in the community » May not have the economic resources to attend appointments.	» Encourage participation in treatment support programs. » Consider down referral or reschedule appointment to fit in with other commitments.
Healthcare team related » Little or no time during the visit to provide information. » Information may be provided in a way that is not understood. » Relationship with the patient may not promote understanding and self-management.	» Encourage patient to ask questions. » Use patient literacy materials in the patient's language of choice. » Engage active listening.
Treatment related » Complex medication regimens (multiple medications and doses) can be hard to follow. » May be discouraged if they do not feel better right away. » May be concerned about adverse effects.	» If possible, reduce treatment complexity. » Help the patient understand the condition and the role of their medication. » Discus treatment goals in relation to potential adverse effects.

Although many of these recommendations require longer consultation time, this investment is rewarded many times over during the subsequent years of management.

For a patient to consistently adhere to long term pharmacotherapy requires integration of the regimen into his or her daily life style. The successful integration of the regimen is informed by the extent to which the regimen differs from his or her established daily routine. Where the pharmacological proprieties of the medication permits it, the pharmacotherapy dosing regimen should be adapted to the patient's daily routine. For example, a shift worker may need to take a sedating medicine in the morning when working night shifts, and at night, when working day shifts. If the intrusion into life style is too great, alternative agents should be considered if they are available. This would include situations such as a lunchtime dose in a school-going child who remains at school for extramural activity and is unlikely to adhere to a three times a regimen but may very well succeed with a twice-daily regimen.

Towards concordance when prescribing

Establish the patient's:

» occupation,
» daily routine,
» recreational activities,
» past experiences with other medicines, and
» expectations of therapeutic outcome.

Balance these against the therapeutic alternatives identified based on clinical findings. Any clashes between the established routine and life style with the chosen therapy should be discussed with the patient in such a manner that the patient will be motivated to a change their lifestyle.

Note:

Education that focuses on these identified problems is more likely to be successful than a generic approach toward the condition/medicine.

Education points to consider

» Focus on the positive aspects of therapy whilst being encouraging regarding the impact of the negative aspects and offer support to deal with them if they occur.
» Provide realistic expectations regarding:
  - normal progression of the Illness - especially important in those diseases where therapy merely controls the progression and those that are asymptomatic;
  - the improvement that therapy and non-drug treatment can add to the quality of life.
» Establish therapeutic goals and discuss them openly with the patient.
» Any action to be taken with loss of control or when side effects

develop.

» In conditions that are asymptomatic or where symptoms have been controlled, reassure the patient that this reflects therapeutic success, and not that the condition has resolved.

» Where a patient raises concern regarding anticipated side effects, attempt to place this in the correct context with respect to incidence, the risks vs. the benefits, and whether or not the side effects will disappear after continued use.

Note:

Some patient's lifestyles make certain adverse responses acceptable which others may find intolerable. Sedation is unlikely to be acceptable to a student but an older patient with insomnia may welcome this side effect. This is where concordance plays a vital role.

Notes on prescribing in chronic conditions.

» Do not change doses without good reason.

» Never blame anyone or anything for non-adherence before fully investigating the cause.

» If the clinical outcome is unsatisfactory- investigate adherence (remember side effects may be a problem here).

» Always think about side effects and screen for them from time to time.

» When prescribing a new medicine for an additional health related problem ask yourself whether this medicine is being used to manage a side effect.

» Adherence with a once daily dose is best. Twice daily regimens show agreeable adherence. However once the intervals decreased to 3 times a day there is a sharp drop in adherence with poor adherence to 4 times a day regimens.

» Keep the total number of tablets to an absolute minimum as too many may lead to medication dosing errors and may influence adherence

Improving Continuity of Therapy

» Make clear and concise records.

» Involvement the patient in the care plan.

» Every patient on chronic therapy should know:

- his/her diagnosis
- the name of every medicine
- the dose and interval of the regimen

- his/her BP or other readings

Note: The prescriber should reinforce this only once management of the condition has been established.

» When the patient seeks medical attention for any other complaints such as a cold or headache, he/she must inform that person about any other condition/disease and its management.

» If a patient indicates that he/she is unable to comply with a prescribed regimen, consider an alternative - not to treat might be one option, but be aware of the consequences e.g. ethical.

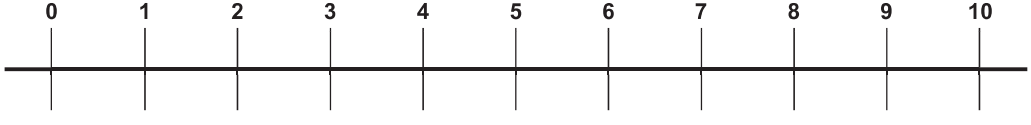
Patient Adherence Record

Folder No.	Date (dd/mm/yyyy) / /

Self-Reporting

Question	Yes	No
Do you sometimes find it difficult to remember to take your medicine?		
When you feel better, do you sometimes stop taking your medication?		
Thinking back over the past four days, have you missed any of your doses?		
Sometimes if you feel worse when you take the medicine, do you stop taking it?		

Visual Analogue Scale (VAS)



Score ____%

Pill Identification Test (PIT)

Medication	Knows the name (Y/N)	Knows the number of pills per dose (Y/N)	Time the medication is taken			Knows any additional instruction
			Morning (hour)	Evening (hour)	Considered Acceptable (Y/N)	

Pill Count

Did the client return the medication containers? Yes* No

If yes, check that the client only used medication from this container since the date of their last visit. If leftover medication had been used or an emergency prescription obtained, then the calculation will be invalid – skip to adherence assessment.

$$\text{\% Adherence} = \frac{\text{Dispensed} - \text{Returned}}{\text{Expected to be taken}} \times 100 = \frac{\square - \square}{\square} \times 100 = \square\ \%$$

Adherence Assessment

Self-reporting	Answered 'No' to all questions	Answered 'Yes' to 1 question	Answered 'Yes' to 2 or more questions
VAS	> 95%	75–94%	Less than 75%
PIT—*Client knows the…*	Dose, Time, and Instructions	Dose and Time	Dose only or confused
Pill count	> 95%	75–94%	Less than 75%
Overall Adherence	High	Moderate	Low

CHAPTER 1

EMERGENCIES AND TRAUMA

1.1 PAEDIATRIC EMERGENCIES

Certain emergencies are dealt with in the chapters on respiratory, cardiac and nervous system. This section deals only with the approach to the severely ill child and selected conditions (cardiorespiratory arrest, anaphylaxis, shock, foreign body inhalation and burns). All doctors should ensure that they can provide basic (and preferably advanced) life support to children.

The most experienced clinician present should take control of the resuscitation.

1.1.1 TRIAGE

Early recognition of life-threatening emergencies and rapid provision of appropriate care can prevent childhood deaths and reduce associated morbidity.

Triage aims to identify those children most in need of resuscitation and emergency care. It involves the rapid examination of all sick children when they first arrive in hospital in order to appropriately prioritise their care. They should be reassessed regularly while awaiting definitive care.

Categories
1. Emergencies: Conditions that cannot wait and require immediate treatment.
2. Priority signs (place ahead of the normal queue).
3. Non-urgent (join the queue).

Emergencies:

Conditions that cannot wait and require immediate treatment

If any emergency sign is present: give emergency treatment, call for help, and perform relevant emergency laboratory investigations.

(A&B) Airway and breathing

» Not breathing

or

» Airway obstructed

or

» Central cyanosis

or

» Severe respiratory distress

(C) Circulation

» Cold hands

and

» Capillary refill ≥ 3 seconds

and

» Weak and fast pulse

(C) Coma/convulsing

» Coma

or

» Convulsing (at the time of evaluation)

(D) Severe dehydration

Fluid loss plus any two of the following:

» Lethargy
» Sunken eyes
» Very slow skin pinch (the fold is visible for more than 2 seconds)

Priority signs

These children need prompt assessment and treatment:

» young infant (< 3 months),
» temperature very high (> 38ºC) or very low (<36.4º),
» trauma or other urgent surgical condition,
» severe pallor,
» history of poisoning,
» severe pain,
» respiratory distress,
» restless, continuously irritable, or lethargic,
» urgent referral from another health professional,
» malnutrition: visible severe wasting,
» oedema of both feet,
» burns (major).

Non-urgent (queue)

Proceed with assessment and further treatment according to the child's priority.

A number of different triage processes exist and the above is based on the South African Emergency Triage Assessment and Treatment (ETAT).

In addition, the use of clinical markers such as respiratory rate, blood pressure and pulse rate add precision to triage.

Other important conditions may be added to the ETAT guidelines based on local circumstances, such as identifying infectious diseases that need immediate isolation, dehydration (not severe), facial or inhalational burns, evidence of meningococcal septicaemia, and inconsolable crying.

The ETAT triage presented above should be a minimum standard of triage in community health centres, district or regional hospitals in South Africa.

1.1.2 RESUSCITATION OF THE CHILD

A structured approach to the seriously ill or injured child can rapidly optimise their outcome.

Estimation of weight in children is inaccurate and they should be weighed as soon as stabilised. The PAWPER tape allows for consideration of body habitus when estimating weight and can be used as an alternative to the formulae provided (in diagram below).

The following is a diagrammatic overview derived from an advanced paediatric life support approach.

A brief summary of the approach and primary survey adapted from paediatric life support documentation – for comprehensive competence an advanced paediatric life support course should be attended.

To optimise oxygen delivery:

- Oxygen, high flow, 15 L/minute via facemask with reservoir bag **or** 6–10 L/minute via head box.
  - If oxygen saturation < 92% or P_aO_2 < 80 mmHg despite maximal oxygen supply, consider providing additional respiratory support.

1.1.3 ANAPHYLAXIS/ANAPHYLACTIC REACTIONS

T78.2

DESCRIPTION

An acute, potentially life-threatening hypersensitivity reaction starting within seconds to minutes after administration of, or exposure to, a substance to which the individual is sensitised. Clinical manifestations include at least one of the following: upper airway obstruction, bronchospasm, hypotension, or shock.

The reaction can be short-lived, protracted or biphasic, i.e. acute with recurrence several hours later. Immediate reactions are usually the most severe.

DIAGNOSTIC CRITERIA

Clinical

» **Acute onset** of signs and symptoms.
» Dizziness, paraesthesia, syncope, sweating, flushing, dysrhythmias.
» Swelling of eyes, lips and tongue (angioedema).
» Upper airway obstruction with stridor.
» Hypotension and shock.
» Bronchospasm, wheezing, dyspnoea, chest tightness.
» Gastrointestinal symptoms such as nausea, vomiting, diarrhoea.

A life-threatening anaphylactic reaction requires **immediate** treatment. Facilities to initiate treatment must be available at all health centres.

GENERAL AND SUPPORTIVE MEASURES

» Place hypotensive or shocked patient in horizontal position. Do not place in a sitting position.
» Assess and secure airway. If necessary, bag via mask or intubate.

MEDICINE TREATMENT

To maintain arterial oxygen saturation ≥ 95%:

- Oxygen, 100%, at least 1–2 L/minute by nasal prong.

In severe anaphylaxis nasal oxygen is unlikely to be adequate:

- Oxygen, 100%, 15 L/minute by face mask.

- Epinephrine (adrenaline) 1:1 000 (undiluted), IM, 0.01 mL/kg. (i.e. 10 mcg/kg).
  - Can be repeated every 5 minutes, if necessary.
  - Maximum per dose: 0.5 mL.
  - Do not administer IV unless there is failure to respond to several doses of IM.

Crystalloid solutions e.g.:

- Sodium chloride 0.9%, IV, 20 mL/kg rapidly.
  - Repeat if necessary until circulation, tissue perfusion and blood pressure improve (up to 60 mL/kg).

- Promethazine, IV/IM, 0.25–0.5 mg/kg/dose. Contra-indicated in children <2 years old.

Then continue with:

- Chlorphenamine, oral, 0.1 mg/kg/dose 6 hourly for 24–48 hours, **if necessary**.

If associated bronchospasm:

- Salbutamol, nebulised, 1 mL salbutamol respirator solution in 3 mL sodium chloride 0.9%.
  - Nebulise at 20 minute intervals.

- Hydrocortisone, IV, 5 mg/kg, 4–6 hourly for 12–24 hours.
  - Note: Steroids are adjunctive therapy, are not part of first line treatment, and should never be the sole treatment of anaphylaxis.

If associated stridor:

- Epinephrine (adrenaline), 1:1000, nebulise with oxygen, every 15–30 minutes until expiratory obstruction is abolished.
  - 1 mL epinephrine 1:1 000 diluted in 1 mL sodium chloride 0.9%.

Observe for 24 hours, in particular for recurrent symptoms as part of a 'biphasic' reaction.

PREVENTATIVE MEASURES AND HOME BASED TREATMENT

» Obtain a history of allergies/anaphylaxis on all patients before administering medication/immunisation.
» Identify offending agent and avoid further exposure.
» Ensure patient wears allergy identification disc/bracelet.
» Train patients to self-administer epinephrine pre-filled auto injecting device. Specialist initiated for patients who have anaphylactic reactions.
» Educate patient and parent/caregiver on allergy and anaphylaxis.

REFERRAL

Caution
Do not refer the patient during the acute phase.
Transfer can only be done once patient is stable.
Patients supplied with self-administered epinephrine must be informed of the shelf life of epinephrine and when they must come in to get a replacement.

» Bee sting anaphylaxis for desensitisation.

1.1.4 CARDIORESPIRATORY ARREST

I46.9

DESCRIPTION

Cardiorespiratory arrest in children usually follows a period of circulatory or respiratory insufficiency and less commonly is precipitated by a sudden cardiac event. It is, therefore, important to pre-empt cardiorespiratory arrest in children by recognising and urgently treating respiratory or circulatory compromise.

Cardiorespiratory arrest is diagnosed clinically in the unresponsive child who has no respiratory effort and/or in whom there is no palpable pulse and no signs of life, i.e. cough or spontaneous movement.

GENERAL AND SUPPORTIVE MEASURES

Always call for help immediately.

Ensure an open airway.

If there is still no respiration, then commence with artificial breathing using a self-inflating bag, with a reservoir and an appropriate mask. Connect the bag to a high flow oxygen source (15 L/minute). Movement of the chest in response to artificial breaths should be evident.

If there is inadequate chest movement with bag-valve-mask ventilation, re-assess airway patency. If necessary, place an appropriate sized endotracheal tube. In the event of an unexpected arrest or an arrest where there are no witnesses, consider foreign body obstruction. See section 1.1.6: Inhalation, foreign body.

Once effective breathing has been established, provide chest compressions at a rate of 100–120/minute for all children excluding neonates. Provide artificial breaths at a ratio of 15 compressions to 2 breaths in children (15:2).
Attach a cardiac monitor to the child and secure vascular access. If unable to insert an IV line, obtain intra-osseous access. See section 1.1.8: Intra-Osseous Infusion in Emergencies.

MEDICINE TREATMENT

Asystole or pulseless electrical activity (i.e. no palpable pulse even if normal electrical pattern (PEA))

- Epinephrine (adrenaline) **1:10 000,** IV/ intra-osseous, 0.1 mL/kg. (Follow each dose with a small bolus of sodium chloride 0.9%.)
  - 0.1 mL of 1: 10 000 solution = 10 mcg.
  - Dilute a 1 mL ampoule of epinephrine (adrenaline) 1:1 000 in 9 mL of sodium chloride 0.9% or sterile water to make a 1:10 000 solution.

OR (Of unproven benefit, so only when no vascular access available)

- Epinephrine (adrenaline) 1:1 000, endotracheal, undiluted 0.1 mL/kg down an endotracheal tube. (This is a higher dose due to the route of administration.)

Repeat the dose of epinephrine (adrenaline) every 4 minutes if asystole/PEA persists while CPR continues.
When an ECG sinus rhythm trace is present, continue CPR until an effective pulse and circulation is present.

If the arrest was preceded by circulatory shock:

- Sodium chloride 0.9%, IV, 20 mL/kg as a bolus.

During the resuscitation consider if any of the following correctable conditions are present (and if present correct them):

» Hypoxia.
» Hypovolaemia.
» Hyperkalaemia, hypokalaemia, hypocalcaemia.
» Hypothermia.
» Tension pneumothorax.
» Tamponade (cardiac).
» Toxins (e.g. tricyclic antidepressants).
» Thrombo-embolic event.

Note:
There is no evidence to support the **routine** use of any of the following in cardiac arrest:

» sodium bicarbonate,
» calcium,
» high dose IV epinephrine (adrenaline) (100 mcg/kg/dose).

Ventricular fibrillation or pulseless ventricular tachycardia
Proceed to immediate defibrillation, but during this process cardiorespiratory resuscitation (compressions and ventilation) must continue, except during the actual administration of each shock. Continue until adequate circulation can be demonstrated.

For pulseless ventricular tachycardia and ventricular fibrillation, the defibrillator should be set to asynchronous mode and 4 J/kg shocks administered.

Do not increase voltage, give 4 J/kg repeatedly, if needed.

After each shock continue CPR immediately for 2 minutes and only re-assess the ECG rhythm thereafter.
If ventricular tachycardia/fibrillation has reverted to sinus rhythm, stop shock cycle, but continue CPR until good stable circulation and adequate spontaneous breathing is evident.
If fibrillation/ventricular tachycardia is still present, give further shocks for 3 x 2-minute cycles of shocks.

Thereafter, if necessary, the 2-minute shock cycles should continue but, in addition, give the following after the 3rd shock:

- Epinephrine (adrenaline) **1:10 000,** IV, 0.1 mL/kg and then repeat after every 2nd shock, i.e. every 4 minutes. (Follow each dose with a small bolus of sodium chloride 0.9%).
  - 0.1 mL of 1: 10 000 solution = 10 mcg.
  - Dilute a 1 mL ampoule of epinephrine (adrenaline) 1:1 000 in 9 mL of sodium chloride 0.9% or sterile water to make a 1:10 000 solution.

After the 3rd and 5th shocks, if normal rhythm has not returned:

- Amiodarone, IV/IO, 5 mg/kg bolus.

Allow one minute of cardiopulmonary resuscitation between the administration of any medicine and a repeat cycle of shocks.

If ventricular fibrillation or pulseless ventricular tachycardia persists, consider the following (and if present correct):

» Hypoxia.
» Hypovolaemia
» Hyperkalaemia, hypokalaemia, hypocalcaemia.
» Hypothermia.
» Tension pneumothorax.
» Tamponade (cardiac).
» Toxins (e.g. tricyclic antidepressants).
» Thrombo-embolic event.

REFERRAL

» To an intensive care unit after recovery from an arrest.

1.1.5 CONVULSIONS, NOT FEBRILE CONVULSIONS

See section 13.1: Seizures.

1.1.6 INHALATION, FOREIGN BODY

T17.9

DESCRIPTION

Accidental inhalation of a solid object that may obstruct the airway at any level.

DIAGNOSTIC CRITERIA

Ask specifically about a possible choking episode if there is any suspicion of a foreign body aspiration.

» Initial symptom is frequently sudden onset of choking followed by persistent unilateral wheeze (may be bilateral), chronic cough, or stridor.
» Segmental or lobar pneumonia failing to respond to standard therapy.
» Mediastinal shift.
» Chest X-ray on full expiration and full inspiration may show hyperinflation and/or collapse or sometimes, a radio-opaque foreign body.

GENERAL AND SUPPORTIVE MEASURES

ACUTE EPISODE

» If coughing effectively and breathing adequately, provide oxygen and refer urgently for airway visualisation. Carry out transfer with a person who is able to manage the foreign body process accompanying the child.
» If the child is still breathing but unable to cough or breathe adequately, attempt to dislodge the foreign body by cycles of 5 back slaps followed by 5 chest compressions (infants), or 5 Heimlich manoeuvre (child) repeatedly.
» If the child is unresponsive carry out standard cardiorespiratory resuscitation, i.e. cardiac compressions and ventilation (15:2).

Caution
Blind finger sweeps are dangerous and absolutely contra-indicated.
Foreign bodies may be removed under direct vision.
All cases should have airway visualisation or be referred for airway visualisation.

REFERRAL

» All cases for the removal of retained foreign bodies.
» Unresolved respiratory complications.

1.1.7 SHOCK

R57.9

DESCRIPTION

An acute syndrome that reflects the inability of the pulmonary and circulatory system to provide adequate perfusion, oxygen and nutrients to meet physiological and metabolic demands.

Compensation is achieved by increased pulse rate, and peripheral vascular constriction. The blood pressure is relatively well maintained but the patient still requires urgent resuscitation.

Shock can be further characterised:

» **Hypovolaemic shock:** loss of intravascular fluid, e.g. dehydration, haemorrhage or fluid shifts.
» **Distributive shock:** e.g. septicaemia and anaphylaxis.
» **Cardiogenic shock:** e.g. cardiac dysfunction.
» **Dissociative shock:** e.g. profound anaemia and carbon monoxide poisoning.
» **Obstructive shock:** e.g. pneumothorax and cardiac tamponade.
» **Septic shock:** many mechanisms are operative in septic shock.
» **Neurogenic shock:** e.g. spinal cord trauma.

Complications of shock include multi-organ dysfunction and/or failure.

DIAGNOSTIC CRITERIA

Evidence of compensated shock includes:

» cold peripheries,
» weak pulse pressure especially peripheral pulse weaker than central pulses,
» prolonged capillary filling, i.e. > 3 seconds,
» agitation/confusion/decreased level of consciousness,
» skin pallor,
» increased heart rate,
» signs and symptoms of underlying conditions.

In uncompensated shock, falling BP and failure to act urgently will result in irreversible shock and death.

Facilities to start treatment of shock must be available at all health centres.

GENERAL AND SUPPORTIVE MEASURES

» Follow the ABCD algorithm, see section 1.1.1 Triage.
» Identify and treat the underlying cause.
» Ensure good intravenous or intra-osseous access. In trauma, two large bore lines for access are important. See section 1.1.8: Intra-Osseous Infusion in Emergencies.

» Perform relevant investigations.
» Monitor:
  > vital signs and maintain within normal limits.
  > metabolic parameters and correct as needed.
  > urinary output – aim for at least 1 mL/kg/hour.

MEDICINE TREATMENT

To optimise oxygen delivery to the tissue, administer:

- Oxygen, high flow, 15 L/minute via facemask with reservoir bag or 6–10 L/minute via head box.

If oxygen saturation < 92% or PaO_2 < 80 mmHg consider need to intubate and continue respiratory support.

1. Hypovolaemic shock

Response to each step of management must be reviewed every 15 minutes.
If after administration of a total of 40ml/kg of sodium chloride 0.9% fluid, shock has not resolved, consider other causes and the need for inotropes.

For fluid deficit (vs. blood loss):
IV fluids to correct the intravascular fluid deficit and improve circulation:

- Sodium chloride 0.9%, IV, 20 mL/kg rapidly.
  - Review after each bolus to see if shock has resolved.

In children with **severe malnutrition:**

- Sodium chloride 0.9%, IV, 10 mL/kg administered over 20 minutes.
  - Review after each bolus to see if shock has resolved.

With each re-assessment, if:
» Shock has resolved (capillary filling time < 3 seconds, good pulse, normal blood pressure), do not repeat fluid bolus.
» Shock is better but still present, repeat bolus (up to 40 mL/kg). After this further care should be in an ICU setting. Consider initiation of inotropes.
» Monitor for persistence of shock, i.e.
  > Non-responding or decreasing BP.
  > Non-responding or increasing pulse rate/decreasing volume.
  > Non-responding or increasing capillary filling time.
» Monitor for fluid or circulatory overload, i.e.
  > Increasing respiratory rate.
  > Increasing basal crepitations.
  > Increasing pulse rate.
  > Increasing liver size/tenderness.
  > Increasing JVP.

After circulatory stabilisation, continue with appropriate maintenance fluid.

For blood loss:

- Packed red cells **or** whole blood, 5-10 mL/kg, repeat if required.

While awaiting blood products to arrive, proceed with volume resuscitation

2. Cardiogenic shock

Ideally children receiving treatment for cardiogenic shock should be in high care or ICU.

Inotropic support:

When perfusion is poor and blood pressure response is unsatisfactory, despite adequate fluid replacement.

- Dobutamine, IV, 5–15 mcg/kg/minute.

Chronotropic/inotropic plus vascular tone support:

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.

If poor ventricular contractility and increased afterload are considered as the primary problem, do not give epinephrine (adrenaline) but consider adding an afterload reducing agent to the dobutamine infusion but only with specialist advice.

3. Septic shock

Treatment for septic shock should be initiated urgently and then patients should preferably be transferred to an ICU.

Response to each step of management must be reviewed every 15 minutes.

IV fluids:

- Sodium chloride 0.9%, IV, 10 mL/kg rapidly.
  - o Review after each bolus to see if shock has resolved.

In children with **severe malnutrition:**

- Sodium chloride 0.9%, IV, 10 mL/kg administered over 20 minutes.
  - o Review after each bolus to see if shock has resolved.

With each reassessment, if:

» Shock has not resolved after 40 ml/kg of sodium chloride 0.9% fluid, consider inotropes.

» Shock has resolved (capillary filling time < 3 seconds, good pulse, normal blood pressure), do not repeat bolus. Proceed to other care.

» Shock is better but still present, repeat bolus (up to 40 mL/kg). After this further care should be in an ICU setting.

» Monitor for persistence of shock, i.e.:
  > Non-responding or decreasing BP.
  > Non-responding or increasing pulse rate/decreasing volume.
  > Non-responding or increasing capillary filling time.

» Monitor for fluid or circulatory overload, i.e.:
  > Increasing respiratory rate.
  > Increasing basal crepitations.
  > Increasing pulse rate.
  > Increasing liver size/tenderness.
  > Increasing JVP.

Chronotropic/Inotropic plus vascular tone support

If tissue perfusion and blood pressure do not improve satisfactorily on adequate fluid volume replacement.
Titrate inotropes against the response, and add additional agent if poor response.

- Epinephrine (adrenaline), IV infusion, 0.01–1 mcg/kg/minute.

If inadequate response:
ADD
- Dobutamine, IV, 5–15 mcg/kg/minute.

Unresponsive septicaemic shock:
- Hydrocortisone, IV, 1 mg /kg/dose, 6 hourly until shock has resolved.

Antibiotic therapy
Start antibiotics early.
Before initiating antibiotic therapy, take blood and urine specimens, if appropriate, for culture and sensitivity testing.
Reconsider antibiotic and/or antifungal therapy when culture and sensitivity results become available.

- 3rd generation cephalosporins, e.g.:
- Cefotaxime, IV, 75 mg/kg/dose, 8 hourly (neonates).

OR
Children > 1 month:
- Ceftriaxone, IV, 50 mg/kg/dose, 12 hourly.

Caution
Patients must be resuscitated and stabilised before referral.

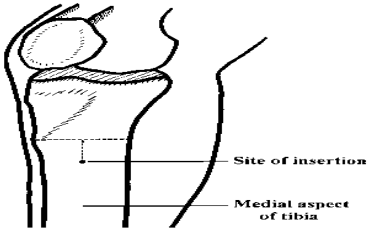
1.1.8 INTRA-OSSEOUS INFUSION IN EMERGENCIES

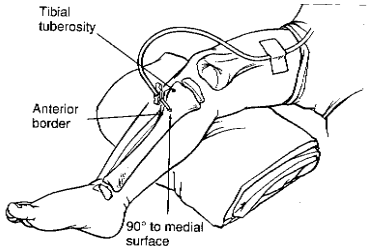
During resuscitation and when managing a critically ill child, if intravenous access is not established within 5 minutes, obtain intra-osseous access.

1. Use an intra-osseous needle or if not available FG18 x 1.5 cm (or less ideally FG20 x 1.5 cm) or lumbar puncture needle.
2. Grasp the thigh and knee above and lateral to the insertion site with the palm of the left hand (if right-handed). Wrap the fingers around the knee to stabilise the proximal tibia. Do not allow any portion of your hand to rest behind the insertion site.
3. Find the site of insertion i.e. feel the tibial tuberosity. The site of insertion is about 2 cm below this tuberosity on the broad flat medial surface of the tibia.
4. Careful surgical preparation of the injection site as for lumbar punctures.
5. Insert the needle through the skin over the flat surface of the tibia.
6. Holding the needle low down near the skin, advance the needle through the bony cortex of the tibia, directing the needle perpendicular, i.e. 90° to the long axis, using a gentle but firm twisting or drilling motion.
7. Stop advancing the needle when a sudden decrease in resistance to forward motion of the needle is felt.
8. Remove the stylet from the needle.
9. Slowly inject a small amount of sodium chloride 0.9% through the needle. Check for any signs of increased resistance to injection, increased circumference of the soft tissues of the calf, or increased firmness of the tissue.
10. If the test injection is successful, disconnect the syringe and join an infusion set to the needle. Secure the needle and tubing with tape and support it with a bulky dressing.
11. If the test injection is unsuccessful, i.e. infiltration of the sodium chloride 0.9% into the leg tissue is observed, remove the needle and try again on the other leg.
12. The flow rate should rapidly increase after flushing through. If flow is poor, consider the use of a 3 way tap and syringe.

Signs of successful insertion:

» Sudden decrease in resistance to insertion as the needle passes through the bony cortex.
» The needle remains upright without support.
» Fluid flows freely through the needle without evidence of subcutaneous infiltration.





Automated hand-held intra-osseous access devices are increasingly available and their use allows for the rapid attainment of vascular access in almost all children – when available, their use is strongly encouraged and should be consistent with the manufacturer's instructions. The same landmarks are used as for manual insertion and the procedure is less painful. For older children (>40kg) the proximal humerus can be used as an access site.

Aspiration and rapid infusion may be painful; lignocaine 0.5mg/kg can be slowly infused as analgesia.

1.1.9 POST RESUSCITATION CARE

Once children have been successfully resuscitated and emergency treatment provided, they remain at high risk for death or disability.

In order to optimise outcomes, the following principles of care apply:

1. Admit or refer to ward with appropriate monitoring facilities e.g. high care or intensive care unit as soon as possible.
2. Identify and manage underlying pathology.
3. Maintain normoxia (avoid both hyperoxia and hypoxia).
4. Avoid hypo- and hypercapnia,
5. Maintain systolic BP ≥5th percentile for age (refer to Chapter 4: Cardiovascular System, section 4.11 Hypertension); this may require intravascular fluids and/or inotropes.
6. Avoid hyperthermia and treat fever aggressively.
7. Provide adequate nutrition,
8. Monitor and correct glucose and electrolyte abnormalities.
9. Provide appropriate analgesia.
10. Consider rehabilitation requirements.

1.2 TRAUMA

1.2.1 BURNS

T30.0

DESCRIPTION

Burns lead to skin and soft tissue injury and may be caused by:

» heat, e.g. open flame, hot liquids, hot steam;
» chemical compounds;
» physical agents, e.g. electrical/lightning;
» radiation.

GENERAL AND SUPPORTIVE MEASURES

Emergency treatment

» Remove smouldering or hot clothing.
» Remove constrictive clothing/rings.
» To limit the extent of the burn, soak the affected area generously in cold water for not more than 10 minutes.
» In all burns > 10% or where carbon monoxide poisoning is possible (enclosed fire, decreased level of consciousness, disorientation) administer high flow oxygen (15 L/minute).
» Examine carefully to determine the extent and depth of the burn wounds.
» Respiratory obstruction due to thermal injury or soot inhalation, production of black coloured sputum, shortness of breath, hoarse voice and stridor are serious signals and may rapidly proceed to respiratory compromise. Consider early endotracheal airway placement.

Further assessment and care

Assessment:

The extent and depth may vary from superficial (epidermis) to full-thickness burns of the skin and underlying tissues.
Initially, burns are usually sterile.

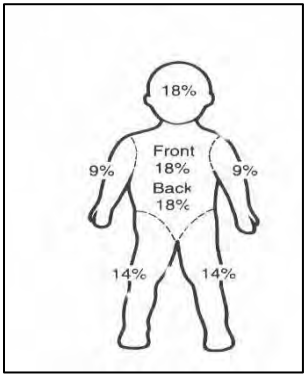
Depth of burn wound	Surface/Colour	Pain sensation/Healing
Superficial or epidermal	Dry, minor blisters, erythema	» Painful » Heals within 7 days
Partial thickness superficial or superficial dermal	Blisters, moist	» Painful » Heals within 10–14 days
Partial thickness deep or deep dermal	Moist white or yellow slough, red mottled	» Less painful » Heals within a month or more » Generally needs surgical debridement and skin graft
Full thickness (complete loss of skin)	Dry, charred whitish, brown or black	» Painless, firm to touch » Healing by contraction of the margins (generally needs surgical debridement and skin graft)

Burns are classified as minor or major burns.

Major burns:
» Partial thickness burns of > 10% body surface area.
» Full thickness burn of > 3% body surface area.
» Any burn involving the head and face, hands, feet and perineum.
» Inhalation injuries.
» Circumferential burns.
» Electrical burn injuries.
» Burns in neonates.
» Burns in patients with serious pre-existing or concomitant injuries.

Minor burns:
» Partial thickness burns of < 10% body surface area in a child > 1 year of age.

Estimation of burn surface area



Published with kind permission from SAMJ. South African Burn Society burn stabilisation protocol. JS Karpelowsky, L Wallis, A Maderee and H Rode. 2007. SAMJ Vol 9, No 8 Page 574–7.

The figure above is used to calculate body surface area %, and indicates percentages for the whole leg/arm/head (and neck in adults) not the front or back.

» In children the palm of the hand is 1%.
» The following adjustments are made in children up to the age of 8 years old after which adult percentages are used for the head, neck and each leg.
» **Less than 1 year**
  > Head and neck are 18% of BSA.
  > Each leg is 14% of BSA.
» **After the first birthday (> 1 year)**

For each year of life:
  > Head and neck decrease by 1% of BSA until 10% (adult value).
  > Leg gains $^1/_2$ % of BSA until 18% (adult value).

Age Years	Head + neck Front + back	Torso Front	Torso Back	Leg + foot Front + back	Arm + hand Front + back
< 1 year	18%	18%	18%	14%	9%
1 to < 2 years	17%	18%	18%	14.5%	9%
2 to < 3 years	16%	18%	18%	15%	9%
3 to < 4 years	15%	18%	18%	15.5%	9%
4 to < 5 years	14%	18%	18%	16%	9%
5 to < 6 years	13%	18%	18%	16.5%	9%
6 to < 7 years	12%	18%	18%	17%	9%
7 to < 8 years	11%	18%	18%	17.5%	9%
8 years and older	10%	18%	18%	18%	9%

Care

Inhalation injury

In addition to other treatment, the degree of inhalation injury may warrant:

» monitoring of blood gases,
» warm humidified oxygen and/or intubation,
» positive pressure ventilation.

Ensure adequate airway in the presence of inhalational burns.
Children with burns may present with delayed onset of airway obstruction. Consider early intubation.

Suspect carbon monoxide poisoning in all fire victims.

» Obtain carboxyhaemoglobin level.
» Treat by administering 100% oxygen.

Prevent heat loss

Nurse all major burns in a warm room (26°C).

Nasogastric drainage

Use a nasogastric tube on free drainage in all burns > 10% (especially during transfer).
After the 1st 24 hours, commence nasogastric feeds in children who had been started on nasogastric drainage where ileus is not suspected.

Nutritional support

Consult a dietician as children with burns require a higher than usual intake of nutrients.
Start enteral feeds within 6 hours in burns < 10%.

Estimate daily energy and protein needs using the formulae:

Energy (kJ):	250 kJ/kg body mass + (150 kJ x % burned BSA)
Protein:	3 g/kg body mass + (1 g x % burned BSA)
Maximum % burn area used for calculation should not exceed 50%	

Give iron and vitamins routinely until burn wounds are healed and/or skin grafting has successfully been completed.

Note:
Do not supplement iron during sepsis or infection.

In addition, provide:
» psychological support,
» physiotherapy,
» occupational therapy,
» waterbeds and cradles.

MEDICINE TREATMENT
Fluid replacement

Burns < 10% of total body surface area:
- Oral fluids.

Burns > 10% of total body surface area:
- IV fluid for resuscitation.

If in shock first treat shock. See section: 1.1.7: Shock.

As in all fluid administration in sick children, volumes are estimates and response must be constantly re-evaluated and rates adjusted appropriately.

CALCULATION OF INITIAL FLUID REPLACEMENT (AFTER SHOCK HAS BEEN TREATED)
First 24 hours:
Replacement fluids for burns
- Sodium chloride 0.9%, IV.
  - Calculate total fluid requirement in 24 hours:
    [Total % burn ____x weight (kg) ___x 4 mL] as sodium chloride 0.9%.
    Give half of this volume in the 1st 8 hours.
    Administer remaining fluid volume in next 16 hours.

Note:
If urine output not adequate, increase fluids for the next hour by 50% (continue at higher rate until urine output is adequate then resume normal calculated rate).

PLUS

Maintenance fluids in children
In children, give oral or intravenous maintenance fluid in addition to above calculated volume.

Child maintenance fluid requirement volumes	
≤1 year	120 mL/kg/24 hours
All children > 1 year – the sum of the following:	
» for each kg of body weight up to 10 kg	100 mL/kg/24 hours
» for each additional kg of body weight more than 10 kg	50 mL/kg/24 hours
» for each additional kg of body weight more than 20 kg	20 ml/kg/24 hours

Example: 24 kg child with 10% burns	
1st 24 hours	
» replacement for expected losses: 4 mL/kg x 24 kg x 10%	**= 960 mL**
» maintenance: first 10 kg = 10 kg x 100 mL/kg/24 hours second 10 kg = 10 kg x 50 mL/kg/24 hours remaining 4kg = 4 kg x 20 mL/kg/24 hours Total maintenance:	= 1 000 mL + = 500 mL + = 80 mL **= 1 580 mL**
Thus	
1st 8 hours = ½ resuscitation fluids + ⅓ maintenance fluids	480 mL sodium chloride 0.9% + 527 mL ½ Darrows/ dextrose 5%
Next 16 hours = ½ resuscitation fluids + ⅔ maintenance fluids	480 mL sodium chloride 0.9% + 1053 mL ½ Darrows/ dextrose 5%

The above are guidelines, need regular review to maintain urine output 1–2 mL/kg/hour.

Avoid circumferential taping when securing infusion lines, as oedema under the eschar may decrease the venous return.

Second 24 hours:
If urine output is adequate, continue resuscitation:
- Sodium chloride 0.9%, IV, 1.5 mL/kg/% burn/ 24 hours.

PLUS

Maintenance:
- ½ Darrows/dextrose 5%, as per maintenance requirement above.

Part of this volume may be replaced by enteral feeds.

Thereafter, progressively decrease IV fluids and increase enteral fluids according to response over time.

Anaemia
If haemoglobin < 7 g/dL:
- Packed red cells, 10 mL/kg over 3 hours.

Hypoalbuminaemia
If indicated by symptomatic hypoalbuminaemia:

- Albumin 20%, IV, 2 g/kg/day. (2 g = 100 mL).

For pain

- Paracetamol, oral, 15 mg/kg/dose 6 hourly as required.

Children with large burns need effective pain relief.
See section Chapter 20, section 20.1.2: Management of pain.

Change of dressing
Provide analgesic cover at each dressing change (Chapter 20 Pain Control). In major burns, change dressings under procedural sedation or general anaesthesia.

Gastric erosions
Preventative medication treatment is not given. Effective early resuscitation and early feeding decrease the incidence of gastric erosion.

If gastric erosion is suspected due to haematemesis or brownish gastric aspirates.

- Omeprazole, oral, 0.4–0.8 mg/kg/dose 12 hourly. Specialist initiated.
  - Maximum dose: 20–40 mg/dose.
  - If 1 month–2 years: 2.5 mg 12 hourly.
  - If > 2–6 years: 5 mg 12 hourly.
  - If > 7–12 years: 10 mg 12 hourly.

If unable to take orally:

- Ranitidine, IV, 1 mg/kg 6 hourly.

Local treatment of burns
Gently clean the wounds with running water.
Remove loose skin and debride dead tissue and dress with topical antiseptic cream and non-adherent dressing.
Thereafter, daily rinse with running water and dress with topical antiseptic cream and non-adherent dressing.

In < 20% body surface area burns:

- Povidone-iodine 0.5% with occlusive dressings.

In > 20% body surface area burns:

- Silver-sulphadiazine 1%, on non-adhesive dressings.
  - Cover with paraffin gauze.
  - Change dressings daily.

Excise and graft all full thickness or deep dermal burns as soon as the patient is stable.

Consider skin grafting in wounds not healed in two weeks.

Antibiotics

Consider if signs of infection are present as these may be subtle:

» pyrexia/hypothermia,
» shock (compensated or not compensated),
» rising pulse or respiratory rate,
» petechiae.
» leucocytosis/thrombocytopaenia,
» looks ill /toxic/altered level of consciousness,
» local inflammatory changes,

The choice of antibiotics is based on the culture and sensitivity results of wound, urine and blood cultures once available.
Positive wound cultures alone do not indicate systemic infections requiring antibiotic treatment.

- Ceftriaxone, IV, 50 mg/kg/dose 24 hourly for 5 days.

If MRSA is suspected or confirmed, replace with:

- Vancomycin, IV, 15 mg/kg/dose 6 hourly for 5–14 days.

AND

- Amikacin, IV, for 5–14 days if renal function is satisfactory.
  - 1 week to < 10 years: 25 mg stat then 18 mg/kg once daily.
  - 10 years and older: 20 mg stat then 15 mg/kg.

Tetanus prevention

Patients with no previous immunisation in the last 5 years:

- Tetanus toxoid, IM, 0.5 mL.

Complete course in previously unvaccinated patients.

Where deep necrotic lesions are part of the burn and if the immunisation status is not known:

- Tetanus immunoglobulin, IM, 500 IU.

Prior to transport/referral

» Commence resuscitative measures, if necessary.
» Administer 100% humidified oxygen by facemask for inhalation injuries, if necessary.
» Cover wounds with clean dressings after hot or smouldering clothing have been removed.

REFERRAL

» Major burn injuries.

CHAPTER 2
ALIMENTARY TRACT

2.1 DENTAL AND ORAL DISORDERS

2.1.1 GINGIVITIS, UNCOMPLICATED

K05.1

DESCRIPTION

Inflammation of the gum margin causing the gums to separate from the teeth.

Pockets form between the gums and the teeth where pus and bacteria can collect, eventually causing periodontitis, a disease in the tissue that surrounds and supports the teeth – See section 2.1.2: Periodontitis.

Characteristics of uncomplicated gingivitis:

- » change in the normal gum contour,
- » redness,
- » watery exudate/bleeding,
- » may be recurrent.
- » may be painful,
- » swollen gums,
- » gum recession m ay occur,

GENERAL AND SUPPORTIVE MEASURES

Oral hygiene is usually adequate to prevent superficial mouth and gum infection:

- » Oral hygiene after each meal to remove plaque and food debris.
- » Frequent thorough brushing of teeth, at least twice daily.
- » Dental flossing at least once a day.
- » Homemade warm saline rinse. Dissolve ½ teaspoon of table salt (sodium chloride) in ± 200 mL warm water. Rinse mouth for one minute twice daily but do not swallow.

MEDICINE TREATMENT

- Paracetamol, oral, 15 mg/kg/dose 6 hourly when required to a maximum of 4 doses per 24 hours.
- Chlorhexidine 0.2%, 15 mL as a mouthwash, 2–4 times daily for 5 days; use after brushing and flossing.

2.1.2 PERIODONTITIS

K05.4

DESCRIPTION

Progressive gingivitis to the point where the underlying bone is eroded, is characterised by teeth becoming loose in their sockets.

It is a cause of tooth loss in adults.

GENERAL AND SUPPORTIVE MEASURES

» Advice on improving and maintaining oral hygiene. See section 2.1.1: Gingivitis, uncomplicated. General and supportive measures.

MEDICINE TREATMENT

- Chlorhexidine 0.2%, 15 mL as a mouthwash, 2–4 times daily for 5 days.

REFERRAL

» All cases to a dentist.

2.1.3 NECROTISING PERIODONTITIS

K05.6

DESCRIPTION

An acute very painful infection of the gingival margin characterised by:

» foul smelling breath,
» loss of gingiva and supporting bone around teeth, and
» presence of underlying disease, e.g. HIV.

May lead to loss of surrounding lips and cheeks if not adequately treated.

GENERAL AND SUPPORTIVE MEASURES

» Advice on improving and maintaining oral hygiene. See section 2.1.1: Gingivitis, uncomplicated. General and supportive measures.

MEDICINE TREATMENT

- Amoxicillin/clavulanic acid, oral, 25 mg/kg/dose of the amoxicillin component 8 hourly for 5 days.

- Chlorhexidine 0.2%, 15 mL as a mouthwash, 2–4 times daily 30 minutes after brushing and flossing.
  - Continue for 5 days.

For pain:

- Paracetamol, oral, 15 mg/kg/dose 6 hourly when required, to a maximum of 4 doses per 24 hours.

REFERRAL

For dental treatment:

» No improvement within 5 days.

2.1.4 CANDIDIASIS, ORAL

B37.0

See section 8.6: Candidiasis, systemic and other.

2.1.5 APHTHOUS ULCERS

K12.0

DESCRIPTION

Painful ulcers in the oropharynx. Minor ulcers (< 1 cm diameter) usually heal within 2 weeks. Major ulcers (> 1 cm diameter) are very painful, often very deep and persist.

GENERAL AND SUPPORTIVE MEASURES

» Maintain adequate nutrition and hydration by encouraging fluid and food intake – use bland foods and fluids as they cause less pain.
» For minor aphthous ulcers, use homemade warm saline rinse. Dissolve ½ teaspoon of table salt (sodium chloride) in ± 200 mL warm water. Rinse mouth but do not swallow.

MEDICINE TREATMENT

For pain:

- Paracetamol, oral, 15 mg/kg/dose 6 hourly when required to a maximum of 4 doses per 24 hours.

REFERRAL

» Major aphthous ulcers for further diagnostic evaluation.
» Aphthous ulcers not resolving in 3 weeks for further evaluation.

2.1.6 HERPES GINGIVOSTOMATITIS

B00.2

DESCRIPTION

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.

DIAGNOSTIC CRITERIA

Clinical

» 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.

GENERAL AND SUPPORTIVE MEASURES

» Maintain adequate nutrition and hydration by encouraging fluid and food intake – use bland foods and fluids as they cause less pain.
» If oral nutrition cannot be maintained use oral/nasogastric and/or IV fluids, if necessary.

MEDICINE 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:

- Aciclovir, oral, 250 mg/m^2/dose 6 hourly for 7 days (or per kg dose equivalent below)
  - If > 1month to 1 year old: 12.5 mg/kg/dose.
  - If > 1 year to 6 years old: 10 mg/kg/dose.
  - If > 6 years to 12 years old: 6 mg/kg/dose.

LoE III[i]

If very severe infection, consider:

- Aciclovir, IV, 250 mg/m^2/dose 8 hourly for 7 days (per kg dose equivalent below)
  - If > 1 month to 1 year old: 12.5 mg/kg/dose.
  - If > 1 year to 6 years old: 10 mg/kg/dose.
  - If > 6 years to 12 years old 6 mg/kg/dose.
    Change to oral as soon as possible.

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.

2.2 GASTROINTESTINAL DISORDERS

2.2.1 CHOLERA

A00.9
***** Notifiable condition.

DEFINITION

An acute diarrhoeal disease caused by *V. cholerae*.

DIAGNOSTIC CRITERIA

Clinical

» Sudden onset of severe, watery diarrhoea, i.e. 'rice water' diarrhoea.
» Low-grade or no fever.
» Persistent vomiting not associated with nausea.
» Rapid fluid and electrolyte losses with dehydration, acidosis and hypovolaemic shock with/without renal failure.
» History of contact with a cholera case or the presence of cholera in the community.

Investigations

» Positive stool culture.
» Agglutinating or toxin-neutralising antibodies in the serum.

GENERAL AND SUPPORTIVE MEASURES

» Isolate patient and institute barrier nursing.
» Ensure adequate hydration and nutrition.
» Check blood glucose in patients with decreased level of consciousness.

The management of the fluid requirements is the most critical element of treating a patient with cholera.

MEDICINE TREATMENT

First treat shock.
Once shock has resolved, manage as acute diarrhoea. See section 2.2.4 Diarrhoea, acute.

For the management of shock during recognised cholera outbreaks, there may be benefit to replace sodium chloride 0.9% with:

- Modified Ringers–Lactate, IV.

Antibiotic treatment

Recommended antibiotics may vary according to sensitivities in epidemics. Consult the NICD for the latest recommendations.
Current recommendations for severe dehydration are:

- Ciprofloxacin, oral, 15 mg/kg/dose 12 hourly for 3 days.

<u>In all children who are able to take oral medication:</u>

- Zinc (elemental), oral for 14 days:
  - If < 10 kg: 10 mg/day.
  - If > 10 kg: 20 mg/day.

REFERRAL

» Cholera with complications, e.g. persistent shock, renal failure and severe electrolyte disturbances.

2.2.2 CONSTIPATION / FAECAL LOADING

K59.0

DESCRIPTION

Constipation: the infrequent passage of hard stools. This is often due to behavioural retention following previous painful episodes of defaecation (functional constipation), but may also be due to organic causes (metabolic, endocrine, neurogenic, lower bowel abnormalities and medication side-effects).

Constipation-associated faecal incontinence: the involuntary leakage of small amounts of soft or watery stools secondary to faecal loading.

DIAGNOSTIC CRITERIA

Rome IV Criteria:

Infants up to 4 years of age should have at least two symptoms for 1 month prior to diagnosis and those over developmental age 4 years should have at least two symptoms present for the previous 2 months:

- Two or fewer defaecations per week.
- At least 1 episode of faecal incontinence per week.
- Retentive posturing or stool retention.
- Painful or hard bowel movements.
- Presence of a large faecal mass in the rectum.
- Large diameter stools that may obstruct the toilet.

LoE III[ii,iii]

GENERAL AND SUPPORTIVE MEASURES

» Determine and treat the underlying cause.
» Treatment involves 3 steps:
  > initial clearance of stools,
  > prevent re-accumulation of hardened retained stool, and
  > retraining of the gut to achieve regular toilet habits.
» Management is long-term and requires the active involvement of the parents.

MEDICINE TREATMENT

Initial therapy

(Disimpaction if indicated)

- Phosphate-containing enema (sodium phosphate 6 g, sodium biphosphate 16 g/100mL).
  - Age 2–5 years: 32 mL.
  - Age 5–11 years: 64 mL.
  - Repeat once, if necessary.

OR

- Polyethylene glycol 59 g/L solution with sodium sulphate and electrolytes, oral/ nasogastric tube, 10–25 mL/kg/hour until clear fluid is passed rectally.

Note: No additional ingredient should be added to the solution, e.g. flavourings or sugar containing cold drinks.

Maintenance therapy
The child and parents should be counselled and educated about behaviour modification (regarding toilet habits) and diet changes (additional natural fibre from fruit, vegetables and bran).

(a) Osmotic laxative
- Lactulose 0.5-1 mL/kg/dose once or twice daily.

AND/OR
(b) Stool softener
- Liquid paraffin, oral, 1-3 mL/kg/day. Single or divided dosage.
- Do not use in children under 1 year or those with neurological conditions or swallowing disorders

AND/OR
(c) Bulk-forming agent
- Ispaghula husk, oral, 1.75–3.5 g, stirred in water with breakfast.

If faecal loading was present, maintenance therapy should be continued for months to years.

REFERRAL
» Suspected organic cause e.g. constipation from birth in a breast-fed baby.
» Inadequate response to therapy.

2.2.3 CYSTIC FIBROSIS
E84.9

DESCRIPTION
An autosomal recessive disorder of exocrine glands, mainly affecting the gut, pancreas and lungs.

DIAGNOSTIC CRITERIA
Clinical
» Recurrent infections of the respiratory tract with later bronchiectasis, respiratory failure and cor pulmonale.
» Bulky, greasy and foul-smelling stools.
» Occasionally presents with constipation.
» Malabsorption with weight loss and failure to thrive.
» Meconium ileus.
» Positive family history is uncommon unless cystic fibrosis is present in a sibling.

Investigations

» Sweat test:
  > Quantitative analysis of sodium and chloride concentrations in sweat collected after stimulation by pilocarpine iontophoresis with chloride > 60 mmol/L.
  > Sweat conductivity tests are more readily available but not as reliable as sweat electrolyte testing. Positive range for conductivity is 90 mmol/L and above.
» DNA analysis for delta F508 and a few other mutations. Negative mutation analysis does not exclude cystic fibrosis.
» Stool elastase will be low in cystic fibrosis patients with pancreatic insufficiency.

GENERAL AND SUPPORTIVE MEASURES

» Nutritional support.
» Physiotherapy and postural drainage.
» Psychosocial support.
» Genetic counselling.

MEDICINE TREATMENT

Medicinal treatment is specialised and individualised and should be under the supervision of a subspecialist.

- Pancreatic enzymes (lipase/amylase/protease), with meals according to clinical response.

REFERRAL

» All to a recognised cystic fibrosis centre and/or specialist health facility for confirmation of diagnosis and initiation of treatment.
» Management of exacerbations.

2.2.4 DIARRHOEA, ACUTE

A09.0

DESCRIPTION

Diarrhoea is a serious common childhood illness evidenced by the passing of frequent profuse loose watery stools. Vomiting may or may not be present.

Diarrhoeal disease is often caused by viral infection but may be due to bacterial infection, dietary or other causes.
Dehydration and metabolic disturbances are common if treatment is not instituted early and may result in severe disease, irreversible organ damage and death in children.

Malnutrition is a serious co-morbidity and/or result of diarrhoeal disease and must be managed correctly, employing ongoing feeding. Feeding, minerals, micronutrients and vitamins are continued except during ileus or shock. See section 2.4: Malnutrition.
In severe malnutrition or in the young infant (< 2 months of age) bacterial co-infection is common.

DIAGNOSTIC CRITERIA

Clinical

The assessment of shock and dehydration in children is not always simple. A good initial assessment and frequent re-assessments (4-hourly if dehydration is present) are required. In the presence of shock continuous reassessments with appropriate adjustment of care are vital in the care of these children.

Shock is shown by one or more of the following:
Compensated shock:
» delayed capillary refilling time (CRT) (> 3 seconds),
» rapid, weak pulse rate,
» cool peripheries.
Late (Preterminal):
» decreased level of consciousness,
» decreased blood pressure,
» decreased pulse volume.

Dehydration **is treated <u>after</u> shock is dealt with:**

Severe dehydration	**Some dehydration**
Sunken eyes Very slow skin pinch (≥ 2 sec) Drinking poorly	Sunken eyes Slow skin pinch (< 2 sec) Drinks eagerly Irritable/restless

Other indicators of dehydration may be sought but do not add substantially to assessment, e.g. depressed fontanelle, absent tears, decreased passage of urine.

Also assess for signs of metabolic, nutritional and other co-morbidities:
» severe malnutrition,
» decreased level of consciousness,
» abnormal tone or floppiness,
» abdominal distension,
» decreased bowel sounds,
» increased respiratory rate a nd chest indrawing,
» persistent or bile stained vomiting,
» urine for leucocytes or nitrites.

Investigations
» After resuscitation, in children with severe dehydration, shock or other signs of metabolic, nutritional or other co-morbidities:
  > sodium, potassium, urea, creatinine, blood acid-base assessment.

» Stool culture if suspected dysentery, typhoid, cholera.
» Urine test strip on fresh/clean urine specimen for leucocytes, nitrites and blood.
» Ascertain HIV status with consent in every child.

GENERAL AND SUPPORTIVE MEASURES

» Adequate initial assessment and frequent re-assessment, including weight, is vital.
» Re-assess the patient continuously while shock persists.
» If dehydration is present, re-assess the patient 4-hourly and immediately correct shock or deterioration.
» Monitor and maintain:
  > hydration and circulation,
  > blood pressure,
  > acid-base status.
  > normal blood glucose,
  > blood electrolytes,
» Monitor urine output, should be at least 1 mL/kg/hour. This may be difficult in small children with diarrhoea, especially in female infants.
» Monitor body mass regularly. Weigh daily, or 6-hourly if unsure of hydration status and child is very ill or small. This can be used to indicate response of hydration.
» Continue oral feeds during period of diarrhoea:
  > if the child is breastfed, continue breastfeeds and encourage the child to feed longer at each feed;
  > if the child is exclusively breastfed, give oral rehydration solution (ORS) in addition to each feed;
  > if the child is not exclusively breastfed, give ORS and other appropriate feeds, e.g. breast milk substitutes or food based fluids;
  > if the child is severely dehydrated or shocked, withhold feeding until stable, usually a few hours only.

MEDICINE TREATMENT

There is no place for antidiarrhoeal medications, i.e. kaolin and pectin, atropine and diphenoxylate, loperamide, or antiemetics in the routine management of acute diarrhoea.

OUTLINE OF PRACTICAL FLUID THERAPY OF DEHYDRATING WATERY DIARRHOEA

With severe malnutrition the assessment of dehydration is more difficult. Avoid intravenous infusions, if possible.
Treatment of dehydration requires more care/more frequent assessments.

1. First treat shock, if present (If no shock, proceed to section 2 below)

If an IV infusion cannot be set up within 5 minutes use an intra-osseus infusion. See section 1.1.8: Intra-Osseous Infusion in Emergencies.
During treatment of shock administer oxygen.

- Sodium chloride 0.9%, IV, 20 mL/kg given as a bolus rapidly.
  - After each bolus reassess for persistence of shock, or evidence of circulatory overload.
  - Repeat the fluid bolus up to 3 times if shock still persists, provided that evidence of circulatory overload is not present.
  - If after the second bolus, i.e. total of 40 mL/kg has been given and the response is inadequate, a third bolus can be started. Move the patient to ICU for CVP monitoring and inotropic support.

Treatment of shock in severe malnutrition

Shock treatment should be more cautious in patients with severe malnutrition due to poor cardiac reserve and high prevalence of gram negative septicaemia.

- Sodium chloride 0.9%, IV, 10 mL/kg administered over 10 minutes.
  - Up to 4 boluses may be given. However, deterioration may be due to fluid overload and shock may be due to septicaemia, not always hypovolaemia.
  - After 4 boluses (40 mL/kg) further treatment should be in a high care unit.
  - Re-assess frequently during treatment of shock. Patient's response should guide further fluid therapy.

If pulse and respiratory rate increases, increasing liver span and gallop rhythm are found suspect fluid overload/cardiac dysfunction and manage appropriately. See section 1.1.7: Shock.

When shock has been treated proceed to the management of dehydration.

2. Severe dehydration or some dehydration

2a) If the child has not failed oral rehydration and was not in shock:

- Oral rehydration solution (ORS), oral, 80 mL/kg over 4 hours using frequent small sips (i.e. 5 mL/kg every 15 minutes for 4 hours).
  - Give more if the child wants more.
  - Show the caregiver how to give ORS with a cup and spoon.
  - If child vomits, wait 10 minutes and then continue more slowly.

  Nasogastric tube (NGT) rehydration 20 mL/kg/hour over 4 hours can be used as alternative

PLUS

- Encourage caregiver to continue feeding the child, especially breastfeeding.
- Oral feeds should be given at normal volumes and times if:
  - » the level of consciousness is normal,
  - » the child is not in severe distress,
  - » not shocked and,
  - » has no surgical abdomen.

Review after 4 hours:

» general condition,
» capillary filling time,
» level of consciousness,
» skin turgor,
» sunken eyes.
» respiratory rate,
» abdomen (liver sp an),
» if passing urine,
» number/quality of stools, and

See Figure 1: *Summary flow chart for correction of dehydration in diarrhoeal disease.*

Assess response 4 hourly.

2b) If child fails the above oral/NGT treatment, was in shock or has already failed at primary health care level then:

IV fluid *

- ½ Darrows/dextrose 5%, IV, 10 mL/kg/hour administered for 4 hours, then re-assess.

* *(This rate is in line with current safety evidence but the need for regular reassessment 4-hourly remains.)*

PLUS

Oral rehydration solution

- Oral rehydration solution (ORS), oral, 80 mL/kg over 4 hours using frequent small sips (i.e. 5 mL/kg every 15 minutes for 4 hours) or NGT rehydration 20 mL/kg/hour over 4 hours.

PLUS

Oral feeds at normal feed volumes and times if:

» the level of consciousness is normal,
» the child is not in severe distress,
» not shocked and,
» has no surgical abdomen.

Review after 4 hours:

» general condition,
» capillary refilling time,
» level of consciousness,
» skin turgor,
» sunken eyes.
» respiratory rate,
» abdomen (liver sp an),
» urine output,
» number/quality of stools, and

3. No visible signs of dehydration on presentation or a child stable with no dehydration after treatment of dehydration.

Show the caregiver how to give ORS with a cup and spoon using frequent small sips.

Encourage caregiver to give 10 mL/kg after each diarrhoeal stool until diarrhoea stops.

Instruct the caregiver on how to make and use ORS/SSS at home.
Homemade sugar and salt solution may be used if oral rehydration formula is not available.

HOMEMADE SUGAR AND SALT SOLUTION (SSS)
½ level medicine measure of table salt
plus
8 level medicine measures of sugar
dissolved in 1 litre of boiled (if possible) then cooled water
(1 level medicine measure = approximately 1 level 5 mL teaspoon)

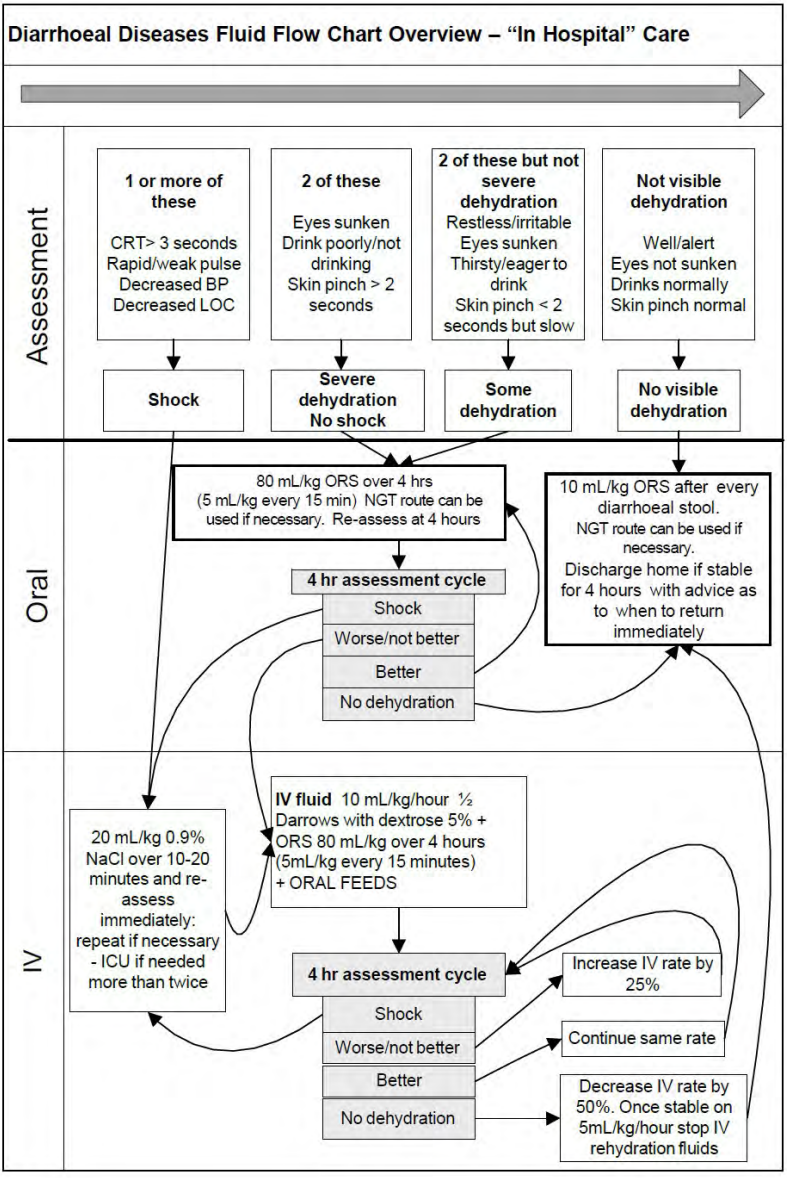
Encourage the caregiver to continue feeding the child, especially breastfeeding.

Instruct the caregiver to give the child extra feeds after the diarrhoea has stopped to make up for the period of inadequate intake.

Child should return to hospital immediately if:
- » no improvement,
- » condition deteriorates,
- » poor drinking or feeding,
- » slow skin pinch.
- » blood in stool,
- » fever develops,
- » sunken eyes,

Educate caregivers about hygiene, oral rehydration solution and danger signs of diarrhoea.

Figure 1: Summary flow chart for correction of dehydration in diarrhoeal disease



Metabolic disturbances

Acidosis

Metabolic acidosis will correct with appropriate fluid therapy and does not require additional treatment unless severe, i.e. pH < 7.1, or if the body is unable to correct the deficit, e.g. salicylate poisoning or renal failure. Additional treatment should only be considered with expert supervision. Correcting the renal circulation and shock will lead to self-correction in almost all cases.

If correction is necessary: volume of sodium bicarbonate 4.2% required is:

- Sodium bicarbonate 4.2% as a bolus. Dose in mL to be given = 0.3 x base deficit x weight in kg. Review response to assess the need for further correction.

Hypokalaemia

Note: Potassium levels are affected by the degree of acidosis.

If potassium is 2.5 mmol/L to 3.5 mmol/L:

- Potassium chloride, oral, 25–50 mg/kg/dose 8 hourly.

If potassium is < 2.5 mmol/L:

- ½ Darrows/dextrose 5%, 200 mL **plus** potassium chloride 15%, 2 mL, into the vacoliter:
  - 1 mL potassium chloride 15% = 2 mmol potassium. If 2 mL is added in the above solution it gives a combined K^+ of 37 mmol/L – do not exceed this amount.
  - Mix well before administration.
  - Run at normal rehydration rate (as above).

Oral potassium may also be given during this period:

- Potassium chloride, oral, 25–50 mg/kg/dose 8 hourly.

Monitor serum potassium 8–12 hourly. Once above 3.0 mmol/L, stop IV potassium and continue with oral.

Hypernatraemia (> 150 mmol/L)

Severe symptoms usually only develop when the serum sodium is > 160 mmol/L. Symptoms tend to be more severe with acute hypernatraemia (i.e. over a period of hours) while chronic hypernatraemia is often better tolerated because of cerebral compensation.

The true degree of dehydration is often underestimated because the intravascular volume is preserved; signs of intracellular dehydration include lethargy, irritability, "doughy skin", high-pitched cry, hyperreflexia and seizures.

Too rapid reduction of the serum sodium in hypernatraemia can cause cerebral oedema, convulsions and permanent brain injury. More frequent serum sodium monitoring is needed where hypotonic solutions are used.

- Moderate hypernatraemic dehydration (Na 150 - 169 mmol/L):
  - » If shock is present resuscitate with boluses of 20 mL/kg of 0.9% sodium chloride (see above: step 1 - treat shock).
  - » Aim to lower the serum sodium slowly with no more than 0.5 mmol/L/hour (10 – 12 mmol/L) over 24 hours.
  - » Fall of sodium levels more than 1 mmol/L/hour on average means the rehydration rate should be reduced.
  - » Oral rehydration (10 mL/kg/hour) is preferable to IV rehydration.
  - » If oral rehydration is tolerated, feeding should be continued.
  - » Because of longer duration of dehydration, continuous nasogastric tube administration is preferable.
  - » Fluid is calculated as replacement of deficit (50-70 mL/kg) plus maintenance (over 2 days) over 48 hours.

Calculation of maintenance (mL):

≤ 1 year:	120 mL/kg/24 hours
> 1 year = sum of the following: » First 10 kg body weight » Second 10 kg body weight » Additional weight > 20 kg body weight	 100 mL/kg/24 hours 50 mL/kg/24 hours 20 mL/kg/24 hours

If oral/NGT rehydration fails, rehydrate using IV with ½ Darrows dextrose 5% over 48 hours. The sodium concentration of the ½ Darrows can be initially raised to between 90-105 mmol/L by adding 8.4% sodium bicarbonate 15-20 mL to the first 500 mL of ½ Darrows and thereafter, continue with ½ Darrows without any additives.

LoE III[iv]

IV Fluid rate
Rate:

- o If 2–10 kg: 6 mL/kg/hour
- o If > 10–20 kg: 5 mL/kg/hour
- o If > 20–40 kg: 4 mL/kg/hour

» Oral rehydration can be continued for ongoing losses (such as profuse diarrhoea).
» Fluid status, ongoing losses and neurological status should be monitored 2-hourly.

- Severe hypernatraemic dehydration (sodium > 170 mmoL (discuss with specialist paediatrician)

This is a medical emergency and referral to and intensive or high care unit should be considered.

» Sodium chloride 0.9%/dextrose 5% plus potassium chloride (see below) is used to correct clinical dehydration for the first 48 hours.

Sodium chloride 0.9%/dextrose 5% plus potassium chloride (to 20 mmol/L), IV.

- To every litre 0.9% sodium chloride add 100ml 50% dextrose and 10ml 15% KCl [20mmol potassium]). Infusion rate as above.

» Repeat serum sodium every 8–12 hours to monitor progress.

» Failure to decrease sodium levels usually means the rehydration rate is too slow.

» Frequent clinical reassessment is the key to the safe management of this situation. Serum sodium levels may be done more frequently where this is possible. Adjust the drip rate according to response.

» If convulsions are considered likely, (decreased level of consciousness, hyper-irritable child), in the setting of high serum sodium, consider the use of prophylactic anticonvulsants:

- Phenobarbitone, IV, 20 mg/kg as a single dose.

OR

If IV phenobarbitone not available:

- Phenobarbitone, oral, 20–30 mg/kg as a single dose.

Hyponatraemia

The correction of hyponatraemia is usually only necessary where the serum sodium is significantly decreased (i.e. < 120 mmol/L), or if the patient is symptomatic.

Use sodium chloride 0.9% and add potassium chloride and dextrose as indicated below.

Give at the rate indicated for dehydration and expect correction to have occurred after the following estimated volume:

Volume of sodium chloride 0.9% (mL) = (130–Na^+) x body weight in kg x 4.

- Administer sodium chloride 0.9%, 200 mL **plus** potassium chloride 15%, 2 mL **plus** dextrose 50%, 20 mL into the vacoliter.
  - Mix well before administration.

After the calculated volume has been given, resume with:

- ½ Darrows/dextrose 5%, IV, at the required rate.
  - Recheck the serum electrolytes.

OR

- Oral rehydration solution (ORS), oral, at the required rate.

Antibiotic therapy

Note:

» Antibiotics are not routinely used for diarrhoeal disease.

» During diarrhoea, absorption of antibiotics may be impaired due to intestinal hurry. Give antibiotics orally if administered for intra-luminal effect.

» Other antibiotics for systemic action are best administered parenterally.

» Consider urinary tract infection, or septicaemia in children with severe malnutrition, the immunocompromised and infants < 2 months old.

Dysentery

Treat initially as shigella dysentery:

- Ceftriaxone, IV, 50 mg/kg as a single daily dose for 5 days.

OR

- Ciprofloxacin, oral, 15 mg/kg/dose 12 hourly for 3 days.

For entamoeba histolytica (if demonstrated on stool microscopy, or strongly suspected - this is now a relatively uncommon condition in children in South Africa).

- Metronidazole, oral, 15 mg/kg/dose 8 hourly for 7 days.
  - Severe disease: treat for 10 days.

Cholera

Treat according to current sensitivities of the organism during epidemic.
See section 2.2.1: Cholera.

Typhoid

- Ceftriaxone, IV, 50 mg/kg once daily for 10–14 days.

Severe malnutrition

See section 2.4.1: Malnutrition, severe acute.

- Ampicillin, IV, 50 mg/kg/dose 6 hourly for 5 days.

PLUS

- Gentamicin, IV, 6 mg/kg as a single daily dose for 5 days.
  - Confirm normal renal function before second dose.

Very young infants < 2 months

- Ampicillin, IV, 25–50 mg/kg/dose 6 hourly for 5 days.

PLUS

- Gentamicin, IV, 6 mg/kg as a single daily dose for 5 days.
  - Confirm normal renal function before second dose.

Mineral and micronutrient supplementation

All children with diarrhoea.

- Zinc (elemental), oral, for 14 days
  - If < 10 kg: 10 mg/day.
  - If > 10 kg: 20 mg/day.

LoE III[v]

- Potassium chloride, oral, 8 hourly.
  - If < 6 months: 125 mg.
  - If > 6 months: 250 mg.

  Do not give if patient is hyperkalaemic or anuric.

REFERRAL

» Inability to correct/treat shock/dehydration.
» Metabolic complications: non-responsive acidosis, severe hypernatraemia (> 170 mmol/l) and symptomatic hypokalaemia.

2.2.5 PERSISTENT DIARRHOEA

DESCRIPTION

Persistent diarrhoea is a diarrhoeal episode of presumed infectious aetiology that begins acutely but has a prolonged duration lasting more than 14 days.

GENERAL AND SUPPORTIVE MEASURES

Treatment strategy includes a stepwise approach with modification of the diet, which are not mutually exclusive and are applied according to local resources.

» Monitor hydration, stools, nutritional status, weight gain, growth and other nutritional parameters such as serum proteins.
» Nutritional support:
  > Aim to provide at <u>least</u> 460 kJ/kg/day orally within three days to protect nutritional state.

STEP-WISE EMPIRIC PROTOCOL FOR MANAGEMENT OF DIARRHOEA

Commence management at the most appropriate step according to previous management – many infants with persistent diarrhoea will already have failed the “day 1-2” stage and will commence management on “day 3-7”.

<u>Day 0 (presentation at Health Care Facility with acute diarrhoea)</u>
» Rehydration according to figure above. Recommence breast or formula feeds within 4-6 hours, and additional oral rehydration solution (ORS) to maintain hydration.

<u>Day 1–2</u>
» Continue full-strength feeds with additional ORS as required.

<u>Day 3–7</u>
» 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.

<u>Day 8–13</u>
» Semi-elemental formula: sucrose- and lactose-free, protein hydrolysate, medium chain triglyceride.
» Continue additional ORS as required.

» If diarrhoea resolves, discharge if possible on semi-elemental feeds for at least 2 weeks. If this is not possible a trial of lactose free feeds before discharge should be given and if successful, the child should be discharged on this feed.

If giardia is not excluded:
- Metronidazole, oral, 7.5 mg/kg/dose 8 hourly for 5 days.

In HIV infected children: *Isospora belli* and *Cyclospora*:
- Co-trimoxazole, oral, 5 mg/kg/dose of trimethoprim 12 hourly for 10 days.

If diarrhoea persists the child should be referred for further investigations and/or intravenous alimentation.

> Where the stepwise approach is not possible:
- Under 4 months:

Encourage exclusive breastfeeding if lactose intolerance is not severe.
If not exclusive breastfeeding, use breast milk substitutes that are low in lactose, e.g. yoghurt or amasi or specialised formulae or lactose-free milk formula.
- Children aged 4 months and older:

Feeding should be restarted as soon as the child can eat, with small meals 6 times a day.

> Nasogastric feeding may be required in children who eat poorly.
If the response is good, give additional fruit and well-cooked vegetables to children who are responding well.
After 7 days of treatment with an effective diet, resume an appropriate diet for age, including milk, which provides at least 460 kJ/kg/day.
Follow up regularly to ensure recovery from diarrhoea, continued weight gain and adherence to feeding advice.

MEDICINE TREATMENT

CAUTION
Antidiarrhoeal and anti-emetic agents are NOT recommended.

Antibiotic therapy
Antibiotics are only indicated when specific infections are suspected or where they are used in the Step-Wise Based Empiric Protocol for Management of Diarrhoea.

All persistent diarrhoea with blood in stool should be treated as dysentery. See section 2.2.6: Dysentery.

For *campylobacter*:

- Azithromycin, oral, 10 mg/kg/ day for 3 days.

LoE III[vi]

For *G. lamblia*:

- Metronidazole, oral, 7.5 mg/kg/dose 8 hourly for 5–7 days.

For *Y. enterocolitica*:

- Ceftriaxone, IV, 50 mg/kg/dose once daily.

OR

- Cefotaxime, IV, 50 mg/kg/dose 6 hourly.

For *Cryptosporidium*:

- No effective treatment available in the presence of HIV related immunosuppression.

For *Isospora belli*:

- Co-trimoxazole, oral, 5 mg/kg/dose of trimethoprim component 6 hourly for 10 days then 12 hourly for 3 weeks.

For *Cyclospora cayetanensis:*

- Co-trimoxazole, oral, 5 mg/kg/dose of trimethoprim component 6 hourly for 5 days.

For *Microsporidia*:

- Albendazole, oral, 7.5 mg/kg 12 hourly. (Specialist supervision)

LoE III[vii]

After success as indicated by weight gain, return of appetite and decrease of diarrhoea, less elemental diets can be judiciously and slowly re-introduced.

Mineral and micronutrient deficiencies

- Zinc (elemental), oral,
  - If < 10 kg: 10 mg/day.
  - If > 10 kg: 20 mg/day.

Provide nutritional support.

2.2.6 DIARRHOEA, CHRONIC OTHER THAN POST-INFECTIOUS

K52.9

DESCRIPTION

Chronic diarrhoea: diarrhoea for longer than two weeks.

Chronic diarrhoea results in significant morbidity and mortality associated with poor nutrition.

Chronic diarrhoea is most frequently due to:

» Temporary loss of disaccharidase activity in the intestinal microvillous brush border, e.g. lactase loss; or luminal infection/infestation, which may be non-specific bacterial overgrowth.
» Rare causes include food allergies, cystic fibrosis and coeliac disease.

DIAGNOSTIC CRITERIA

Clinical

» Chronic diarrhoea without weight loss or dehydration – consider Toddler's diarrhoea.
» Chronic diarrhoea with weight loss and dehydration – consider small bowel mucosal injury with multiple pathophysiological mechanisms, e.g. lactose intolerance, small bowel bacterial overgrowth and immunosuppression.
» Chronic diarrhoea with weight loss but no dehydration – consider a malabsorption syndrome, e.g. coeliac disease, allergic enteropathy, cystic fibrosis, etc.
» Consider the possibility of HIV infection.
» In the presence of abdominal pain, bloody stools, weight loss, perianal disease or extraintestinal features such as arthritis or uveitis, consider inflammatory bowel disease and refer to an appropriate specialist.

Investigations

Where weight gain falters, dehydration recurs, the child is ill or the diarrhoea continues:

» full blood count,
» serum proteins,
» urine and stool microscopy, culture and sensitivity tests (MCS),
» positive stool-reducing substances if on a lactose-containing diet. Stool pH < 5.5 also suggests carbohydrate malabsorption,
» faecal elastase.

REFERRAL

» Inability to maintain hydration (persisting watery diarrhoea even when fasting).
» Lack of local resources to support the stepwise protocol at any step.
» All cases not responding by day 12–13 of the stepwise protocol.
» If cystic fibrosis, allergic enteropathy or coeliac disease is suspected, but difficult to diagnose due to lack of local resources.

2.2.7 DYSENTERY

A03.9

DESCRIPTION

Passage of blood and mucus in the stools.
Shigella infection is the most common serious cause in children in South Africa.

Complications include:

- dehydration,
- shock,
- acidosis,
- renal failure, and
- convulsions,
- toxic megacolc n,
- rectal prolapse ,
- haemolytic ura emic syndrome.

DIAGNOSTIC CRITERIA

Clinical

- Sudden onset.
- Abdominal cramps, peritonism, urgency, fever and diarrhoea with blood and mucus in the stools.
- Meningismus and convulsions may occur.
- Exclude intussusception. Evidence of intussusception includes:
  - pain or abdominal tenderness,
  - bile-stained vomitus,
  - red currant jelly-like mucus in stool,
  - appearance of the intussusceptum through the anus.

Investigations

- Stool culture to confirm diagnosis of Shigellosis.
- Polymorphs and blood on stool microscopy.
- Immediate microscopy of warm stool to diagnose amoebic dysentery.

GENERAL AND SUPPORTIVE MEASURES

- Monitor fluid and electrolyte balance.
- Ensure adequate nutrition and hydration.

MEDICINE TREATMENT

Fluid and electrolyte replacement

See section 2.2.4: Diarrhoea, acute.

Antibiotic therapy

Treat as Shigella during an epidemic of Shigellosis, or if the child is febrile, “toxic”-looking, has seizures or if Shigella is cultured from the stool and the child is still ill.

- Ciprofloxacin, oral, 15 mg/kg/dose 12 hourly for 3 days.

Where oral medication cannot be used:

- Cefotaxime, IV, 75 mg/kg/dose 8 hourly for 5 days.

OR

- Ceftriaxone, IV, 50 mg/kg as a single daily dose for 5 days.

For entamoeba histolytica (only if demonstrated on stool microscopy, or strongly suspected):

- Metronidazole, oral, 15 mg/kg/dose 8 hourly for 7 days.

REFERRAL

» Dysentery with complications, e.g. persistent shock, haemolytic uraemic syndrome and toxic megacolon.

2.2.8 GASTRO-OESOPHAGEAL REFLUX DISEASE (GORD)

K21

DESCRIPTION

Gastro-oesophageal reflux is repetitive regurgitation/reflux of gastric contents into the oesophagus.

It is termed “Complicated GOR” or “GORD” if associated with the diagnostic criteria below.

It should be differentiated from “Uncomplicated GOR” if the only symptom is frequent small vomits, in which case no further investigation or treatment is needed and other causes of vomiting. Parents should be reassured that regurgitation improves spontaneously during the first year of life.

DIAGNOSTIC CRITERIA

» GORD should be suspected if: Recurrent vomiting or regurgitation and any of the following:
  > respiratory symptoms, i.e. recurrent wheeze or cough, chronic obstructive airway disease, recurrent aspiration/pneumonia, stridor, apnoea and apparent life-threatening event;
  > faltering of growth; and
  > abnormal posturing or opisthotonus (Sandifer syndrome).

Consider other causes of vomiting and faltering of growth, such a pyloric stenosis, cow's milk allergy.

Investigations

Note: Routine investigations are seldom indicated. Discuss with specialist prior to performing investigations.

GENERAL AND SUPPORTIVE MEASURES

» Postural treatment: lying on the left side is currently recommended.
» Dietary measures such as feed thickeners. If not breastfeeding, frequent small volume feeds or specialised anti-reflux infant formula.

MEDICINE TREATMENT

Note: Evidence in support of the following recommendations is weak:

Specialist initiated:

- Omeprazole, oral, 0.7-1.4 mg/kg/day once daily, on an empty stomach for 4 weeks, then stop therapy. If symptoms reoccur and persist for 3-4 days after stopping, consider reinitiating.
  - Maximum dose: 20–40 mg/dose.
    If 1 month–2 years: 5 mg once daily
    If > 2–6 years: 10 mg once daily
    If > 7–12 years: 20 mg once daily

LoE III [viii]

REFERRAL

» For diagnostic investigations, if not available locally.
» GORD not responding to treatment.

2.2.9 PEPTIC ULCER DISEASE

K27

DESCRIPTION

Varying degrees of gastritis or frank ulceration of the stomach or duodenum due to acid and pepsin-laden stomach contents on the gastric and duodenal mucosa in the face of inability of mucosal defence mechanisms to prevent these effects.
Peptic ulcers may be primary (e.g. *Helicobacter pylori* related) or secondary, (e.g. stress related or associated with NSAID use).

DIAGNOSTIC CRITERIA

Clinical

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

Investigations

» Endoscopy to confirm diagnosis.

GENERAL AND SUPPORTIVE MEASURES

» Manage circulation and anaemia, as required.
» Stop all non-steroidal anti-inflammatory agents.
» Remove all stressors identified.

MEDICINE TREATMENT

- Proton pump inhibitor, e.g.:
- Omeprazole, oral, 0.7-1.4 mg/kg/day once daily. Specialist initiated.
  - Maximum dose: 20-40 mg/dose.
    If 1 month–2 years: 5 mg once daily.
    If > 2–6 years: 10 mg once daily.
    If > 7–12 years: 20 mg once daily.

LoE III [viii]

PLUS

If *Helicobacter pylori* positive. (Not routine)

- Metronidazole, oral, 7.5 mg/kg 12 hourly for 14 days.

PLUS

- Amoxicillin, oral, 25–30 mg/kg 12 hourly for 14 days.

LoE III [ix]

Penicillin allergy

In case of severe penicillin allergy replace amoxicillin with:

- Azithromycin, oral, 10mg/kg daily for 5 days.

REFERRAL

» Poor response to treatment.
» Suspicion of underlying cause.

2.3 HEPATIC DISORDERS

2.3.1 CIRRHOSIS

K74.6

DESCRIPTION

The end result of irreversible damage to the liver tissue, causing a widespread, diffuse process of fibrosis with regenerating nodule formation. The fibrosis and abnormal portosystemic vascular connections that result cause ongoing damage. The progression rate is variable, but ultimately results in liver failure.

Causes are divided into biliary cirrhosis due to bile duct obstruction and post necrotic cirrhosis where the lesion is hepatocellular.

Complications include:

» fat malabsorption,
» liver failure,
» portal hypertension,
» ascites secondary to portal hypertension.

DIAGNOSTIC CRITERIA

Clinical

» Clubbing may be present.
» Jaundice.
» Hepatomegaly and/or splenomegaly and/or ascites.
» Signs and symptoms of complications.

Investigations

» Liver enzymes may be normal.
» FBC may show signs of hypersplenism with reduced circulating red cells, white cells and platelets.
» Prolonged prothrombin time/INR.
» Hypo-albuminaemia.
» Ultrasound of the liver and spleen may be abnormal.
» Liver biopsy confirms cirrhosis.

GENERAL AND SUPPORTIVE MEASURES

» Ensure adequate nutrition:
  > Consult dietician, if available.
» If not encephalopathic:
  > High protein diet, i.e. 3 g/kg/day and medium chain triglyceride supplementation (if cholestatic jaundice).
  > High carbohydrate diet, supplement with glucose polymers.
  > If high serum cholesterol or if xanthelasma: low cholesterol diet.

MEDICINE TREATMENT

- Multivitamin, oral, 5 mL as a single daily dose.

If INR is abnormal, consider a trial of vitamin K and if no response stop.

- Vitamin K_1 (phytomenadione), oral, 2-5 mg three times weekly.
  - Monitor INR and titrate dose accordingly.
  - In the presence of cholestatic jaundice vitamin K should be given parenterally.

REFERRAL

» All children with suspected cirrhosis should be referred to determine possible cause.

2.3.2 CHRONIC CHOLESTASIS

DESCRIPTION

Impairment of bile formation and/or bile flow which may present with pruritis and/or jaundice. It is classified as intrahepatic (e.g. chronic hepatitis, paucity of bile ducts) or extrahepatic (e.g. biliary atresia).

GENERAL AND SUPPORTIVE MEASURES

Diet supplemented with medium-chain triglycerides.

MEDICINE TREATMENT

For pruritus of cholestasis:

- Colestyramine, oral, 240 mg/kg/day in 3 divided doses with meals.
  - Mix with water or other fluids.
  - Other medications should be given 1 hour before or 4-6 hours after colestyramine use.

For sedation:

Chlorphenamine, oral, 0.1 mg/kg/dose up to 6 hourly.

2.3.3 PORTAL HYPERTENSION

K76.6

DESCRIPTION

Increased portal venous pressure above vena cava pressure. Most commonly secondary to cirrhosis, but causes without cirrhosis may be divided into prehepatic portal vein obstruction, intra-hepatic (pre-or post-sinusoidal) and post-hepatic causes.

DIAGNOSTIC CRITERIA

Clinical

» Splenomegaly with ascites, variceal haemorrhage or hypersplenism.

Investigations

» FBC may show hypersplenism.
» Doppler assisted ultrasound and angiography.
» Investigations as listed under cirrhosis.

GENERAL AND SUPPORTIVE MEASURES

» Determine and manage underlying cause.

REFERRAL

» All children with portal hypertension should be referred.

2.3.3.1 BLEEDING OESOPHAGEAL VARICES

I85.0

DESCRIPTION

Presentation with haematemesis (fresh blood) or melaena in a patient who has a spontaneous bleed from varices at the oesophageal-gastric junction. The patient may or may not have been known to have chronic liver disease and portal hypertension. This bleeding may be hard to control and be life threatening.

GENERAL AND SUPPORTIVE MEASURES

» Resuscitation and blood transfusion as required.
» For local control of acute bleeds that are not controlled with medicine treatment: Sengstaken tube.
» For secondary prophylaxis after a bleed: refer for endoscopic injection sclerotherapy or variceal banding every 2 weeks until eradicated.
» If either or both treatments fail: surgical over-sewing.

MEDICINE TREATMENT

- Octreotide, IV, bolus, 1–2 mcg/kg immediately then 1–5 mcg/kg/hour by infusion. (Specialist initiated).

LoE III[x]

Post bleed prophylactic management

- Proton pump inhibitor, e.g.:
- Omeprazole, oral, 0.7-1.4 mg/kg/day once daily. Specialist initiated.
  - Maximum dose: 20-40 mg/dose.

    If 1 month–2 years: 5 mg once daily.
    If > 2–6 years: 10 mg once daily.
    If > 7–12 years: 20 mg once daily.

LoE III
viii

AND

- Propranolol, oral, 2 mg/kg daily in 3 divided doses.
  - If needed, increase dose to 8 mg/kg/24 hours.
  - Aim to reduce the resting pulse rate by 25%.

REFERRAL

» All, to establish diagnosis and initiate treatment.
» Bleeding varices: only after commencement of resuscitation and octreotide, if available.

2.3.3.2 ASCITES, DUE TO PORTAL HYPERTENSION

R18

GENERAL AND SUPPORTIVE MEASURES

» Restrict sodium intake, 1-2 mmol/kg/24 hours.
» Restrict fluids if serum sodium < 130 mmol/L.

MEDICINE TREATMENT

- Spironolactone, oral, 1–3 mg/kg as a single daily dose. Can increase dosage slowly to 4-6 mg/kg/day.
  - Continue for as long as needed to control ascites.
  - Monitor serum potassium.

If insufficient response, add:

- Furosemide, oral, 1-3 mg/kg as a single daily dose.

- Spironolactone to furosemide ratio should be 2.5:1.

OR (do not give furosemide and hydrochlorothiazide together)

- Hydrochlorothiazide, oral, 1 mg/kg/dose 12–24 hourly.
  - Maximum dose: 25 mg daily.

Therapeutic paracentesis may be performed to relieve the cardiorespiratory and gastrointestinal manifestations of tense ascites. The upper abdomen, surgical scars, the bladder and collateral vessels should be avoided when inserting the paracentesis needle. 50 mL/kg ascites can be tapped over an hour with IV albumin 1 g/kg to prevent circulatory dysfunction.

LoE III[xi]

REFERRAL

» **Urgent:** Refractory ascites interfering with respiration.
» For determination of the underlying cause of the cirrhosis, portal hypertension and initiation of treatment.
» Cirrhosis, portal hypertension and/or liver failure not responding to adequate therapy.
» Hepatic encephalopathy.

2.3.4 HEPATITIS, VIRAL, ACUTE

B17.9
* Notifiable condition

DESCRIPTION

Acute inflammation of the liver with varying degrees of hepatocellular necrosis caused by hepatitis A, B and less commonly C, D and E viruses.

DIAGNOSTIC CRITERIA

Clinical

» Prodromal phase:
  > nausea,
  > vomiting,
  > fever, and
  > malaise,
  > anorexia,
  > right upper quadrant abdominal pain.
» Jaundice, tender hepatomegaly and dark urine.

Investigations

» Raised transaminases and bilirubin.
» Serological evidence of hepatitis virus infection. See section 2.3.7 Hepatitis B, chronic for Hepatitis B interpretation chart.

GENERAL AND SUPPORTIVE MEASURES

» Isolate patient if Hepatitis A for 7–10 after the onset of jaundice.
» Inform patient of infectivity risk if hepatitis B, C or D.
» Bed rest does not alter the course of the disease.

MEDICINE TREATMENT

Prophylaxis

- Hepatitis B vaccine, IM, 0.5 mL.
  - If < 1 year: Outer side of the right thigh.
  - If > 1 year: Upper arm.

Use opposite side to that for the DPT/Td injection.

Give at 6, 10 and 14 weeks as part of the routine expanded programme on immunisation.

Neonatal transmission:

Babies born to mothers with acute hepatitis B infection at the time of delivery or to mothers who are HBsAg-positive or HBeAg-positive:

- Hepatitis B immunoglobulin, IM, 0.5 mL within 12 hours of delivery.

PLUS

- Hepatitis B vaccine, IM, first dose within 12 hours of delivery.
  - Continue hepatitis B immunisation according to the recommended immunisation schedule.

REFERRAL

» Acute hepatitis with bleeding tendency and altered level of consciousness – isolation recommended.
» Prolonged jaundice or raised transaminases.
» Chronic hepatitis with/without cirrhosis.

2.3.5 HEPATITIS, TOXIN INDUCED, ACUTE

K71.6

DESCRIPTION

Liver damage attributed to a toxin or medicine. The most common herbal toxin in South Africa is atractyloside (*Impila)*, which causes a Reye's-like syndrome, with liver failure. *Senecio* ingestion is also seen but this causes endothelial damage in hepatic veins, resulting in hepatic sinudoidal obstruction syndrome with secondary cirrhosis and portal hypertension.

There are many medicines that are hepatotoxic. The commonest are:

» anticonvulsants,
» cytotoxics,
» analgesics,
» antiretrovirals.
» immunosuppressants,
» anti-inflammatories,
» antituberculous medicati on,

DIAGNOSTIC CRITERIA

» Depends on the toxin, but the history is usually diagnostic.
» *Impila* poisoning, given orally or rectally, may result in anicteric hepatic encephalopathy.

» Presents with onset of severe vomiting, followed by anuria and then rapid depression of level of consciousness, progressing to seizures and/or coma within a day.

GENERAL AND SUPPORTIVE MEASURES

» Stop all potentially hepatotoxic medication, including paracetamol.
» Education regarding herbal toxins, if appropriate.

MEDICINE TREATMENT

For paracetamol poisoning:
See section 18.1.11: Paracetamol poisoning.

Acute liver failure/Hepatic encephalopathy:
See section 2.3.9: Liver failure, acute.

REFERRAL

» All cases of hepatic encephalopathy due to toxin ingestion.
» All cases in which rechallenge of medication is considered.

2.3.6 HEPATITIS, CHRONIC, AUTOIMMUNE

K75.4

DESCRIPTION

Autoimmune induced hepatitis.

DIAGNOSTIC CRITERIA

Clinical

» Jaundice.
» Hepatosplenomegaly.
» Cutaneous features of chronic liver disease.
» Extrahepatic manifestations of the autoimmune process.

Investigations

» Elevated bilirubin and transaminases.
» Hypoalbuminaemia and prolonged prothrombin time/INR.
» Auto-immune marker screen.
» Total serum globulin or gammaglobulin or IgG greater than 1.5 times upper normal limit.
» Diagnosis confirmed on liver biopsy.

MEDICINE TREATMENT

Induction therapy:

- Corticosteroids. Specialist initiated.

Maintenance therapy:

- Azathioprine. Specialist initiated.

REFERRAL

» All for confirmation of diagnosis and initiation of treatment.

2.3.7 HEPATITIS B, CHRONIC

B18.1

DESCRIPTION

Persistently elevated transaminases after hepatitis B infection.

DIAGNOSTIC CRITERIA

» Transaminases are double upper limit of normal.
» Liver biopsy is characteristic.
» Hepatitis B serology positive.

Interpretation of Hepatitis B Serological Test Results

> Susceptible:

HBsAg	negative
Anti-HBc	negative
anti-HBs	negative
IgM anti-HBc	negative

> Immune due to vaccination:

HBsAg	negative
Anti-HBc	negative
anti-HBs	positive > 10 milli-unit/mL

> Immune from natural infection:

HBsAg	negative
Anti-HBc	positive
anti-HBs	positive

> Acute infection:

HBsAg	positive
Anti-HBc	positive
anti-HBs	negative
IgM anti-HBc	positive

> Chronic infection:

HBsAg	positive
Anti-HBc	positive
anti-HBs	negative
IgM anti-HBc	negative

> Four possible interpretations:

1. Recovering from acute HBV infection.
2. Distantly immune anti-HBs level too low to detect.
3. Susceptible with false positive anti-HBc.
4. Chronic infection with HBsAg levels too low to detect.

HBsAg	negative
Anti-HBc	positive
anti-HBs	negative

REFERRAL
» For confirmation of diagnosis and initiation of treatment.

2.3.8 HEPATITIS C, CHRONIC
B17.1

DESCRIPTION
A chronic inflammation of the liver caused by vertical (perinatal) transmission of Hepatitis C virus from an infected mother. The disease is mostly mild in childhood and in up to 25% the virus can be spontaneously cleared from age 2 up to 7 years.

DIAGNOSTIC CRITERIA
» Anti-HCV Elisa which detects IgG antibodies. Transplacental maternal IgG antibodies may persist up to age 18 months.
» HCV RNA (quantitative).
» HCV genotyping is only done if treatment is considered.

REFERRAL
All children with positive HCV RNA.

2.3.9 LIVER FAILURE, ACUTE
K72.0

DESCRIPTION
Acute liver failure is a devastating clinical syndrome, which has a high mortality. It results from massive necrosis of liver cells leading to the development of hepatic encephalopathy. The clinical appearance can be deceptive and it is easy to underestimate how critically ill these patients are. Refer patients early to secondary or tertiary hospital. Paediatric acute liver failure is said to be present once the INR is greater than 2 (not correctable with vitamin K), or greater than 1.5 in the presence of encephalopathy.

The following complications can occur:
» coagulopathy,
» cerebral oedema,
» encephalopathy,
» metabolic acidosis, and
» hypoglycaemia,
» renal failure,
» cardiorespiratory f ailure,
» sepsis.

DIAGNOSTIC CRITERIA
Clinical
Appears deceptively well in the early stages. Progressive features include:
» malaise,
» stupor,
» vomiting,
» anorexia,

» encephalopathy,
» bleeding tendency,
» jaundice.
» foetor hepaticus,
» ascites, and

The absence of jaundice suggests another process, such as Reye syndrome, which also leads to hepatic encephalopathy.

Investigations

» Raised or low liver enzymes, low serum albumin, raised bilirubin, raised blood ammonia, hypoglycaemia.
» Prolonged prothrombin time/INR.
» Low fibrinogen.

GENERAL AND SUPPORTIVE MEASURES

» Admit to high care or intensive care unit.
» Monitor:
  > blood pressure,
  > heart rate,
  > respiration,
  > haematocrit,
  > acid-base status,
  > coagulation competence (INR),
  > urine output,
  > neurological state,
  > gastro-intestinal bleeding,
  > blood glucose – 3 hourly if comatose,
  > liver and renal functions,
  > electrolytes: sodium, potassium, calcium and phosphate, magnesium.
» Maintain hydration.
» With encephalopathy, aim to reduce ammonia production by the gut and optimise renal excretion.
» Withdraw protein intake completely initially followed by restricted intake if level of consciousness improves, i.e. 0.5-1 g/kg/24 hours.
» Stop sedatives, diuretics and hepatotoxic medicines, if possible.

MEDICINE TREATMENT

To reduce intestinal protein absorption:

- Lactulose, oral, 1 g/kg/dose (1.5 mL/kg/dose) 4–8 hourly via nasogastric tube, then adjust dose to produce 2-3 soft stools daily.

OR

- Polyethylene glycol 59 g/L solution with sodium sulphate and electrolytes, oral/ nasogastric tube, 10–25 mL/kg/hour until clear fluid is passed rectally (about 4–6 hours).
  - No additional ingredient should be added to the solution, e.g. flavourings or sugar containing cold drinks.
  - Follow with regular lactulose to keep stool loose.

- Gentamicin, oral, 12.5 mg/kg/dose 6 hourly for 5 days.
  - The intravenous formulation can be given orally.

Cerebral oedema:
For management of cerebral oedema, see section 13.5: Status epilepticus (convulsive).

For pre-operative use or with active bleeding:
- Fresh frozen plasma, IV, 20 mL/kg administered over 2 hours.

OR
- Lyophilised plasma (fresh dried plasma), IV, 20 mL/kg administered over 2 hours.

- Vitamin K_1 (phytomenodione), IV, 2.5–10 mg daily.
  - Monitor response to vitamin K_1 with INR and PTT.

If platelet count < 10 x 10^9/L or if < 50 and with active bleeding:
- Platelet transfusion.

For gastrointestinal bleeding:
- Omeprazole, oral. 0.7-1.4 mg/kg/day once daily. Specialist initiated.
  - Maximum dose: 20–40 mg/dose.
    If 1 month–2 years: 5 mg once daily.
    If > 2–6 years: 10 mg once daily.
    If > 7–12 years: 20 mg once daily.

LoE III [viii]

For hypoglycaemia:
- Dextrose 10%, IV bolus 5 mL/kg.
  - Administer maintenance as below.

Maintenance of fluids until enteral feeding resumed:
- ½ Darrows/dextrose 5%, IV, 60–80 mL/kg/day.
  - Ensure a minimum of 3–6 mmol/kg/day of potassium.
  - Avoid diuretics.

For anaemia:
- Packed red cells, 10 mL/kg over 3 hours if haemoglobin < 7 g/dL.

For shock:
See Section 1.1.7: Shock.

For sedation, if essential:
- Midazolam, IV, 0.1 mg/kg.
  - Benzodiazepines are poorly metabolised in liver failure and may result in prolonged sedation.
  - Do not repeat without clinical indication.

Seizures are often subclinical or subtle. For seizures:
- Diazepam, IV, 0.2 mg/kg
  - Repeat dose if not controlled in 5 minutes.

- Benzodiazepines are poorly metabolised in liver failure and may result in prolonged sedation.
- Do not repeat without clinical indication.

Antibiotic therapy
Where sepsis is suspected, prevent and treat aggressively with intravenous broad spectrum antibiotics. Empiric antibiotic therapy until cultures is known.

- Ampicillin, IV, 50 mg/kg/dose, 6 hourly.

PLUS

- Cefotaxime, IV, 75 mg/kg/dose, 8 hourly.

REFERRAL

» All for determination of the underlying cause after initiation of treatment.
» Combined hepato-renal failure.
» Failure to contain bleeding.

2.4 MALNUTRITION

E40–E46

2.4.1 MALNUTRITION, SEVERE ACUTE

E40–E43

Z-scores

» For practical purposes a "z-score" is the number of standard deviations (SD) below or above the mean.
» 2 SD or 2 z-scores above the mean (+2) equates fairly closely to the 97th percentile and 2 SD or 2 z-scores below the mean (–2) equates fairly closely to the 3rd percentile.
» 3 SD or 3 z-scores above or below the mean would be regarded as severe deviation from normal.
» In deviation below normal, consider if a reasonable explanation exists, e.g. severe low birth weight with adequate growth profile subsequently.

Admit all cases with complicated severe acute malnutrition.

Uncomplicated cases may be managed with "ready to use therapeutic food (RUTF)" in ambulatory setting where this service is established.

DESCRIPTION

Severe Acute Malnutrition (SAM)
A multi-deficiency state of severe undernutrition of essential nutrients exacerbated by acute/chronic infection and metabolic disturbances. Severe Acute Malnutrition (SAM) includes but is not restricted to the clinical entities of bilateral pitting oedema or severe wasting. It is associated with a high but significantly modifiable mortality.

Criteria for ambulatory treatment of severe acute malnutrition,
All of the following must apply:

» Children over the age of 6 months with no pitting oedema.
PLUS
» Alert and feeding well.
PLUS
» None of the IMCI danger signs/nor those listed below.
PLUS
» Exclusion of other morbidity, TB and HIV infection.

DIAGNOSTIC CRITERIA

SAM in children aged 6–60 months:

Indicator	Measure	Cut-off
	Weight-for-height	z–score less than –3
	Mid upper arm circumference (MUAC)	Less than 11.5 cm
Bilateral pedal oedema	Clinical sign	

Where a suitable measuring device is not available the following less sensitive findings would also indicate the need to manage as severe acute malnutrition:

» **Severe underweight**
  > weight for age z-score less than –3 (usually clinically reflective of marasmus) where no other reasonable explanation is present, and/or
  > clinically visible severe wasting (usually clinically reflective of marasmus – thin arms, thin legs, “old man” appearance, baggy pants folds around buttocks, wasted buttocks).

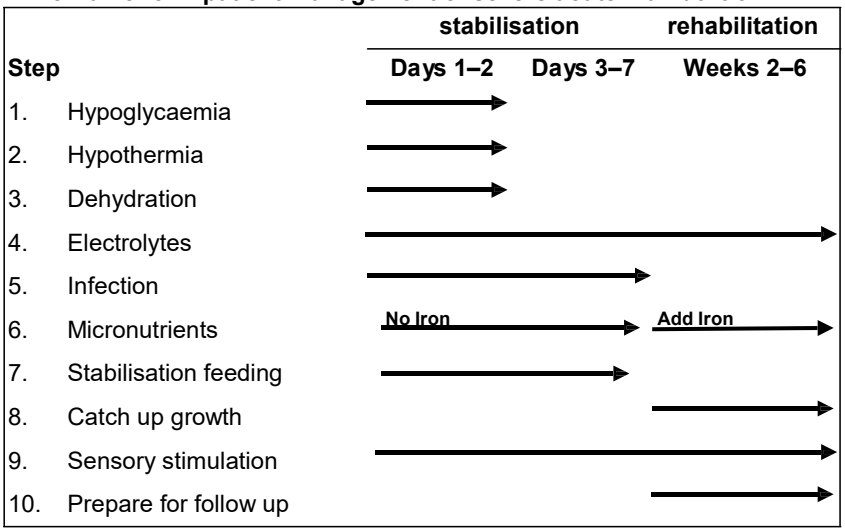
» **Nutritional oedema** (usually clinically reflective of kwashiorkor – bilateral pedal oedema usually supported by findings of skin changes, fine pale sparse hair, enlarged smooth soft liver, moon face).

Danger signs:

» Lethargy.
» Shock.
» Refusing feeds.
» Weeping skin lesions.
» Hypothermia.
» Convulsions.
» Hypoglycaemia.
» Jaundice.
» Dehydration.
» Respiratory distre ss.
» Bleeding.
» Vomiting everything.

Note: Any of these danger signs indicates the need for more intensive inpatient management.

Time frame for inpatient management of severe acute malnutrition



The general approach to the inpatient management of severe acute malnutrition is encapsulated in the 10 step approach illustrated above.
Within this approach the first days are involved in achieving metabolic and physical stability and this phase usually moves to the rehabilitation phase somewhere between the 3rd and 7th day of admission.

Stabilisation phase:

» feeding,
» preventing/treating hypoglycaemia,
» preventing/treating hypothermia,
» treating infections,
» giving minerals, vitamins and trace elements, and
» preventing/treating dehydration.

Rehabilitation phase:

» continued feeding,
» catch up growth,
» management chronic infections/infestations,
» continued administration of minerals and vitamins (including commencing iron),
» play and love; stimulation, and
» preparation for discharge.

Step 1: Hypoglycaemia (Blood glucose <3 mmol/L)

Prevention

Feed child with severe acute malnutrition immediately (within 30 minutes of presentation) and then ensure every feed is given by day and at night. See step 7: Stabilisation feeding.

Keep the child warm. See step 2: Hypothermia.

Detection and treatment

Test blood glucose level 3 hourly in severely ill child for first 24 hours and until stable (longer if the child is very ill).

Asymptomatic hypoglycaemia:

If blood glucose < 3 mmol/L in asymptomatic child, give immediately (oral bolus):

- Stabilisation/F75 formula, oral, 15 mL/kg.

OR

- Dextrose, 10%, oral, 10 mL/kg.
  - Dextrose 10% = Dextrose 50% 2 mL/kg with water for injection 8 mL//kg.

OR

- Sugar solution, oral, 10 mL/kg
  - 1 rounded teaspoon sugar in 50 mL or 3 ½ tablespoons of water.

Check blood glucose after 30 minutes and maintain it above 3 mmol/L. Continue feeds.

If symptomatic or persistent hypoglycaemia:

- Dextrose, 10%, IV, 5 mL/kg.

OR

- Neonatal maintenance solution, IV, 5 mL/kg.

Continue feeds once responsive.

- Change feeds to 2 hourly if hypoglycaemia has occurred. See step 7: Stabilisation feeds.

These children have poor cardiac reserves and are easily volume overloaded. Do not start or maintain IV infusions unless absolutely necessary.

Step 2: Hypothermia (Axillary temperature <35ºC)

Prevent hypothermia

Care for child in a warm area, i.e. 25–30ºC room temperature.

Ensure child's body, especially the head, is covered at all times particularly at night.

Avoid drafts and change wet napkins/clothing.

Avoid exposure e.g. bathing.

Feed immediately and 2–3 hourly as this provides energy to generate heat.

Allow child to sleep with mother/carer at night for warmth.

Treat hypothermia

Check axillary (underarm) temperature, 3 hourly.

Axillary temperature <36ºC indicates an urgent need to warm child.

Allow child to sleep with mother/carer at night for warmth. Use mother-child skin-skin contact, i.e. Kangaroo care, to keep child warm and wrap both with blankets.

Place heater nearby. If a radiant heater is used for warming check temperature at least every ½ hour.

If severely hypothermic and not improving use other heating measures but do not apply direct heat to the skin as this may burn the child.

Check temperature 2-hourly until > 36.5ºC.

Consider and treat for infection and sepsis. See step 5: Infection.

Step 3: Dehydration

See section 2.2.4: Diarrhoea, acute.

Continue feeds and other care of severe malnutrition.

Step 4: Electrolytes (hypokalaemia, hypomagnesaemia, hypophosphataemia and hypernatraemia)

All severely malnourished children have excess body sodium even though the plasma sodium may be low. Oedema is partly due to these imbalances, not fluid overload.

Giving high sodium load fluids is dangerous. Do **NOT** treat oedema with a diuretic.

Potassium

Serum potassium does not indicate total body potassium status. Potassium supplementation is required unless frank hyperkalaemia.

Feeds made with combined mineral and vitamin complex contains potassium. When this is used, do not add further potassium.

If the formula is made without combined mineral and vitamin complex**, add** potassium:

- Potassium chloride solution, 25–50 mg/kg/dose, oral, 8 hourly until oedema subsides:
  - If < 10 kg: 250 mg.
  - If > 10 kg: 500 mg.

Magnesium

Feeds made with combined mineral and vitamin complex or trace element mix contains magnesium. If formula is made without either of these additives, **add** magnesium:

- Trace element mix, oral, daily.
  - If < 10 kg: 2.5 mL.
  - If > 10 kg: 5 mL.

OR

- Magnesium sulphate 50%, oral, 0.2 mL/kg as a once daily dose for at least 2 weeks. The IV preparation can be given orally.

Refeeding syndrome may occur at any stage during the stabilisation phase. Regular phosphate level monitoring is advisable and cautious feeding with slow feed advancement is encouraged.

Phosphate replacement:
If serum phosphate 0.73–0.96 mmol/L give 0.32 mmol (0.25 ml/kg) in divided dosages orally.
If serum phosphate 0.51–0.72 mmol/L give 0.64 mmol/kg (0.5 ml/kg) in divided dosages orally.

- If serum phosphate less than 0.5 mmol/L give 1.0 mmol/kg (0.75 ml/kg) in divided dosages orally.

Phosphate enemas have 1.38 mmol/ml phosphate.

Step 5: Infection

Antibiotics
Start antibiotics on the first day at admission.

If the child has no danger signs, is alert and feeding well:

- Amoxicillin, oral, 30 mg/kg/dose 8 hourly for 5 days.

All other children:

- Ampicillin, IV/IM, 50 mg/kg 6 hourly for 7 days.
  - Avoid IV infusions, if possible. Use a heparin lock to avoid fluid overload because of poor cardiac reserves.

PLUS

- Gentamicin, IV, 6 mg/kg once daily for 7 days.

As soon as there is a response and patient can tolerate oral medication change ampicillin to amoxicillin and continue with gentamicin:

- Amoxicillin, oral, 30 mg/kg/dose 8 hourly for a further 5 days.

PLUS

- Gentamicin, IV/IM, 6 mg/kg once daily for 7 days.

If the child is severely ill or fails to improve after 48 hours:

- Third generation cephalosporin, e.g.:
- Ceftriaxone, IV/IM, 50 mg/kg/dose once daily.
  - If meningitis suspected: use 80 mg/kg/dose.

If child does not improve after 5 days, or deteriorates:

- Refer to higher level of care.

Intestinal worm infestation

Treat after the acute phase:

Children 1–2 years of age:

- Mebendazole, oral, 100 mg 12 hourly for three days.

Children > 2 years:

- Mebendazole, oral, 500 mg as a single dose immediately.

HIV and TB

In children with HIV and TB, good recovery from malnutrition is possible but may take longer. Treatment failure of malnutrition may be more common.

Actively investigate for TB and HIV as soon as possible.

TB is difficult to diagnose and confirm.

Ask about contacts, symptoms, do tuberculin skin test (TST) and chest X-ray. If TST negative, repeat just before discharge.

If TB is clinically likely, presumptive TB treatment is often reasonable, but once begun should be completed. See Chapter 10 - Tuberculosis, section 10.2: Tuberculosis, pulmonary.

HIV is relatively simple to diagnose and confirm.

Children < 18 months: PCR and confirm with viral load > 10 000 copies/mL.

Children ≥ 18 months: rapid test/ELISA and confirm with different rapid test/ELISA.

ART is the same as for HIV negative children.

Once the child enters the rehabilitative phase, commence antiretroviral therapy without delay if HIV infected. See Chapter 9 – Human Immunodeficiency Virus Infection, section 9.1: Human immunodeficiency virus infections.

Step 6: Micronutrients

Vitamins

- Vitamin A, oral, as a single dose:

Age	Dose	No. of capsules
Infants < 6 months:	50 000 IU	1 capsule
Infants 6–11 months:	100 000 IU	1 capsule
Children 12 months to 5 years:	200 000 IU	1 capsule

Record doses in the Road-to-Health booklet.

All children with clinical signs of severe vitamin A deficiency (eye changes: xerophthalmia, corneal ulceration, Bitot's spots, corneal clouding) **and** severe measles:

- Vitamin A, oral, 3 doses.
  - First dose, immediately; second dose on day 2 and third dose after 14 days.
  - Record the dose given in prescription and the Road to Health Book.

If on feeds with combined mineral and vitamin complex:

- Folic acid, oral, 2.5 mg as a single dose.

If not on feeds with combined mineral and vitamin complex:

- Folic acid, oral, 2.5 mg as a single daily dose.

PLUS

- Multivitamin, oral, 5 mL as a single daily dose.

Anaemia in malnourished children

Non-acute management:

Although anaemia is common, do NOT give iron initially but wait until the child has a good appetite and starts gaining weight (usually by the second week).

Treat severe anaemia with blood transfusion, if:

» Symptomatic anaemia (Hb usually below 4 g/dL).

OR

» If there is respiratory distress with a low Hb.

- Packed red cells, IV, 5 mL/kg administered over 3 hours.

PLUS

- Furosemide, IV, 1 mg/kg at the start of the transfusion.

Repeat only if severe anaemia or respiratory distress persists and the haemoglobin is still low.

Once gaining weight and oedema has resolved:

- Iron, oral, 2 mg/kg elemental iron per dose 8 hourly with meals.
  - Continue for at least 2 months to replace iron stores.

Step 7: Stabilisation feeding

Immediate: stabilisation phase:

Begin feeding immediately – do not miss feeds.

Give "F75/stabilising feed" at 130 mL/kg/day divided into 3 hourly feeds, i.e. 8 times daily. Give all feeds including that at 03h00.

If child has gross oedema i.e. if the oedema is up to or beyond the knee or anasarca, give 100 mL/kg initially and increase progressively.

Monitor and record intake carefully.

F75 formula/Stabilisation	
Fresh cow's milk	300 mL
Sugar	100 g
Vegetable oil	20 g
Combined mineral and vitamin complex*	indicated by insert
Water to make up to:	1 000 mL

* If no combined mineral and vitamin complex:

- Trace element mix, oral, 20 mL daily.

If danger signs, hypothermia or hypoglycaemia present, feed the same daily volume but divided into 2 hourly feeds, i.e. 12 times daily. Give all feeds including those at 02h00 and 04h00.
Give from a cup. Very weak children may be fed by spoon, dropper or syringe.
If feeds refused/not finished (i.e. less than 80% of daily amount taken) give all feeds via nasogastric tube.
Weigh daily and plot weight gain.

Readiness to enter the rehabilitation phase is signalled by a return of appetite, usually about one week after admission.

Step 8: Transition feeding and catch up growth

Feeding (rehabilitation phase)

» Transition
» For the first two days replace the initial feeds with equal amounts of "rebuilding/catch-up/F100 formula". Gradually increase the volume by 10 mL/feed until some formula remains unfinished, usually ± 200 mL/kg/day.
» When appetite returns introduce a modified diet. Balance the intake by giving 3 modified meals and 5 feeds of F100. Prepare food without adding salt.

F100 formula/Rebuilding formula (catch-up)	
Fresh cow's milk	880 mL
Sugar	75 g
Vegetable oil	20 mL
Combined mineral and vitamin complex *	as indicated by insert
Water to make up to:	1 000 mL

* If no combined mineral and vitamin complex:

- Trace element mix, oral, 20 mL.

Monitor progress after the transition by assessing the rate of weight gain.
Weigh child each morning before feeding and plot the weight.
Each week calculate and record weight gain as g/kg/day.

If weight gain is:

» poor (< 5 g/kg/day) – child requires full reassessment.
» moderate (5–10 g/kg/day) – check whether intake targets are being met, or if infection has been overlooked.
» good (>10 g/kg/day) – continue to praise staff and mothers.

Step 9: Sensory stimulation

Stimulation and loving care

» Provide tender loving care.
» Help and encourage mothers to comfort, feed and play with their children.
» Involve occupational therapist, if available, for structured play otherwise arrange this as best possible in the ward.
» Provide a stimulation program in the ward.

Step 10: Prepare for follow up

Preparation for discharge

» Obtain information on household food security, family background and socio-economic status and refer appropriately.
» Instruct mothers how to modify family foods, how often to feed, what and how much to give.
» Ready to Use Therapeutic Foods (RUTF) may be supplied to facilitate earlier discharge where this is indicated and available.
» Involve mother in discharge planning and follow up plans.
» Social assessment: Before discharge, ensure parent/caregiver is able to access food for the child, ensure all financial supports and grants have been accessed. A social worker may assist in ensuring this. The social worker should also assess for other social risks.
» Make follow-up arrangements. Link patient to PHC systems and Family Health Teams/Community Care Givers Workers for close follow-up and monitoring of feeding and compliance with therapeutic feeding program.
» Ensure all immunisations are up to date.
» Do not discharge any malnourished child without having adequately investigated for TB and HIV infection. Repeat TST before discharge as immunity may have returned to normal.
» Write full clinical summary in Road to Health book.

Discharge criteria

» good appetite,
» no infection,
» no oedema,
» continuous good weight gain for last 5 days,
» playful and alert, and
» all preparation in place for discharge.

Feed volume charts

Initial stabilisation /F75 formula volumes at 130 mL/kg/day.
Use 2 hourly if child very sick or has hypoglycaemia or hypothermia.

Childs Weight (kilograms)	Amount feed		If total volume taken in a day is less than the below figure change to nasogastric feeding
	Every 3 hours 8 times a day	Every 2 hours 12 times a day	
2	35	25	210
2.1	35	25	220
2.2	35	25	230
2.3	40	25	240
2.4	40	25	250
2.5	40	25	260
2.6	40	30	270
2.8	45	30	290
3	50	30	310
3.2	50	35	330
3.4	55	35	350
3.6	60	40	370
3.8	60	40	400
4	65	45	420
4.2	70	45	440
4.4	70	50	460
4.6	75	50	480
4.8	80	50	500
5	80	55	520
5.2	85	55	540
5.4	90	60	560
5.6	90	60	580
5.8	95	65	600
6	100	65	620
6.5	105	70	670
7	115	75	730
7.5	120	80	780
8	130	90	830
8.5	140	90	880
9	150	100	940
9.5	150	100	990
10	160	110	1050

If severe oedema decrease volume by 25% per feed initially and then increase progressively to above volumes.

2.5 RICKETS

E55.0

DESCRIPTION

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. In older children it is caused by renal tubulopathy and other rare conditions.

DIAGNOSTIC CRITERIA

Clinical

» Bowing of long bones, widening of metaphyses and cranial bossing.
» Occasionally convulsions or tetany due to hypocalcaemia.

Investigations

» Elevated alkaline phosphatase.
» Serum calcium and/or phosphate abnormalities.
» X-ray of wrists.

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.

MEDICINE TREATMENT

Prophylaxis

For premature babies:

- Vitamin D, oral, 800 IU, once daily.

Infants who are exclusively breastfed or not on adequate volume of commercial milk formula:

- Vitamin D, oral, 400 IU, once daily.

Treatment of active rickets

Treat only after confirmation of active rickets on X–ray.

- Vitamin D, oral, 5 000 IU, once daily, in addition to milk in the diet.
  - 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.

REFERRAL

» Rickets presenting in children older than 2 years.
» No radiological response to treatment after 6–8 weeks.
» Incomplete radiological response.
» Rickets secondary to other disease processes.

2.6 WORM BOLUS

B77

DESCRIPTION

Partial or complete obstruction of the bowel by a "knot" of *Ascaris lumbricoides* curled around each other. Usually presents with cramping abdominal pain with/without other evidence of obstruction. May occasionally lead to local necrosis and perforation of the small bowel.

DIAGNOSTIC CRITERIA

Clinical

Cramping abdominal pain associated with/without a palpable worm mass, which may also be identified on X-ray abdomen straight or with contrast (when considered safe).
Exclusion of other causes of acute abdomen or acute abdominal pain.

GENERAL AND SUPPORTIVE MEASURES

» Maintain fluid, electrolyte and nutritional needs, IV route may be needed.
» Nil per mouth and free drainage, where clinically indicated.
» Observe for failure of resolution, complete obstruction or evidence of necrosis/perforation.
» Surgery for complete obstruction, evidence of necrosis or perforation.
» Identify possible iron deficiency.
» Be alert for possible worm aspiration.

MEDICINE TREATMENT

Once the bolus resolves treat the ascaris:
Children 1–2 years of age:

- Mebendazole, oral, 100 mg 12 hourly for three days.

Children > 2 years:

- Mebendazole, oral, 500 mg as a single dose immediately.

REFERRAL

» Inability to manage surgical problems, if present.
» Obstruction not relieved after 48 hours.

2.7 RECURRENT ABDOMINAL PAIN

R10.4

DESCRIPTION

Recurrent abdominal pain for which no cause can be found occurring at least monthly for 3 consecutive months with severity that interferes with routine function of the child.

DIAGNOSTIC CRITERIA

Clinical

» Peri-umbilical pain associated with belching, bloating with negative findings on clinical evaluation and no response to acid-blocking medication **OR** pain below the umbilicus accompanied by abdominal cramps, bloating and distension and with an altered bowel pattern that are consistent with Irritable Bowel Syndrome in adults.
» Either of the above syndromes with the exclusion of organic disease with appropriate investigation.
» Avoid excessive investigation where the diagnosis is strongly suspected in the presence of a normal clinical evaluation.
» Exclude the following:
  > Urinary tract infections, urinary tract anomalies, renal disease.
  > GIT infection, infestation or inflammation.
  > Chronic abdominal conditions such as tumours or infections, e.g. TB abdomen.
  > Gall bladder disease.
  > Pancreatic disease.

GENERAL AND SUPPORTIVE MEASURES

» Manage psychological stressors, anxiety or depression, where present, appropriately.
» Reassure child and family.
» Counselling to avoid the re-inforcement of the symptoms with secondary gain.
» Adequate dietary fibre in children with irritable bowel syndrome-type condition.

MEDICINE TREATMENT

Manage constipation, where present. See section 2.2.2: Constipation/faecal loading.

Manage comorbid anxiety or depression appropriately. See Chapter 14 – Child and Adolescent Psychiatry, section 14.4.1: Depression in Childhood and Adolescence and section 14.5: Anxiety disorders.

REFERRAL

» Failure to respond to management.
» For appropriate psychiatric/psychological management, if not locally available.

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CHAPTER 3

BLOOD AND BLOOD-FORMING ORGANS

APPROACH TO A CHILD WITH A HAEMATOLOGICAL PROBLEM

3.1 Combined/multiple abnormalities
Bi- or pancytopaenia: systematic disease affecting bone marrow e.g. aplastic anaemia.

3.2 Abnormalities of red blood cells
Anaemia: haemorrhage, haemolysis, haematinic deficiencies or haematological malignancy.
Polycythaemia: compensatory mechanism in hypoxia.

3.3 Abnormalities of white blood cells
Leukopaenia or leukocytosis and abnormal function: infection, tumours, allergies.

3.4 Abnormalities of platelets
Thrombocytopaenia or thrombocytosis & abnormal function: bleeding, infections.

3.5 Abnormalities with bleeding
Clotting factors from intrinsic, extrinsic and/or final common pathway and platelet number and/or function abnormal.

3.6 Abnormalities with thrombosis and embolism
Virchow's triad: vessel/circulation/hypercoagulability - can be arterial or venous.

Common blood products dosing, volumes and storage
Red cell products:
Storage: between 1-6 degrees Celsius,
Administered by: blood administration sets.

- Paediatric red cell concentrate (volume 25 - 150 mL).
- Paediatric red cell concentrate: leucodepleted (75 mL).
- Packed cells (volume in mL) = 4 x weight x desired increase in haemoglobin.
- Whole blood (volume 485mL) leucodepleted: used in exchange transfusion volume to be infused = 6 x weight x deficit.

Platelet products:
Storage: do not refrigerate, use immediately.
Administration: special platelet administration set.

- Paediatric platelets concentrate single donor apheresis leucodepleted (50 - 60 mL).

- Platelet concentrate single donor apheresis leucodepleted (100-300 mL).
- Random donor pooled platelets (200-300 mL).
- Platelet concentrates = 5 - 10 mL/kg used for ordering, but administer the entire volume.

Plasma products:
Storage and administration: transfuse immediately after reconstitution and issue.

Clotting Factors:
- Fresh Frozen Plasma (75mL) *(kept in blood bank)*
  - 15mL/kg/dose (100 iu/unit)
- Fresh Dried Plasma (260mL) *(can be kept on the shelf)*
  - 15mL/kg/dose (100-160 mL)
- Cryoprecipitate-fibrinogen rich (30 mL)
  - 1 u/10 kg/dose (150-200 iu/unit)
- Factor VIII concentrate
  - 25-50 iu/kg/dose (100-500 iu/unit)
- Factor IX concentrate
  - 40-60 iu/kg/dose

3.1 ANAEMIA, APLASTIC
D61.0

DESCRIPTION
Pancytopaenia caused by bone marrow failure with a hypocellular bone marrow without infiltration or fibrosis. May be acquired or inherited. Inherited bone marrow failure syndromes include Fanconi anaemia, which has specific associated phenotypic features and chromosomal abnormalities.

DIAGNOSTIC CRITERIA
Clinical
» Pallor, petechiae, purpura, bleeding, with frequent and/or severe infections.
» Phenotypic features of Fanconi anaemia include:
  > Café-au-lait spots (skin pigmentary changes),
  > short stature and dysmorphic faces,
  > hypoplasia/absence of radius, fingerised thumb,
  > microcephaly, small eyes, hyperreflexia,
  > renal tract and cardiac abnormalities,
  > hypogonadism.

Investigations

» Full blood count shows pancytopaenia, with anaemia (may be macrocytic), leucopaenia and thrombocytopaenia.
» Hypoplastic bone marrow on trephine biopsy.

GENERAL AND SUPPORTIVE MEASURES

Limit the use of blood products as the patient may be sensitised and jeopardise a future bone marrow transplant.
Avoid contact sport.

MEDICINE TREATMENT

For symptomatic anaemia (usually Hb < 7 g/dL):

- Packed red cells, IV, 34 x weight x deficit in haemoglobin
  - Use leukocyte depleted products.

For active bleeding:

- Platelets, IV, 20 mL/kg, administered immediately and rapidly over 15–30 minutes through a platelet giving set.
  - If transplant is a possibility, use single donor apheresis platelets rather than pooled random donor platelets; preferably group specific.
  - Use the whole unit, unless the volume compromises cardiovascular status, (particularly in neonates). Apheresis platelets are available in paediatric volumes

For fever (T > 38ºC), broad spectrum antibiotics:
Take blood cultures first.

- Ceftriaxone, IV, 50–80 mg/kg once daily.

OR

If < 1 month old:

- Cefotaxime, IV, 25–50 mg/kg/dose, 6 hourly.

AND

- Amikacin, IV, 25 mg/kg as a loading dose, then 18 mg/kg/dose once daily.

REFERRAL

» All cases of suspected aplastic anaemia.
» Stabilise patient before transport with blood and/or platelet transfusions, if necessary, after consultation with a paediatrician or paediatric haematologist.
» All cases for consideration for bone marrow transplant or immunosuppressive therapy in the case of acquired aplastic anaemia.

3.2 ANAEMIA, HAEMOLYTIC

D55–59

DESCRIPTION

Anaemia caused by excessive destruction of red blood cells.
Destruction may be due to:

» Corpuscular defects:
  > abnormalities of the cell membrane (e.g. hereditary spherocytosis),
  > enzyme abnormalities (e.g. G6PD deficiency), or
  > abnormal haemoglobin (e.g. sickle cell anaemia, thalassaemia).
» Extra-corpuscular defects:
  > Autoimmune or isoimmune:
    idiopathic warm or cold antibodies,
    infection triggered e.g. Mycoplasma pneumonia,
    medicine related e.g. penicillin,
    secondary to autoimmune disorders e.g. SLE, juvenile arthritis,
    secondary to tumours e.g. lymphoma, thymoma.
  > Non-immune:
    secondary to microangiopathy e.g.: haemolytic uraemic syndrome,
    infections causing haemolysis e.g. malaria,
    miscellaneous causes, including hypersplenism.

DIAGNOSTIC CRITERIA

Clinical

» Pallor, jaundice, fatigue.
» Splenomegaly.

Investigations (before transfusion)

» Full blood count.
» Evidence of haemolysis:
  > anaemia,
  > decreased haptoglobin,
  > reticulocytosis,
  > unconjugated hyperbilirub inaemia,
  > increased lactate dehydrogenase (LDH),
  > urobilinogen in the urine.
» Direct Coombs test (direct antiglobulin) is positive with autoimmune haemolysis.
» Haemoglobin electrophoresis.
» Renal function is abnormal in haemolytic uraemic syndrome.
» Exclude other autoimmune disorders.
» Consider underlying neoplasms.
» In patients receiving recurrent transfusions (e.g. thalassaemia), monitor ferritin levels 3-monthly and discuss with your referral centre if elevated > 1000 mcg/L.

GENERAL AND SUPPORTIVE MEASURES

» After appropriate investigations, transfuse the patient and then discuss with a paediatrician or paediatric haematologist.

» Coombs-positive autoimmune haemolytic anaemia may require transfusion with the least incompatible blood (if cross-matching yields no compatible units).
» In G6PD deficiency, avoid medicines known to cause haemolysis (e.g. aspirin, sulphonamides and primaquine) **and** be sure to give the patient a list of such medicines at discharge.

MEDICINE TREATMENT

Warm antibody autoimmune haemolytic anaemia

Under specialist supervision:

- Prednisone, oral, 2 mg/kg/24 hours until a satisfactory response is obtained.
  - Continue treatment for a minimum of 4 weeks.
  - Taper dose slowly over several weeks while monitoring for relapse.

Chronic haemolytic anaemia

All patients indefinitely:

- Folic acid, oral, 2.5 mg daily between birth and 6 months and 5 mg daily for > 5 kg and/or 6 months to 5 years.

SURGICAL TREATMENT

Splenectomy for hereditary spherocytosis with Hb < 10 g/dL and transfusion dependent but **only** after the child's fifth birthday.

Pre-splenectomy immunization

2 weeks prior to surgery

- Pneumococcus conjugate vaccine (PCV) 13, IMI, 0.5 mL followed by pneumococcus polysccharide (PPV) 23, IMI, 0.5 mL 8 weeks later.
- Haemophilus influenza, type B (Hib) booster, IMI, 0.5 mL.
- Meningococcal conjugate vaccine (MCV), IMI, 0.5mL.

Post splenectomy

- Phenoxymethylpenicillin, oral, 12 hourly.
  - If < 5 years: 125 mg.
  - If > 5 years: 250 mg.
  - Give indefinitely until at least 18 years of age.
- Annual influenza vaccine, IMI, 0.5 mL.
- After splenectomy:
  - Pneumococcus conjugate vaccine (PCV) 13, IMI, followed by pneumococcus polysccharide (PPV)23, IMI (a month later).
  - Haemophilus influenza, type B (Hib) and meningococcal conjugate vaccine (MCV) booster.

Note: For catch up of routine conjugate pneumococcal vaccination

- < 12 months of age: 3 dose series.
- 12 months of age and older: 2 doses 8 weeks apart. (See Primary Healthcare Standard Treatment Guidelines, Chapter 13 - Immunisation).

REFERRAL

» Any child with haemolytic anaemia e.g. thalassaemia, especially those who are transfusion dependent (more than 10 transfusions) for assessment for chelation therapy.
» All cases associated with evidence of haemolysis as above should be managed in consultation with a paediatrician or paediatric haematologist.

3.2.1. THALASSAEMIA

D56

DESCRIPTION

Hereditary single gene defect causing abnormal production or translation of beta-globin mRNA, resulting in foetal haemoglobin (HbF) production. Presents with pallor, jaundice, fever, failure to thrive, abdominal distension and hepatosplenomegaly, bossing.

DIAGNOSTIC CRITERIA

Investigations

» Microcytic hypochromic anaemia.
» Haemoglobin electrophoresis.
» Genetic studies.
» Family screening.

MEDICINE TREATMENT

B Thalassaemia major – homozygous trait:
Monthly blood transfusion to maintain Hb between 9.5 and 14 g/dL.

REFERRAL

» All cases for confirmation of diagnosis and a comprehensive care transfusion program.
» Iron chelation therapy.

3.2.2 ANAEMIA, SICKLE CELL

D57

DESCRIPTION

Haemolytic anaemia due to homozygous inheritance of the sickle cell gene.
Patients may experience complications:

» Painful vaso-occlusive crises.
» Haemolytic crises (usually secondary to infection).
» Aplastic crises.
» Thrombotic crises, e.g. acute chest syndrome, priapism or stroke.
» Splenic sequestration.
» Severe infections.

DIAGNOSTIC CRITERIA

Clinical

» Pallor, jaundice, fatigue all of which may worsen abruptly (sequestration crisis, aplastic crisis).
» Features of complications:
  > painful swelling of the hands and feet (dactylitis);
  > bone pain, abdominal pain;
  > chest pain, fever, dyspnoea (acute chest syndrome);
  > convulsions, hemiparesis;
  > priapism.

Investigations

» Laboratory features of haemolytic anaemia. See section 3.2: Anaemia, haemolytic.
» Haemoglobin electrophoresis shows an SS pattern (both parents will be AS).

GENERAL AND SUPPORTIVE MEASURES

» Avoid exposure to cold, dehydration and stress.
» Increase fluid intake during painful crises.
» Heat and/or massage for pain.

MEDICINE TREATMENT

For sequestration crisis or aplastic crisis:

- Packed red cells, IV, 15 mL/kg.
  - Avoid over-transfusing patients since the increase in viscosity may aggravate the vasculopathy associated with sickle cell disease (a Hb threshold of 13 g/dL has been recommended).

If hypoxic:

- Oxygen, by face mask.

Exchange transfusions may be used to treat severe complications (see referral criteria).

Prophylaxis against infection

Is given to all children because functional asplenia is present by 1–2 years of age.

- Routine vaccinations during infancy.
- Catch up conjugate pneumococcal vaccine
  - If < 12 months of age: 3 dose series.
  - If 12 months of age and older: 2 doses 8 weeks apart.
    - Pneumococcal polysaccharide vaccine at 2 years (at least 8 weeks after conjugate vaccine). Repeat vaccination as a booster 5 years after the initial dose.
- Annual influenza vaccination.

- Phenoxymethylpenicillin, oral, 12 hourly.
  - o < 5 years: 125 mg
  - o > 5 years: 250 mg
  - o Give indefinitely.

Treatment
Analgesia as required:
- Paracetamol, oral, 15 mg/kg 6 hourly.

AND
- Ibuprofen, oral, 10 mg/kg 8 hourly.

- Hydroxyurea, oral, 15 mg/kg.
  - o Increase by 5 mg/kg every12 weeks.
  - o Maximum dose: 35 mg/kg daily.

Infections:
All children with axillary temperature ≥ 38°:
- Ceftriaxone, IV, 50–80 mg/kg/dose once daily.

Acute chest syndrome:
Consult a paediatrician.

REFERRAL
» All children with sickle cell anaemia should be managed in consultation with a paediatric haematologist or paediatrician.
» All children with severe complications that may benefit from exchange transfusion or intensive care, e.g. stroke, severe vaso-occlusive disease and acute chest syndrome.
» All cases of stroke should be referred for a regular transfusion program.

3.3 ANAEMIA, MEGALOBLASTIC
D53.1

DESCRIPTION
Anaemia caused by a deficiency of folate and/or vitamin B_{12}.

DIAGNOSTIC CRITERIA
Clinical
» Pallor and fatigue.
» History of chronic diarrhoea.

Investigations
» Megaloblastic anaemia: elevated MCV (mean corpuscular volume) and MCH (mean corpuscular haemoglobin).
» Macro-ovalocytes on blood smear, hypersegmentation of neutrophils.
» Decreased serum vitamin B_{12} or red blood cell folate.

» Investigations to identify reason for folate or B_{12} deficiency, e.g. malabsorption.
» Pancytopaenia in severe cases.
» Actively exclude leukaemia and aplastic anaemia, which may cause macrocytosis.

GENERAL AND SUPPORTIVE MEASURES

» Dietary modifications to ensure adequate intake of folate and vitamin B_{12}.
» Packed red blood cell transfusion for symptomatic anaemia. Try to avoid blood transfusion until all investigations have been done.

MEDICINE TREATMENT

Folic acid deficiency:

- Folic acid, oral, 5 mg daily until haemoglobin returns to normal value for age. Prolonged treatment may be needed for malabsorption states and congenital deficiencies.

Vitamin B_{12} deficiency:

- Vitamin B_{12}, IM, 500 mcg monthly. Should be given together with folate to prevent developmental of subacute combined degeneration of spinal cord. Prolonged treatment may be needed.

REFERRAL

» All cases of megaloblastic anaemia, except clear nutritional folate deficiency.

3.4 ANAEMIA, IRON DEFICIENCY

D50.9

DESCRIPTION

Iron deficiency is the most common cause of anaemia. The commonest causes of iron deficiency anaemia are poor nutritional intake, excessive milk ingestion and blood loss due to parasites (whipworm and hookworm).

Lower limits of normal haemoglobin:

Age	Hb (g/dL)
Birth	13.5
6 weeks	9.5
3 months	10.0
6–12 months	10.5
12–18 months	10.5
18 months–4 years	11.0
4–7 years	11.0
7–12 years	11.5
12 years and older	12 (F) : 13 (M)

DIAGNOSTIC CRITERIA

Clinical

Symptoms and signs vary with the severity of the deficiency:

» pallor,
» fatigue,
» irritability,
» behavioural and cognitive effects.
» delayed motor development,
» pica,
» soft ejection systolic murmur,

Investigations

» Haemoglobin below normal for age.
» Hypochromic microcytic anaemia.
» Low MCV (mean corpuscular volume) and MCH (mean corpuscular haemoglobin), increased red cell distribution width.
» Decreased serum iron, ferritin and transferrin saturation.
» Elevated total iron binding capacity.
» Stool examination to identify intestinal parasites or to confirm occult blood loss.
» Iron studies are not necessary if nutritional iron deficiency is strongly suspected. Document a response to a trial of iron therapy to confirm the diagnosis.

Note:

Chronic infections may also cause microcytic hypochromic anaemia.
See section 3.5: Anaemia of chronic disorders (infection or disease).

GENERAL AND SUPPORTIVE MEASURES

» Dietary adjustment.
» Counselling.

MEDICINE TREATMENT

Treatment

NB sepsis must be excluded prior to iron treatment

- Iron (elemental), oral, 3 mg/kg/dose 12 hourly with meals.

Elemental iron per preparation

Ferrous gluconate elixir	350 mg/5 mL	40 mg elemental iron per 5 mL	8 mg elemental iron per mL
Ferrous gluconate syrup	250 mg/5 mL	30 mg elemental iron per 5 ml	6 mg elemental iron per mL
Ferrous lactate drops	25 mg/mL	25 mg elemental iron per mL	1 mg elemental iron per 0.04 mL
Ferrous sulphate compound tablets	170 mg	± 65 mg elemental iron per tablet	± 65 mg elemental iron per tablet

» Follow up at monthly intervals.

The expected response is an increase in Hb of 2 g/dL or more in 3 weeks.
Continue for 3–4 weeks after Hb is normal to replenish body iron stores.
The reticulocyte count will increase if there is a positive response and may be useful where the diagnosis is in doubt, if done within 1–2 weeks after iron therapy is started.

Treat for intestinal helminths.
Children 1–2 years of age:
- Mebendazole, oral, 100 mg 12 hourly for three days.

Children > 2 years:
- Mebendazole, oral, 500 mg as a single dose immediately.

CAUTION
Iron is extremely toxic in overdose, particularly in children All medication should be stored out of reach of children

Prophylaxis
All preterm babies, day 15 to 1 year:
- Iron (elemental), oral, 2 mg/kg daily.
- Multivitamin, drops, oral, 0.3 mL daily for formula fed babies.
- Multivitamin, drops, oral, 0.6 mL daily for breast fed babies.

REFERRAL
» Patients not responding to adequate therapy.
» Patients in whom easily treatable causes for non-response have been excluded, e.g.:
  > non-adherence to therapy,
  > on-going GIT/other blood loss,
  > on-going infection.

3.5 ANAEMIA OF CHRONIC DISORDERS (INFECTION OR DISEASE)
D63

DESCRIPTION
Anaemia caused by chronic infection or disease. This may be due to interference with nutrient supply or suppression of haemopoiesis. Iron may be trapped in the reticuloendothelial system resulting in relative iron deficiency.

Symptomatic anaemia may manifest with tachypnoea, tachycardia not attributable to other causes and heart failure.

DIAGNOSTIC CRITERIA

Clinical

» Pallor, fatigue;
» Features of malnutrition or chronic infection e.g. TB, HIV, chronic renal failure; or
» Autoimmune disease may be present.

Investigations

» Haemoglobin low with usually normocytic, normochromic red cells (may be microcytic).
» TST, chest X-ray and renal function tests.

GENERAL AND SUPPORTIVE MEASURES

» Emphasise a nutritionally balanced diet that is adequate in protein, vitamins and minerals for nutritional rehabilitation.
» Transfuse for symptomatic anaemia only.

MEDICINE TREATMENT

» Treat underlying cause, e.g. TB infection.
» Defer iron treatment until acute diseases are controlled, then provide extra iron (see above) and multivitamins.

REFERRAL

» All cases with unresolving anaemia and no cause found.

3.6 HAEMOPHILIA A AND B

D66.7/D66.8

DESCRIPTION

Haemophilia A and haemophilia B are chronic bleeding disorders caused, respectively, by a lack of clotting factor VIII or clotting factor IX.

Sub classification of severity

Class	Clotting factor	% of normal	Signs
Mild	VIII or IX	5–40%	Occasional bleeds usually after trauma or surgery.
Moderate	VIII or IX	1–5%	Less frequent bleeds than severe usually post trauma/surgery/dental extraction.
Severe	VIII or IX	<1%	Spontaneous joint and muscle bleeds.

DIAGNOSTIC CRITERIA

Clinical

» Major bleeds:
  > CNS,
  > severe injury,
  > muscle compartment (e.g.forearm and calf),
  > gastrointestinal tract,
  > neck/throat (airway),
  > advanced joint and soft tissue,
  > hip and ilio-psoas.
» Minor bleeds:
  > early joint bleed,
  > soft tissue,
  > mouth and gum,
  > muscle,
  > epistaxis,
  > haematuria.
» Pain/tingling in a joint suggests bleeding in a known haemophiliac.

Investigations

» Prolonged partial thromboplastin time (PTT).
» Normal INR.
» Factor VIII or factor IX concentration levels < 40% of normal activity.

GENERAL AND SUPPORTIVE MEASURES

» Haemophilia register.
» MedicAlert bracelet.
» Dental care (see below for management of tooth extraction).

Acute bleeds into joints - Infuse IV factor concentrate first with the following adjunct therapeutic measures:

» Apply ice packs: 5 minutes on and 10 minutes off.
» Rest the affected joint/limb until pain free and no further bleeding.
» No weight bearing.
» Splint. Do not use circumferential casts.
» **Do not** aspirate affected joints.

MEDICINE TREATMENT

For pain (as required):
Do not use NSAIDs and aspirin.

- Paracetamol, oral, 15 mg/kg 6 hourly.

If needed:
ADD

- Tilidine, oral, 1 mg/kg/dose (1drop per 2.5 kg 6 hourly).

For bleeds
Emergency treatment while awaiting transfer, if indicated.

If serious bleeding in known haemophiliac, and no factor available:

- Lyophilised Plasma (Freeze dried), IV, 20 mL/kg. Lyophilised plasma contains a minimum of 0.4 units/mL of each coagulation factor.

OR

- Fresh frozen plasma, IV, 20 mL/kg.

Factor VIII deficiency (with no inhibitor present)
Give until patient is pain free. Administration should be 12 hourly for major bleeds, but may be daily for minor bleeds.

Minor bleeds:
- Factor VIII, intravenous, 20 units/kg.

Major bleeds:
- Factor VIII, intravenous, 40 units/kg.

Use the entire contents of the appropriate volume ampoule.

For intracranial bleeds:
- Factor VIII, intravenous**,** 40 units/kg 6 hourly.

Decrease frequency if trough factor level is > 60%, if possible.

Factor IX deficiency (with no inhibitor present)
Give daily until patient is pain free.

Minor bleeds:
- Factor IX, intravenous, 40 units/kg.

Major bleeds:
- Factor IX, intravenous, 60 units/kg.

Available product is factor IX complex and also contains factors II, VII and X.

Home treatment
Home treatment of bleeds is promoted by haemophilia treatment centres. Patients or caregivers are educated on the storage, reconstitution and administration of factor and provided with a supply of factor to be kept at home for use in the event of a bleed. Factor use and bleeding episodes are monitored through the use of an appropriate chart which can be reviewed at consultations and medication collection.

For dental extraction:
Check that inhibitors are absent.
Admit for procedure and post-procedure care and observation.

Haemophilia A:
- Factor VIII, IV, 40 units/kg, immediately before extraction.

AND
- Tranexamic acid, oral, 25 mg/kg/dose 6–8 hourly for 5 days.

Haemophilia B:
- Factor IX, intravenous, 40 units/kg, immediately before extraction.

For mucous membrane bleeds

- Tranexamic acid, oral, 25 mg/kg/dose 6–8 hourly.
  - Contra-indicated in haematuria.
  - Use with caution with factor IX complex or factor VIII inhibitor-bypassing activity and preferably only 12 hours after administration of the factor.

REFERRAL

» All cases with **suspected** or established haemophilia (prolonged PTT and normal INR), for assessment, genetic counselling and planning of management to a haemophilia treatment centre.

3.7 VON WILLEBRAND DISEASE

D68.0

DESCRIPTION

Von Willebrand disease is the most common congenital bleeding disorder and is due to reduced amounts or abnormal forms of von Willebrand factor in the circulation.

DIAGNOSTIC CRITERIA

Clinical

» Recurrent epistaxis, prolonged bleeding from lacerations, easy bruising or gum bleeds.

Investigations

» Reduction in one or more of the following:
  > von Willebrand factor antigen,
  > ristocetin co-factor and/or collagen binding activity,
  > factor VIII coagulant activity.

GENERAL AND SUPPORTIVE MEASURES

» Apply pressure to the bleeding site.
» For tooth socket bleeds bite down on a piece of gauze.
» For epistaxis, see Chapter 17 – Ear, nose, throat: section 17.4: Epistaxis (Nose bleeds).

Avoid aspirin and NSAIDS.

MEDICINE TREATMENT

For bleeds:

- Factor VIII, IV (Factor VIII containing von Willebrand factor).
  - Initial dose: 30 units/kg.

For mucous membrane bleeds:

- Tranexamic acid, oral, 25 mg/kg/dose 6–8 hourly.

For menorrhagia:

- Combined oral contraceptive, low dose.

REFERRAL

» All suspected cases of von Willebrand disease to a haemophilia treatment centre for assessment.

3.8 HAEMORRHAGIC DISEASE OF THE NEWBORN

P53

See section 19.4: Haemorrhagic disease of the newborn.

3.9 IMMUNE THROMBOCYTOPAENIC PURPURA (ITP)

D69.3

DESCRIPTION

A common bleeding disorder of childhood due to the autoimmune destruction of platelets.

It occurs most frequently in children aged 2 to 5 years and often follows infection with viruses including HIV and medications. Chronic ITP (more than 6 months duration) occurs in 10 to 20% of children with ITP.

Complications include severe haemorrhage and bleeding into vital organs.

DIAGNOSTIC CRITERIA

Clinical

» Sudden onset of bruising and bleeding, either spontaneously or after minor trauma, into the skin and mucous membranes and rarely into the organs in an otherwise well child.
» The lesions may range from pinpoint petechial bleedings to large ecchymoses, and are often increased on pressure points.
» Epistaxis is common.
» Exclude child abuse.
» The presence of the following makes the diagnosis of ITP unlikely:
  > splenomegaly,
  > hepatomegaly,
  > lymphadenopathy,
  > masses,
  > joint swelling,
  > bone pain,
  > rashes present other than petechiae or ecchymoses.

Investigations

» Thrombocytopaenia with normal white cell count and differential, and normal haemoglobin and red cell morphology, other than the effects of blood loss. Mean Platelet volume is often increased.
» Normal INR (PT) and partial thromboplastin time (PTT).

» Abundant megakaryocytes on bone marrow aspiration with normal erythroid and myeloid cellularity.
» A normal LDH and uric acid help to rule out leukaemia.
» Indications for bone marrow biopsy/aspiration: Prior to starting steroids, or any other abnormality on FBC or any atypical cells on differential count.
» Test all newly diagnosed cases for HIV.

Follow up patients with diagnosis of ITP not confirmed with bone marrow aspiration for development of new clinical signs and abnormalities on laboratory investigations.

GENERAL AND SUPPORTIVE MEASURES

» Avoid:
  > platelet transfusions unless bleeds are life-threatening,
  > contact sport, injury and trauma, and
  > dental procedures in acute phase.
» Re-assure patient and family that resolution usually occurs.

MEDICINE TREATMENT

Avoid medication that affects platelet function, e.g. NSAIDs and aspirin.

Acute ITP

Active bleeding:

- Prednisone, oral, 4 mg/kg/dose as a single daily dose for 4 days.
  - Stop after 4 days without tapering dose.

Chronic ITP

Intermittent treatment if platelets $\leq 10 \times 10^9$/L **and** significant bleeding episodes:

- Prednisone, oral, 4 mg/kg/dose as a single daily dose for 4 days.
  - Stop after 4 days without tapering dose.

Acute life-threatening bleeds (e.g. intracranial bleeding): (acute or chronic ITP)

- Methylprednisolone, IV, 30 mg/kg/dose administered over 30–60 minutes as a single daily dose for 3 days.
  - Maximum dose: 1 g.
  - Beware of arrhythmias, hypertension, etc.
  - Check BP daily.

AND

After administration of methylprednisolone:

- Paediatric platelets concentrate, leuco-depleted 5-10mL/kg

Refer to specialist for advice on further management.

SURGICAL TREATMENT

Consider splenectomy in children 5 years and older with chronic ITP for more than one year plus significant bleeding or substantial limitation in activities as a result of the ITP.

Pre-splenectomy

- 2 weeks prior to surgery:
  - PCV13, IMI, 0.5 mL, followed by PPV23, IMI, 0.5 mL 8 weeks later.
  - HIB booster, IMI 0.5 mL.
  - Meningococcal vaccine, IMI, 0.5 mL.

Post splenectomy

- Phenoxymethylpenicillin, oral, 12 hourly.
  - If < 5 years of age: 125 mg.
  - If > 5 years of age: 250 mg.
  - Give indefinitely until at least until 18 years.

- Pneumococcal polysaccharide vaccine. Repeat vaccination as a booster 5 years after the initial dose.

- Annual influenza vaccine.

- Hib and MCV boosters every 5-10 years

- Catch up conjugate pneumococcal vaccine:
  - If < 12 months of age: 3 dose series.
  - 12 months of age and older: 2 doses 8 weeks apart.

REFERRAL

» Suspected ITP with unusual features such as splenomegaly or lymphadenopathy.
» ITP complicated by severe haemorrhage, bleeding into vital organs or an intracranial haemorrhage.
» ITP needing surgery.
» ITP that fails to resolve in 6–12 months on adequate treatment (chronic ITP).
» If there is no local capacity to fully investigate the condition.

3.10 THROMBOTIC THROMBOCYTOPAENIC PURPURA/ HAEMOLYTIC URAEMIC SYNDROME

M31.1/D59.3

DESCRIPTION

An acute syndrome that presents with diarrhoea/dysentery or renal infection with varying combinations of the following:

Non-immune microangiopathic haemolytic anaemia with fragmentation haemolysis (schistocytes), thrombocytopaenia often with purpura, acute renal insufficiency, fever and neurologic abnormalities.

DIAGNOSTIC CRITERIA

Investigations

» HIV testing
» INR/PTT is normal as compared to DIC where it is abnormal.
» Stool for Shiga toxin producing E coli.
» Blood cultures.
» FBC and smear.
» Urea and electrolytes.

MEDICINE TREATMENT

- Fresh frozen plasma (FFP) IV infusion, 30 mL/kg/day in 3-4 doses

OR

- Freeze dried plasma (FDP), IV infusion, 30 mL/kg/day in 3-4 doses

For Infections

- Ceftriaxone, IV, 50–80 mg/kg once daily.

OR

If < 1 month old:

- Cefotaxime, IV, 25–50 mg/kg/dose, 6 hourly.

Need for platelet transfusion to be discuss with a haematologist.
Early dialysis - discuss with a nephrologist.

REFERRAL

All patients - early consultation and transfer to a regional centre.

3.11. DISSEMINATED INTRAVASCULAR COAGULATION

D65

DESCRIPTION

Complication of an underlying condition e.g. severe sepsis that is characterized by widespread activation of the clotting cascade leading to consumption of platelets and clotting factors with generalized bleeding.

DIAGNOSTIC CRITERIA

Investigations

» Prolonged INR and PTT.
» Thrombocytopaenia.
» Decreased fibrinogen.
» Increased D- Dimers.
» Repeat test for monitoring.
» Identify the cause.

MEDICINE MANAGEMENT

For low fibrinogen:

- Cryoprecipitate 1 unit/10kg.

For an abnormal INR or PTT:

- Fresh Frozen Plasma or Freeze Dried Plasma 15 mL/kg.

Active bleeding with low platelet:

- Apheresis platelet transfusion 5-10 mL/kg.

No bleeding with low platelets:

- No platelet transfusion.

REFERRAL

All unresponsive cases to a regional hospital.

3.12 VENOUS THROMBO-EMBOLIC DISEASE

I82

DESCRIPTION

An occulusive or non-occlusive thrombus in the venous circulation, with or without pulmonary embolus. Associated risk factors included central venous catheters, venous stasis, endothelial damage and hypercoaguable states, e.g. nephrotic syndrome. Causes include protein C and S deficiency, factor V leiden and antithrombin III deficiency.

DIAGNOSTIC CRITERIA

Clinical

Depends on the site of thrombosis, may be silent.

» Deep venous thrombosis of an extremity presents with unilateral limb swelling.
» Upper extremity thrombus may present with associated facial and neck oedema.
» Pulmonary embolus presents with sudden onset of shortness of breath and chest pain.
» Cerebral sinus venous thrombosis presents with seizures or other neurological symptoms and signs.
» Renal vein thrombosis presents with haematuria, thrombocytopaenia, oliguria and renal failure if bilateral.

Investigations

» Doppler ultrasonography, CT scan or MRI demonstrate thrombosis or embolus.
» D-dimer, antithrombin III, protein C, protein S, Factor V Leiden and antiphospholipid antibody testing may reveal underlying thrombophilia.

GENERAL AND SUPPORTIVE MEASURES

» Appropriate fluid restriction and electrolyte management if renal failure.

If hypoxic:

- Oxygen by face mask.

For acute thrombotic episode:

- Low molecular weight heparin e.g.
  - Enoxaparin sodium, SC, 1 mg/kg 12 hourly

OR

- Unfractionated Heparin (UFH), IV, administered over 10 minutes as a bolus followed by an initial maintenance dose as a continuous infusion.

	Bolus	Initial maintenance dose
Preterm neonates	25–50 units/kg	15 units/kg/hour
Term neonates	75–100 units/kg	28 units/kg/hour
Children	75–100 units/kg	20 units/kg/hour

Note: Neonates need a higher maintenance dose per body weight compared with older children.

Target levels

If available LMWH dosing can be guided by anti-Xa levels 3-4 hours after dose.

For UFH

PTT: 60–85 seconds or 2–3 times the baseline value (if normal for age).
Monitor PTT 4 hours after bolus injection and adjust the continuous IV dose according to the result (See table below)

Nomogram for adjusting UFH dose*

PTT (seconds)	Bolus (units/kg)	Hold infusion (minutes)	Dose change	Repeat PTT (hours)
<50	50	0	Increase by 20%	4
50–59	0	0	Increase by 10%	4
60–85	0	0	No change	24
86–95	0	0	Decrease by 10%	4
96–120	0	30	Decrease by 10%	4
>120	0	60	Decrease by 15%	4

*The sensitivity of the PTT towards UFH depends on the reagent used.

Maintain PTT 2.5–3.5 times the control.

Discontinue heparin once therapeutic INR is achieved with warfarin.

Table reproduced from Venous thromboembolism: Prophylactic and therapeutic practice guideline. S Afr Med J 2013;103(4):260-267. Published with kind permission.

AND

- Warfarin, oral, 0.1 mg/kg daily from day 1.
  - Target INR: 2–3.
  - Continue warfarin therapy for 3–6 months if no underlying severe thrombophilia.
  - Inherited thrombophilic conditions may need lifelong therapy.

- Beware of drug interactions.

Weight	Starting dose of warfarin
10–20 kg	2.5 mg alternate days
20–35 kg	2.5 mg daily
35–50 kg	2.5 mg alternating with 5 mg daily
50 kg+	5 mg daily

Adjust schedules using combinations of 2.5 mg and 5 mg **or** 5 mg and 7.5 mg **or** 7.5 mg and 10 mg if a standard daily dose does not provide a therapeutic INR. For example: 2.5 mg Monday, Wednesday, Friday and 5 mg Tuesday, Thursday, Saturday, Sunday.

REFERRAL

» All patients to an appropriate centre for diagnostic imaging.
» Long term management of thrombophilic states should be in consultation with a paediatric haematologist or paediatrician.

3.13 SPECIAL CONSIDERATIONS IN HIV INFECTED CHILDREN

In addition to the usual causes of blood disorders in childhood, HIV infected children are at increased risk of developing anaemia, thrombocytopaenia and neutropaenia secondary to drugs (especially zidovudine in the case of anaemia), opportunistic infections or neoplasms. They are also at increased risk of thrombo-embolic disease secondary to vasculopathy or the induction of a thrombophilic state.

3.13.1 THROMBOCYTOPAENIA

D69.6

DESCRIPTION

Most cases of thrombocytopaenia in children with HIV infection are due to immune thrombocytopaenic purpura.
Exclude other causes of thrombocytopaenia if the diagnosis is made clinically.

DIAGNOSTIC CRITERIA

Clinical

» Bleeding tendency in a child with HIV infection.
» Asymptomatic finding on full blood count.

Investigations

» Thrombocytopaenia with normal white cell count and red cell indices, apart from the effects of blood loss.
» Normal INR (PT) and partial thromboplastin time (PTT).
» Abundant megakaryocytes on bone marrow aspiration with normal erythroid and myeloid cellularity.
» Indications for bone marrow investigation: Prior to starting steroids or any other abnormality on FBC or any atypical cells on differential count.

GENERAL AND SUPPORTIVE MEASURES

» As for the HIV uninfected child.
» Avoid:
  > platelet transfusions, unless life-threatening bleeds;
  > contact sport, injury and trauma;
  > dental procedures in acute phase;
  > medications that affects platelet function, e.g. NSAIDs and aspirin.
» Check for interactions with ARTs.

MEDICINE TREATMENT

As for the HIV uninfected child.

Initiate ART if not already initiated.

Acute ITP

Active bleeding:

- Prednisone, oral, 4 mg/kg/24 hours as a single daily dose for 4 days.

REFERRAL

» All children with refractory symptomatic thrombocytopaenia.

CHAPTER 4

CARDIOVASCULAR SYSTEM

4.1 CARDIAC DYSRHYTHMIAS

I49.9

DESCRIPTION

A heart rate that is either abnormally slow or fast for age or irregular.
Normal heart rate/minute for age:

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

DIAGNOSTIC CRITERIA

Clinical

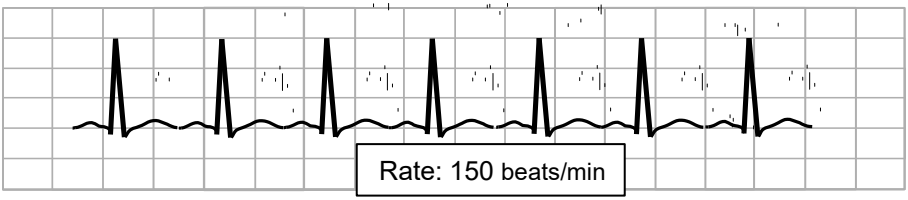
» Presenting features may vary with the age of the patient:
  > infants:
    colour changes (pale, mottled), irregular pulse,
    irritability, tachycardia,
    feeding difficulties, bradycardia,
    sweating, signs of cardiac f ailure,
    tachypnoeic/apnoeic spells.
  > children:
    dizziness, tachycardia,
    palpitations, bradycardia,
    fatigue, syncope,
    chest pain, signs of cardia c failure.

Investigations

» ECG is essential for diagnosis, preferably a 12- lead ECG.
» Monitors are inadequate to diagnose most dysrhythmias.
» A standard ECG is recorded at 25mm/second. Each small block on the ECG paper is 1mm x 1mm and represents 40 milliseconds and each large block 5mm x 5mm and represents 200 milliseconds. A length of 300 large blocks represents 1 minute and the heart rate can be estimated from the ECG strip by dividing 300 by the number of large blocks between sequential R waves provided that there is not substantial variability in the RR interval lengths. The ECG tracings below show only the large (5mm) blocks.

TACHYDYSRHYTHMIA

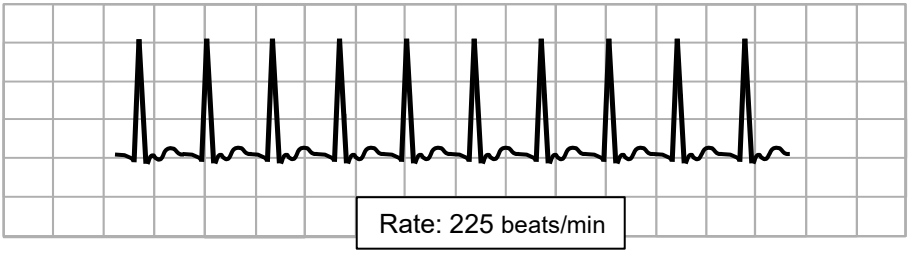
Sinus tachycardia



ECG Criteria

Rate: > upper limit for age
Rhythm: regular
P wave: present and normal
QRS: normal

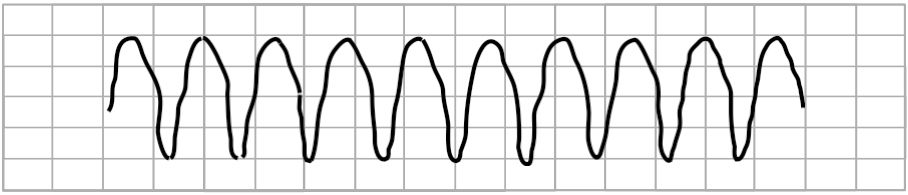
Supraventricular tachycardia



ECG Criteria

Rate: usually > 200 beats per minute
Rhythm: regular
P wave: abnormal
QRS: normal

Ventricular tachycardia



ECG Criteria

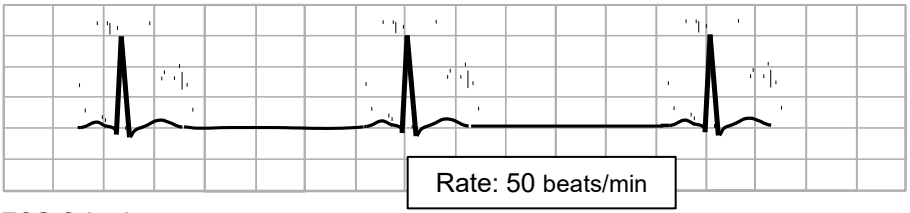
Rate: generally 100–220 beats per minute
Rhythm: generally regular
P wave: mostly not seen
QRS: abnormal, width of QRS > 120 milliseconds

BRADYDYSRHYTHMIA

Important causes of bradycardia:

- Hypoxia
- Congenital heart block
- Drug ingestion
- Excessive vagal stimulation

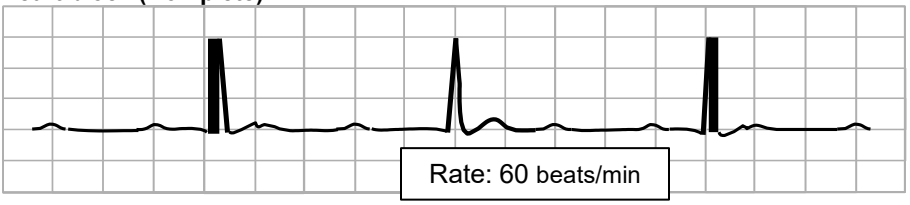
Sinus bradycardia



ECG Criteria

Rate: < lower limit for age
Rhythm: regular
P wave: present, all look the same
QRS: normal, 80–120 milliseconds

Heart block (Complete)



ECG Criteria

Rate: low, usually < 60 beats per minute
Rhythm: regular
P wave: independent P waves and QRS complexes with no relationship between the two (AV dissociation)
QRS complex: can be normal or wide, depending on escape rhythm

GENERAL AND SUPPORTIVE MEASURES

» Sinus tachycardia usually requires management of the underlying condition.
» Apply ABC of resuscitation if needed.
» Admit to high care or intensive care unit if indicated.
» Monitor:
  > ECG,
  > blood pressure,
  > heart rate,
  > respiratory rate,
  > oxygen saturation,
  > haemoglobin,
  > acid–base status,
  > blood gases.
» Maintain adequate nutrition and hydration.
» Treat pyrexia.

MEDICINE TREATMENT

Tachydysrhythmia
Emergency treatment.

Narrow complex tachycardia
Commonly due to supraventricular tachycardia.

Stable patient:
Attempt vagal stimulation.

- Place ice bag on face, or
- Infants: immerse face in ice-cold water for a few seconds.
- Older children: try a valsalva manoeuvre.
- Eye-ball pressure and carotid massage is contraindicated in children.

- In consultation with a paediatric specialist: Adenosine, IV, 0.1 mg/kg rapid IV push (within seconds).
  - Follow immediately with a rapid flush of at least 5 mL sodium chloride 0.9%.
  - Increase dose in 0.1 mg/kg increments every 2 minutes until return of sinus rhythm. Follow each dose with a rapid flush of sodium chloride 0.9%.
  - Maximum dose: 0.5 mg/kg. Do not exceed 12 mg in total.
  - Because adenosine is rapidly metabolised, inject adenosine into an intravenous cannula capable of supporting rapid infusion and preferably located as centrally as possible (i.e. cubital rather than hand or foot). Follow immediately, with a rapid flush of a fluid bolus. It is helpful to have both the syringe with adenosine and the fluid bolus connected to the giving set. The line between the syringes and the patient should be as short as possible.

Unstable patient – heart failure / shocked:

DC synchronised cardioversion at 1- and then 2 J/kg.
If possible, empty the stomach before cardioversion is attempted. Resuscitation facilities must be available.
Midazolam for sedation, if necessary.

Broad complex tachycardia
Commonly due to ventricular tachycardia.
Causes include electrolyte disturbances and drug ingestion.

Stable patient (rare):

» Send ECG immediately to paediatric cardiologist.
» AVOID giving adenosine to patients with broad complex tachycardia unless the rhythm is regular with a monomorphic QRS complex.

Medicines that may be recommended by a paediatric cardiologist include:

» Magnesium sulphate intravenous 25-50 mg/kg over a few minutes for torsade de pointes.
» Amiodarone intravenous 5mg/kg over 20 minutes.

LoE III[1]

Unstable patient – heart failure/shock:

» Pulseless treat as ventricular fibrillation. See Chapter 1: Emergencies and Trauma, section 1.1.4 Cardiorespiratory arrest.
» DC synchronised cardioversion at 1- and then 2 J/kg.
» If synchronised cardioversion fails, use asynchronised shocks.
» Resuscitation facilities must be available.
» Midazolam for sedation, if level of awareness indicates.

Monitor and correct electrolytes and acid-base status on blood gases. Consider underlying causes.

If DC cardioversion fails:

- Amiodarone, IV, 5 mg/kg slowly over 20 minutes.

And continue with DC cardioversion.

BRADYDYSRHYTHMIA

Try and correct underlying causes.

Stable patient:
Observe.

Bradydysrhythmia due to vagal stimulation:

- Atropine, IV/IO, 0.02 mg/kg. Maximum single dose 0.5mg.
  - If no response, repeat in 5 minutes.

LoE III[ii]

Unstable patient:
Treat as impending arrest:

- Adrenaline (epinephrine), IV/IO, 0.01 mg/kg.
  - Repeat if necessary conferring with referral institution.

If no sustained response, consider:

- Adrenaline (epinephrine), IV infusion, 0.05–2 mcg/kg/minute.

LoE III[iii]

REFERRAL

» All children with tachydysrhythmias after acute treatment, excluding sinus tachycardia due to other causes.
» Bradycardia unresponsive to medical treatment, or heart block.

4.2 CONGENITAL HEART DISEASE (CHD)

Q24.9

DESCRIPTION

Structural abnormalities of the heart or great vessels present at birth. They fall into 4 pathophysiological groups:

1. Acyanotic Left to right shunts - ventricular septal defect (VSD), patent duct arteriosus (PDA), atrial septal defect (ASD), atrioventricular septal defect (AVSD), Truncus arteriosus.

2. Acyanotic Obstructive lesions - pulmonary stenosis, aortic stenosis, coarctation of the aorta.
3. Cyanotic CHD - mostly right to left shunts tetralogy of fallot (TOF), pulmonary atresia (PA), tricuspid atresia (TA), but including parallel circulation - transposition of great arteries (TGA) (see Chapter 19: Prematurity and Neonatal Conditions, section 19.2 Cyanotic Heart Disease in the Newborn) and Eisenmenger syndrome.
4. Regurgitant lesions - aortic incompetence (AI), mitral incompetence (MI) are not common in CHD.

Some patients with CHD present with life threatening symptoms in the newborn period, see Chapter 19: Prematurity and Neonatal Conditions, section 19.5 Heart Failure in Neonates. Left to right shunts if large may be symptomatic due to pulmonary over circulation and pulmonary hypertension or if small may present with an incidental murmur. Many will require surgery but this may follow a period of medical therapy.

Obstructive lesions are often asymptomatic until they precipitate ventricular failure or symptoms related to decreased cardiac output. The management is usually surgical or interventional. Angiotensin-converting enzyme inhibitor (ACE-Inhibitor) should be avoided in the treatment of heart failure in patients with obstructive lesions.
Right to left shunts present with cyanosis and variable degrees of effort intolerance. Patients with tetralogy of Fallot may present with hypercyanotic spells.

4.2.1 CYANOTIC CONGENITAL HEART DISEASE WITH HYPOXAEMIA ATTACKS/SPELLS (HYPERCYANOTIC SPELLS)

Q24.9

DESCRIPTION

Acute worsening of central cyanosis in patients with a Tetralogy of Fallot and certain other cyanotic heart diseases with pulmonary stenosis and ventricular septal defect.

DIAGNOSTIC CRITERIA

Clinical

» Rapid worsening of central cyanosis, tachypnoea/dyspnoea, anxiety and alteration in consciousness in the presence of congenital cyanotic heart disease.
» Restless and crying in the presence of congenital cyanotic heart disease.
» Decrease in intensity or disappearance of the systolic murmur in Tetralogy of Fallot during crying.

GENERAL AND SUPPORTIVE MEASURES

» Exclude and treat precipitants such as fever or dehydration.
» Calm patient and keep on mother's lap, if possible.
» Place patient in knee-chest position to raise systemic blood pressure and increase systemic venous return.
» Monitor SaO_2, heart rate, respiratory rate and acid-base status.
» Ensure adequate hydration.

MEDICINE TREATMENT

- Oxygen, 100%, by facemask or by nasal cannula.
- Volume expander e.g. sodium chloride 0.9%, IV bolus, 20mL/kg administered over 5 minutes.
- Morphine, IV, 0.1–0.2 mg/kg as a single dose.
  - o May cause impairment of airway reflexes and respiratory depression.

If clinically acidotic or pH < 7.2:

- Sodium bicarbonate 4.2%, IV, 2 mL/kg.

If failure to improve the cyanotic spell, consider in consultation with specialist:

- Ketamine, IV, 0.5–1 mg/kg.

> **Note:** IV ketamine is a general anaesthetic.
> Take standard precautions for respiratory arrest.

After resolution of spell:
If Hb < 10 g/dL, child is anaemic:

- Packed red cells, 10 mL/kg administered over 3 hours.
- Propranolol, oral, 0.5–1 mg/kg/dose 6 hourly.
  - o Do not exceed 5 mg/kg/day.

REFERRAL

» If above measures do not work refer urgently.
» Refer all cases for assessment.

4.2.2 TETRALOGY OF FALLOT

Q21.3

DESCRIPTION

Ventricular septal defect with aortic override and right ventricular outflow tract obstruction.
Suspect tetralogy of Fallot in a child with cyanosis after the neonatal period.

DIAGNOSTIC CRITERIA

Clinical

» Child with central cyanosis.
» May be plethoric due to polycythemia – normal haemoglobin represents relative anaemia.
» May have clubbing.
» Possible history of cyanotic spells.
» Heart not clinically enlarged.
» Right ventricular hypertrophy usually not palpable.
» Single second heart sound.
» Coarse, ejection systolic murmur over right ventricular outflow tract.

» Chest X-ray:
  > normal/small heart,
  > boot shaped/pulmonary bay – concavity where pulmonary artery should be,
  > oligaemic lung fields.
» ECG:
  > right axis deviation and right ventricular hypertrophy.

GENERAL AND SUPPORTIVE MEASURES
» Good dental hygiene.

MEDICINE TREATMENT
- Iron (elemental), oral, 1 mg/kg/dose 8 hourly.
- Folic acid, oral, 2.5– 5 mg/day.
- Propranolol, oral, 0.5–1 mg/kg/dose 6 hourly.
  o Do not exceed 5 mg/kg/day.

Endocarditis prophylaxis:
See section 4.3: Endocarditis, infective.

REFERRAL
» Refer all children with cyanotic heart defects.

4.2.3 CONGENITAL HEART DISEASE WITH LEFT TO RIGHT SHUNT.

DESCRIPTION
Structural abnormalities of the heart and great vessels that are usually associated with left to right shunting - most commonly: ventricular septal defect, atrial septal defect, patent ductus arteriosus and atrioventricular septal defect.

DIAGNOSTIC CRITERIA
Each condition has specific clinical, radiological and ECG findings.
Large left to right shunts present clinically with:
» Tachypnoea and indrawing.
» Sweating during feeds.
» Failure to thrive.
» Chest deformity: respiratory sulcus, praecordial bulge.
» Chest X-ray: usually cardiomegaly with plethoric lung fields.

GENERAL AND SUPPORTIVE MEASURES
» Special attention to nutrition.

MEDICINE TREATMENT:
- Furosemide, oral, 1mg/kg/dose 8-12 hourly.
- Supplement with potassium chloride, oral, 25-50 mg/kg/dose 8-12 hourly.

If needed:

- Spironolactone oral, 1 mg/kg/dose 12 hourly in which case potassium supplementation should be stopped.

And if needed, in consultation with a paediatric cardiologists:

- ACE inhibitor, e.g.
  - Captopril, oral
    - Infants: 0.15-0.3 mg/kg/dose, 8-12 hourly (maximum 2 mg/kg/day).
    - Children: 0.3-0.5 mg/kg/dose 8-12 hourly (maximum 6 mg/kg/day).

LoE II[iv,v]

REFERRAL:

- All children with suspected left to right shunts due to CHD should be referred to a paediatric cardiology centre for diagnostic evaluation and planning of further management.

4.3 ENDOCARDITIS, INFECTIVE

I33.0

DESCRIPTION

Infection of the endothelial surface of the heart.
Suspect infective endocarditis in all children with fever and underlying heart disease.
Antibiotic therapy in these children is highly dependent on the results of microbiology.

DIAGNOSTIC CRITERIA

Clinical

» An underlying heart defect and a persistent low grade fever without an obvious underlying cause.
» Associated other findings include: fatigue, joint pain, new murmurs, clubbing, splenomegaly and haematuria.
» Must be differentiated from acute carditis due to rheumatic fever.
» The Duke criteria have been suggested as a guide to diagnosis, but have definite limitations as they were developed for use in adult patients.

Table 1: 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.	» 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.
» 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.	» Microbiologic evidence: > positive blood culture but not meeting major criterion, or > serologic evidence of active infection with organism consistent with IE.

*A group of fastidious gram negative organisms originating in the mouth.

Table 2: Modified Duke criteria for diagnosis of infective endocarditis (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 1 » 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 like CRP or ESR, which may be of value, have also not been included.

Investigations

» Blood cultures:
  > Sterile blood culture technique is essential.
  > Take three blood cultures (venous) from different sites within 2 hours if very ill, otherwise within 24 hours. There is little benefit of doing more than five blood cultures.
  > Child need not necessarily have a fever as patients are mostly constantly bacteraemic.
» Urine test strips – haematuria.
» CRP/ESR may be helpful.

GENERAL AND SUPPORTIVE MEASURES

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

MEDICINE TREATMENT

For heart failure see section 4.9: Heart failure.

For fever:

- Paracetamol, oral, 15 mg/kg/dose, 6 hourly as required.

Antibiotic therapy

Antibiotics are seldom indicated as part of emergency treatment.
It is important to obtain adequate blood culture specimens prior to initiation of antibiotics.

Antibiotics are **always** given IV.

Empiric treatment

If culture is not yet available or remains negative:

- Benzylpenicillin (Penicillin G), IV, 50 000 units/kg/dose, 6 hourly for 4-6* weeks.

PLUS

- Cloxacillin, IV, 50 mg/kg/dose 6 hourly for 4-6* weeks.

LoE III[vi]

PLUS

- Gentamicin, IV, 3 mg/kg/day for 2 weeks.

LoE II[vii]

**The longer duration of therapy is used for patients with complications or prosthetic valves.*

If positive culture available: Consult paediatric cardiologist, infectious disease specialist or clinical microbiologist.

Prophylaxis

The use of prophylaxis is controversial but still recommended.

For children with the following cardiac conditions:

» rheumatic heart disease;
» prosthetic cardiac valve or prosthetic material used in valve repair;
» previous infective endocarditis;
» unrepaired cyanotic heart disease, including palliative shunts;
» during the first 6 months after complete repair of congenital heart defect with prosthetic material or device (complete endothelialisation of prosthesis after 6 months);
» repaired cyanotic heart disease with residual defect at or adjacent to prosthetic patch or device; or
» cardiac transplant recipients who develop cardiac valvulopathy.

Children with the above cardiac conditions should receive prophylaxis when undergoing the following procedures:

» All dental procedures that involve manipulation of gingival tissues or periapical region of teeth or trauma to oral mucosa.
» Prophylaxis is not recommended for procedures involving the GIT, GUT, respiratory tract, skin or soft tissue in the absence of existing infections. (If infections of GIT/GUT are present include cover for enterococcus e.g. amoxicillin or ampicillin, and for infections of respiratory tract, soft tissue and skin include cover for staphylococcus aureus e.g. cloxacillin or cephalexin).

Regimens for dental procedures

- Amoxicillin, oral, 50 mg/kg (maximum 2 g) 1 hour before the procedure.

Patients unable to take oral medication:

- Ampicillin, IV, 50 mg/kg (maximum 2 g) ½ hour before the procedure.

REFERRAL

» All patients with suspected (for echocardiography) and confirmed (for antibiotic and possible surgical management) infective endocarditis as soon as possible.

4.4 RHEUMATIC FEVER, ACUTE

I01.9

* Notifiable condition.

DESCRIPTION

Rheumatic fever is an inflammatory condition that may follow a throat infection with group A streptococci. It is an important cause of acquired heart disease with significant morbidity and mortality rates, both in the acute phase of the disease and as a result of chronic valvular sequelae.

DIAGNOSTIC CRITERIA

Revised Jones criteria:

» Evidence of recent streptococcal infection:
  > Elevated ASO-titre or other streptococcal antibody titres.
  > Positive throat culture for group A beta haemolytic streptococcus.

  PLUS

» Two major manifestations, **or** one major and two minor manifestations, justifies the presumptive diagnosis of acute rheumatic fever.

Major manifestations	Minor manifestations
▪ polyarthritis ▪ carditis ▪ erythema marginatum ▪ subcutaneous nodules ▪ Sydenham's chorea	▪ polyarthralgia ▪ fever ▪ acute phase reactants: increased erythrocyte sedimentation rate (ESR) or C-reactive protein (CRP) ▪ ECG: prolonged PR-interval, ≥ 0.18 seconds in the absence of carditis

  > 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.

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.

GENERAL AND SUPPORTIVE MEASURES

» Hospitalise with bed rest until sleeping pulse is normal and signs of rheumatic activity have resolved.
» Restrict physical activity for at least 2 weeks after acute phase reactants have normalised.
» Keep a record of patients on rheumatic fever prophylaxis so that attendance can be monitored.

MEDICINE TREATMENT

Antibiotic therapy

To eradicate any streptococci:

- Benzathine benzylpenicillin (depot formulation), IM, as a single dose.
  - o If < 30 kg: 600 000 IU.
  - o If ≥ 30 kg: 1.2 MU.

OR

- Phenoxymethylpenicillin, oral, 250 (<30kg)–500 mg 12 hourly for 10 days.

LoE III[viii]

Anti-inflammatory therapy

Do not start until a definite diagnosis is made.

Severe arthritis:

- Aspirin soluble, oral, 20 mg/kg/dose 6 hourly until the arthritis resolves.

OR

If aspirin cannot be tolerated:

- Ibuprofen, oral, 5 mg/kg/dose, 6 hourly.

Cardiac failure: See section 4.9: Heart failure.

Chorea: See Chapter 13: The Nervous System, section 13.9: Sydenham's Chorea.

Prevention of repeated attacks

Any patient with documented rheumatic fever must receive prophylaxis.

Intramuscular penicillin is superior to other forms of prophylaxis.

- Benzathine benzylpenicillin (depot formulation), IM, every 3-4 weeks.
  - o If < 30 kg: 600 000 IU.
  - o If > 30 kg: 1.2 MU.

OR

- Phenoxymethylpenicillin, oral, 250 mg 12 hourly.

Continue therapy until patients reach 21 years of age if no rheumatic valvular disease, and until 35 years of age in patients with rheumatic valvular disease.

LoE III[viii]

REFERRAL

Rheumatic fever:

» with residual valvular damage electively for planning of care,
» with symptomatic valvular damage,
» unresponsive to treatment.

4.5 MYOCARDITIS

I40

DESCRIPTION

Myocarditis is an inflammatory disease of the cardiac muscle. The majority of paediatric myocarditis cases are caused by viral infection. Viral myocarditis should be suspected whenever a child presents with dysrhythmia, heart failure or cardiogenic shock following a viral illness. Myocarditis should be considered in children with unexplained shortness of breath.

DIAGNOSTIC CRITERIA

Clinical

» Tachycardia.
» Clinical signs of biventricular heart failure.
» May present with cardiogenic shock.

Investigations

» ECG changes are non-specific but ST elevation, T wave inversion, prolonged QTc, small complexes, dysrhythmias or extra-systole may be seen.
» Chest X-ray:
  > pulmonary congestion,
  > cardiomegaly,
  > possible pleural effusion.
» Elevated cardiac troponin T levels are markers of myocarditis but normal levels do not exclude the diagnosis.

GENERAL AND SUPPORTIVE MEASURES

» Restrict fluid (75% of daily requirements) – not at expense of adequate caloric intake.
» Ensure adequate nutrition, tube-feeding may be necessary.

MEDICINE TREATMENT OF VIRAL MYOCARDITIS

To prevent hypoxia:

- Oxygen via face mask, nasal cannula or head box.

For pulmonary oedema:

- Furosemide, IV, 1mg/kg, 8 hourly monitor urinary output
- If response is inadequate, change to an IV infusion 0.1-1 mg/kg/hour.
- Switch to oral furosemide as soon as patient condition allows.
  » Monitor clinically and biochemically for, and avoid, over diuresis.
  » Monitor for hypokalaemia and other electrolyte disturbances.

LoE III[iii]

If response still inadequate consider:

- Hydrochlorothiazide, oral, 1mg/kg/dose, 12 hourly in consultation with a paediatric cardiologist.

LoE III [xi, xii]

- Inotropic support may be needed see section 4.9.1: Heart Failure, acute with pulmonary oedema.

REFERRAL

» All children with suspected myocarditis should be managed in consultation with a paediatrician. Long term (at least 6 months) exercise avoidance, medicine treatment and follow up is needed.

4.6 DILATED CARDIOMYOPATHY

I42.0

DESCRIPTION

Dilated cardiomyopathy is a clinical diagnosis characterised by dilation and impaired contraction of the left or both ventricles that is not explained by abnormal loading conditions. It is difficult and sometimes impossible to distinguish myocarditis from dilated cardiomyopathy. Dilated cardiomyopathy is often a sequel to viral myocarditis.

DIAGNOSTIC CRITERIA

Clinical

» Cardiomegaly with clinical signs of heart failure and poorly localised apical impulse.
» May present with cardiogenic shock.

Investigations

» Chest X-ray:
  > pulmonary congestion,
  > cardiomegaly,
  > there may be pleural effusion.
» ECG:
  > Mostly non-specific.
  > Dysrhythmias or extra-systoles may occur.

GENERAL AND SUPPORTIVE MEASURES

» Fluid restriction (75% of daily requirements) – not at expense of adequate caloric intake.
» Ensure adequate nutrition, tube-feeding may be necessary.
» Advise bed rest.

MEDICINE TREATMENT

To prevent hypoxia:

- Oxygen via face mask, nasal cannula or head box.

See section 4.9 Heart Failure.

REFERRAL

» **Urgent:** To ICU for inotropic support if indicated.
» All patients for assessment and consideration of underlying disorders.

4.7 PERICARDIAL EFFUSION

I30

DESCRIPTION

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

DIAGNOSTIC CRITERIA

Clinical

» 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 X-ray.
» Often associated with TB.
» Acute septic pericarditis may occur in patients with septicaemia.

Investigations

» Exclude TB in all cases. Tuberculin skin test.
» ECG:
  > small complexes tachycardia,
  > diffuse T wave changes,
» Chest X-ray:
  > in pericardial effusion – “water bottle” large globular heart or cardiac shadow with smoothed out borders.
» Ultrasound of heart and pericardium.
» Diagnostic pericardiocentesis:
  > in all patients with suspected bacterial or neoplastic pericarditis, and in all others in whom the diagnosis is not readily obtained;
  > include cell count and differential, culture and gram stain;
  > an elevated adenosine deaminase (ADA) may be helpful in diagnosing TB.

CARDIAC TAMPONADE

Cardiac tamponade is the accumulation of pericardial fluid that restricts ventricular filling and stroke volume. The child usually presents with a tachycardia, pulsus paradoxus, elevated JVP, hypotension, shock or pulseless electric activity.

Features on ECG include electrical alternans and low voltage QRS.
Diagnosis is confirmed by ultrasound.

GENERAL AND SUPPORTIVE MEASURES

Urgent pericardiocentesis under ultrasound guidance by an experienced person.

Pericardiocentesis

» Do a coagulation screen if coagulation problems are suspected.
» Preferably under ultrasound guidance by an experienced person.
» In an emergency, drainage by using a large bore intravenous cannula.

» Technique:
  > Ensure that full resuscitation equipment is available as well as an IV line and cardiac monitor.
  > Administer oxygen via face mask, nasal cannula or head box.
  > If the patient is restless, it may be necessary to sedate the patient. In an emergency situation, this is unnecessary.
  > Position the patient in a 30° sitting-up position.
  > Prepare the preferred site just to the left of the xiphoid process, 1 cm inferior to the costal margin.
  > Infiltrate this area with 1% lidocaine (lignocaine).
  > Maintaining negative pressure on the syringe, insert the needle at a 45° angle to the skin, advancing in the direction of the patient's left shoulder.
  > While advancing the needle, observe closely on ECG for ventricular ectopic beats, a sign of myocardial contact. If this is noted, gradually withdraw the needle a few mm.
  > Once air (pneumopericardium) or fluid begins to fill the syringe, advance the intravenous cannula, withdraw the needle, attach the syringe to the hub of the cannula and slowly aspirate the pericardial fluid.
  > Potential complications include: haemopericardium (from laceration of the heart wall or coronary artery), cardiac dysrythmias, pneumothorax, and pneumopericardium.

MEDICINE TREATMENT

If suspected or proven TB pericarditis, give antituberculosis drugs for 6 months plus corticosteroids.

- Prednisone, oral, 6 weeks:
  » Week 1: 2 mg/kg/day,
  » Week 2: 1.5 mg/kg/day,
  » Week 3: 1 mg/kg/day,
  » Week 4: 1 mg/kg/day,
  » Week 5: 0.5 mg/kg/day,
  » Week 6: 0.25 mg/kg/day.

LoE III[ix,x]

Pain management

See Chapter 20: Pain Control, section 20.1.2: Management of pain.

Antibiotic therapy

If suspected bacterial pericarditis give empiric antibiotic treatment until culture and sensitivity results are available.

Antibiotic therapy should be continued for 4 weeks.

In case of purulent pericarditis:

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

PLUS

- Ceftriaxone, IV, 100 mg/kg as a single daily dose.

REFERRAL
» Refer all patients after stabilisation.

4.8 PERICARDITIS
I30.9

DESCRIPTION
An inflammation of the pericardium. Causes include viral or bacterial and autoimmune disease. The commonest cause is viral but the clinician should entertain a high index of suspicion for tuberculous and bacterial pericarditis as these require specific antimicrobial treatment.

DIAGNOSTIC CRITERIA
Inflammation of the pericardium:
» Classical presentation of viral pericarditis, loud pericardial rub and chest pain that is relieved by sitting up. Children often do not complain of chest pain.
» Acute septic pericarditis may occur in patients with septicaemia.

TB pericarditis
TB pericarditis may present as pericardial effusion (most cases), effusive constrictive pericarditis or constrictive pericarditis.
Clinical features include:
» chronic cough,
» chest pain,
» night sweats,
» and weight loss.
» dyspnoea,
» fever,
» orthopnoea,

Severe pericardial pain is uncommon.

Investigations
» Exclude TB.
» Echocardiogram.

MEDICINE TREATMENT
Treat the cause.

For tuberculous and bacterial pericarditis treatment see section 4.7: Pericardial Effusion.

Viral pericarditis:
NSAIDs e.g.
- Ibuprofen, oral, 5 mg/kg/dose 6 hourly.

REFERRAL
» All patients in whom the cause is unidentified or merits further referral.

4.9 HEART FAILURE

I50.9

DESCRIPTION

Clinical syndrome reflecting the inability of the myocardium to meet the oxygen and nutritional/metabolic requirements of the body.

Causes include:

» volume overload:
  o L-R shunt lesions
  o mitral/aortic regurgitation
» pump failure:
  o myocarditis/cardiomyopathy
» high output failure:
  o septicaemia
  o severe anaemia

DIAGNOSTIC CRITERIA

Clinical

» Acute cardiac failure may present with shock. See Chapter 1: Emergencies and Trauma, section 1.1.7: Shock.
» History of recent onset of:
  > poor feeding,
  > poor or excessive weight gain,
  > tachypnoea,
  > breathlessness,
  > sweating,
  > cough.
» Physical findings:
  > tachycardia,
  > cardiomegaly,
  > hypotension,
  > cold extremities,
  > weak pulses,
  > reduced urinary o utput,
  > gallop rhythm with/without a cardiac murmur,
  > pulmonary venous congestion and fluid retention:
    ▪ tachypnoea,
    ▪ dyspnoea,
    ▪ orthopnoea,
    ▪ recession,
    ▪ wheezing,
    ▪ coarse crepitations,
    ▪ cyanosis;
  > systemic venous congestion:
    ▪ hepatomegaly,
    ▪ periorbital oedema - not seen in infants,
    ▪ abnormal weight gain,
  > signs and symptoms of underlying condition/disease.

Investigations as appropriate for the possible underlying cause

» Chest X-ray: cardiomegaly is almost always present.
» Electrocardiogram may show evidence of hypertrophy/enlargement of one or more heart chambers and/or dysrhythmias.

4.9.1 HEART FAILURE, ACUTE WITH PULMONARY OEDEMA

I50.9

GENERAL AND SUPPORTIVE MEASURES

» Treat the underlying disorder/condition. Where the primary cause of acute pulmonary oedema is renal failure treat as per renal failure. See Chapter 6: Nephrological/Urological Disorders, section 6.4 Acute Kidney Injury.
» Restrict fluids, beware of IV fluids.
» Place patient in an upright or semi-upright sitting position.
» Intubation and ventilation may be required in an ICU setting.

MEDICINE TREATMENT

- Oxygen 100%, administered via face mask or nasal cannula.

Treat the underlying condition:

- Furosemide, IV, 1 mg/kg, 8 hourly.
- If response is inadequate, change to an IV infusion 0.1-1mg/kg/hour.
- Switch to oral furosemide as soon as patient condition allows.
  - » Monitor clinically and biochemically for, and avoid, overdiuresis.
  - » Monitor for hypokalaemia and other electrolyte disturbances.

LoE III[iii]

If response still inadequate consider:

- Hydrochlorothiazide, oral, 1 mg/kg/dose, 12 hourly in consultation with a paediatric cardiologist.

LoE III[xi,xii]

Manage severe hypotensive or refractory failure in an ICU setting.

Inotropic support may help to stabilise patients with severe myocardial dysfunction and hypotension.

May be lifesaving in severe myocarditis or cardiogenic shock.

- Dobutamine, IV infusion, 2–15 mcg/kg/minute.
  - o Continue until myocardial function and blood pressure improve.

If no response to dobutamine, consider adrenaline (epinephrine) infusion. Ensure adequate renal function.

Once patient stable and maintaining blood pressure wean the inotrope and introduce:

- ACE inhibitor, Note: ACEI should be avoided in patients with obstructive heart lesions.
- e.g.:
- Captopril, oral.
  - o Initial dose: 0.5 – 1 mg/kg/24 hours in 3 divided doses (8 hourly) for 24–48 hours.
  - o Increase by 0.5 mg/kg/24 hours every 24–48 hours until maintenance dose of 3–5 mg/kg/24 hours is reached. Monitor blood pressure and renal function.
  - o Continue for as long as needed to control the cardiac failure and allow myocardial recovery.

LoE III [xiii]

4.9.2 HEART FAILURE, MAINTENANCE THERAPY

I50.9

GENERAL AND SUPPORTIVE MEASURES

» Recognise and treat the underlying condition, e.g. infection, hypertension, cardiac tamponade, fluid overload.
» Fluid restriction (75% of daily requirements) – not at the expense of adequate caloric intake.
» Ensure adequate nutrition, tube-feeding may be necessary.
» Monitor blood potassium levels, urea and electrolytes.

MEDICINE TREATMENT

- Oxygen 100%, administered via face mask or nasal cannula.

Combination drug therapy is usually indicated, i.e. start with diuretic, then add an ACE inhibitor.

Diuretic therapy

- Furosemide, oral, 1-2 mg/kg/dose 12 hourly. Titrate dose against clinical response. Potassium supplements are necessary if furosemide is used without an aldosterone antagonist, i.e. spironolactone.
- Monitor for response.

LoE III[xiv]

If response still inadequate consider:

- Hydrochlorothiazide 1 mg/kg/dose oral, 12 hourly in consultation with a paediatric cardiologist.

LoE III[xi, xii]

AND

ACE inhibitor

Note:
ACE inhibitors are contraindicated in bilateral renal artery stenosis, coarctation of the aorta, aortic stenosis and mitral stenosis.

- Captopril, oral.
  - Initial dose: 0.5-1 mg/kg/24 hours in 3 divided doses (8 hourly) for 24–48 hours.
  - Increase by 0.5 mg/kg/24 hours every 24–48 hours until maintenance dose of 3–5 mg/kg/24 hours is reached. If < 1 year do not exceed 4 mg/kg/day.
  - Continue as long as needed to control the cardiac failure and allow myocardial recovery.

LoE III[xiii]

OR

- Enalapril, oral, 0.2–1 mg/kg/day as a single dose or 2 divided doses. Start at the low dose and increase by 0.2 mg/kg/day at 1-2 day intervals.

In still symptomatic add:

- Spironolactone, oral, 1–3 mg/kg/dose once daily. May be divided 12 hourly.

In those patients that are refractory, refer to paediatric cardiologist for consideration of beta-blockers and digoxin.

REFERRAL

» For determination of the underlying cause, where this is not known and review of treatment after stabilisation.
» Deterioration despite adequate treatment.

4.10 DYSLIPIDAEMIA

E78.9

DESCRIPTION

Dyslipidaemia is a broad term used to describe disorders of lipid metabolism that may be classified according to the Frederickson classification.

Phenotype	Elevated particles	Lipid increased	Frequency
I	Chylomicron	TG	Rare
IIA	LDL	LDL-C	Common
IIB	LDL and VLDL	LDL-C, TG	Common
III	IDL	TC, TG	Rare
IV	VLDL	TG	Common
V	Chylomicron and VLDL	TG	Uncommon

The three common types of dyslipidaemia are important because they are associated with an increased risk of cardiovascular disease due to atherosclerosis

DIAGNOSTIC CRITERIA:

Children with severe hypercholesterolaemia may present with xanthomas or myocardial infarction but most children with hypercholesterolaemia will be asymptomatic in childhood.

Children should be screened for dyslipidaemia if any of the following are present:

- Family history of premature cardiac disease or dyslipidaemia
- A medical condition associated with dyslipidaemia: diabetes mellitus, nephrotic syndrome, liver disease, obesity.

INVESTIGATIONS

» Exclude causes of secondary hyperlipidaemia
» In most cases non-fasting total cholesterol is determined in children at risk.
If level is higher than upper limit, lipid profile is done after 12 hours of fasting.
> Upper limit of S-cholesterol and triglycerides: Total cholesterol 5.2 mmol/L.
> Triglycerides (after 12 hours of fasting):
- influenced by lifestyle – needs attention if > 1.68 mmol/L,
- pancreatitis risk if > 10 mmol/L.

GENERAL AND SUPPORTIVE MEASURES

Manage secondary causes of hyperlipidaemia according to guidelines.
Schedule for integrated cardiovascular health promotion in children.

» **Obesity**
  > See Chapter 7: Endocrine System, section 7.15: Obesity.
» **Blood pressure**
  > With family history of hypertension < 55 years of age: routine BP measurement from 3 years of age once a year.
  > If BP ≥ 95th percentile for sex, age, and height percentile, follow up and investigate if persistently elevated.
» **Diet**
  > Refer to a dietician.
  > Learning healthy eating habits is an important preventative measure.
  > Moderate salt intake.
» **Physical activity**
  > Encourage active child-parent play.
  > Limit child's sedentary behaviour such as time watching television and playing video computer games to a maximum of 2 hours per day or 14 hours per week.
  > Children should not be allowed to eat while watching television, i.e. "no grazing".
  > Organised sport 5 times per week for at least 20–30 minute periods.
» **Smoking**
  > Encourage members of the household who smoke to stop.

MEDICINE TREATMENT

Consider medicine treatment only after failure of general and supportive measures to lower the cholesterol over 6-12 months.
Children should be at least 8 years of age for consideration of pharmacological intervention.
If LDL-C remains above 4.1 mmol/L in children with 2 or more risk factors, or above 4.9 mmol/L regardless of the presence of risk factors, refer to a paediatric specialist for consideration of statins:
Risk factors: smoking, hypertension, BMI >= 95th centile (z-score +1.96), HDL-C < 35 mg/dL, diabetes mellitus, renal disease, male sex.

- Statins, e.g.:
- Simvastatin, oral, 10 mg at night.

Secondary hypercholesterolaemia due to nephrotic syndrome
See Chapter 6 Nephrological/Urological Disorders, section 6.3 Nephrotic Syndrome.

REFERRAL

» Children with homozygous familial hypercholesterolaemia.
» Children with or inadequate response to statins.

4.11 HYPERTENSION IN CHILDREN

I10

DESCRIPTION

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 mmHg is abnormal in children between 6 weeks and 6 years of age. Measure blood pressure with the child in a sitting or supine position with the entire arm in line with the level of the heart.

In children, it is easier to monitor the systolic blood pressure because of better correlation and less technical pitfalls than diastolic blood pressure.

In the majority of children, hypertension is due to an identifiable cause. Severe hypertension suggests renal disease.

Hypertensive emergency/crisis exists when CNS signs of hypertension appear such as encephalopathy, convulsions, retinal haemorrhages 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.

Hypertensive urgency is defined as a significant elevation of blood pressure without accompanying end organ damage. Patients are generally symptomatic with complaints of headache, blurred vision and nausea, despite the lack of end organ involvement.

A valid assessment of the blood pressure is of extreme importance.
The blood pressure is measured by standard auscultation technique in children > 1 year of age.

In children < 1 year of age, a flush technique is usually used, although Doppler measurement would be preferable.

Measure the BP in at least one limb, preferably the right upper arm. If hypertension is present, measure BP on all four limbs.

One should 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 acromion and the olecranon. It is better to use a cuff that is slightly too large than one that is too small. Large cuffs, if covered with linen-like material, can be folded to the appropriate size in smaller infants as long as the bladder encompasses the arm.

DIAGNOSTIC CRITERIA

Clinical

» Symptoms and signs of any of the following systems:
  > central nervous,
  > cardiovascular,
  > respiratory,
  > urogenital.

» The most common associated features are:
  > oedema, haematuria, proteinuria,
  > skin sores (impetigo),
  > convulsions, coma and visual symptoms,
  > acute heart failure and pulmonary oedema,
  > acute respiratory distress, cyanosis and apnoea.
» Some children may be asymptomatic.
» Blood pressure in children correlates with body size and increases with age.

Categories of hypertension
» Normal: below 90th percentile.
» Prehypertension: 90th–95th percentile or BP > 120/80 mmHg.
» Stage 1 hypertension: > 95th–99th percentile plus 5 mmHg.
» Stage 2 hypertension: > 99th percentile plus 5 mmHg.

Age of child	95th Percentile of systolic and diastolic blood pressure	
	First 12 hours	First week
newborn premature	65/45 mmHg	80/50 mmHg
newborn fullterm	80/50 mmHg	100/70 mmHg

Blood pressure levels for Boys by age and height percentile

Age (year)	BP Percentile	Systolic BP (mmHg)							Diastolic BP (mmHg)						
		Percentile of Height							Percentile of Height						
		5th	10th	25th	50th	75th	90th	95th	5th	10th	25th	50th	75th	90th	95th
	50th	80	81	83	85	87	88	89	34	35	36	37	38	39	39
	90th	94	95	97	99	100	102	103	49	50	51	52	53	53	54
	95th	98	99	101	103	104	106	106	54	54	55	56	57	58	58
	99th	105	106	108	110	112	113	114	61	62	63	64	65	66	66
	50th	84	85	87	88	90	92	92	39	40	41	42	43	44	44
	90th	97	99	100	102	104	105	106	54	55	56	57	58	58	59
	95th	101	102	104	106	108	109	110	59	59	60	61	62	63	63
	99th	109	110	111	113	115	117	117	66	67	68	69	70	71	71
	50th	86	87	89	91	93	94	95	44	44	45	46	47	48	48
	90th	100	101	103	105	107	108	109	59	59	60	61	62	63	63
	95th	104	105	107	109	110	112	113	63	63	64	65	66	67	67
	99th	111	112	114	116	118	119	120	71	71	72	73	74	75	75
	50th	88	89	91	93	95	96	97	47	48	49	50	51	51	52
	90th	102	103	105	107	109	110	111	62	63	64	65	66	66	67
	95th	106	107	109	111	112	114	115	66	67	68	69	70	71	71
	99th	113	114	116	118	120	121	122	74	75	76	77	78	78	79

Age (year)	BP Percentile	Systolic BP (mmHg)							Diastolic BP (mmHg)						
		Percentile of Height							Percentile of Height						
		5th	10th	25th	50th	75th	90th	95th	5th	10th	25th	50th	75th	90th	95th
	50th	90	91	93	95	96	98	98	50	51	52	53	54	55	55
	90th	104	105	106	108	110	111	112	65	66	67	68	69	69	70
	95th	108	109	110	112	114	115	116	69	70	71	72	73	74	74
	99th	115	116	118	120	121	123	123	77	78	79	80	81	81	82
	50th	91	92	94	96	98	99	100	53	53	54	55	56	57	57
	90th	105	106	108	110	111	113	113	68	68	69	70	71	72	72
	95th	109	110	112	114	115	117	117	72	72	73	74	75	76	76
	99th	116	117	119	121	123	124	125	80	80	81	82	83	84	84
	50th	92	94	95	97	99	100	101	55	55	56	57	58	59	59
	90th	106	107	109	111	113	114	115	70	70	71	72	73	74	74
	95th	110	111	113	115	117	118	119	74	74	75	76	77	78	78
	99th	117	118	120	122	124	125	126	82	82	83	84	85	86	86
	50th	94	95	97	99	100	102	102	56	57	58	59	60	60	61
	90th	107	109	110	112	114	115	116	71	72	72	73	74	75	76
	95th	111	112	114	116	118	119	120	75	76	77	78	79	79	80
	99th	119	120	122	123	125	127	127	83	84	85	86	87	87	88
	50th	95	96	98	100	102	103	104	57	58	59	60	61	61	62
	90th	109	110	112	114	115	117	118	72	73	74	75	76	76	77
	95th	113	114	116	118	119	121	121	76	77	78	79	80	81	81
	99th	120	121	123	125	127	128	129	84	85	86	87	88	88	89

Age (year)	BP Percentile	Systolic BP (mmHg)							Diastolic BP (mmHg)						
		Percentile of Height							Percentile of Height						
		5th	10th	25th	50th	75th	90th	95th	5th	10th	25th	50th	75th	90th	95th
	50th	97	98	100	102	103	105	106	58	59	60	61	61	62	63
	90th	111	112	114	115	117	119	119	73	73	74	75	76	77	78
	95th	115	116	117	119	121	122	123	77	78	79	80	81	81	82
	99th	122	123	125	127	128	130	130	85	86	86	88	88	89	90
	50th	99	100	102	104	105	107	107	59	59	60	61	62	63	63
	90th	113	114	115	117	119	120	121	74	74	75	76	77	78	78
	95th	117	118	119	121	123	124	125	78	78	79	80	81	82	82
	99th	124	125	127	129	130	132	132	86	86	87	88	89	90	90
	50th	101	102	104	106	108	109	110	59	60	61	62	63	63	64
	90th	115	116	118	120	121	123	123	74	75	75	76	77	78	79
	95th	119	120	122	123	125	127	127	78	79	80	81	82	82	83
	99th	126	127	129	131	133	134	135	86	87	88	89	90	90	91
	50th	104	105	106	108	110	111	112	60	60	61	62	63	64	64
	90th	117	118	120	122	124	125	126	75	75	76	77	78	79	79
	95th	121	122	124	126	128	129	130	79	79	80	81	82	83	83
	99th	128	130	131	133	135	136	137	87	87	88	89	90	91	91
	50th	106	107	109	111	113	114	115	60	61	62	63	64	65	65
	90th	120	121	123	125	126	128	128	75	76	77	78	79	79	80
	95th	124	125	127	128	130	132	132	80	80	81	82	83	84	84
	99th	131	132	134	136	138	139	140	87	88	89	90	91	92	92

Age (year)	BP Percentile	Systolic BP (mmHg)							Diastolic BP (mmHg)						
		Percentile of Height							Percentile of Height						
		5th	10th	25th	50th	75th	90th	95th	5th	10th	25th	50th	75th	90th	95th
	50th	109	110	112	113	115	117	117	61	62	63	64	65	66	66
	90th	122	124	125	127	129	130	131	76	77	78	79	80	80	81
	95th	126	127	129	131	133	134	135	81	81	82	83	84	85	85
	99th	134	135	136	138	140	142	142	88	89	90	91	92	93	93
	50th	111	112	114	116	118	119	120	63	63	64	65	66	67	67
	90th	125	126	128	130	131	133	134	78	78	79	80	81	82	82
	95th	129	130	132	134	135	137	137	82	83	83	84	85	86	87
	99th	136	137	139	141	143	144	145	90	90	91	92	93	94	94
	50th	114	115	116	118	120	121	122	65	66	66	67	68	69	70
	90th	127	128	130	132	134	135	136	80	80	81	82	83	84	84
	95th	131	132	134	136	138	139	140	84	85	86	87	87	88	89
	99th	139	140	141	143	145	146	147	92	93	93	94	95	96	97

Blood pressure levels for Girls by age and height percentile

Age (year)	BP Percentile	Systolic BP (mmHg)							Diastolic BP (mmHg)						
		Percentile of Height							Percentile of Height						
		5th	10th	25th	50th	75th	90th	95th	5th	10th	25th	50th	75th	90th	95th
	50th	83	84	85	86	88	89	90	38	39	39	40	41	41	42
	90th	97	97	98	100	101	102	103	52	53	53	54	55	55	56
	95th	100	101	102	104	105	106	107	56	57	57	58	59	59	60
	99th	108	108	109	111	112	113	114	64	64	65	65	66	67	67
	50th	85	85	87	88	89	91	91	43	44	44	45	46	46	47
	90th	98	99	100	101	103	104	105	57	58	58	59	60	61	61
	95th	102	103	104	105	107	108	109	61	62	62	63	64	65	65
	99th	109	110	111	112	114	115	116	69	69	70	70	71	72	72
	50th	86	87	88	89	91	92	93	47	48	48	49	50	50	51
	90th	100	100	102	103	104	106	106	61	62	62	63	64	64	65
	95th	104	104	105	107	108	109	110	65	66	66	67	68	68	69
	99th	111	111	113	114	115	116	117	73	73	74	74	75	76	76
	50th	88	88	90	91	92	94	94	50	50	51	52	52	53	54
	90th	101	102	103	104	106	107	108	64	64	65	66	67	67	68
	95th	105	106	107	108	110	111	112	68	68	69	70	71	71	72
	99th	112	113	114	115	117	118	119	76	76	76	77	78	79	79

Age (year)	BP Percentile	Systolic BP (mmHg)							Diastolic BP (mmHg)						
		Percentile of Height							Percentile of Height						
		5th	10th	25th	50th	75th	90th	95th	5th	10th	25th	50th	75th	90th	95th
	50th	89	90	91	93	94	95	96	52	53	53	54	55	55	56
	90th	103	103	105	106	107	109	109	66	67	67	68	69	69	70
	95th	107	107	108	110	111	112	113	70	71	71	72	73	73	74
	99th	114	114	116	117	118	120	120	78	78	79	79	80	81	81
	50th	91	92	93	94	96	97	98	54	54	55	56	56	57	58
	90th	104	105	106	108	109	110	111	68	68	69	70	70	71	72
	95th	108	109	110	111	113	114	115	72	72	73	74	74	75	76
	99th	115	116	117	119	120	121	122	80	80	80	81	82	83	83
	50th	93	93	95	96	97	99	99	55	56	56	57	58	58	59
	90th	106	107	108	109	111	112	113	69	70	70	71	72	72	73
	95th	110	111	112	113	115	116	116	73	74	74	75	76	76	77
	99th	117	118	119	120	122	123	124	81	81	82	82	83	84	84
	50th	95	95	96	98	99	100	101	57	57	57	58	59	60	60
	90th	108	109	110	111	113	114	114	71	71	71	72	73	74	74
	95th	112	112	114	115	116	118	118	75	75	75	76	77	78	78
	99th	119	120	121	122	123	125	125	82	82	83	83	84	85	86
	50th	96	97	98	100	101	102	103	58	58	58	59	60	61	61
	90th	110	110	112	113	114	116	116	72	72	72	73	74	75	75
	95th	114	114	115	117	118	119	120	76	76	76	77	78	79	79
	99th	121	121	123	124	125	127	127	83	83	84	84	85	86	87

Age (year)	BP Percentile	Systolic BP (mmHg)							Diastolic BP (mmHg)						
		Percentile of Height							Percentile of Height						
		5th	10th	25th	50th	75th	90th	95th	5th	10th	25th	50th	75th	90th	95th
	50th	98	99	100	102	103	104	105	59	59	59	60	61	62	62
	90th	112	112	114	115	116	118	118	73	73	73	74	75	76	76
	95th	116	116	117	119	120	121	122	77	77	77	78	79	80	80
	99th	123	123	125	126	127	129	129	84	84	85	86	86	87	88
	50th	100	101	102	103	105	106	107	60	60	60	61	62	63	63
	90th	114	114	116	117	118	119	120	74	74	74	75	76	77	77
	95th	118	118	119	121	122	123	124	78	78	78	79	80	81	81
	99th	125	125	126	128	129	130	131	85	85	86	87	87	88	89
	50th	102	103	104	105	107	108	109	61	61	61	62	63	64	64
	90th	116	116	117	119	120	121	122	75	75	75	76	77	78	78
	95th	119	120	121	123	124	125	126	79	79	79	80	81	82	82
	99th	127	127	128	130	131	132	133	86	86	87	88	88	89	90
	50th	104	105	106	107	109	110	110	62	62	62	63	64	65	65
	90th	117	118	119	121	122	123	124	76	76	76	77	78	79	79
	95th	121	122	123	124	126	127	128	80	80	80	81	82	83	83
	99th	128	129	130	132	133	134	135	87	87	88	89	89	90	91
	50th	106	106	107	109	110	111	112	63	63	63	64	65	66	66
	90th	119	120	121	122	124	125	125	77	77	77	78	79	80	80
	95th	123	123	125	126	127	129	129	81	81	81	82	83	84	84
	99th	130	131	132	133	135	136	136	88	88	89	90	90	91	92

Age (year)	BP Percentile	Systolic BP (mmHg)							Diastolic BP (mmHg)						
		Percentile of Height							Percentile of Height						
		5th	10th	25th	50th	75th	90th	95th	5th	10th	25th	50th	75th	90th	95th
	50th	107	108	109	110	111	113	113	64	64	64	65	66	67	67
	90th	120	121	122	123	125	126	127	78	78	78	79	80	81	81
	95th	124	125	126	127	129	130	131	82	82	82	83	84	85	85
	99th	131	132	133	134	136	137	138	89	89	90	91	91	92	93
	50th	108	108	110	111	112	114	114	64	64	65	66	66	67	68
	90th	121	122	123	124	126	127	128	78	78	79	80	81	81	82
	95th	125	126	127	128	130	131	132	82	82	83	84	85	85	86
	99th	132	133	134	135	137	138	139	90	90	90	91	92	93	93
	50th	108	109	110	111	113	114	115	64	65	65	66	67	67	68
	90th	122	122	123	125	126	127	128	78	79	79	80	81	81	82
	95th	125	126	127	129	130	131	132	82	83	83	84	85	85	86
	99th	133	133	134	136	137	138	139	90	90	91	91	92	93	93

GENERAL AND SUPPORTIVE MEASURES

» There is a strong association between overweight patients and high blood pressure.
» The majority of these patients have mild hypertension and usually only need lifestyle modification.
» Acute hypertension:
  > Bed rest – fowler's position.
  > Control fluid intake and output (restriction).
  > Restrict dietary sodium.
  > Manage end organ effects.
» Chronic hypertension:
  > 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.

4.11.1 HYPERTENSION, ACUTE SEVERE

I10

For acute or chronic hypertension, blood pressure needs to be lowered cautiously.
Initiate medicines for sustained control as soon as possible to maintain the effect when the emergency measures are discontinued.

Rate of BP reduction depends upon starting BP and age of the child.
In the absence of central nervous system signs, acute hypertension can be rapidly controlled over 24 hours. If in doubt about the duration of hypertension, reduce BP slower over 48 hours.

Aim to reduce the systolic BP with not more than ⅓ of the interval between the patient's systolic blood pressure and the 95th percentile for that age or height in the first 8 hours, then a further gradual decline over the next 24–48 hours.
Do not decrease BP to < 95th percentile in first 24 hours.

GENERAL AND SUPPORTIVE MEASURES

» Admit patient to paediatric intensive care unit, if possible.
» Monitor BP every 10 minutes until stable, thereafter every 30 minutes for 24 hours.
» Set up two peripheral intravenous drips.

MEDICINE TREATMENT

Do not combine medicines of the same class.

- Furosemide, IV, 1–2 mg/kg as a bolus slowly over 5 minutes.
  - If oliguric, maximum dose: 5 mg/kg/dose.
  - Repeat appropriately for fluid overload.

AND

- Labetalol, IV, 0.5–3 mg/kg/hour.
  - 100 mg labetalol in 80 mL sodium chloride 0.45% = 1 mg/mL.
  - Infuse with infusion pump.
  - Give bolus of 0.5 mg/kg and then titrate the dose slowly upwards until the desired blood pressure is achieved.
  - Repeat based on BP response.

If there is an inadequate response:

ADD

- Amlodipine, oral, 0.2 mg/kg/dose.
  - May be repeated after 12 hours.
  - Thereafter every 24 hours.

If phaeochromocytoma suspected use an alpha blocker instead of amlodipine while tapering labetalol, e.g.:

- Prazosin, oral, 12 hourly.
  - 1 month to 18 years: 0.005 mg/kg as a test dose, then 0.025-0.1mg/kg adjusted according to response.

LoE III[iii]

In patients with hypertension due to a neurosecretory tumour (phaeochromocytoma or neuroblastoma), use an α-blocker either as single medicine or in combination with β-adrenergic blocker.

Once blood pressure is controlled, taper to oral treatment.
See section 4.11.2 Hypertension, chronic.

URGENT REFERRAL

» Severe hypertension for specific diagnosis and treatment.

4.11.2 HYPERTENSION, CHRONIC

I10

DESCRIPTION

Primary/Essential hypertension

Occurs most commonly in adolescents.
The patient is often asymptomatic and well.
It is diagnosed by excluding underlying causes of hypertension.
Hypertension is confirmed by sustained high blood pressure measured on 3 follow-up occasions.

Chronic secondary hypertension

All children with incurable forms of persistent secondary hypertension require medicine treatment over and above general and supportive measures.

DIAGNOSTIC CRITERIA

Investigations

» Urine dipstick test.
» Urine MCS.
» Blood urea, calcium, creatinine and electrolytes.
» Chest X-ray, ECG and abdominal ultrasound.

If all tests are negative, start lifestyle intervention.

GENERAL AND SUPPORTIVE MEASURES

» Introduce physical activity, diet management and weight reduction, if obese.
» Advise teenagers against smoking.
» 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;
  > if BP is stable but persistently > 95th percentile and secondary causes have been excluded, start medicine treatment after failed non-drug management for 6 months.
» Consider earlier initiation of medicine treatment if positive family history for cardiovascular disease, essential hypertension or diabetes mellitus.

MEDICINE TREATMENT

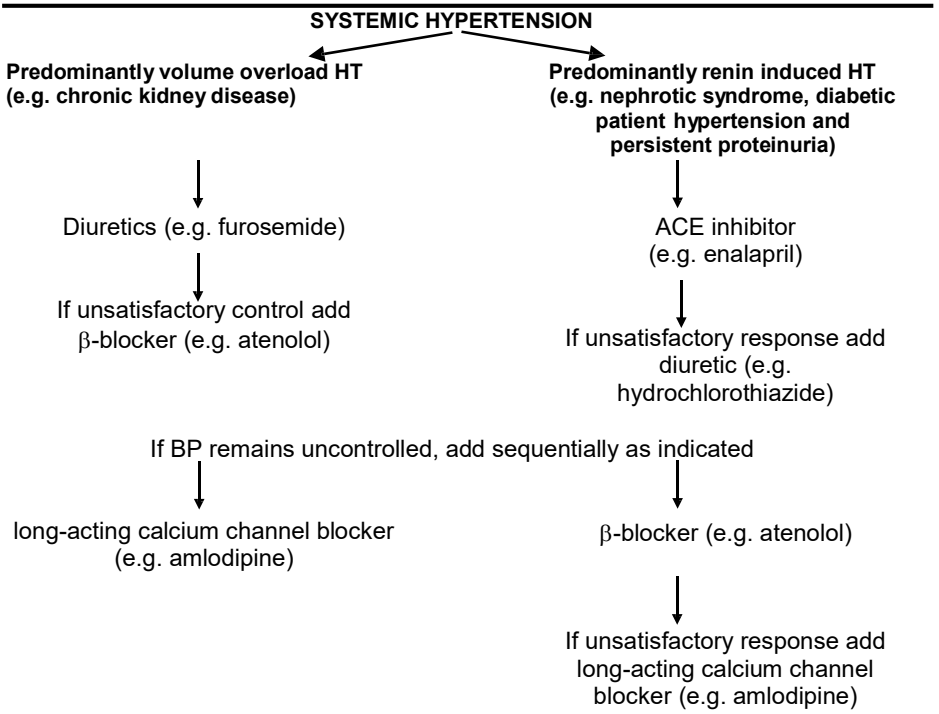
Goal of treatment in uncomplicated primary hypertension with no target-organ damage is to achieve BP < 95th percentile. For chronic renal disease, diabetes or hypertension with target-organ damage, target is BP < 90th percentile.
Medicine treatment is initiated for Stage 2 hypertension. Consider therapy in Stage 1 hypertension if there is a family history of cardiovascular disease, hypertension or diabetes.

Aim to achieve control of BP over 48–72 hours in symptomatic patients.

For ambulatory patients start at the lowest dose of the preferred medicine and increase the dose until control is achieved.

Once the highest recommended dose is reached or if the patient experiences adverse effects from the medicine, add a second medicine from a different class.
For patients with persistent hypertension despite the use of first line medicine, add a second/third medicine. There is no specific order in which medicine should be added.

Use specific classes of antihypertensive medicine according to the underlying pathogenesis or illness.



ACE inhibitor

Contraindicated in bilateral renal artery stenosis.

- Enalapril, oral, 0.04 mg/kg/dose 12 hourly.
  - Maximum 0.3 mg/kg/dose up to 40 mg/day.

OR

For young children less than 10 kg body weight:

- Captopril, oral.
  - Initial dose: 0.1 mg/kg/dose 8 hourly.
  - Maximum 2 mg/kg/dose.

β-blocker

- Atenolol, oral, 0.5–1 mg/kg/dose once daily.
  - Maximum dose: 2 mg/kg/day.
  - Contraindicated in severe heart failure and asthma.

OR

If child less than 10 kg body weight:

- Propranolol, oral, 0.25–1 mg/kg/dose 8–12 hourly.
  - Maximum dose: 1.5 mg/kg/dose.

Calcium channel blocker

- Amlodipine, oral, 0.1–0.2 mg/kg/dose once daily.

Diuretic

- Hydrochlorothiazide, oral, 0.5–1 mg/kg/dose once daily.
  - o May cause hypokalaemia.

OR

- Furosemide, oral, 0.5–1.5 mg/kg/dose 12–24 hourly.
  - o Maximum dose: 6 mg/kg/day.
  - o May cause hypokalaemia.

α-blocker,
Also indicated in patients with phaeochromocytoma-associated hypertension.

- Prazosin, oral, 12 hourly.
  - o 1 month to 18 years: 0.005 mg/kg as a test dose, then 0.025-0.1mg/kg adjusted according to response.

LoE III [iii]

REFERRAL

» All children with chronic hypertension for specific diagnosis, planning of treatment and long-term follow-up.

4.12 CHILDREN WITH PROSTHETIC HEART VALVES

Z95.2

DESCRIPTION

Valve replacement may be required for severe valvular disease when valve repair is not feasible or advisable. The valves may be mechanical valves or bioprosthetic valves or preserved human tissue valves.

In children bioprosthetic valves tend to degenerate, calcify and have structural deterioration more frequently and more rapidly compared with adults.
Mechanical valves are more commonly used in children.

Complications include:

» Valve failure. May be abrupt (tearing of components) or gradual (with calcification and stiffening of leaflets).
» Prosthetic valve thrombosis.
» Prosthetic valve endocarditis.
» Haemolytic anaemia.

MEDICINE TREATMENT

After mechanical valve replacement warfarin therapy is indicated to achieve an INR of 2.5 (range 2.0–3.0):

- Warfarin, oral, 0.1 mg/kg/daily.
  - o Adjust the dose depending on INR.
  - o Beware of haemorrhage.

PLUS

  - o Aspirin oral, 1mg/kg/day. In patients at a low risk of bleeding.

LoE III [xv]

Warfarin dose adjustment based on INR

INR < 1.5	Verify adherence. If non-adherent resume at previous dose. If dosage adjustments needed increase dose by 20% and review in 3 – 7 days.
INR 1.5–1.9	Verify adherence first. Increase maintenance dose by 10%.
INR 2.0–3.0	No change needed. In mitral valve prosthesis, INR should be closer to 3.0.
INR 3.1–4.0	Consider withholding one dose, and decrease by 10%.
INR 4.1–4.5	Decrease dose by 20%.
INR > 4.5	Withhold dose, evaluate INR daily until <4.5, then restart at 20% below previous dose.

The half-life of warfarin is 40 hours; dose adjustments may thus be calculated over a 48-hour period. The 10% and 20% dose adjustments may not be precisely achieved; approximate doses are acceptable.
If warfarin of 1 mg per tablet is not available and dosage adjustments are problematic discuss with paediatric cardiologist.
Some medicines and foods interfere with the warfarin effect.

Medicines that enhance anticoagulant effect include:
» allopurinol,
» aspirin,
» NSAIDS,
» paracetamol (regular use),
» valproate,
» phenytoin,
» imidazoles,
» metronidazole,
» macrolides, and
» quinolones.

Medicines that diminish anticoagulant effect include:
» carbamazepine,
» phenobarbital,
» phenytoin, (both diminished and enhanced effects have been reported)
» nevirapine,
» rifampicin.

Foods that contain high amounts of vitamin K and can decrease the effectiveness of warfarin, e.g.:

» spinach,
» parsley, and
» brussel sprouts.

Certain drinks can increase the effect of warfarin e.g. cranberry juice.

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CHAPTER 5

DERMATOLOGY

Skin lesions are best characterised by their morphologic appearance which allows consideration of a suitable differential diagnosis.

5.1 BULLAE

5.1.1 EPIDERMOLYSIS BULLOSA

Q81.9

DESCRIPTION

Congenital, hereditary blistering skin lesions with onset in the newborn. Lesions do not have an erythematous base. Loss of nails may occur.

GENERAL AND SUPPORTIVE MEASURES

» May require monitoring in high or intensive care unit.
» Aseptic aspiration of bullae on the side can be performed to relieve pressure (ensure the roof of the blister remains intact to protect underlying skin).
» Prevent infection with appropriate wound care.
» Attend to fluid and nutrition balance.

REFERRAL

» All cases.

5.1.2 STAPHYLOCOCCAL SCALDED SKIN SYNDROME

L00

DESCRIPTION

Blistering skin condition that presents like scalded skin.

GENERAL AND SUPPORTIVE MEASURES

» Appropriate wound care.

MEDICINE TREATMENT

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

OR

» Flucloxacillin, oral, 25 mg/kg/dose 6 hourly for 7 days.

LoE III[i]

For Pain Management:
Refer to Chapter 20: Pain Control, section 20.1.2 Management of Pain.

REFERRAL
» Recalcitrant cases.

5.1.3 CHRONIC BULLOUS DISEASE OF CHILDHOOD
L12.2

DESCRIPTION
Tense blisters that lead to ulceration involving the groin, face and trunk.

DIAGNOSTIC CRITERIA
» Skin biopsy with immunofluorescence.

GENERAL AND SUPPORTIVE MEASURES
» Appropriate wound care.

REFERRAL
» All cases.

5.2 ERYTHEMA AND DESQUAMATION

5.2.1 ERYTHEMA MULTIFORME
L51.9

DESCRIPTION
An acute, self-limiting and commonly recurrent inflammatory eruption of the skin with variable involvement of the mucous membranes and without systemic symptoms.

Symmetrically distributed crops of target lesions (dark centre, an inner, pale ring surrounded by an outer red ring) often involving palms and soles are characteristic. This condition is mainly caused by:
» medicines, e.g. sulphonamides, phenytoin, phenobarbitone,
» exposure to toxic substances, and
» infections, e.g. herpes simplex and mycoplasma.

Complications include:
» conjunctivitis,
» uveitis,
» corneal scarring,
» fluid loss,
» infections,
» anaemia, and
» oesophageal strictures.

DIAGNOSTIC CRITERIA

Iris or target lesions consisting of a dark centre, an inner pale ring and an erythematous outer border. In erythema multiforme these lesions are pathognomonic.

Erythematous macules evolve into papules, vesicles, bullae, urticarial plaques or patches of confluent erythema. The centre of the lesion may be vesicular, purpuric or necrotic.

Erythema multiforme minor

Prodromal symptoms are generally absent. Symmetric crops of skin lesions of diverse morphology, primarily on the extensor surfaces of the arms and legs and often including soles and palms with relative sparing of the mucous membranes and the trunk.

Erythema multiforme major (often equated with Stevens-Johnson syndrome)

A serious, systemic condition involving the skin and at least two mucous membranes.

Eruption may be preceded by non-specific prodromal symptoms including:

» malaise,
» fever,
» rigors, or
» upper respiratory tract infection.

Cutaneous lesions tend to rupture, leaving the skin denuded leading to fluid loss, with high risk of infection. Anaemia is common. The oral mucosa is frequently involved.

GENERAL AND SUPPORTIVE MEASURES

» 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.
» Encourage oral fluids, to prevent adhesions.
» Regular supervised oral, genital and eye care to prevent adhesions and scarring.
» 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.

MEDICINE TREATMENT

For pain:

These patients require effective pain control.

Change of dressing protocol: See Chapter 20: Pain Control.

Dressings
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

Antibiotic therapy
For secondary infections
Use IV antibiotics if the oral route cannot be used.
- Cloxacillin, IV, 50 mg/kg/dose 6 hourly.

OR
- Flucloxacillin, oral, 25mg/kg/dose 6 hourly.

LoE III[i, ii]

OR *(if flucloxacillin is unavailable)*
- 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.

If Herpes Simplex Virus (HSV) is suspected to be the cause:
- Aciclovir, oral, 250mg/m^2/dose 8 hourly for 7 days.

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
» Erythema multiforme not responding to adequate therapy.
» Erythema multiforme with ocular involvement.

5.2.2 STEVENS-JOHNSON SYNDROME (SJS)/TOXIC EPIDERMAL NECROSIS (TEN)
L51.1/ L51.2

DESCRIPTION
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), antiepileptics (phenytoin, phenobarbitone, carbamazepine, lamotrigine), allopurinol, laxatives (phenolphtalein).

Complications include:
» Dehydration, electrolyte disturbances and shock,
» Hypoalbuminaemia,
» hypo- and more commonly hyperthermia,
» high output cardiac failure,
» 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 MEASURES

» 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.

MEDICINE TREATMENT

For pain:
These patients require effective pain control.
Change of dressing protocol: See Chapter 20: Pain Control.

Dressings
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

- Flucloxacillin, oral, 25mg/kg/dose 6 hourly.

LoE III[i, iii]

OR *(if flucloxacillin is unavailable)*

- 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

» Discuss with a specialist, if considering re-initiation of medicine treatment.

5.3 MACULES AND PAPULES

5.3.1 DRUG REACTIONS

L27.0

Commonly associated with:

» sulphur-containing agents,
» penicillin,
» anti-epileptics (e.g. carbamazepine, lamotrigine),
» NSAIDs,
» anti-tuberculosis drugs, and
» non-nucleoside reverse transcriptase inhibitors.

A variety of rashes may occur, including:

» erythema multiforme (see section 5.2.1),
» uriticarial eruptions,
» measles-like maculopapular rash, or
» fixed drug reactions, which are flat or slightly raised, symmetrical patches of <0.5cm in size.

Lesions recur upon re-exposure to the causative agent and may present as blisters.

GENERAL AND SUPPORTIVE MEASURES

» Stop causative agents.

MEDICINE TREATMENT

Antihistamines:

For children 2 years and older:

- Cetirizine, oral, as a single dose.
  - Children 2 - 6 years: 5 mg.
  - Children 6 - 12 years: 10 mg.

LoE III[iv]

For children less than 2 years:

- Chlorphenamine, oral, 0.1mg/kg/dose as a single dose at night. (Maximum 4mg).

Where the oral route cannot be used:

- Promethazine, IV, 0.1 mg/kg/dose 8–12 hourly. (Maximum 25mg).

REFERRAL

» Systemic involvement with organ dysfunction.

5.3.2 ACNE

L70

DESCRIPTION

An inflammatory condition of hair follicles leading to comedone formation that can cause scarring and post inflammation hyper-pigmentation.

DIAGNOSTIC CRITERIA

» Black or white heads (comedones).

GENERAL AND SUPPORTIVE MEASURES

» Avoid greasy and oily topical products.
» Discourage excessive facial washing.

MEDICINE TREATMENT

- Doxycycline, oral, 100 mg once daily for a maximum of three months.

If ineffective, after 3 months:

To limit skin irritation, introduce topical retinoids, gradually at night.

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.
  - To prevent irritation, introduce tretinoin gradually - apply on alternate days for 1 - 2 weeks.

- o Limit exposure to sunlight, especially with concomitant use of doxycycline.

Tretinoin is teratogenic. Do not use where pregnancy is a possibility. If used, ensure adequate contraception. Teratogenic risk also applies to males.

To avoid sun irritation:

- Sunscreen, topical, applied daily.

REFERRAL

» Recalcitrant and/or fulminant acne.
» Psychologically disturbed or depressed patient.
» Young females with premenstrual flare or with clinical signs of hyperandrogenism for consideration of oral contraceptives.

5.3.3 CELLULITIS AND ERYSIPELAS

L03.9/A46

DESCRIPTION

Infection of the skin and subcutaneous tissue usually caused by streptococci, staphylococci or *H. influenzae.* In cellulitis, the border of the lesion is indistinct.

Erysipelas

The affected area is:

» well demarcated with clear borders,
» very tender and warm,
» bright red and swollen.

Erysipelas must be distinguished from necrotising fasciitis, where there is infection and inflammation by a gas-forming organism that spreads rapidly along the fascial tissue.
Complications include septicaemia.

DIAGNOSTIC CRITERIA

» Acutely ill child with fever and malaise.
» Affected area is swollen, indurated, erythematous and tender, with regional lymphadenopathy.

GENERAL AND SUPPORTIVE MEASURES

» Ensure adequate nutrition and hydration.
» Elevate the affected limb to reduce swelling.
» Exclude eczema, immunocompromised state, diabetes and underlying osteomyelitis.

MEDICINE TREATMENT

Choice of intravenous or oral antibiotics depends on the severity of the condition.

Severe disease

- Cloxacillin, IV, 50 mg/kg/dose 6 hourly for 5 days.

Non-severe disease

- Flucloxacillin, oral, 25mg/kg/dose 6 hourly for 7 days.

LoE III[1]

- **OR** *(if flucloxacillin is unavailable)*
- Cephalexin, oral, 12.5–25 mg/kg/dose 6 hourly for 7 days.
  - Child < 2 years: 125 mg.
  - Child 2–10 years: 250 mg.
  - > 10 years: 500 mg.

Penicillin allergy
Macrolide, e.g.:

- Azithromycin, oral, 10 mg/kg/day, for 3 days.

For pain:

- Paracetamol, oral, 15 mg/kg/dose, 6 hourly as required.

If needed **ADD**:

- Ibuprofen, oral, 5–10 mg/kg/dose, 6-8 hourly for 72 hours.
  - Child <30 kg, maximum dose: 500 mg/day.

REFERRAL

» **Urgent**: necrotising fasciitis.
» Poor response to therapy.
» Recurrent cellulitis.

5.3.4 ECZEMA

L20.9

DESCRIPTION

An inflammatory itchy skin condition characterised by:
» Vesicles, weeping and crusting during the acute stage.
» Scaling and lichenification during the chronic stage.

DIAGNOSTIC CRITERIA

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

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.

MEDICINE TREATMENT

Antihistamine

For children 2 years and older:

- Cetirizine, oral, as a single dose.
  - Children 2 - 6 years: 5 mg.
  - Children 6-12 years: 10 mg.

LoE III [iv]

For children less than 2 years:

- Chlorphenamine, oral, 0.1mg/kg/dose as a single dose at night. (Maximum 4mg).

To relieve skin dryness:

- Emulsifying ointment.

For baths, as a soap substitute:

- Aqueous cream.

For the face and skin folds:

- Hydrocortisone 1%, topical, 12 hourly.

For the body:

- Betamethasone 0.1%, topical, undiluted applied once daily for 7 days.
  - Moisturise with emulsifying ointment during therapy and in subsequent weeks.

Secondary infection:

Bacterial

- Cephalexin, oral, 6.25–12.5 mg/kg/dose, 6 hourly.

Viral

If HSV suspected:

- Aciclovir, oral, 250mg/m^2/dose 8 hourly for 7 days

Note:

Short-term use of topical steroids is recommended.
Oral corticosteroids do not have a role in the management of this condition.

REFERRAL

» Recalcitrant cases.
» Concomitant food allergy (allergy clinic).

5.3.5 CANDIDIASIS

B37.2

DESCRIPTION

Skin infection involving axillae, neck and perineum. Commonly occurs in immunocompromised individuals. Involvement of mouth and perineal regions suggests systemic disease.

DIAGNOSTIC CRITERIA

Clinical

» Red, raw-looking patches with satellite white pustular lesions on an erythematous base.
» Mucosal involvement.

Investigations

» Wet preparation with potassium hydroxide or biopsy and culture.

GENERAL AND SUPPORTIVE MEASURES

» Control underlying immunosuppressive state, e.g. diabetes, HIV.
» Personal hygiene of mothers prior to breast-feeding.

MEDICINE TREATMENT

- Imidazole cream 1%, e.g. clotrimazole, topical, applied 8 hourly for 14 days.

If no response:

- Fluconazole, oral, 3–6 mg/kg/day for 14 days.

REFERRAL

» Recalcitrant infection.

5.3.6 PSORIASIS

L40.9

DESCRIPTION

An inflammatory condition of the skin and joints.

DIAGNOSTIC CRITERIA

» Scaly, red, itchy papules and plaques over scalp, perineum, and skin folds and extensor surfaces.
» Nails may be opaque, deformed and crumbling.
» Occasional pustules are seen.

GENERAL AND SUPPORTIVE MEASURES

» Avoid precipitants, e.g. medication (such as antiepileptic and antimalarial agents).

MEDICINE TREATMENT

Local plaques

To remove scales in children 12 years and older:

- Salicylic acid 2% and coal tar in white soft paraffin, applied 8 hourly.

OR

- Face: Hydrocortisone 1%, topical, applied 12 hourly.
- Body: Betamethasone 0.1%, topical, applied 12 hourly.

For scalp lesions:

- Mild coal tar shampoo.
  OR
- Betamethasone 1% scalp application, apply 12 hourly.

Severe pustular psoriasis (in consultation with a specialist)

- Prednisone, oral, 1–2 mg/kg as a single daily dose for 7 days.

REFERRAL

» Severe psoriasis and recalcitrant cases.
» Intolerance to salicylic acid.
» No response to treatment.

5.3.7 URTICARIA

L50.9

DESCRIPTION

An itchy, inflammatory skin and mucosal condition recognised by wheal and flare reaction. May be acute or chronic, often due to irritants, insect bites or allergens. Secondary infective features include excoriation, vesicles and pigmentary changes. Chronic papular eruptive urticaria is often seen in HIV infected individuals.

DIAGNOSTIC CRITERIA

» History of a recent infection or parasitic infestation.
» History of allergen exposure.
» Wheal and flare reaction (“hives”).
» Positive skin test if due to allergy.

GENERAL AND SUPPORTIVE MEASURES

» Limit exposure to precipitants, e.g. drugs, allergens and toxins.
» Limit exposure to insects by using topical insect repellent which contains more than 10% diethyltoluamide (DEET).
» Search for and treat an underlying infection or parasitic infestation.
» Wrap with dressings soaked in sodium chloride 0.9%.

MEDICINE TREATMENT

- Chlorphenamine, oral, 0.1 mg/kg/dose as a single dose at night.

AND

- Betamethasone 0.1%, topical, applied twice daily as required.
  - Useful when applied immediately after insect bite.

Severe chronic urticaria

For children 2 years and older:

- Cetirizine, oral, as a single dose.
  - Children 2 - 6 years: 5 mg.
  - Children 6-12 years: 10 mg.

LoE III[iv]

REFERRAL

» Recurrent cases.
» Recalcitrant and chronic cases.

5.3.8 TINEA CAPITIS

B35.0

Refer to the Primary Healthcare Standard Treatment Guidelines and Essential Medicines List, 2014:

- Chapter 5 Skin Conditions, section 5.5.2.3 Scalp infections - Tinea Capitis.

5.4. PURPURA

D69.9

5.4.1 MENINGOCOCCAEMIA

A39.2/A39.4

DESCRIPTION

Palpable bleeding into skin caused by *N. meningitides* and is associated with rapid spread.

This is a medical emergency and can be fatal.
See Chapter 8: Infective/Infectious Diseases, section 8.27: Sepsis.

5.4.2 HENOCH-SCHÖNLEIN PURPURA

D69.0

See Chapter 12: Rheumatology and Vasculitides, section 12.1: Henoch-Schönlein Purpura (HSP).

5.4.3 IMMUNE THROMBOCYTOPENIC PURPURA (ITP)

D69.3

See Chapter 3: Blood and Blood Forming Organs, section 3.10: Immune thrombocytopaenic purpura (ITP).

5.5. VESICLES AND PUSTULES

5.5.1 INFECTIONS

R23.8/L08.9

See Chapter 8: Infective/Infectious Diseases, section 8.25: Varicella (chickenpox) and section 8.26: Zoster.

5.5.2 SKIN AND MUCOSAL DISORDERS IN HIV

Skin and mucosal disorders are more severe in immune suppressed (HIV-infected) patients and may be worsened by IRIS. HIV may present initially with skin or mucosal lesions, or these lesions may develop during the course of the illness.

Lesions respond to antiretroviral therapy together with treatment for the specific skin and/or mucosal disorder. Skin eruptions or rashes are relatively common in HIV patients and may be due to antiretroviral and other medicines.

Conditions that are more common in patients with HIV, and may be present atypically include:

» Papular pruritic eruption.
» Kaposi sarcoma.

5.5.2.1 HIV PAPULAR PRURITIC ERUPTION

T78.4

DESCRIPTION

Chronic itchy condition with a relapsing course. In HIV-infected patients, insect bites may be severe and recalcitrant with post inflammatory pigmentation and scarring.

DIAGNOSTIC CRITERIA

» Initial lesion is a pruritic urticarial spot with a central red punctum.
» Lesions progress to pruritic papules with or without blisters. Scratching lesions may cause inflammatory changes, erosions, crusts or scabs with secondary infection.
» Post inflammatory pigmentation and scarring are common.

GENERAL AND SUPPORTIVE MEASURES

» Prevent insect bites with use of, insect repellents. Eradicate fleas and other insects.

MEDICINE TREATMENT

- Calamine lotion, topical, applied as needed.

AND

- Chlorphenamine, oral, 0.1 mg/kg/dose 6 hourly.

AND

- Betamethasone 0.1%, topical, applied 12 hourly for 3 days.

THEN, until pruritus subsides:

- Face: Hydrocortisone 1%, topical applied 12 hourly.
- Body: Betamethasone 0.1%, topical applied 12 hourly

Treat secondary infection with an appropriate antibiotic, if indicated.

Treatment of HIV. See Chapter 9: Human immunodeficiency Virus Infections.

REFERRAL

» No response to treatment.

5.5.2.2 KAPOSI SARCOMA

C46.9

DESCRIPTION

Kaposi sarcoma is a vascular tumour that can present anywhere on the skin and oral mucosa. Lymph nodes and internal organs, primarily lungs and gastrointestinal tract, may also be involved.

It is associated with human herpes virus 8 and occurs most commonly in immunocompromised HIV-infected patients.
It can be asymptomatic and indolent or aggressive, characterised by explosive growth and death.

DIAGNOSTIC CRITERIA

» Presents with skin lesions on the limbs particularly the lower leg and foot, but may occur anywhere on the body.
» Lesions (skin and mucosal) may be bruise-like patches, purple or purple-red plaques, subcutaneous papules or nodules.
» Lymphoedema, ulceration and secondary bacterial infection may occur.

GENERAL AND SUPPORTIVE MEASURES

» Counselling to assist patient in dealing with the condition.

MEDICINE TREATMENT

- Manage in consultation with an oncologist.
- Treat secondary infection with an appropriate antibiotic, if indicated.
- Treatment of HIV. See Chapter 9: Human immunodeficiency virus infections.
- Supportive treatment, e.g. pain. See section 20.1: Management of pain.

REFERRAL

» All suspected cases for initial diagnosis.
» Kaposi sarcoma cases unresponsive to ART.
» Extensive progressive disease.

5.5.2.3 WARTS

B07

MEDICINE TREATMENT

Common warts

- Salicylic acid 25% ointment, applied under plaster nightly.
  - Protect surrounding skin with petroleum jelly.
  - Repeat until the wart falls off.

Genital warts

- Podophyllin resin 20%, applied under plaster nightly.
  - Protect surrounding skin with petroleum jelly.
  - Repeat until the wart falls off.

REFERRAL

» Extensive warts involving the face.
» Genital warts: Refer to STI clinic.

5.5.3 IMPETIGO

L01

Refer to the Primary Healthcare Standard Treatment Guidelines and Essential Medicines List, 2014:

- Chapter 5 Skin Conditions, section 5.4.2 Impetigo.

5.5.4 CUTANEOUS HAEMANGIOMAS

D18.0

DESCRIPTION

Benign tumours of the vascular endothelium that may be classified as either congenital or infantile. They are characterised by abnormal proliferation of endothelial cells and abnormal blood vessel architecture.

» Congenital haemangiomas: fully grown at birth, and are either rapidly involuting or non-involuting.
» Infantile haemangiomas: Usually appear before 4 weeks of age and continue to grow until 5 months.

DIAGNOSTIC CRITERIA

» Most haemangiomas can be diagnosed clinically.

GENERAL AND SUPPORTIVE MEASURES

» Counselling to assist patient in dealing with the condition.

REFERRAL

- Life-threatening haemangiomas (airways), function-threatening haemangiomas, ulcerating lesions; for consideration of propranolol.
- Diagnostic uncertainty.
- Failure to respond to therapy.
- Peri-ocular haemangioma.
- Suspected airway haemangioma.
- Large segmental haemangioma on face, neck, or vital organ for echocardiogram.
- Propranolol pre-treatment evaluation reveals cardiac or pulmonary abnormalities.
- Multiple haemangiomas (> 5 lesions).

References

[i] Flucloxacillin dose: The British National Formulary for Children 2014-2015. BMJ Group, Pharmaceutical Press, RCPCH Publication Ltd.
[ii] Flucloxacillin dose: South African Medicines Formulary. 11th Edition. Division of Clinical Pharmacology. University of Cape Town. 2014
[iii] Flucloxacillin dose: South African Medicines Formulary. 11th Edition. Division of Clinical Pharmacology. University of Cape Town. 2014
[iv] Cetirizine: South African Medicines Formulary. 11th Edition. Division of Clinical Pharmacology. University of Cape Town. 2014

CHAPTER 6

NEPHROLOGICAL/UROLOGICAL DISORDERS

6.1. POST STREPTOCOCCAL GLOMERULONEPHRITIS

N00.9

DESCRIPTION

Acute post-streptococcal glomerulonephritis 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 mesangium of the glomeruli.

DIAGNOSTIC CRITERIA

Clinical

» Occurs predominantly in children 3–12 years old.
» Presents 1–3 weeks after streptococcal pharyngitis or skin infection (impetigo).
» Characteristic features include:
  > facial or generalised oedema,
  > painless macroscopic haematuria (smoky or tea coloured urine),
  > oliguria, and
  > hypertension.

Special investigations to confirm APSGN

Urine analysis	
Macroscopic appearance	smokey, 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 ASO or Anti-DNAseB titre	positive in the absence of prior antibiotic treatment (ASO often negative in preceding skin infections)
Complement study C_3 C_4	 decreased normal
S-biochemistry	
Serum electrolytes	dilutional hyponatraemia, hyperchloraemic hyperkalaemic metabolic acidosis is common
S-Urea & creatinine	mildly elevated in the acute phase
Full blood count	dilutional anaemia; thrombocyte count is normal

GENERAL AND SUPPORTIVE 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**: Do not give fluid.
  > **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.

IMPORTANT
Insensible water loss is calculated as: • Neonates and young babies: 30 - 40 mL/kg/day • Older children: 25 mL/kg/day (400 mL/m^2/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.

MEDICINE TREATMENT

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 (depot formulation), IM, 30 000 units/kg/dose, 2 doses given 5 days apart.
  o Maximum dose: 1.2 million units.

For severe penicillin allergy:

- Refer to Chapter 24 Drug Allergy, section 24.4.1: Allergies to Penicillins.

Hypertension

Hypertension usually develops acutely due to fluid overload and presents as hypertension emergency (crisis), hypertension urgency or persistent significant hypertension. See Chapter 4: Cardiovascular System, Section 4.11: Hypertension in Children.

If Hypertensive emergency/crisis: Patient with signs of hypertensive encephalopathy, i.e. convulsions, retinal haemorrhages, visual loss and end organ disease e.g. left heart failure.

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 **Hypertensive urgency:** Symptomatic patients with significant elevation of blood pressure with complaints of headache, blurred vision and nausea but lacks the above clinical manifestations or persistent significant hypertension:

- Propranolol, oral, 1-2 mg/kg/dose, 6 hourly.
  - Maximum dose: 8 mg/kg/24 hours.

If blood pressure is not adequately controlled:

ADD

- Amlodipine, oral, 0.2 mg/kg/dose.
  - May be repeated 6 hours later, thereafter once every 24 hours.
  - Maximum dose: 5 mg.
  - Crush 5 mg tablet and disperse in 5 mL water: amlodipine 1 mg/mL.

Once blood pressure has normalised, taper and stop antihypertensive treatment. Monitor blood pressure over the next 48 hours to exclude rebound hypertension.

If Volume overloaded

See fluid management in general and supportive measures.

- 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:

See fluid management in general and supportive measures.

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

REFERRAL

Urgent (as soon as possible)

» 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.

For specialist advice

» Macroscopic haematuria persisting for more than 4 weeks or persistent proteinuria.
» Family history of renal disease.
» Streptococcal aetiology unproven (ASOT and anti-DNAseB negative, normal C_3 levels, decreased C_4 levels).
» Decreased complement levels which persist for more than 6 weeks.
» Persistent renal failure after initial recovery.
» Persistent hypertension.

6.2 URINARY TRACT INFECTION (UTI)

N39.0

DESCRIPTION

Bacterial infection of the urinary tract.

Uncomplicated urinary tract infection (UTI) is an infection, which is limited to the lower urinary tract, and there are no associated urological anomalies. It is seen most commonly in girls over two years of age.

Complicated urinary tract infection (UTI) is an infection of the urinary tract involving the renal parenchyma (acute pyelonephritis) or which is 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.

DIAGNOSTIC CRITERIA

Clinical

» Signs and symptoms are related to the age of the child and are often non-specific.
Uncomplicated urinary tract infections present with localising symptoms of dysuria, frequency, urgency, cloudy urine and lower abdominal discomfort. Urine test strip shows positive leucocyte esterase, nitrites and haematuria.

» Complicated infections may present with fever and other systemic features described below:

» Neonates may present with:
- > fever,
- > hypothermia,
- > poor feeding,
- > sepsis,
- > vomiting,
- > prolonged jaundice,
- > failure to thrive,
- > renal failure.

» Infants and children may present with:
- > failure to thrive,
- > persisting fever,
- > abdominal pain,
- > frequency,
- > dysuria,
- > enuresis or u rgency.

A urinary tract infection must be excluded in any child with fever of unknown origin.

Special investigations

» Urine bag specimens are used for screening purposes only.
- > When urine dipstick test of bag specimen reveals presence of leucocytes or nitrites, collect urine aseptically for urine MCS.
- > Urine specimen is collected aseptically:
  - by in/out catheter or suprapubic aspiration in acutely ill children < 2 years of age or in smaller children who are unable to co-operate **or**
  - by mid-stream clean catch method in older children.

» Criteria for the diagnosis of UTI:
- > any culture from a suprapubic urine sample,
- > a culture of > 10^4 col/mL urine of a single organism from a catheter specimen,
- > a pure culture of > 10^5 col/mL in a mid-stream clean catch sample or consistent culture of a pure growth even with counts as low as 10^4 col/mL.

» Ultrasound:
- > Do a renal ultrasound in **all** children with first UTI as soon as possible, unless a normal ultrasound was previously seen.

» MCUG:
- > in children who have abnormalities of the kidneys, ureter or bladder demonstrated by ultrasound.

GENERAL AND SUPPORTIVE MEASURES

» Ensure adequate nutrition and hydration. Maintain hydration with oral and/or IV fluids if necessary.
» For recurring infections:
  > avoid irritant soaps and bubble baths,
  > treat constipation, if present,
  > treat pinworm,
  > perineal hygiene,
  > regular complete emptying of the bladder and/or double voiding, i.e. making an additional attempt at voiding after the initial flow of urine has ceased.

Note: Consider the possibility of sexual abuse in children presenting with a UTI with genital, perineal and/or anal bruising, abrasions or lacerations; secondary incontinence or a marked fear of examination.

MEDICINE TREATMENT

Uncomplicated UTI

See the Standard Treatment Guidelines and Essential Medicines List for Primary Health Care Level.
NB: antibiotic therapy for 3 days only

LoE I[i]

Complicated UTI

Antibiotic therapy

Total duration of antibiotic therapy: 7 days.

IMPORTANT:
Increase duration to 10–14 days in infants who have acute pyelonephritis or septicaemia.

LoE I[ii]

The empiric choice of antibiotics depends on the expected sensitivity of the suspected organism. Review antibiotic choice once culture and sensitivity results become available.

Oral treatment:

Children > 3 months old, who are unwell but not acutely ill and who are not vomiting:
Children with uncomplicated UTI:

- Amoxicillin/clavulanic acid, oral, 25 mg/kg/dose of amoxicillin component 8 hourly.

Parenteral treatment:

All neonates and acutely ill infants should preferably be treated parenterally for the first few days until temperature has normalised and they are able to tolerate feeds.

- Amoxicillin/clavulanic acid, IV, 25 mg/kg/dose 8 hourly.

OR

- Ceftriaxone, IV, 80 mg/kg daily.

If there is no improvement after 24 hours of IV amoxicillin/clavulanic acid treatment, a resistant organism may be the cause, and treatment should be according to culture. Consult a specialist.

If there is evidence of good clinical response to amoxicillin/clavulanic acid alone, change to:

- Amoxicillin/clavulanic acid, oral, 25 mg/kg/dose of amoxicillin component 8 hourly.

Penicillin Allergy

See Chapter 24 Drug Allergies, section 24.4.1 Allergies to Penicillin.

For pain:

- Paracetamol, oral, 15 mg/kg/dose, 6 hourly as required.

For children with a structural or functional abnormality of the urinary tract:

Investigate for recurrent UTIs if the patient has temperature > 38.5˚C or symptoms of urinary tract infection by performing a urine dipstick test.

If positive leucocytes and/or nitrites in are present in fresh urine, collect urine aseptically for MCS and treat empirically as above for urinary tract infection.

Prophylactic Antibiotic Therapy:

Prophylaxis may be indicated in specific risk groups, i.e. for children < 2 years of age and who have a structural or functional abnormality of the urinary tract associated with increased risk of recurrent infections, i.e. grade III or more vesico-ureteric reflux. In this setting consult nephrologist and microbiologist.

Asymptomatic bacteriuria does not require treatment.
Use of long-term prophylactic antibiotic therapy for UTI is not recommended.

REFERRAL

» Poor response to adequate therapy, i.e. persistent positive urine culture and/or fever.
» If complicated urinary tract infection, i.e. obstruction is suspected or renal failure present.
» If recurrent urinary tract infections or repeated positive pure culture of any micro-organism.

6. 3 NEPHROTIC SYNDROME (NS)

N04

DESCRIPTION

Nephrotic syndrome (NS) is a clinical syndrome associated with massive proteinuria due to increased permeability of the glomerular basement membrane. Most children have primary (idiopathic) nephrotic syndrome associated with minimal change nephrotic syndrome (MCNS) or focal segmental glomerulosclerosis (FSGS). In an undefined proportion of patients, the disease is caused by genetic mutations in podocyte specific genes. Main causes of secondary nephrotic syndrome include infections (HIV, Hepatitis C), Systemic lupus erythematosis (SLE) and reflux nephropathy.

Main complications:

» Increased risk of infections with encapsulated organisms, *S. pneumoniae, E coli.* Chicken pox and measles are the main major viral infections.
» Hypercoagulable state: increased risk of arterial and venous thrombosis. Aggressive investigation and treatment may be necessary to prevent fatal pulmonary embolism.

DIAGNOSTIC CRITERIA

Clinical

» Massive proteinuria.
» Hypo-albuminaemia.
» Oedema.
» Hyperlipidaemia (hypercholesterolaemia).
» Usually normal blood pressure.
» Transient microscopic haematuria and/or hypertension in 25% of children.
» Usually normal renal function.

Investigations

» Urine test strip: ≥ 3+ proteinuria; may have trace to 1+ haematuria.
» Spot random urine sample protein:creatinine ratio: > 0.2 g/mmol.
» Urine microscopy: hyaline and lipid casts. May have occasional red and white blood cells.
» Serum albumin: < 25 g/L.
» S-urea and creatinine and electrolytes usually normal.
» S-cholesterol: increased.
» Investigations to exclude secondary causes of nephrotic syndrome, including: ASO and Anti-DNAseB titre, hepatitis B s-antigen, hepatitis C antibody, RPR, HIV and CMV antibodies.
» C3/C4
» Antinuclear factor antibody and anti-dsDNA.

A presumptive diagnosis of MCNS can be made in children:

» who are 2–6 years old and who have:
  > normal blood pressure,
  > normal renal function,
  > only a trace/1+ haematuria, but no red cell casts,
  > normal complement levels, and
  > in whom secondary causes have been excluded.

GENERAL AND SUPPORTIVE MEASURES

» Monitor fluid balance.
» Monitor urine output strictly and weigh daily (1 kg = 1 L of fluid).
» Assess hydration status.
  - Suspect
    - Hypovolaemia: in the presence of hypotension, small pulse volume and cold extremities.
    - Normovolaemia: with normal moist mucosa and normal blood pressure with well perfused limbs.
  - Replace ongoing extra-renal losses as for dehydrated child e.g. oral rehydration for gut losses, etc.

Continued weight gain or anuria is an indication for referral.

» Dietary measures:
  > Do not restrict oral fluid intake,
  > Restrict salt intake in all patients. No salt should be added during preparation of food and there should be no salt on the table during meals. Restrict all salt preserved foods.
  > Limit intake of saturated fat.
  > Normal energy intake.
  > Normal protein diet for all with normal renal function.

MEDICINE TREATMENT

Specific treatment of causative conditions where possible e.g.

» HIV infection.
» Syphilis infection.
» SLE.
» Streptococcal infection.

For hypovolaemia:

- Sodium chloride 0.9%, IV, 20 mL bolus, immediately over 10 minutes.

Replace ongoing extra-renal losses as for dehydrated child e.g. oral rehydration solution for gut losses, etc.

Note: Beware of intravascular volume depletion which can be induced by over aggressive diuresis. In patients with oedema, exclude hypovolaemia prior to the administration of furosemide.

For patients with oedema and hypervolaemia:

- Furosemide, oral, 1 mg/kg/dose, 12 hourly.

LoE III [iii]

AND

- Potassium chloride (100mg/ml), oral, 75 - 225 mg/kg/day (1-3 mmol/day or 0.75 -2.25 ml/kg/day) in divided doses.
  - Monitor serum potassium.

For patients with intractable oedema who fail to improve with furosemide treatment only:

ADD

- Hydrochlorothiazide oral, 1 mg/kg, once daily.
  - Do not exceed 12.5 mg daily.

For Severe ascites:

Add

- Spironolactone, oral 1.5 – 2.5 mg/kg/dose, 12 hourly.

For short term treatment of congenital nephrotic syndrome and for patients with oedema (anasarca), volume contraction and oliguria:

- Albumin, human 20% (salt poor solution), IV, 1 g/kg (i.e. 5 mL/kg) administered over 5 hours on 2 consecutive days.

AND

- Furosemide, IV, 2 mg/kg, slow IV infusion over 5 hours, i.e. 0.4 mg/kg/hour.

For all children with non-remitting nephrotic syndrome:

- Multivitamin, oral, 5 mL daily.
  (Formulation to include pyridoxine, other B vitamins, vitamin C 30 mg and vitamin D 400 IU)
- Folic acid, oral, 5 mg daily.
- Calcium (elemental), oral, 10–15 mg/kg/dose, 12 hourly.
  - Maximum dose: 1 000 mg (1 g) daily.
  - Calcium carbonate 420 mg = 168 mg elemental calcium.

Give all children with non-remitting nephrotic syndrome renoprotective treatment as for patients with chronic renal failure. IMPORTANT: Renoprotective strategies are not indicated in children with steroid responsive nephrotic syndrome.

- **ACE inhibitor**

An ACE inhibitor is given to decrease proteinuria, irrespective of presence or absence of systemic hypertension.
Begin with low dosage and titrate against response and blood pressure.

- Enalapril, oral, 0.1 mg/kg once daily.
  - Increase dose to 0.5 mg/kg/day, as a single dose or two divided doses.
  - Monitor for adverse effects: hyperkalaemia (increased risk when potassium sparing diuretic is used simultaneously) and acute renal failure (increased risk in children with impaired renal function or volume depletion).
  - Do not use if estimated CrCl < 30 mL/minute.

Cholesterol lowering drugs

For children > 8 years who have non-remitting nephrotic range proteinuria and persistent cholesterol levels > 7 mmol/L:

- HMGCoA reductase inhibitors (statin), e.g.:
- Simvastatin, oral, 10 mg at night.

Immunisation

Do not give live vaccines to patients receiving steroid and other immunosuppressive treatment.

Once in remission

Provide all other EPI vaccines according to the schedule.

In children > 2 years who received conjugate pneumococcal vaccine 13:

- Pneumococcal vaccine (polysaccharide), IM, 0.5 mL as a single dose

Give Varicella-zoster vaccine, 0.5mL, SC, 2 doses 6 weeks apart.

Check Hepatitis B immunity. In the absence of any immunity

- Hepatitis B vaccine, IM, 1 mL, 3 doses one month apart.
  - If the antibody level is considered non-protective or insufficient, give 2 booster doses one month apart.

Antibiotics

For patients with anasarca who have an increased risk for spontaneous pneumococcal peritonitis:

- Phenoxymethylpenicillin, oral, 125–250 mg, 12 hourly.

<u>For severe penicillin allergy:</u>

- Refer to Chapter 24 Drug Allergy, section 24.4.1: Allergies to Penicillins.

Corticosteroids

Initiate corticosteroid treatment only in consultation with a specialist.

In the absence of a histological diagnosis, empiric steroid treatment should only be given to children with presumed minimal change disease where a rapid response is expected.

In patients with initial macroscopic haematuria, persistent hypertension, persistent low C_3 and renal function impairment a diagnosis other than MCNS is suggested. These cases should be referred for kidney biopsy before steroid treatment is given.

Initial treatment (first course of steroid treatment)

- Prednisone, oral, 2 mg/kg/dose as a single dose in the morning for 4 weeks.
  - Maximum dose: 60 mg daily. If in remission
  - Taper dose over next 16 weeks as follows:
    - 2 mg/kg/dose as a single dose on alternate mornings for 4 weeks.
    - 1.5 mg/kg/dose as a single dose on alternate mornings for 4 weeks.
    - 1 mg/kg/dose as a single dose on alternate mornings for 4 weeks.
    - 0.5 mg/kg/dose as a single dose on alternate mornings for 4 weeks.

A shorter initial treatment course i.e. 8 weeks vs. 20 weeks is associated with more frequent relapses.

If the patient fails to achieve remission after 4 weeks of treatment, continue with the high dose for another 4 weeks (maximum of 8 weeks). Patients who go into remission must then the tapering regimen above. Patients who fail to go into remission after 8 weeks of steroid treatment are considered steroid resistant and should be referred for kidney biopsy.

IMPORTANT
Long-term corticosteroid treatment suppresses adrenal function. Therefore, additional steroids or steroid supplementation is necessary during periods of acute stress, e.g. surgery or septic shock.

Assessment of treatment response

For practical reasons a dipstick test is usually performed on a spontaneously voided urine sample instead of a 24-hour urine sample.

» Test urine every morning during corticosteroid treatment.
» Dipstick test should be negative for minimum of 3 consecutive mornings before decreasing the dose.
» If proteinuria recurs, go back one step in the suggested dose for a few more days before again attempting to decrease the dose.
» Some patients do not understand alternate day treatment schedules in which case daily dose of prednisone is given instead of alternate days.

Classifying treatment responses

» **Remission**: No/trace protein on urine test strip test for 3 consecutive days (spot sample urine protein:creatinine ratio < 0.02 g/mmol).
» **Steroid-sensitive NS**: No/trace protein on urine test strip for 3 consecutive days within 4 weeks after start of standard oral prednisone therapy.

» **Steroid-dependent NS:** Relapse develops during tapering of steroid treatment or within 2 weeks after stopping treatment.
» **Steroid-resistant NS**: Failure to achieve remission in spite of maximum 8 weeks' treatment with prednisone 2 mg/kg/day. (Spot sample urine protein:creatinine ratio > 0.02 g/mmol).
» **Relapse of NS**: 3+ proteinuria on urine test strip or urine protein:creatinine ratio > 0.2 g/mmol for 3 consecutive days.
» **Frequently-relapsing NS**: two or more relapses per 6 months or ≥ 4 per 12-month period.

Schedule for relapse: similar as initial course, but for shorter period:
» Prednisone, oral, 2 mg/kg/dose as a single daily dose for minimum of one week. Urine test strip should be negative for minimum of 3 consecutive mornings before the dose is decreased.
- Then taper dose as follows:
  - 2 mg/kg/dose as a single dose on alternate mornings for 2 weeks.
  - 1.5 mg/kg/dose as a single dose on alternate mornings for 2 weeks.
  - 1 mg/kg/dose as a single dose on alternate mornings for 2 weeks.
  - 0.5 mg/kg/dose as a single dose on alternate mornings for 2 weeks.
    - If proteinuria recurs, go back one step in the suggested dose for a few more days before again attempting to decrease the dose.

Second-line immunosuppressive treatment
» Second line immunosuppressive treatment is indicated in children with steroid sensitive nephrotic syndrome with frequently-relapsing NS, steroid-dependent NS and in those with steroid toxicity.
» It should only be prescribed after consultation with a paediatric nephrologist. It remains the prescriber's responsibility to monitor the patient at regular intervals for side effects of treatment.
  - Full blood count, urea, creatinine, electrolytes and albumin needs to be done every 10–14 days throughout the course of treatment.
» Second line immunosuppressive treatment for steroid sensitive nephrotic syndrome should only be started when the urine dipstick test is negative.
» It is always given in combination with steroid treatment.
» Kidney biopsy is preferably done before second line immunosuppressive treatment is started due to the risks associated with this treatment.

- Immunosuppressive Therapy - nephrologist initiated
  - Cyclophosphamide, oral, 2 mg/kg/dose once daily for 12 weeks.
  - Ensure adequate fluid intake to avoid haemorrhagic cystitis.

IMPORTANT
Children with steroid resistant nephrotic syndrome do not benefit from treatment with cyclophosphamide and should be referred to a paediatric nephrologist.

REFERRAL

» All with congenital nephrotic syndrome.
» All with clinical features and/or laboratory results, which suggest a diagnosis other than MCNS, e.g. initial macroscopic haematuria, persistent hypertension, persistent low C_3 and renal function impairment.
» Patients with steroid resistant nephrotic syndrome.
» All patients before second line immunosuppressive treatment is prescribed.

6.4 ACUTE KIDNEY INJURY (RENAL FAILURE, ACUTE)

N17.9

DESCRIPTION

Acute kidney injury (AKI) is a syndrome characterised by a rapid decline in glomerular filtration rate and retention of fluid and nitrogenous waste products. It often presents as a continuum of volume responsiveness "prerenal AKI" up to a point of volume unresponsiveness. AKI is classified as prerenal, renal and postrenal failure.

Levels of AKI is defined by pRIFLE criteria (mnemonic p=paediatric, Risk, Injury, Failure, Loss and End Stage Renal Failure).

Paediatric modified RIFLE (pRIFLE) criteria

Level	Estimated creatinine clearance (eCrCl)*	Urine output
1	↓ eCrCl by 25 %	<0.5 mL/kg/hour for 8 hours
2	↓ eCrCl by 50 %	<0.5 mL /kg/hour for >16 hours
3	↓ eCrCl by 75%	<0.5 mL /kg/hour for >24 hours or anuria for 12 hours

The previous method of measuring creatinine clearance using 24-hour urine sample is not recommended due to the difficulty in obtaining an accurate 24 hour urine collection in children. A calculated glomerular filtration rate can be ascertained using the height of the child in cm, the serum creatinine (micromol/L) and a factor "K". (**Modified Schwartz formula**)

$$\text{eCrCl (mL/min/1.73 m}^2\text{)} = \frac{\text{[K x height (cm)]}}{\text{S-creatinine (micromol/L)}}$$

Value of K	
Low birth-weight (<2.5kg) infant	30
Infant 0 - 18 months	40
Girls 2 - 16 years	49
Boys 2- 13 years	49
Boys 13 - 16 years	60

LoE III[iv]

Normal values for GFR in children:

Age	Mean GFR (ml/min/1.73/ m^2)	Range
Birth	20	
7 days	40	25–60
1 month	50	30–70
6 months	75	40–100
12 months	115	65–160
2–12 years	125	90–165

DIAGNOSTIC CRITERIA

Clinical

» In neonates exclude congenital abnormality of the urinary tract.
» 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

» Urine macroscopic appearance: brownish with acute tubular necrosis.
» Urine test strip: haematuria, proteinuria indicative of glomerular disease; leucocytes and nitrites in favour of pyelonephritis.
» Urine microscopy: red blood cell casts, leukocyte, hyaline and granular casts.
» Urine culture to exclude pyelonephritis.
» Urine biochemistry:

	Pre-renal failure	Intrinsic renal failure
U-Osmol (mOsmol/L)	↑ > 320	equal to serum Osmol
FeNa % *	< 1 %	≥ 3 %

$$\text{Fractional excretion of sodium\%} = \frac{\text{Urinary sodium}}{\text{Urinary creatinine}} \times \frac{\text{Serum creatinine}}{\text{Serum sodium}} \times 100$$

*FeNa % becomes an invalid test for pre-renal failure if the child has received furosemide.

Note: Serum creatinine is measured in micromol/L and urine creatinine in millimol/L. To convert micromol/L to millimol/L ÷ by 1000

» Ultrasound of kidneys and bladder.
» Serum urea, urate, creatinine, electrolytes and osmolarity, glucose, calcium, phosphate and albumin.
» Typical biochemistry: hyperkalaemic metabolic acidosis, hyponatraemia, hypocalcaemia, hyperphosphataemia.
» Full blood count, differential and platelet count.
» Clotting profile.
» Cultures and DIC workup as indicated.

» ECG on to exclude life threatening hyperkalaemia.
» Chest X-ray to evaluate cardiomegaly, pleural effusions and pulmonary oedema.

GENERAL AND SUPPORTIVE MEASURES

» Treat the underlying cause.
» Monitor fluid intake and output, blood pressure.
» Weigh daily.
» Nutritional support.
  > High-energy diet. Give supplementary nasogastric feeds, if required. Infants should preferably be given breast feeds or an infant milk formula.
  > Daily requirements:
    - protein: 1 g/kg maximum
    - carbohydrate: 2–3 g/kg
    - fat: 2 g/kg
» Restrict NaCl, potassium and phosphate intake.
» Restrict protein intake when S-urea > 25 mmol/L.

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.

IMPORTANT
Fluid balance is critical. Assess at a minimum, every 12 hours to make appropriate changes to fluid prescription.

» Fluid management according to fluid status:

IMPORTANT
Insensible water loss is calculated as:
- Neonates and young babies: 30 - 40 mL/kg/day
- Older children: 25 mL/kg/day (400 mL/m^2/day)

Pulmonary oedema plus oliguria/anuria: Do not give fluid.
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.
Shock: See Chapter 1: Emergencies and Trauma, section 1.1.7: Shock.
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.

MEDICINE TREATMENT

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, nebulise over 20 minutes.
  0.5–1 mL salbutamol in 2-4 mL sodium chloride 0.9%.
  OR Salbutamol, IV, 4 mcg/kg in 5 mL water administered over 30 minutes.

- 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, 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.
  - Do not mix calcium and sodium bicarbonate containing solutions.

Hypertension
See section Chapter 4: Cardiovascular System, 4.11: Hypertension in children.

Infection
Avoid nephrotoxic antibiotics.

Uraemic convulsions
See Chapter 13: The Nervous System, section 13.1: Seizures.
» Exclude specific causes of convulsions, e.g. hypoglycaemia, hyper- or hyponatraemia, hypocalcaemia or hypertension and treat accordingly.
» Ensure urea levels are appropriately high
» Refer for urgent dialysis

Anaemia
For acute blood loss/active haemolysis and Hb < 7 g/dL:
- Packed red cells, IV, 10 mL/kg administered over 6 hours.

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.

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

REFERRAL

Urgent for dialysis when:
» Fluid overload is causing pulmonary oedema.
» Anuria > 24 hours.
» Central nervous system signs, e.g. convulsions or coma.
» Uraemic bleeding diathesis.
» Uraemic pericarditis.
» Hyperkalaemia or hyponatraemia not responding to conservative treatment.
» Persistent metabolic acidosis pH < 7.1 or serum bicarbonate < 10 mmol/L.
» Uncontrollable hypertension.
» Severe hyperphosphataemia and hypocalcaemia.

6. 5 CHRONIC KIDNEY DISEASE (RENAL FAILURE, CHRONIC)

N18.9

DESCRIPTION

Chronic kidney disease (CKD) is defined as: "evidence of structural or functional kidney abnormalities (abnormal urinalysis, imaging studies or histology) that persist for at least 3 months, with or without a decreased glomerular filtration rate (GFR), as defined by a GFR of less than 60 mL/min/1.73 m^2".

It is characterised by a progressive decline in renal function to end stage renal failure due to progressive loss of functioning glomeruli and is accompanied by the onset or worsening of proteinuria.

A calculated glomerular filtration rate can be ascertained using the height of the child in cm, the serum creatinine (micromol/L) and a factor "K". (**Modified Schwartz formula**).

$$\text{eCrCl (mL/min/1.73 m}^2\text{)} = \frac{\text{[K x height (cm)]}}{\text{S-creatinine (micromol/L)}}$$

Value of K	
Low birth-weight (<2.5kg) infant	30
Infant 0 - 18 months	40
Girls 2 - 16 years	49
Boys 2- 13 years	49
Boys 13 - 16 years	60

Staging of chronic kidney disease (KDQOI definition)

Stage	*eGFR (mL/min/1.73 m^2)	Features
0	≥ 90	Screening of at risk for CKD patients
1	≥ 90	Renal parenchymal disease present with normal eGFR - monitor annual
2	60–89	Usually asymptomatic – biochemical abnormalities present - monitor annually
3	30–59	Biochemical abnormalities and poor growth, poor appetite - monitor 3-6 monthly
4	15–29	Severe disease - consider renal replacement therapy
5	<15 (ESRF)	End stage renal failure - consider renal replacement therapy

*eGFR: estimated glomerular filtration rate

DIAGNOSTIC CRITERIA

Renal function may deteriorate without clinical symptoms.

» Children are likely to present with acute on chronic renal failure during episodes of acute intercurrent illness.
» Poor weight gain and stunting.
» Poor appetite, chronic constipation, polydipsia and polyuria.
» Children with renal tubular disorders or bilateral renal dysplasia have obligatory salt wasting and are often unable to concentrate urine. This may result in severe dehydration and metabolic acidosis if they do not have free access to water.
» May present with tachypnoea mimicking acute "respiratory distress" to compensate for metabolic acidosis.
» Chronic anaemia.
» Renal osteodystrophy, i.e. bone pain and skeletal deformities.
» Volume overload: oedema, hypertension, heart failure, pulmonary oedema.
» Uraemic symptoms and signs: nausea, vomiting, pruritis, brownish skin pigmentation, uraemic frost.
» Bleeding tendency (mucosa).
» Convulsions due to hyponatraemia, hypernatraemia, hypocalcaemia, uraemia or hypertension.

Investigations

» Urine:
  > Protein:creatinine ratio is usually increased (normal < 0.02 g/mmol).
  > Iso-osmolar, i.e. urine Osmol ± 300–350 mOsm/L (normal maximal urine concentration > 1000 mOsmol/L).
» Urine volume may be:
  > normal, or
  > increased (polyuria): > 4 mL/kg/hour, or
  > decreased (oliguria): < 1.0 mL/kg/hour.
» Urine test strip:
  > May be normal or reveal proteinuria, haematuria, glycosuria.
  > Nitrites and leucocytes may indicate UTI. Do urine MCS.
» Urine microscopy
  > May be normal or reveal casts.
  > Pus cells, leucocyte casts and bacteria may indicate UTI. Do urine MCS.
» Serum urea:
  > Increased, depending on hydration, nutritional state and protein intake.
» Serum creatinine is a better indicator of renal function than serum urea but
  > It is influenced by age of child and muscle bulk.
  > It may be only mildly increased in a malnourished child with little muscle bulk despite advanced renal failure (serum creatinine only

starts increasing once renal function has fallen to less than half normal).

» Serum electrolytes:
  > Hyperkalaemia.
  > Hyperchloraemia and decreased bicarbonate.
» Calcium, phosphate and ALP:
  > Decreased calcium.
  > Increased phosphate.
  > Increased ALP.
» Plasma parathyroid hormone:
  > Increased.
» Renal ultrasound:
  > To exclude obstruction.
  > Small shrunken kidneys are indicative of chronic renal failure.

There is no place for renal biopsy in patients with end stage renal failure.

GENERAL AND SUPPORTIVE MEASURES

» Determine and treat the underlying cause of chronic renal failure.
» Monitor fluid intake and output, and blood pressure.
» Weigh daily.
» If in respiratory distress due to volume overload:
  > Place in sitting position.
  > Give oxygen, 100%, 2–3 L/minute by nasal prongs.
» Dietary management:
  > Monitor potassium closely.
  > Limit potassium intake if serum potassium > 5.5 mmol/L.
  > Restrict fruit juices, dried fruit, all citrus fruits, bananas, guavas and tomatoes.
  > All vegetables should either be soaked for 24 hours before cooking or water should be decanted twice during cooking.
  > Restrict phosphate once serum phosphate reaches or exceeds the upper limit of normal for age, usually >1.8 mmol/L and when GFR <70 mL/min/1.73m^2.
  > Limit dairy products and other foods with high phosphate content like grains and cereals, carbonated cool drinks, etc.
  > Do not limit protein intake.
  > Restrict salt intake. No salt added during preparation of food, no salt on the table during meals and restrict all salt preserved foods. Generally, salt is restricted for hypertensive, oedematous patients, but not for patients with salt losing nephropathies who are polyuric, unless they are hypertensive.
  > High-energy diet with supplementary nasogastric feeds or nocturnal fluids for children with poor appetite, polyuria/nocturia and with inadequate intake to maintain growth.

» Fluid management:
  > Depends on underlying kidney disease.
  > Use body weight to guide fluid prescription.
  > Only use parenteral fluids if oral intake is not possible.
  > Children with tubular abnormalities may be unable to concentrate their urine and therefore require free access to water.
  > **Anuric**: Fluid to replace insensible water losses only.
  Use an electrolyte free solution i.e. dextrose 5% or 10%, IV.
  Insensible water loss is calculated as:
    - Neonate and young baby: 30–40 mL/kg/day.
    - Older children: 25 mL/kg/day (400 mL/m^2/day).
  > **Oliguric with oedema and hypertension**: Total volume fluid allowed calculated as:
  Insensible water loss is calculated as:
    - Neonate and young baby: 30–40 mL/kg/day.
    - Older children: 25 mL/kg/day (400 mL/m^2/day).

  Use an electrolyte free solution i.e. dextrose 5% or 10%, IV.
  plus
  50% of urine output.
  plus
  Extra-renal losses (volume for volume).
  Use a potassium-free solution, e.g. sodium chloride 0.9%.
  Once euvolaemic, give same fluids as above to replace 100% of urine output.
  > **Dehydrated and hypotensive**: Give sodium chloride 0.9%, IV bolus immediately and re-assess.
  Repeat bolus, if necessary.
  Strictly monitor urine output and fluid losses.

MEDICINE TREATMENT

Avoid nephrotoxic agents and appropriately adjust renally excreted medicines, e.g. NSAIDs, aminoglycosides, vancomycin, amphotericin B, radiocontrast drugs.

Vitamins and minerals

- Multivitamin, oral, 5 mL daily.
  (Formulation to include pyridoxine, other B vitamins, vitamin C 30 mg and vitamin D 400 IU)

AND

- Folic acid, oral, 5 mg daily.

For management of hyperphosphataemia/osteodystrophy and hyperparathyroidism:
In combination with restricted dietary intake of phosphate:

- Calcium carbonate, oral, 1–4 tablets chewed 8 hourly with meals.
  - 1 tablet is equivalent to 0.168 g elemental calcium.

- Alfacalcidol oral, 0.25 mcg daily. Specialist initiated.

- If serum phosphate is > 2.5 mmol/L, treat the hyperphosphataemia first with:
  - Dietary modification,
  - Calcium (elemental), oral, 10 -15 mg/kg/dose, 12 hourly.
    - Maximum dose: 1 000 mg (1 g) daily.
    - Calcium carbonate 420 mg = 168 mg elemental calcium.

  To decrease to below < 1.8 mmol/L before beginning the alfacalcidol (to avoid metastatic calcification).

In patients with serum calcium < 2.2 mmol/L start alfacalcidiol early:
- Alfacalcidol oral, 0.25 mcg, initially twice weekly. (Specialist initiated)
  - Increase dose as necessary to maintain serum calcium in upper normal range.

Chronic metabolic acidosis
If serum bicarbonate < 18 mmol/L:
- Sodium bicarbonate, oral, 1 mmol/kg/dose 2–3 doses per day after meals.
  - Adjust according to response.

  Note: The intravenous formulation can be given orally.

Hyperkalaemia
Discontinue all medicines that may cause hyperkalaemia, e.g. potassium sparing diuretics, spironolactone, ACE inhibitors.
Exclude volume depletion as an underlying cause for hyperkalaemia.

If serum potassium remains > 5.5 mmol/L:
- Sodium polystyrene sulphonate, oral/rectal, 1 g/kg/dose in dextrose water, once or twice daily.
  - Treat accompanying metabolic acidosis.

Anaemia
Ensure adequate intake of haematinics.
Ensure adequate iron stores. Measure ferritin, transferrin, transferrin saturation and total iron binding capacity.
Avoid transfusions if possible due to risk of developing antibodies in a patient who may be a potential candidate for renal transplantation.

If a patient has symptomatic anaemia, haemoglobin usually < 7g/dL:
- Packed cells, IV, 10 mL/kg administered over 6 hours.

If the patient has a persisting haemoglobin level < 8g/dL despite correction of possible deficiencies of iron, folic acid or vitamin B_{12} treatment, start recombinant human erythropoietin (rHuEPO) in consultation with a paediatric nephrologist.

Note:
Blood pressure must be controlled before starting rHuEPO treatment.
Dose of erythropoietin is gradually increased according to increase in haemoglobin. Target haemoglobin is 10–12 g/dL.

- Erythropoietin, SC, 75 units/kg/week in divided doses 2–3 times a week.
  - Monitor Hb levels every 4 weeks.
  - Adjust dose until target haemoglobin level of 12 g/dL is reached. Continue with this dose.
  - If the Hb level is increasing, do not change dose.
  - If the Hb level remains unchanged, increase by 25% at 4-week intervals until maximum dose of 300 units/kg/week is reached.
  - If Hb level increases > 12 g/dL, stop treatment for one week. Thereafter continue with 25% less than previous dose per week.

For persistent anaemia:
Refer to tertiary centre for nephrologist assessment.

Hypertension
See Chapter 4: Cardiovascular System, section 4.11: Hypertension in children.

Dyslipidaemia
Dyslipidaemia may contribute to the progression of chronic kidney disease, particularly in children with nephrotic syndrome. Hypertriglyceridaemia and abnormal apolipoprotein metabolism is a feature of CRF. Dietary intervention is necessary, including limiting saturated fat and cholesterol intake.

For children > 8 years with persistent total cholesterol levels > 7 mmol/L:
- HMGCoA reductase inhibitors (statins), e.g.:
- Simvastatin, oral, 10 mg at night.
  - Maximum dose: 20 mg at night.

Refer for advice on management.

Renoprotective treatment
All children with persistent nephrotic range proteinuria and GFR > 30 mL/minute:
- ACE inhibitor (with nephrologist supervision).
- Enalapril, oral, 0.1 mg/kg/dose, once daily.
  - Increase dose to 0.5 mg/kg/day, as a single dose or two divided doses.
  - Monitor for adverse effects: hyperkalaemia (increased risk when potassium sparing diuretic is used simultaneously) and acute renal failure (increased risk in children with impaired renal function or volume depletion).
  - May cause hyperkalaemia, worsening metabolic acidosis and declining renal function while reducing proteinuria.
  - Monitor serum urea and electrolytes, i.e. serum potassium and bicarbonate, and renal function within 7 days.

- If serum creatinine has doubled, check hydration status, stop diuretics and halve the dose of ACE inhibitors.
- If renal function does not improve, or hyperkalaemia > 5.5 mmol/L persists, stop ACE inhibitor treatment.

Immunisation

Give all EPI vaccines according to the schedule.
Provide all routine vaccinations or missing vaccinations in older children.
Check immunity against chicken pox and Hepatitis B.

In children > 2 years of age:

- Pneumococcal vaccine (polysaccharide), IM, 0.5 mL as a single dose.

In the absence of any immunity against chickenpox give:

- Varicella-zoster vaccine, SC, 2 doses 6 weeks apart.

In the absence of immunity against Hepatitis B, vaccinate as for any non-immune individual.

- Hepatitis B vaccine, IM, 1 mL, 3 doses one month apart.
  - If the antibody level is considered non-protective or insufficient, give 2 booster doses one month apart.

REFERRAL

» All children with chronic kidney disease
» Patients with dyslipidaemia or hypercholesterolaemia.

6. 6 ENURESIS

R32

See Chapter 14: Child and Adolescent Psychiatry, section 14.2.1 Enuresis.

References

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[iii] Furosemide dose: Shann F. Drug Doses. 15th Edition, 2010. Royal Children's Hospital, Australia.

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CHAPTER 7

ENDOCRINE SYSTEM

7.1 DISORDERS OF SEXUAL DEVELOPMENT (DSD)

Q52.9/ Q55.9

DESCRIPTION

The current terminology for neonates or children presenting with incomplete differentiation of the external genitalia is “disorder of sexual development”.

DIAGNOSTIC CRITERIA

Clinical

» DSDs present with one or more of the following:
  > varying degrees of hypospadias, sometimes with chordee
  > maldescent of one or both gonads,
  > atypical size of the phallus,
  > scrotalisation of labia.
  > urogenital sinus
» Isolated hypospadias is not DSD.
» Suspect congenital adrenal hyperplasia in an infant with non-palpable gonads and DSD.

Investigations

» Urgent urea/electrolytes, venous blood gas and blood glucose to identify possible adrenal insufficiency in suggestive DSD cases (see above).
» Elevated 17-hydroxyprogesterone level to confirm diagnosis of adrenal hyperplasia. (To be done after day 3 of life with maternal extraction for an accurate interpretation of the result).
» Further investigations done in the referral centre.

GENERAL AND SUPPORTIVE MEASURES

» Gender assignment in these infants should only be undertaken after extensive counselling and evaluation by a multidisciplinary team.
» Stabilise all neonates suspected of having congenital adrenal hyperplasia with a salt-losing crisis (see below), prior to urgent referral, as a crisis may be life threatening.

MEDICINE TREATMENT

Congenital adrenal hyperplasia can present with an adrenal crisis. See section 7.3: Adrenal insufficiency, acute.

REFERRAL

» All cases for confirmation of the diagnosis, counselling and possible initiation of treatment.
» Urgent: All cases of congenital adrenal hyperplasia.

7.2 ADRENAL HYPERPLASIA, CONGENITAL

E25.0

DESCRIPTION

Autosomal recessive enzymatic defects of the cortisol biosynthetic pathways in the adrenal gland. The presentation depends on the severity and type of the enzyme defect.

DIAGNOSTIC CRITERIA

Clinical

» Neonates with disorder of sexual development (ambiguous genitalia).
» Adrenal insufficiency. See section 7.3: Adrenal insufficiency, acute.
» Accelerated growth velocity or precocious pseudopuberty.

Investigations

See section 7.3: Adrenal insufficiency, acute.
» Elevated 17-hydroxyprogesterone in the serum.
» Elevated serum renin.

GENERAL AND SUPPORTIVE MEASURES

» Psychological support for child and family.
See section 7.3: Adrenal insufficiency, acute - for stress management.

MEDICINE TREATMENT

Glucocorticoid and mineralocorticoid replacement. To be initiated in consultation with subspecialist.

- Hydrocortisone, oral, 0.5 mg/kg/day in three divided doses. Specialist initiated.
  - The morning dose should be given as early as possible.
  - ½ dose on waking up, ¼ dose at midday ¼ dose and at 4pm.

- Fludrocortisone acetate, oral, 5 mcg/kg/day as single daily dose.
  - Range: 50–200 mcg daily.

For salt losing patients:

- Sodium chloride, oral, 0.5–1 g for every 10 kg body weight per day.

Glucocorticoids are administered for life. Once growth is complete, prednisone may be given once or twice daily. Long-acting glucocorticoids are generally avoided in children because of potential growth suppression.
The dose is individualised by monitoring growth, bone age and hormonal levels.

In all patients with poor adherence, Prednisone 1.5 - 3 mg/m^2 BSA as a single dose in the morning can be considered as a sub-optimal alternative.

LoE II^i

REFERRAL

» All cases for confirmation of the diagnosis, counselling and initiation, and monitoring of treatment.

7.3 ADRENAL INSUFFICIENCY, ACUTE

E27.4

DESCRIPTION

Acute failure of adrenal function, suspected when a patient presents with hypotension, hypoglycaemia, hyponatraemia, hyperkalaemia and metabolic acidosis.

Patients on chronic steroid therapy are at risk for adrenal insufficiency.

Consider augmentation of the steroid dose during times of stress (fever, trauma and surgery).

DIAGNOSTIC CRITERIA

Clinical

» Acute circulatory collapse. The features include:
  - > tachycardia,
  - > pallor,
  - > cool clammy skin,
  - > coma,
  - > metabolic acidosis,
  - > hypotension,
  - > poor peripheral perfusion,
  - > dehydration,
  - > decreased level of consciousness.

» A history of weakness, anorexia, vomiting, weight loss, salt craving, hyperpigmentation (primary adrenal insufficiency),

» Auto-immune endocrinopathies, steroid-dependence and ambiguous genitalia may be present.

» Hyperkalaemia.

» Hypoglycaemia.

» Hyponatraemia.

Investigations

Take blood for estimation of

» Serum electrolytes and blood glucose.

» In all suspected cases, take a sample of clotted blood for estimation of plasma cortisol prior to treating the patient. Send this sample with the patient to the central hospital if laboratory facilities are not locally available.

MEDICINE TREATMENT

Stabilisation

For shock

- Sodium chloride 0.9%, IV, 20 mL/kg bolus as needed.

For hypoglycaemia
Dextrose 10%, IV, 2–5 mL/kg bolus as needed.

- Hydrocortisone, IV, 2 mg/kg immediately as a single dose.
  - Follow with 0.5 mg /kg/dose every 6 hours.

Manage hyperkalaemia. See Chapter 6: Nephrological/Urological Conditions, section 6.4: Acute kidney injury (Renal failure, acute).

Prevention
Patients on chronic steroid therapy are at risk of adrenal insufficiency during stressful situations e.g. sepsis, trauma, elective or emergency surgery. Augment the dose of steroids for the duration of stress.

For major stress:
- Hydrocortisone, IV, 2 mg/kg/day for the duration of the stress.

For minor stress, e.g. URTI:
- Hydrocortisone, IV, 1 mg/kg/day for 3 days.

Adrenal insufficiency is a life threatening emergency

REFERRAL
» All cases immediately after stabilisation.

7.4 DIABETES INSIPIDUS
E23.2/N25.1

DESCRIPTION
Suspect diabetes insipidus in any child with polydipsia and polyuria. Infants may present with failure to thrive.

Central diabetes insipidus is due to deficiency of antidiuretic hormone.
Nephrogenic diabetes insipidus occurs if the kidney is unable to respond to antidiuretic hormone.

DIAGNOSTIC CRITERIA
» Pathological polyuria defined as excretion of > 1.5 L/m^2 of urine. In infants, the corresponding value is > 2.5 L/m^2.
» Serum osmolality > 300 mOsm/kg, with urine osmolality < 300 mOsm/kg is suggestive of diabetes insipidus.
» A positive water deprivation test. (Only conduct under specialist supervision).

MEDICINE TREATMENT

Central diabetes insipidus (Specialist initiated)

Older children:

- Desmopressin, oral, 50–300 mcg/day 8 hourly.
  - Titrate according to response. Use the lowest dose at which an antidiuretic effect is obtained.
  - Maximum dose: 1200 mcg daily.

Infants or where oral administration is not feasible:

- Desmopressin, nasal spray, 10 mcg/day (0.1 mL), starting dose.
  - Titrate according to response. Use the lowest dose at which an antidiuretic effect is obtained.
  - Maximum daily dose: 30 mcg/day once or twice daily.

Note: Dosing of oral and nasal formulations is different owing to the difference in absorption rates.

The patient must have a phase of urinary dilution or breakthrough urination before the next dose to ensure that water intoxication does not result.

Nephrogenic diabetes insipidus

If no response to desmopressin.

Treat the underlying cause.

- Hydrochlorothiazide, oral, 0.5–1 mg/kg/dose 12 hourly.
- Ibuprofen, oral, 5 mg/kg/dose 12 hourly.

REFERRAL

» All cases for evaluation.

7.5 DIABETES MELLITUS

DESCRIPTION

A syndrome of abnormal carbohydrate metabolism, associated with a relative or absolute impairment of insulin secretion with varying degrees of peripheral resistance to the action of insulin.

7.5.1 TYPE 1 DIABETES MELLITUS

E10

DESCRIPTION

Most diabetic children have type 1 diabetes, and:

» have auto-immune destruction of the pancreatic beta cells as the underlying cause,
» have an absolute requirement for insulin therapy,
» will develop diabetic ketoacidosis (DKA) if not given insulin.

DIAGNOSTIC CRITERIA

The following are criteria for the diagnosis of diabetes mellitus:

» Classical features of diabetes (polydipsia, polyphagia, polyuria, weight loss or failure to gain weight, weakness or tiredness, glycosuria, recurrent protracted infections, pruritis vulvae in a girl) with a random serum glucose concentration ≥11.1 mmol/L; or
» Fasting plasma glucose ≥7.0 mmol/L (fasting defined as no caloric intake for at least 8 h);
» An oral glucose tolerance test is generally not needed.

GENERAL AND SUPPORTIVE MEASURES

» Refer to a unit that is able to manage type 1 diabetic patients.
» Educate child and caregiver about all aspects of the disease.
» Medical alert bracelet should be worn at all times.
» Follow up by medical practitioner or at clinic/hospital at least every 3 months.
» Monitor thyroid function annually.
» Screen for coeliac disease at diagnosis, and 3 years post diagnosis.
» Annual screening for dyslipidaemia, microalbuminuria, retinopathy and peripheral neuropathy 5 years after diagnosis in non-pubertal children and 2 years after diagnosis in pubertal children.

Diet: healthy lifelong eating habits

» Refer a newly diagnosed patient and family to a dietician.
» Principles of the prudent diet:
  > Encourage children to reduce the intake of fats and salt and to increase dietary fibre content.
  > Provide all diabetics with a meal plan, e.g. “constant carbohydrate meal plan” or “carbohydrates counting meal plan”. There is no one ‘diabetic’ diet. Individualise the diet giving consideration to usual eating habits and other lifestyle changes required.
  > Six main nutrition factors contribute to better glucose control, i.e. lower HbA1c levels. These are:
    1. Following a meal plan. Keep day-to-day intake consistent.
    2. Avoiding extra snacks that are not part of the meal plan.
    3. Avoiding over-treatment of low blood glucose levels (hypoglycaemia).
    4. Prompt correction of high blood glucose levels.
    5. Adjusting insulin levels for meals in patients using the “carbohydrates counting meal plan”.
    6. Consistency of night snacks.

CONSTANT CARBOHYDRATE MEAL PLAN

Consistency is the key. The amount of insulin, usually two or three doses per day, is kept relatively constant from day-to-day. Carbohydrates should be manipulated to match the relatively constant insulin dose. **If able to count carbohydrates, give 1 unit of insulin per 15 g of carbohydrate.**

The amount of carbohydrate (types can vary) is kept about the same for each meal and each snack from one day to the next.

As part of the educational process, the family must get used to reading food labels to know the grams (g) of carbohydrates being eaten. The dietician may suggest a range of carbohydrates for each meal.

Examples of carbohydrate content of some foods
The following foods have 15 g of carbohydrate per serving:
1 cup = 250 mL

FOOD	SERVING SIZE
Beans (cooked, canned)	½ cup
Bread (white, brown)	1 slice
Pap (cooked)	¼ cup
Soft maize porridge (cooked)	½ cup
Pasta (cooked)	½ cup
Potato (mashed)	½ cup
Rice (cooked)	⅓ cup
Apple (small)	1
Fruit juice	½ cup
Grapes	½ cup (12 medium grapes)
Orange (small)	1
Banana (small)	1
Milk	1cup
Yoghurt (low fat, unsweetened)	1 cup
Pizza (thin-crust, medium size)	1/8 of medium pizza
Potato slap chips (not crisps)	8–12

» Tailor the advice to the patients' lifestyle, economic circumstances and usual diet and, where possible, avoid drastic changes.
» Do not forbid any particular food as this may lead to disturbed attitudes to food, e.g. carbohydrates are not forbidden but can be taken before exercise, incorporated into a main meal or used as a source of energy during illness when children have a poor appetite.
» Diet should provide adequate nutrition for growth and development.

Dietary composition

It is recommended that:

> approximately 35% of dietary energy should be derived from mono- and polyunsaturated fat,
> 15% from protein,
> 50% from carbohydrates. Carbohydrates should always provide at least 40% of the total calories.

Timing of meals and snacks

Children receiving twice daily injections of combined short and intermediate acting insulin regimens need three main meals and three snacks (mid morning, mid afternoon and prior to bed time).

Eat meals and snacks at the same time each day. The timing of insulin injections may need to be adjusted according to the patients' own circumstances.

Preschool aged children may have unpredictable eating habits and may require frequent small meals.

Exercise

» Regular exercise helps increase insulin sensitivity; maintains proper weight, blood pressure, blood glucose and blood lipid levels.
» Exercise must be regular, i.e. daily. The same amount of exercise should ideally be done at the same time of the day.
» Some form of carbohydrate is necessary before and after intense exercise to reduce the risk of hypoglycaemia. Blood glucose monitoring may be necessary before and after intense exercise.

Blood glucose testing, record keeping and review of records

» Glucometers with compatible strips and bloodletting devices.
» Encourage children to perform their own finger-prick blood glucose testing.
» Finger prick should be performed at the side of the fingertips.
» Encourage the child to monitor his/her blood glucose prior to each main meal and at bedtime. A daily record of all tests performed should be recorded in a logbook. Review logbook frequently to ensure optimal insulin adjustments.
» More frequent blood glucose testing is indicated if the child is unwell, partaking in unusual amounts of physical activity or feels hypoglycaemic.
» For a basal-bolus regimen, testing can be done up to 6 times a day (180 strips/month) and for other regimens, two to four times daily (60 - 120 strips/month). If control is poor, more frequent testing is recommended with appropriate adjustment to therapy.

Glycaemic targets

» Glycaemic targets for young children should not be as strict as for adults. Balance t he ability of the family to avoid recurrent hypoglycaemia. A paediatrician should assist in setting practical goals. See table "Monitoring, control and adjustments".

» Severe hypoglycaemia is the presence of recurrent and unpredictable hypoglycaemic episodes, requiring third party assistance. It leads to anxiety about repeated episodes and results in a poorer quality of life.
» Ideally 80% of the pre-meal blood glucose values should fall within the target range during home monitoring, but targets may need to be altered based on the age of the child and the ability of the family.
» Infants, toddlers, and preschoolers are unable to recognise or communicate signs and symptoms of low blood glucose. They also have unpredictable eating habits.
» Some school-age children and young adolescents have more predictable eating habits, but may be lacking in judgement. They are able to recognise or communicate signs and symptoms of low blood glucose.
» Most adolescents and young adults are able to recognise and treat low blood glucose reactions. They have predictable eating habits and are able to plan ahead.
» Acceptable target range before meals:

	Blood glucose levels
> Infants and toddlers	6– 12 mmol/L
> School-age children and some young adolescents	4– 10 mmol/L
> Most adolescents and young adults	4– 8 mmol/L

» Monitor HbA1c levels 3 monthly. The aim is to maintain HbA1C as close as possible to the recommended range, i.e. 6.5 - 7.5%. Aim for a lower HbA1C in patients who are adherent with regard to home glucose monitoring.

Monitoring control and adjustments

Level of control	**Optimal**	**Suboptimal:** (need to take action)	**High risk** (refer patient to specialised diabetic clinic)
Clinical assessment			
Raised blood glucose	No symptoms	» polyuria,* » polydypsia,* and » enuresis.*	» blurred vision, » poor weight gain, » poor growth, » delayed puberty, » poor school attendance, » skin or genital infections, » signs of vascular compromise.
Low blood glucose	Few, mild No severe hypoglycaemic episodes.	Severe hypoglycaemia (unconsciousness and/or convulsions)**	

Level of control	Optimal	Suboptimal: (need to take action)	High risk (refer patient to specialised diabetic clinic)
Monitoring Biochemical assessment Self monitoring finger prick glucose monitoring			
AM fasting (preprandial)	4–6	>8	>9
Postprandial	5–10	10–14	>14
Bed time	6.7–10	<6.7*** or 10–11	< 4.4*** or >11
Nocturnal	4.5–9	<4.2*** or >9	<4*** or >11
HbA_{1C}	6.5-7.5	7.5–9.0	>9.0

*In situations with polyuria, polydypsia and enuresis, adjust the doses of the insulin upwards. Dose adjustments should usually not be greater than 10% of the daily dose at any one time.

** Identify and address the specific reasons for hypoglycaemia e.g. skipping meals or snacks.

In specific situations where the lifestyle cannot be modified or there are recurrent episodes of severe hypoglycaemia, consider referral to a tertiary centre.

*** Consider hypoglycaemia unawareness in situations where there are consistently low readings and the patient does not report symptoms.

» Hypoglycaemia unawareness is dangerous. The insulin dose may need to be adjusted downwards if more than 30% of the readings during a single week are below the target values indicated.

Blood or Urine ketone testing

» Hyperglycaemia and a capillary beta-hydroxybutarate level > 3 mmol/L indicates that DKA is present. At levels of 0.6-0.3 mmol/L a mild DKA may still be diagnosed.

» If capillary beta-hydroxybutarate strips are not available, significant ketonuria (+++) and hyperglycaemia may also indicate that a DKA is present.

» Test capillary blood or urine for ketones in the following circumstances:
  - if vomiting occurs,
  - any time the blood glucose > 15 mmol/L, especially if the child is unwell and particularly if the blood glucose has been high for more than 24 hours,
  - if unusual drowsiness is present,
  - in the presence of high temperature, vomiting or diarrhoea, even when the glucose is < 15 mmol/L,
  - if abdominal pains occur,
  - if the breathing is deep and rapid or smells of acetone.

MEDICINE TREATMENT

Insulin therapy

Principles of insulin therapy:

» To provide sufficient insulin throughout the 24-hour period to cover basal requirements.
» To deliver boluses of insulin in an attempt to match the glycaemic effect of meals.
» The most suitable areas for insulin injection are:
  > the upper, outer area of the arms;
  > the front and side of the thigh;
  > the upper, outer surface of the buttocks; and
  > the abdomen, except the area close to the navel.
» Establish a pattern for injecting, i.e. horizontally or vertically. Vary the site of injection according to this pattern. When the area has been fully covered move to another area.
» Patients doing strenuous exercise should not inject into their legs.

Insulin injection technique

Pinching the skin to give an insulin injection. A small pinch with the finger and thumb is enough.

» Insulin injection by syringe is usually given into deep subcutaneous tissue through a two-finger pinch of skin at an angle of 45–90 degrees.
» The subcutaneous fat layer should be thicker than the needle length.
» There is significant risk of accidental intramuscular injections with more rapid absorption, especially in lean individuals. This can be minimised by using a two-finger pinch technique, an injection angle of 90 degrees and use of 5 mm needles rather than longer needles in all ages.
» Withdraw the needle and release the skin fold on the count of ten.
» Disinfection of the skin is not necessary prior to insulin injections, however injections should be given through clean, healthy skin.
» Needles should not be used for more than 6 injections.
» Prefilled insulin syringes are recommended for children. Pen devices delivering less than 1 unit should be available for selected patients.
» Thoroughly mix all insulin suspensions before injection by rolling or inverting the vial ten times so that the cloudy suspension mixes thoroughly and uniformly.

Duration of action of standard insulins

Insulin	Onset of action	Peak action	Effective duration
Regular/short acting	30–60 minutes	2–3 hours	8–10 hours
Intermediate acting	2–4 hours	4–12 hours	12–20 hours

Choice of insulin regimen

» No insulin injection regimen satisfactorily mimics normal physiology. The choice of insulin regimen should be individualised and will depend on age, duration of diabetes, lifestyle (dietary patterns, exercise schedules, school, work commitments, etc), targets of glycaemic control, and particularly, individual patient/family preferences.

» The choice of an insulin regimen is determined by the patient's circumstances. Depending on the patient's scope to undertake insulin therapy, a number of alternatives will allow insulin therapy to be tailored to their lifestyle. Discussion with parents should provide the basis for such important decisions.

» It is not possible to prescribe a single best regimen for preschool and primary school children. Individualise the choice of regimen according to family circumstances.

» Multiple daily injections provide for the best glycaemic control in young people with type 1 diabetes. If manageable, this should be the regimen of choice. Initially, a twice daily injection regimen may be more manageable.

Questions to be considered when choosing a regimen

What scope does the patient have for insulin therapy?

» Will the patient be able to undertake, financially and culturally, an advanced insulin regimen if necessary?

» Is a responsible person available to give insulin injections at all times of the day or only at certain times?

» How goal-orientated is the patient/caregiver in terms of diabetes control?

What is the patient's eating pattern?

» What is the typical pattern of meals?

» What type of food do they typically eat at each meal, and how much?

» Is their eating pattern relatively constant, or does it vary?

» Can and will they change their eating habits?

All chosen insulin regimens should be supported by comprehensive education appropriate for the age, maturity and individual needs of the child and family.

Selecting an insulin regimen

Total daily insulin dose

This is individualised and varies according to age, puberty development, stress and individual variability. Usual range is 0.5–1 units/kg/day, but may be higher or lower.

The aim is to select a regimen that allows the achievement of glycaemic control without disabling hypoglycaemia. This also requires a comprehensive support programme for the child and family enabling the implementation of an appropriate diet and other care strategies. These include home blood glucose monitoring and the ability to recognise and manage hypoglycaemic episodes. Where glycaemic control is not achieved despite an adequate support programme consider referral to a tertiary centre**.**

Insulin regimens

Consult with a paediatric endocrinologist or paediatrician with experience in diabetes care. Repeated consultations are indicated when glycaemic control targets are not achieved.

Basal-bolus regimen

- Short acting insulin 15–30 minutes before a meal or rapid acting insulin with main meals e.g. breakfast, lunch and main evening meal; intermediate acting insulin before bed.
- Normally, 30–40% of the total daily dose of insulin is given at bedtime as intermediate acting insulin. The remaining insulin is given prior to breakfast, lunch and evening meal in the form of short acting insulin.

Basal-bolus regimen Short acting insulin is indicated in the child (especially < 5 years of age) with erratic eating habits despite adequate education		
Breakfast	short acting insulin	20% of total daily dose (if able to count carbohydrates: give 1 unit per 15 g)
Lunch	short acting insulin	20% of total daily dose
Supper	short acting insulin	20% of total daily dose
At night (± 21h00)	intermediate acting (ideally this ought to be a basal insulin acting over 24 hours)	40% of total daily dose

OR

Three injections daily

- A mixture of short and intermediate acting (premixed 70:30) insulin before breakfast; short acting insulin alone before an afternoon snack or main evening meal; intermediate acting insulin before bed; or variations of this regimen may be used at times.
- This requires that the caregiver is aware of three different insulin preparations and can differentiate between them.

Three injections daily		
Breakfast	short acting insulin (30% of morning dose) + intermediate acting (70% of morning dose)	$^2/_3$ of total daily dose
Supper	short acting insulin (1/3 of evening dose)	1/3 of total daily dose
At night (± 21h00)	intermediate acting (2/3 of evening dose)	

OR

Two Injections daily

- A mixture (premixed combination) of short and intermediate acting insulins (before breakfast and the main evening meal).
- The total daily dose is divided so that $^2/_3$ is given in the morning and $^1/_3$ in the evening.
- The morning or evening dose is then again split between the intermediate-acting and the short-acting insulin in a 70:30 ratio which is pre-mixed
- This regimen is less flexible but easier to instruct.

Two injections daily: Premixed 70/30		
Breakfast	intermediate acting (70% of morning dose) + short acting insulin (30 % of morning dose)	$^2/_3$ of total daily dose in units
Supper	intermediate acting (70% of evening dose) + short acting insulin (30% of **evening** dose)	$^1/_3$ of total daily dose in units

None of these regimens can be optimised without frequent assessment of blood glucose monitoring.

Achieving a balance between food intake, insulin levels and energy expenditure is an essential pre-requisite for achieving glycaemic control.

Adjustment of insulin dosage for 3 injection regimen and 2 injection regimen

The insulin dose should not be changed after a single abnormal blood glucose reading.

Adjust the dose only once a pattern has been established. The dose to be adjusted depends on the time of abnormal glucose readings, as indicated in the table below:

	Timing of the unsatisfactory blood glucose level			
	Before breakfast	**Before Lunch**	**Before supper**	**At ± 21h00**
Two injections daily/three injections daily regimens				
Insulin dose to be **increased** if *glucose too high*	Supper (in case of premixed insulin) or 21h00 dose: intermediate acting insulin	Breakfast dose: short acting insulin	Breakfast dose: intermediate acting insulin	Supper dose: short acting insulin
Insulin dose to be **decreased** if *glucose too low*				
	Timing of the unsatisfactory blood glucose level			
	Before breakfast	**Before Lunch**	**Before supper**	**At ± 21h00**
Basal-bolus regimen				
Insulin dose to be **increased** if *glucose too high*	21h00 dose: intermediate acting insulin	Breakfast dose: rapid (or short acting) insulin	Lunch dose: rapid (or short acting) insulin	Supper dose: rapid (or short acting) insulin
Insulin dose to be **decreased** if *glucose too low*				

REFERRAL

» Management of all children with diabetes should be supervised by a paediatrician with experience in managing diabetes in the young and should involve a multidisciplinary team, i.e. paediatrician, dietician, nurse educator, psychologist, ophthalmologist.
» Complications.
» Uncontrolled diabetics, such as children with unpredictable blood glucose control, nocturnal or frequent hypoglycaemic events or children who do not reach their therapeutic goals for consideration of analogue insulin.
» Periodic screening of eyes by an ophthalmologist:
  > prepubertal onset of diabetes: 5 years after onset and annually thereafter;
  > pubertal onset of diabetes: 2 years after onset and annually thereafter.

7.5.1.1 GUIDELINES FOR MANAGEMENT OF DIABETICS ON SICK DAYS

DESCRIPTION

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.

MEDICINE TREATMENT

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%.

Generally, the body will require more energy during illness. Insulin allows more glucose to enter the cells, providing more energy to fight infection.

General guidelines when giving extra insulin:

» If the blood glucose is rising or if ketones are present in the urine, the patient must seek urgent medical attention.

Moderate urine ketones

» The extra dose of insulin is usually 10–20% of the total daily dose.
This extra insulin is given as short (or rapid) 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 medical or nursing 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.

7.5.2 DIABETES MELLITUS, INSULIN DEPENDENT : ACUTE COMPLICATIONS

E10

7.5.2.1 CEREBRAL OEDEMA IN DIABETIC KETOACIDOSIS (DKA)

G93.6

DESCRIPTION

A condition of brain swelling during the course of treatment for DKA.

Cerebral oedema usually occurs 4–12 hours after the initiation of treatment, but may be present at the time of diagnosis. It often follows an initial period of clinical and biochemical improvement.

Cerebral oedema causes significant neurological morbidity and has a mortality of approximately 80%.

The cause of cerebral oedema during treatment remains unclear. However, very rapid reduction in intravascular osmolality may aggravate the process. Therefore, rehydration should occur more slowly in children with DKA than in other causes of dehydration.

DIAGNOSTIC CRITERIA

Clinical

» Signs and symptoms of cerebral oedema include:
  > headache,
  > confusion,
  > irritability and restlessness,
  > reduced consciousness,
  > papilloedema (late sign),
  > hypoxaemia, and
  > specific neurological signs and raised intracranial pressure.

» The risk of cerebral oedema is increased if urea levels are increased or if the PCO_2 is persistently low, i.e. < 20 mmHg.

GENERAL AND SUPPORTIVE MEASURES

» Admit to ICU, if possible, or to a centre experienced with managing this condition.
» Restrict intravenous fluids to ⅔ maintenance and replace deficit over 72 hours rather than 48 hours pending ICU admission.
» Elevate head of bed.
» Exclude hypoglycaemia.
» Do not use bicarbonate.
» Exclude thrombosis, intracranial haemorrhage or infection.
» Do not delay treatment while waiting for a CT scan to confirm cerebral oedema.

MEDICINE TREATMENT

For the management of cerebral oedema, see Chapter 13: The Nervous System, section 13.5 Status Epilepticus (convulsive), cerebral oedema.

7.5.2.2 DIABETIC KETOACIDOSIS

E10.1

DESCRIPTION

Diabetic ketoacidosis (DKA) occurs with relative or absolute insulin deficiency, either caused by non-adherence to insulin regimens or by excessive secretion of counterregulatory hormones during stress, e.g. infection, trauma and surgery.

DIAGNOSTIC CRITERIA

» Heavy glycosuria (2+ or more).
» Hyperglycaemia, i.e. blood glucose usually > 11 mmol/L, ketonuria, or/and pH < 7.3.
» Bicarbonate < 15 mmol/L **and** patients who are clinically dehydrated.
» May be vomiting.
» May be drowsy.

Note:
In rare cases blood glucose is not elevated.
Children with mild dehydration and not clinically unwell usually tolerate oral rehydration and subcutaneous insulin.
See section 7.5.1.1: Guidelines for management of diabetics on sick days.

GENERAL AND SUPPORTIVE MEASURES

» Admit all children and adolescents to an ICU or ward experienced in the management of DKA in children and adolescents, if possible.
» Ensure patent airway.
» If the child is comatose, secure the airway and insert a urinary catheter.
» If comatose or recurrent vomiting insert oro/nasogastric tube and apply free drainage.

MEDICINE TREATMENT

Seek specialist advice early in the management.

If hypoxaemic:

- Oxygen via facemask.

The objectives of fluid and sodium replacement therapy in diabetic ketoacidosis are:

» To restore circulating volume.
» To replace sodium and water deficits from extracellular and intracellular compartments.
» To restore glomerular filtration rate to enhance clearance of glucose and ketones from the blood.
» To reduce the risk of cerebral oedema.

Fluids

a: Fluids for resuscitation in shock:

- Sodium chloride 0.9%, IV, 10–20 mL/kg over 10–30 minutes.
  - Repeat if shock persists.

b: Fluid requirements after resuscitation

Calculation of fluid requirement during the subsequent phase of rehydration (see table below for the calculations determined for different weights)
Fluid requirement = deficit + maintenance
Calculate deficit = estimated % dehydration x body weight (kg and equivalent in mL)
Calculate maintenance (mL): ≤1 year: 120 mL/kg/24 hours All children older than 1 year – the sum of the following: • first 10 kg body weight: 100 mL/kg/24 hours • second 10 kg body weight: 50 mL/kg/24 houro • additional weight > 20 kg body weight: 20 ml/kg/24 hours
Add deficit to 48 hour maintenance and replace this volume evenly over 48 hours, initially with sodium chloride 0.9%. When blood glucose falls to 12–15 mmol/L change the infusion to a dextrose-containing maintenance fluid, e.g. dextrose 5% in sodium chloride 0.45%.
Assess hydration status every 4–6 hours

Examples of fluid volumes for **subsequent phase** of rehydration (i.e. maintenance + 5% of body weight/24 hours)

Body weight kg	Maintenance mL/24 hour	Maintenance + 5% of body weight mL/24 hour	Maintenance + 5% of body weight mL/hour
4	325	530	22
5	405	650	27
6	485	790	33
7	570	920	38
8	640	1040	43
9	710	1160	48
10	780	1280	53
11	840	1390	58
12	890	1490	62
13	940	1590	66
14	990	1690	70
15	1030	1780	74
16	1070	1870	78
17	1120	1970	82
18	1150	2050	85
19	1190	2140	89
20	1230	2230	93
22	1300	2400	100
24	1360	2560	107
26	1430	2730	114
28	1490	2890	120
30	1560	3060	128
32	1620	3220	134
34	1680	3360	140
36	1730	3460	144
38	1790	3580	149
40	1850	3700	154
45	1980	3960	165
50	2100	4200	175
55	2210	4420	184
60	2320	4640	193
65	2410	4820	201
70	2500	5000	208
75	2590	5180	216
80	2690	5380	224

Note: Sodium chloride 0.9% is preferred for resuscitation and the initial phase of rehydration. However, to prevent the occurrence of hyperchloraemic acidosis switch to sodium chloride 0.45%/dextrose 5% after blood glucose has fallen to 12 mmol/L or less.

Note: One of the danger signals for cerebral oedema is a precipitous drop in the serum sodium level.

Bicarbonate

Bicarbonate use is associated with increased risk of cerebral oedema. It should not be used routinely to improve adicosis.

Caution
Consult a specialist before administering any bicarbonate solution.

Potassium

Commence potassium replacement immediately unless patient has anuria. If serum potassium is start replacement after the patient has passed urine.
Early addition of potassium in the fluid regimen (KCl 15% 20mL in 1L = 40 mmol/L.) is essential even if the serum concentration is normal as insulin will drive glucose and potassium into the cells.

DKA protocol:
Two-bag system –Alternative fluid and electrolyte treatment
Under supervision of a specialist.
The two-bag system consists of 2 bags of identical electrolyte content but different dextrose concentrations, 0% and 10%, administered simultaneously into a single IV line. Variations in dextrose delivery are achieved through changing the proportions of the 2 bags contributing to the total rate, which is determined by the degree of dehydration.

- Sodium chloride 0.9%, IV, 10–20 mL/kg.
  - May be repeated if necessary.
  - Then switch to “two bag” system

Bag 1 (dextrose 0%)	Bag 2 (dextrose 10%)
• Sodium chloride 0.45%, 1 L **PLUS** • Potassium chloride, 20 mL	• Dextrose 10%, 1 L **PLUS** • Sodium chloride 5%, 90 mL **PLUS** • Potassium chloride, 20 mL

Run these two riders for easy titration of dextrose from dextrose 10% to dextrose 0%:

Fluid	Blood glucose >15	Blood glucose 10–15	Blood glucose <10
Bag 1	100%	50%	0%
Bag 2	0%	50%	100%

LoE II [ii,iii]

Insulin

- Insulin short acting, 0.1 unit/kg/hour as a continuous IV infusion.
  - Add insulin, 50 units (0.5 mL) to 50 mL sodium chloride 0.9% in a syringe pump to get a solution of 1 unit/mL.
  - Attach this using a Y-connector to the IV fluids already being administered.
  - Do not add insulin directly to the fluid bags.
  - The solution should be administered at a rate of 0.1 mL/kg/hour (0.1 unit/kg/hour).

  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 infusion 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.

  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.

Alternative to insulin infusion

Where there are no facilities for insulin infusion, e.g. no syringe pumps, staff constraints, etc.:

- Insulin short-acting, IV, 0.1 unit/kg, hourly.

Changing from intravenous to subcutaneous insulin

Continue with intravenous fluids until the child is drinking well and able to tolerate snacks. 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.

The most convenient time to change to subcutaneous insulin is just before a meal. Administer the first dose of subcutaneous insulin 30 minutes before the meal and continue with the insulin infusion for 90 minutes after the subcutaneous injection to prevent rebound hyperglycaemia.

In newly diagnosed diabetics, Basal-Bolus regimen is started as described in section 7.5.1 Type 1 Diabetes Mellitus – Insulin Regimens, in a low range dose:

- Prepubertal children: 0.7 units/kg.
- Pubertal children: 1 unit/kg.

In established diabetics, give maintenance insulin.
Give supplemental subcutaneous short acting insulin before meals if the blood glucose > 11 mmol/L:

Blood glucose mmol/L	Short-acting Insulin units/kg/dose
11–12	0.06
13–16	0.09
16	0.12

REFERRAL

» No improvement
» Deterioration of condition, i.e.:
  > pH <7.1,
  > hyperventilation,
  > shock,
  > depressed level of consciousness,
  > persistent vomiting,
  > age < 5 years.
» Rising blood glucose.

7.5.2.3 HYPOGLYCAEMIA IN DIABETICS

E16.0

DESCRIPTION

Autonomic symptoms (hunger, nausea, anxiety, pallor, palpitations, sweating, trembling) usually precede neuroglycopaenic symptoms (impaired thinking, change of mood, irritability, dizziness, headache, tiredness, confusion, and later convulsions and coma). Patients with frequent hypoglycaemic episodes develop hypoglycaemia unawareness, where the symptoms above do not occure despite a dangerously low blood sugar level.

Causes of hypoglycaemia include:
» A missed or delayed snack or meal.
» Exercise without appropriate dietary preparation.
» Alcohol.
» Overdose of insulin.
» Impaired food absorption e.g. gastro-enteritis.
» Addison's disease. Recurrent hypoglycaemia may necessitate investigation for this condition.
» Coeliac disease.

Nocturnal hypoglycaemia

Nightmares and headaches may be suggestive of nocturnal hypoglycaemia. Blood glucose concentrations fall to their lowest levels between 02h00 and 04h00.

DIAGNOSTIC CRITERIA

» Blood glucose < 3.5–4 mmol/L with symptoms in a known diabetic patient.
Good glycaemic control is likely to be associated with occasional hypoglycaemic episodes.

» 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.

GENERAL AND SUPPORTIVE MEASURES

» Determine underlying cause.
» Patient education on diabetes and its complications.

MEDICINE TREATMENT

Mild or moderate hypoglycaemia:
Immediate oral rapidly absorbed simple carbohydrate, e.g.:

- 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 ingested, e.g. fruit, bread, cereal, milk, etc.

Severe hypoglycaemia
Outside hospital

- 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.

LoE II [iv]

In hospital

If there is an unsatisfactory response or inability to take oral carbohydrate and signs of disorientation, stupor, convulsions, coma:

- Dextrose 10%, IV, 2–5 mL/kg.
  - Dilute dextrose 50% solution to 10% strength before use.
  - i.e. Dextrose 50% 1 mL + water for injection 4 mL = 5 mL 10% dextrose solution.

If IV dextrose cannot be given:

- 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.

Monitor blood glucose every 15 minutes until stable, then repeat 1–2 hourly. Keep blood glucose between 6 and 8 mmol/L.

REFERRAL

» Recurrent episodes of hypoglycaemia.

7.5.2.4 DIABETIC NEPHROPATHY

E10.21

DIAGNOSTIC CRITERIA

» Persistent microalbuminuria:
  > 3 specimens over a 3–6 month period all show increased albumin:creatinine ratio on a spot urine:
  males: > 2.5 mg/mmol,
  females: > 3.5 mg/mmol.
» Screening for microalbuminuria should start from:
  > prepubertal children: 5 years post diabetes diagnosis.
  > pubertal children: 2 years post diabetes diagnosis.

GENERAL AND SUPPORTIVE MEASURES

» Optimise diabetes control.
» Monitor blood pressure.

MEDICINE TREATMENT

If urinary albumin:creatinine ratio is persistently above reference range for sex:

- ACE inhibitor, e.g.:
- Enalapril, oral, 0.1 mg/kg/dose as a single dose or two divided doses.
  - Maximum dose: 0.5 mg/kg or 40 mg/day.

  Note: Exclude non-diabetic nephropathy.

Note: Discuss patient with an endocrinologist or nephrologist if there is a poor response to ACE inhibitor and improved glycaemic control.

7.5.2.5 DYSLIPIDAEMIA

E78.9

DIAGNOSTIC CRITERIA

Refer to Chapter 4: Cardiovascular system - section 4.10 Dyslipidaemia.

GENERAL AND SUPPORTIVE MEASURES

» Optimise diabetes control.
» Refer to a dietician.
» Increase physical activity.
» Members of household who smoke to stop smoking.

MEDICINE TREATMENT

If no improvement in LDL levels after 6 months of exercise and dietary interventions, commence statins (Refer to Chapter 4: Cardiovascular system - section 4.10 Dyslipidaemia).

7.5.3 DIABETES MELLITUS IN ADOLESCENTS

E10

DESCRIPTION

Adolescence is the period between 10 to 19 years of age. The adolescent and the transition should be managed with special planning, i.e.:

» the admission policy of the hospital,
» observing the wishes of the adolescent,
» emotional and physical maturity considerations,
» presence of any co-existing medical, surgical or psychiatric disorder that may be more appropriately managed in the paediatric service.

Aggression and agitation may be features of poorly controlled diabetes.

GENERAL AND SUPPORTIVE MEASURES

Promote:

» normal growth and pubertal development,
» psychological development,
» maintenance of glycaemic control and adherence,
» normal lifestyle,
» avoidance of risk-taking behaviours (smoking, substance abuse),
» sex education.

Adolescents with diabetes may have concomitant behavioural and psychiatric disorders. Anxiety disorders are common in adolescents and should be differentiated from hypoglycaemic and hyperglycaemic episodes.

MEDICINE TREATMENT

Failure of current insulin regimens may be attributed to the endocrine changes of puberty which results in poor glycaemic control.
Insulin resistance occurs during puberty, being maximal in late puberty.
Other causes of poor glycaemic control include family dynamics (e.g. resistance to parental supervision), emotional lability and risk-taking behaviour (e.g. intentionally neglecting to inject and substance abuse).

Normal insulin requirements during puberty:
o 1.0–1.4 units/kg/day.
This may occasionally be higher (up to 2.0 units/kg/day), but as a general rule a higher requirement generally necessitates the search for non-adherence and poor absorption through injections in lipohypertrophy sites.

After puberty, the insulin requirements fall to prepubertal levels.
Failure to reduce insulin requirements in the late adolescent stages may result in excessive weight gain.

7.5.4 DIABETES MELLITUS, TYPE 2

E11

DESCRIPTION

Type 2 diabetes develops when insulin secretion cannot meet the increased demand posed by insulin resistance. Type 2 diabetes may be associated with hyperlipidemia, hypertension, acanthosis nigricans, ovarian hyperandrogenism and non-alcoholic fatty liver disease (features of insulin resistance).

DIAGNOSTIC CRITERIA

Clinical

» Obese or overweight.
» Children with a strong family history of type 2 diabetes, usually in adolescents with BMI > 95% without auto-antibodies to islet cells and normal serum C-peptide levels.
» Keto-acidosis is unusual in type 2 diabetes.
» A fasting glucose > 7 mmol/L.
» Type 2 diabetics may have minimal symptoms or signs for months or even years before the diagnosis.

Investigations

To confirm diagnosis:
» Symptoms of diabetes.
PLUS
» Fasting plasma glucose > 7.0 mmol/L.
OR

» Random plasma glucose > 11mmol/L.

OR

» No symptoms, but an abnormal 2 hour serum glucose level on the oral glucose tolerance test:
  > Ingestion of 1.75 g/kg (maximum 75 g) of glucose dissolved in water.
  > Serum glucose > 11 mmol/L 2 hours post ingestion of oral glucose.

GENERAL AND SUPPORTIVE MEASURES

» Lifestyle modification:
Manage patients who are not ill at diagnosis initially with advice on nutrition and exercise, but most will eventually require medicine therapy.

» Education on routine blood glucose monitoring. A logbook with all blood glucose reading should be kept. In most cases fasting, prebreakfast measurement and 2-hour postprandial dinner measurement are sufficient.

» Initial medicine treatment is determined by symptoms, severity of hyperglycaemia and presence of ketosis. This should be decided in consultation with a specialist who is experienced in treating these children.

MEDICINE TREATMENT

Refer for initiation of therapy.

7.6 HYPOGLYCAEMIA IN CHILDREN

E16.2

DESCRIPTION

Infants and small children have relatively limited glycogen stores with larger brain/body ratios than adults and are therefore at greater risk of hypoglycaemia during starvation.

The causes of hypoglycaemia (outside the neonatal period) include:

» hypopituitarism,
» growth hormone deficiency,
» hyperinsulinaemia,
» malnutrition,
» liver dysfunction,
» severe illness with poor intake,
» accelerated starvation (ketotic hypoglycaemia),
» medicine, e.g. insulin, alcohol, aspirin, beta-blockers, oral hypoglycaemic agents, quinine.
» adrenal insufficiency,
» hypothyroidism,
» inborn errors of metabolism,
» sepsis,
» malaria,

DIAGNOSTIC CRITERIA

Clinical

» Acute autonomic symptoms: hunger, nausea, anxiety, pallor, palpitations, sweating, trembling.
» Neuroglycopaenic symptoms: impaired thinking, change of mood, irritability, dizziness, headache, tiredness, confusion, and later convulsions and coma.
» Patients are often asymptomatic especially younger children who may be completely asymptomatic or present only with a behaviour change.

Investigations

» Serum glucose concentration < 2.6 mmol/L.
» Hypoglycaemia is a clinical emergency requiring prompt therapy. However, if possible draw a blood sample for investigation prior to the administration of glucose. Collect 5 mL of blood in a plain tube at the earliest opportunity and send for separation and storage of plasma at –20°C. Such samples may provide clear biochemical evidence of the cause of the hypoglycaemic episode thus avoiding having to subject the child to further investigations.

MEDICINE TREATMENT

After collection of initial blood samples:

- Dextrose 10%, IV, 2–5 mL/kg.
  - Dilute dextrose 50% solution before use to 10% strength. (1 mL/kg of dextrose 50% plus 4 mL/kg of water for injection, gives 10% dextrose solution).

If hypoglycaemia persists or the serum glucose is difficult to maintain in the normal range, consider adrenal insufficiency:

ADD

- Hydrocortisone, IV, 2–3 mg/kg, immediately.

Stabilisation

- Sodium chloride 0.9%/dextrose 5%, or a 10% dextrose IV infusion if needed.

If hypoglycaemia persists, consider adrenal insufficiency or hyperinsulinism. Hyperinsulinism is likely if the rate of glucose infusion required to maintain normoglycaemia is above 8mg/kg/min. An inappropriately high insulin or C-peptide level at the time of the confirmed hypoglycaemia is also strongly suggestive of hyperinsulinism.

If hyperinsulinism is suspected, administer:
Diazoxide, orally, 5 mg/kg/day in three divided doses, may increase to 15 mg/kg/day.

LoE III[v,vi,vii]

Ongoing treatment
Intravenous fluid therapy as needed.
Start oral feeds as soon as possible.

REFERRAL
» All patients with confirmed hypoglycaemia not explained by intercurrent illness, drugs.
» Persisting or recurrent hypoglycaemia.
» Suspected hyperinsulinism.

7.7 GROWTH DISORDERS
R62

DESCRIPTION
Pathological growth failure may be suspected if a child is short relative to his/her peers, his/her parents and possibly disproportionate to his/her weight. It is confirmed by a reduced growth velocity. This could be due to endocrine causes, chronic or bone disease or dysmorphic syndromes.

Idiopathic short stature may be due to constitutional delay in growth and puberty or familial short stature. Constitutional delay in growth is defined by short stature with a disproportionately short trunk and significantly delayed a bone age relative to chronological age. Familial short stature is determined by genetic potential and a bone age equivalent to chronological age. Both have a normal growth velocity.

DIAGNOSTIC CRITERIA
» Measure and plot child's height and weight on growth charts.
Routine monitoring of height and weight for growth assists in timely diagnosis and treatment, and thus ensures maximum benefit.
» A child is regarded as short if his/her height for age z-score is below –2 for gender.
» To further evaluate short stature, assess parental height. Target height:
> for a boy = (father's height + (mother's height + 13 cm)) ÷ 2
> for a girl = ((father's height – 13 cm) + mother's height) ÷ 2
» If the child's predicted final height is > 10 cm below the target height, monitor growth velocity over 6 months to 1 year.
» If the child's height for age z-score is below –3, refer immediately.
» Growth failure occurs when the child's height deviates further from z-score of –2 over a period of 1 year or the growth velocity is below 25th percentile for gender and age.

GENERAL AND SUPPORTIVE MEASURES

» Identify and manage non-endocrine causes of stunted growth, e.g.:
  > intra-uterine growth retardation,
  > chronic disease,
  > psychosocial deprivation,
  > skeletal dysplasia and other dysmorphic syndromes.

REFERRAL

» Height for age z-score below –3.
» Height 10 cm or more below target height.
» Growth failure (height deviates further from z-score of –2 over a period of 1 year) or the growth velocity is below 25th percentile for gender and age.
» Suspected endocrine causes as suggested by a child who is short with a normal or high BMI.
» Dysmorphic child with unidentified syndrome.
» Untreated chronic disease.

7.8 HYPOCALCAEMIA IN CHILDREN

E83.5

DESCRIPTION

The main causes of hypocalcaemia in children are:
» vitamin D deficiency,
» calcium deficiency,
» magnesium deficiency,
» reduced parathyroid hormone production or resistance,
» impaired renal function.

DIAGNOSTIC CRITERIA

Clinical

» Signs and symptoms of tetany include:
  > paraesthesia,
  > cramps,
  > carpopedal spasm,
  > laryngospasm,
  > prolonged QT interval on the ECG.
  > positive Chvostek's sign,
  > positive Trousseau's sign,
  > weakness,
  > lethargy,

Investigations

» Blood level to establish cause:
  > calcium,
  > albumin,
  > phosphate,
  > magnesium,
  > ALP
  > 25 Hydroxyvitamin D.

MEDICINE TREATMENT

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-term therapy depends on the cause.
Manage hypophosphataemia or hyperphosphatemia, depending on the cause of hypocalcaemia, before long-term calcium is initiated.

- Calcium, elemental, 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.

REFERRAL

» Chronic hypocalcaemia.

7.9 HYPERKALAEMIA

E87.5

See Chapter 6: Nephrological/Urological Conditions, section 6.4: Acute kidney injury (Renal failure, acute).

7.10 HYPOKALAEMIA

E87.6

DESCRIPTION

Causes include:

» prolonged decreased intake and protein energy malnutrition;
» increased renal excretion: renal tubular acidosis, amphoteracin B and diuretics;
» increased extrarenal losses;
» transmembrane shifts: ß$_2$ stimulants, alkalosis; and
» mineralocorticoid excess.

DIAGNOSTIC CRITERIA

Clinical

» Cardiac arrhythmias, especially with digitalis.
» Neuromuscular dysfunction, e.g. muscle weakness.
» Renal: impairment of urine concentrating or diluting ability.

Investigations

» Serum potassium < 3.0 mmol/L.

MEDICINE TREATMENT

See Chapter 2: Alimentary Tract, section 2.2.4: Diarrhoea, acute.

Severe respiratory paralysis and or cardiac arrhythmias:

- Potassium chloride, IV, < 1 mEq/kg/hour.
  - ECG monitoring.
  - Potassium concentration should not be > 40 mmol/L/infusion.
  - Never give potassium as an IV bolus.

Less critical situations to correct potassium deficit over 2–3 days:

- Potassium chloride, oral, 2–6 mEq/kg/day.
  Note: 1 g KCl = 13 mEq; 1 mL 15% KCl = 2 mmol; 1 mEq = 1 mmol.

7.11 HYPOPITUITARISM

E23.0

DESCRIPTION

Multiple or isolated deficiencies of adrenocorticoid hormone (ACTH), luteinising hormone, thyroid stimulating hormone, prolactin and growth hormone manifesting as hypoglycaemia, abnormal body proportions and failure to grow and develop. If the posterior pituitary is involved (ADH deficiency), then this condition is known as panhypopituitarism.

The deficiency may be due to:
» congenital abnormalities with/without midline structural abnormalities of the brain,
» central nervous system tumours,
» histiocytosis,
» complications of radiation therapy.

DIAGNOSTIC CRITERIA

Clinical

» Neonates with hypopituitarism may present with:
  > persistent hypoglycaemia,
  > cholestatic jaundice (related to low cortisol),
  > micropenis.
» Growth failure with immature body proportions.
» Polydipsia, polyuria, nocturia in the case of panhypopituitarism.

Investigations

» Endocrine evaluation with pituitary function tests under specialist supervision.
» Confirm diagnosis in older children with stimulation tests.

MEDICINE TREATMENT

To correct hypoglycaemia:
- Hydrocortisone, IV, 2-3 mg/kg.

REFERRAL

» All patients after stabilisation of hypoglycaemia.

7.12 HYPOTHYROIDISM, CONGENITAL

E03.1

DESCRIPTION

Congenital deficiency of thyroid hormone due to:
» aplasia/hypoplasia or ectopia of the thyroid gland,
» defects in thyroid hormone biosynthesis, or
» intrauterine exposure to antithyroid medicines.

Congenital hypothyroidism is one of the common treatable causes of preventable mental retardation in children. Congenital hypothyroidism must be treated as early as possible to avoid intellectual impairment.
Symptoms and signs in neonates are unreliable, thus screening is essential for ensuring early intervention.

DIAGNOSTIC CRITERIA

Clinical

- » Prolonged unconjugated hyperbilirubinaemia.
- » Feeding difficulties.
- » Lethargy.
- » Somnolence.
- » Abdominal distension.
- » Umbilical hernia.
- » Subnormal temperature.
- » Periorbital oedema.
- » Delayed dentition.
- » Broad hands.
- » Coarse, scanty hair.
- » Hoarse voice and goitre.
- » Oedema of the extremities and genitals.
- » Bradycardia.
- » Anaemia.
- » Apnoeic episodes.
- » Coarse cry.
- » Constipation.
- » Wide open fontanelles.
- » Enlarged tongue.
- » Short and thick neck.
- » Dry skin.
- » Hypotonia.
- » Delayed physical and mental development.

Investigations

- » When suspected, perform TSH test.
  - > If elevated perform a free T_4.

Delay in diagnosis and treatment is associated with irreversible neurodevelopmental damage**.**

GENERAL AND SUPPORTIVE MEASURES

- » Routine screening of all newborns for congenital hypothyroidism.
- » Growth and neurodevelopmental assessment.
- » Regular follow up.

MEDICINE TREATMENT

For neonates, started as soon as possible, ideally within the first three weeks after birth:

- Levothyroxine, oral, 10–15 mcg/kg as a single daily dose on an empty stomach.
  - o Adjust dosage to blood levels of T_4 (in the upper half of the reference range) and normalise the TSH (between 0.5–2 mU/L), especially in the first 3 years of life. Check TSH only 6 weeks after adjusting the thyroxine dose.
  - o Continue treatment indefinitely.

REFERRAL

- » All patients for confirmation of diagnosis but initiation of therapy should not be delayed.

7.13 HYPOTHYROIDISM IN OLDER CHILDREN AND ADOLESCENTS

E03.9

DESCRIPTION

Acquired hypothyroidism in childhood and adolescents may be due to:

» auto-immune thyroiditis,
» goitrogen induced,
» iodine deficiency,
» post surgery,
» radioactive iodine,
» infiltrations,
» medicines, e.g. antiretrovirals.

DIAGNOSTIC CRITERIA

Clinical

» Low growth velocity or short stature with short limbs associated with a normal or elevated BMI.
» Subtle features with cold intolerance, dry skin, brittle hair, pallor and myxoedema.

Investigations

» Elevated TSH and low thyroxine levels.

MEDICINE TREATMENT

- Levothyroxine, oral, once daily on an empty stomach.

1 - 6 months	8-10 mcg/kg
6 - 12 months	6-8 mcg/kg
1 - 5 years	5 - 6 mcg/kg
6 - 12 years	4 - 5 mcg/kg
Over 12 years	2 - 3 mcg/kg

REFERRAL

» All cases for investigation and initiation of therapy.

7.14 HYPERTHYROIDISM, GRAVES DISEASE

E05.9/E05.0

DESCRIPTION

Hyperthyroidism is a pathological syndrome in which tissue is exposed to excessive amounts of circulating thyroid hormones.
The most common cause is Grave's disease, although thyroiditis may also present with thyrotoxicosis.

DIAGNOSTIC CRITERIA

Clinical

- » Poor school performance.
- » Warm moist hands.
- » Thyromegaly.
- » Tremor.
- » Proptosis.
- » Fatigue.
- » Tachycardia.
- » Nervousness or anxiety.
- » Weight loss.
- » Palpitations.
- » Heat intolerance.

Investigations

» Elevated thyroxine (T_4) and suppressed TSH.

MEDICINE TREATMENT

- Carbimazole, oral, 0.5 mg/kg once daily.

AND

To block sympathetic hyperactivity:

- Atenolol, oral, 1–2 mg/kg as a single daily dose.

For children less than 10 kg:

- Propranolol, oral, 0.2–0.5 mg/kg 6–12 hourly.
  - o Maximum dose: 1.5 mg/kg/dose 6–12 hourly.

REFERRAL

» All patients for confirmation of diagnosis, initiation and follow up of therapy.

7.15 OBESITY

E66

DESCRIPTION

Most children with obesity do not have an underlying pathological cause and have so-called “simple obesity”, i.e. both weight and height are increased.

In children with pathological obesity, the height is not usually increased when compared to parental height. Causes of pathological obesity include syndromes, hypothalamic damage, endocrine abnormalities, immobility, impaired skeletal growth or medicines.

There has been a dramatic increase in the prevalence of childhood overweight and its resultant comorbidities.

DIAGNOSTIC CRITERIA

Clinical

» Measurement of weight alone is inadequate given the influence of height on weight.

» Assess severity using body mass index (BMI):

$$\text{body mass index} = \frac{\text{weight (kg)}}{[\text{height (m)}]^2}$$

» The BMI varies with age. Use sex-specific BMI charts for accurate identification of obesity.

» In general obesity is likely if BMI:
  > 19 kg/m^2 at age 5 years,
  > 20 kg/m^2 at age 10 years, and
  > 25 kg/m^2 at age 18 years.

Investigations

» Fasting glucose and lipid profile.

» ALT, AST, GGT.

GENERAL AND SUPPORTIVE MEASURES

» Weight control by:
  > education about the nature of obesity and its long term consequences;
  > healthy eating, e.g. regular meal times, avoidance of excessive "snacking", fried foods, added fats and sugars and high energy drinks while encouraging foods with high fibre content, with modest calorie restriction;
  > increasing physical activity;
  > reduce sedentary time, e.g. TV watching, computer games, videogames or time on the telephone;
  > psychological support, e.g. parental guidance in managing abnormal behaviour.

» Weight loss down to an "ideal body weight for height" is unrealistic. Prevention of further weight gain may produce significant longer-term benefits. If the patient is over 7 years, or if complications are present, aim for a weight loss of 0.5 kg/month. Ideally target BMI should be in the overweight range.

MEDICINE TREATMENT

Look for and manage complications such as hyperlipidaemia, hypertension, sleep apnoea, slipped upper femoral epiphysis and non-alcoholic fatty liver. Insulin resistance is another important complication, and this is a key factor in the pathogenesis of metabolic syndrome. Metabolic syndrome is a cluster of cardiovascular and diabetes risk factors such as central abdominal obesity, dyslipidaemia, glucose intolerance, and hypertension (particularly common in patients on HAART).

Refer to Chapter 4: Cardiovascular system: Sections 4.10 Dyslipidaemia and 4.11 Hypertension in Children; and Section 7.5 Diabetes Mellitus.

REFERRAL

» All cases of pathological and morbid simple obesity (as defined by a Z-score > +3).

» Severe/progressive obesity < 2 years.
» Serious co-morbidity requiring weight loss.

7.16 DISORDERS OF PUBERTY

E30

DESCRIPTION

Abnormally early or late development of signs of puberty including the development of breasts (in girls) or enlargement of external genitalia (boys) and sexual hair growth.
Often associated abnormality of growth velocity.

DIAGNOSTIC CRITERIA

» Puberty begins after 9 years and usually not later than 14 years in males.
» Puberty begins after 8 years and usually not later than 13.5 years in females.
» Precocity or delay of puberty occurring outside these ages need investigation.

Investigations

» Puberty staging.
» Radiological bone age.
» Endocrine investigation.

GENERAL AND SUPPORTIVE MEASURES

» Psychological support.
» Treat the cause, e.g. tumours.

REFERRAL

» All.

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CHAPTER 8

INFECTIVE/INFECTIOUS DISEASES

8.1 HELMINTHIASIS, INTESTINAL

B82.0

DESCRIPTION

Infestation of the intestine with adult worms. The following species are commonly encountered:

» *Ascaris lumbricoides* (round worm).
» *Enterobius vermicularis* (pin worm).
» *Trichuris trichiura* (whipworm).
» *Ancylostoma duodenale* and *Necator americanus* (hookworm).
» *Taenia saginatum* and T. *solium* (beef and pork tapeworms).

DIAGNOSTIC CRITERIA

Clinical

» Most infestations are asymptomatic and become apparent with the passage of a worm rectally or orally.
» Signs and symptoms include:
  > vague abdominal pains,
  > diarrhoea,
  > rectal prolapse,
  > protein losing enteropathy.
  > perianal itch,
  > vaginitis,
  > iron deficiency anaemia, and
» Surgical complications are secondary to mechanical obstruction in the bowel, pancreatic duct or biliary tree.
» Migration of worm larvae may cause cutaneous, pulmonary or cerebral symptoms. See Chapter 13: The Nervous System, section 13.7: Neurocysticercosis.

Investigations

» Identification of the adult worm from stool or vomitus.
» Stool microscopy (fresh sample): Recognition of the worm or identification of worm eggs or proglottids in stool.

GENERAL AND SUPPORTIVE MEASURES

Prevent infestation by:

» Hand washing.
» Careful preparation of foods by adequate washing and cooking.
» Wearing shoes (hookworm).
» Improved sanitation will protect the environment from contamination.

Deworming for all children between 12-60 months is performed 6 monthly as part of routine child health care.

MEDICINE TREATMENT

All helminths excluding *Taenia* and *Enterobius*:

Children 1–2 years of age:

- Mebendazole, oral, 100 mg 12 hourly for three days.

Children > 2 years:

- Mebendazole, oral, 500 mg as a single dose immediately.

Enterobius

- Mebendazole, oral, 100 mg immediately as a single dose.
  - Repeat after 2 weeks.

Taenia

- Albendazole, oral, daily for three days.
  - If 1–2 years of age: 200 mg.
  - If > 2 years of age: 400 mg.

REFERRAL

» All patients with mechanical obstruction and complications related to migration of worm larvae.

8.2 AMOEBIASIS (ENTAMOEBA HISTOLYTICA)

A06.9

DESCRIPTION

Amoebic colitis is caused by the parasite *Entamoeba histolytica*. It can cause localised intestinal disease or disseminated disease. Amoebiasis is now relatively uncommon in South Africa, but immunodeficiency is a risk factor.

DIAGNOSTIC CRITERIA

Clinical

» Diarrhoea with mucus, blood and pus (dysentery).
» Liver abscesses:
  > presents with point tenderness over the liver area,
  > pleuritic type pain,
  > fever (often fever of unknown origin).

Investigations (colitis):

» Trophozoites or cysts in fresh stool.
» Trophozoites in rectal smear (danger of perforation if biopsy is done).
» Serological tests (ELISA and agar gel diffusion).

GENERAL AND SUPPORTIVE MEASURES

Prevent infestation by:

» Hand washing.
» Careful preparation of foods by adequate washing and cooking.

Aspirate liver abscess if not responding to treatment in 5 days or if rupture is imminent.

MEDICINE TREATMENT:

- Metronidazole, oral, 15 mg/kg/dose 8 hourly for 7 days.
  - 10 days in severe disease.

8.3 CUTANEOUS LARVA MIGRANS/*ANCYLOSTOMA BRAZILIENSE* (DOG HOOKWORM)

B76.9/B76.0

DESCRIPTION

Infestation of the skin by dog hookworm larvae. Maturation of the larvae cannot occur resulting in a self-limiting infection.

DIAGNOSTIC CRITERIA

» Presents as an itchy "serpiginous" skin lesion.

GENERAL AND SUPPORTIVE MEASURES

» Regular deworming of dogs.
» Wearing shoes to protect against infection.

MEDICINE TREATMENT

- Albendazole, oral, daily for three days.
  - If 1–2 years of age: 200 mg.
  - If > 2 years of age: 400 mg.

8.4 HYDATID DISEASE

B67

DESCRIPTION

The development of hydatid (*Echinococcus granulosus)* cysts follows ingestion of worm ova that are usually passed in the stools of dogs in sheep farming areas. Cysts may occur in any organ, but are most commonly found in the liver and lungs.

DIAGNOSTIC CRITERIA

» Typical radiological features.
» Diagnostic aspiration of an organ cyst should never be attempted.

GENERAL AND SUPPORTIVE MEASURES

» Prevent infestation by:
  > hand washing,
  > adequate food preparation,
  > surgical removal of cysts may be indicated.

MEDICINE TREATMENT

- Albendazole, oral, 10 mg/kg/dose daily for 3 months.
- Monitor FBC/LFT monthly

REFERRAL

» All with liver cysts for consideration of PAIR (Percutaneous Puncture, Aspiration, Injection (of a scolecidal agent), Re-aspiration) which should be carried out under expert supervision.

8.5 SCHISTOSOMIASIS (BILHARZIA)

B65.0/B65.1

DESCRIPTION

» Disease manifestations caused by infestation by species of the genus Schistosoma.
» Infestations with S. haematobium and S. mansoni are endemic in certain areas of South Africa.
» Nematodes reside in venous plexus draining bladder wall (haematobium) or intestine (mansoni).

Complications include:

» haematuria,
» dysuria,
» cystitis,
» calcifications in the bladder wall,
» obstructive uropathy,
» bladder stones,
» intestinal perforation,
» fistulas,
» spinal cord granulomas with pressure effects.
» strictures,
» hepatosplenomegaly,
» portal hypertension,
» cirrhosis,
» ascites,
» pulmonary hypertension,
» bladder cancer,

DIAGNOSTIC CRITERIA

Clinical

» Transient pruritic papular rash (swimmers itch) after exposure to cercariae in the water.
» A few weeks after exposure:
  > fever,
  > chills,
  > headache,
  > urticaria,
  > cough, and
  > wheezing,
  > hepatosplenomegaly,
  > arthralgia,
  > lymphadenopathy,
  > eosinophilia.
» Haematuria and dysuria.
» Abdominal pain and diarrhoea often after ingestion of food.

Investigations:
» Serology for schistosomiasis.
» Urine and stools microscopy for viable eggs or rectal biopsy specimens.

GENERAL AND SUPPORTIVE MEASURES
» Educate patient/caregiver on preventative measures.
» Symptomatic and supportive treatment.
» Avoid exposure to water contaminated by schistosoma.
» Surgical intervention to correct or prevent complications.

MEDICINE TREATMENT
Acute Schistosomiasis
- Prednisone, oral, 0.5 – 1 mg/kg daily for 5 days.

Start antihelmintic once acute symptoms have resolved:
- Praziquantel, oral, 40 mg/kg as a single dose or in 2 divided doses on the same day.

Chronic Schistosomiasis
- Praziquantel, oral, 40 mg/kg as a single dose or in 2 divided doses on the same day.
- If given within 6 weeks of exposure, to be repeated in 4-6 weeks.

REFERRAL
» Schistosomiasis with suspected complications following adequate therapy.

8.6 CANDIDIASIS, SYSTEMIC AND OTHER
B37

DESCRIPTION
Superficial and/or disseminated (systemic) fungal infection caused by *C. albicans, C. Tropicalis* and other candida species.

Risk factors include:
» Prolonged, broad-spectrum antibiotic therapy.
» Compromised immune system, including patients infected with HIV or on cancer chemotherapy, and the premature baby.
» Steroid therapy.
» Diabetes mellitus.
» IV hyperalimentation – contaminated solution or as an associated risk factor.
» Instrumentation, and central or peripheral vascular catheters.

DIAGNOSTIC CRITERIA

Clinical

» Oral candidiasis (thrush):
  > White plaque adheres to inner cheeks, lips, palate and tongue.
  > Stomatitis with red mucosa and ulcers may also be present.
  > In immunocompromised patients, the lesions may extend into the oesophagus.
» Oesophageal candidiasis:
  > Presents as difficulty swallowing, drooling or retrosternal pain (irritability in small children).
» Skin lesions in the newborn:
  > A red, maculopapular or pustular rash is seen in infants born to women with candida amnionitis.
» Cutaneous lesions:
  > May be represented by scattered, red papules or nodules.
  > Superficial infections of any moist area, such as axillae or neck folds, are common and may present as an erythematous, intertriginous rash with satellite lesions.
» Vulvovaginitis:
  > A thick cheesy vaginal discharge with intense pruritus, white plaques on the glans of the penis.
  > Common in diabetics and patients on broad-spectrum antibiotics.
  > In recurrent vulvovaginitis, exclude diabetes, foreign body or sexual abuse.
» Systemic or disseminated candidiasis:
  > Mimics bacterial sepsis but fails to respond to antibiotics.
  > Thrombocytopaenia is common.
  > Ophthalmitis with “cotton wool” retinal exudates may also occur.
  > Is usually nosocomial.

Investigations:

» For oesophageal candidiasis:
  > It is reasonable to initiate treatment on clinical suspicion
  > Oesophagoscopy or barium swallow.
» Systemic candidiasis:
  > Urine and blood fungal cultures are essential.
  > Biopsy specimens, fluid or scrapings of lesions: budding yeasts and pseudohyphae are seen on microscopy.

GENERAL AND SUPPORTIVE MEASURES

» Encourage cup feeding of formula-fed infants, as bottles are difficult to clean and predispose to candida infection.
» Eradicate or minimise risk factors.
» Avoid use of pacifiers (dummies), teats and bottles but if used, these should be sterilised.
» Remove all invasive devices, drain abscesses and debride infected tissue.

MEDICINE TREATMENT

Oral candidiasis

- Nystatin suspension 100 000 IU/mL, oral, 1 mL 4 hourly.
  - Keep in contact with affected areas for as long as possible.

Suspect immunodeficiency if poor response to treatment.
If no response:

- Imidazole oral gel, e.g.:
- Miconazole gel 2%, oral, apply 8 hourly.

Oesophageal candidiasis

- Fluconazole, IV/oral, 6 mg/kg immediately as a single dose.
  - Follow with 3 mg/kg/day for 3 weeks.

LoE III[i]

Vulvovaginitis

- Fluconazole, oral, 12 mg/kg as a single dose.
  - Maximum dose: 150 mg.

OR

- Imidazole topical/vaginal, e.g.
- Clotrimazole **OR** miconazole, applied locally at night for 7–14 days.
  - Do not use applicator in girls who are not sexually active.

Systemic candidiasis

- Amphotericin B deoxycholate, IV infusion in **5% dextrose water only**, 1 mg/kg/dose once daily over 4 hours for at least 2 weeks after first negative culture, or if no repeat culture available at least 3 weeks after clinical improvement.
  - Maximum cumulative dose: 30–35 mg/kg over 4–8 weeks.
  - Adjust dosing interval in patients with renal impairment.
  - Protect the bag from light during infusion.
  - Check serum potassium and magnesium at least 3 times a week.
  - Do **not** use bacterial filter with amphotericin B.

Prehydration before administering amphotericin to prevent renal impairment:

- Sodium chloride 0.9%, IV, 15 mL/kg **plus** potassium chloride, 20 mmol/L infused over 2–4 hours.

REFERRAL

» Candidiasis not responding to adequate therapy.
» Patients with renal and hepatic failure.
» Confirmed azole resistance.

8.7 CYTOMEGALOVIRUS (CMV) INFECTION

B25.9

DESCRIPTION

CMV is an extremely common childhood infection, with almost all children infected by 5 years of age.

Majority of childhood infections are asymptomatic or present with a mononucleosis-like syndrome NOT requiring anti-viral treatment.

CMV can cause clinically significant disease following congenital infection and infections in immunocompromised children (especially HIV infected children, transplant recipients).

DIAGNOSTIC CRITERIA

Clinical:

» Congenital infections vary from asymptomatic through isolated neural deafness, to severe disease including microcephaly.

» Infections in immunocompromised children can develop pneumonia, encephalitis, retinitis and gastrointestinal infections.

Investigations:

Diagnostic tests should be only performed if clinical disease is suspected.

Congenital Infections (performed within 3 weeks post-delivery - in children with suspected CMV older than 3 weeks, discuss with a specialist):

» Serology: CMV IgM indicate recent infection

» CMV PCR – qualitative: blood, or urine/saliva in viral transport medium.

Hearing assessment at baseline and annually for the first 5 years of life

Infections in Immunocompromised children:

» Serology: Presence of antibodies to CMV does not imply active infection or causality.

» CMV PCR – qualitative: blood, or urine/saliva in viral transport medium.

» Quantitative CMV PCR (CMV Viral load > 10 000 copies/ml)

» Intranuclear inclusion bodies may be seen in biopsy material.

AND

» Clinical features suggestive of CMV disease

MEDICINE TREATMENT

Symptomatic congenital infections:

- Valganciclovir, oral, 16 mg/kg, 12 hourly for 6 months.
  - Monitor FBC, AST/ALT weekly initially, then monthly.

- If unable to tolerate oral medication:
  - Ganciclovir, IV, 5 mg/kg administered over 1 hour, 12 hourly until able to tolerate oral medication.

Infections in Immunocompromised children:
Pneumonia and biopsy-proven GIT disease (Specialist initiated)

- Initial therapy:
  - Ganciclovir, IV, 5 mg/kg administered over 1 hour, 12 hourly for 7 days.
  - Follow with: Valganciclovir, oral, 16 mg/kg, 12 hourly for 5 weeks.

- Maintenance therapy: Not indicated

CNS disease **(Specialist initiated)**

- Initial therapy:
  - Ganciclovir, IV: 5 mg/kg administered over 1 hour, 12 hourly for 7 days.
  - Follow with: Valganciclovir, oral, 16 mg/kg, 12 hourly for 5 weeks.
- Maintenance therapy: Indicated for patients with good clinical response
  - Valganciclovir, oral, 16 mg/kg, daily until CD4 count rises to > 100 cell/mm3 on ART, if available

Retinitis:
See Chapter 16: Eye Conditions - Section 16.4 Cytomegalovirus (CMV) Retinitis.

REFERRAL

» All cases of severe organ-related disease or disseminated disease.

8.8 DIPHTHERIA

A36.9
***** Notifiable condition

Telephone Hotline	
NICD hotline (24 hours)	082 883 9920
National Institute of Communicable Diseases	011 555 0327 or 011 555 0352

DESCRIPTION

Diphtheria is an acute, communicable infection of the upper respiratory tract, caused by *Corynebacterium diphtheriae*. Disease is unlikely if the patient shows documented evidence of complete immunisation.
Cutaneous diphtheria can also occur.
Incubation period is between 2 and 7 days.

Complications include:

» In the first 2 weeks of the disease:
  > Cervical lymphadenopathy with peri-adenitis and with swelling of the neck (bull neck).
  > Upper airway obstruction by membranes.
  > Myocarditis.

» Usually after 3 weeks:
  > Neuritis resulting in paresis/paralysis of the soft palate and bulbar, eye, respiratory and limb muscles.

DIAGNOSTIC CRITERIA

Clinical

Any person presenting with: pharyngitis, nasopharyngitis, tonsillitis, laryngitis, tracheitis (or any combination of these), where fever is absent or low-grade.

AND

One or more of the following:

» Adherent pseudomembrane which bleeds if manipulated or dislodged.
» Features suggestive of severe diphtheria, including: stridor, bull-neck, cardiac complications (myocarditis, acute cardiac failure and circulatory collapse), acute renal failure.
» Link to a confirmed case.

Investigations

» Nasal or pharyngeal swab: Microscopy and culture.
» Culture of membrane.
» Important: Inform the laboratory that specimen is from a patient with suspected diphtheria.

GENERAL AND SUPPORTIVE MEASURES

» Staff in direct contact with patient should wear protective mask (N-95).
» Isolate patient in high or intensive care unit until 3 successive nose and throat cultures at 24-hour intervals are negative.
» Usually non-communicable within 4 days of antibiotics.
» Nutritional support.
» If respiratory failure develops, provide ventilatory support.
» Tracheostomy if life-threatening upper airway obstruction.
» Bed rest for 14 days.

MEDICINE TREATMENT

Note:

Do **not** withhold treatment pending culture results.

Antibiotic therapy (must be given for a total of 14 days)

Parenteral treatment for patients unable to swallow: Switch to oral as soon as patient able to swallow:

- Benzylpenicillin, IV, 50 000 units/kg/dose 6 hourly.

Oral treatment for patients able to swallow:

- Phenoxymethylpenicillin, oral, 15 mg/kg/dose 6 hourly.
- Maximum: 500 mg per dose.

In severe penicillin allergy:
Parenteral treatment for patients unable to swallow: Switch to oral as soon as patient able to swallow:

- Azithromycin, IV, 10 mg/kg daily.

Oral treatment for patients able to swallow:

- Azithromycin, oral, 10 mg/kg daily.

Diphtheria antitoxin treatment (DAT):
DAT should be given to all probable classic respiratory diphtheria cases without waiting for laboratory confirmation. DAT neutralises circulating unbound diphtheria toxin and prevents progression of disease; delaying administration increases mortality. The dosing of DAT is product-specific; refer to package insert.

Close contacts (household and regular visitors):
Regardless of immunisation status, isolate contact and swab throat for culture. Keep under surveillance for 7 days. Give antibiotic prophylaxis as follows:

Prophylactic treatment for contacts:

Age group	Benzylpenicillin
	< 6 years: Single dose: 600 000 units IM
	> 6 years: Single dose: 1.2 million units IM
Adults	Single dose: 1.2 million units IM

In severe penicillin allergy:

Age group	Azithromycin
Children	Oral, 10 mg/kg per day on day one THEN 5 mg/kg per day for four days (total of 5 days)
Adults	Oral, 500 mg on day one THEN 250 mg daily for four days (total of 5 days)

All close contacts:
If 1st culture was positive, follow up throat culture after 2 weeks and treat again.

REFERRAL

» All.

8.9 MALARIA

B54

* Notifiable disease.

DESCRIPTION

Malaria is transmitted by the bite of an infected female *Anopheles* mosquito. The incubation period varies with the species of the parasite, *Plasmodium falciparum* being shortest, usually 7–21 days, and *P. malariae* the longest. The incubation period may be prolonged by use of malaria prophylaxis or certain antibiotics.

The confirmation of the diagnosis and treatment of malaria is an emergency as complications develop rapidly. Malaria can be missed outside transmission areas.

DIAGNOSTIC CRITERIA

Clinical

» A child living in, or with recent **travel history** to a malaria transmission area.
» Fever, which may be intermittent.
» Flu-like symptoms including sweating or rigors, i.e. cold shaking feeling.
» Body pains and headache.
» Occasionally diarrhoea, loss of appetite, nausea and vomiting, tachypnoea and cough.
» A young child may present with fever, poor feeding, lethargy, vomiting, diarrhoea or cough.
» Clinical features are non-specific and overlap with many other infections.

Investigations:

» Testing is urgent. Obtain the result immediately.
  > Rapid diagnostic test.
    In areas where malaria transmission occurs, rapid tests should always be available for malaria screening but cannot be used for monitoring response to treatment as they may remain positive for over 4 weeks.

» Malaria parasites in blood smear – thick and thin smears.
  > One negative malaria test does not exclude the diagnosis.
  > Repeat smears if initially negative, and malaria suspected.
  > If severe malaria suspected, commence therapy and repeat smears after 6–12 hours.
  > Repeat smears after 48 hours and if no improvement in degree of parasitaemia, consider alternative therapy.

If severe malaria is suspected and diagnosis cannot be confirmed immediately, treat while awaiting laboratory results.

8.9.1 P. FALCIPARUM MALARIA, NON-SEVERE, UNCOMPLICATED

B50.9

DESCRIPTION

A child with uncomplicated malaria is alert, can tolerate oral medication, has an age appropriate level of consciousness and has no clinical or laboratory evidence of severe malaria.

Ideally treatment should be started in hospital. Initial doses should be directly observed. Observe for 1 hour to ensure dose is not vomited.

MEDICINE TREATMENT

Treat according to the National Malaria Guidelines.

Option 1:

Only for clearly uncomplicated, low risk malaria cases (> 5 kg):

- Artemether/lumefantrine 20/120 mg, oral, with fat-containing food/milk to ensure adequate absorption.
  - Give first dose immediately.
  - Follow with second dose 8 hours later.
  - Then 12 hourly for another 2 days (total number of doses in 3 days = 6).

Weight	Dose	Total tablets per course
5– ≤15 kg	1 tablet	6
15–≤25 kg	2 tablets	12
25– ≤35kg	3 tablets	18
over 35 kg	4 tablets	24

OR

Option 2:

Manage children < 5 kg with uncomplicated malaria with quinine plus clindamycin:

- Quinine, oral, 10 mg/kg/dose 8 hourly for 7–10 days.

2–3 days after initiating treatment with quinine:

- Clindamycin, oral, 10 mg/kg/dose 12 hourly for 7 days.

Children who are vomiting but who have no other indications of severe malaria:

- Quinine, IV, 10 mg/kg/dose 8 hourly administered over 4–6 hours.
  - ECG and heart rate monitoring.
  - Monitor blood glucose levels regularly.
  - Switch to oral medication once able to do so.

8.9.2 P. FALCIPARUM MALARIA, SEVERE, COMPLICATED (OR IF REPEATED VOMITING)

B50.0/B50.8

DIAGNOSTIC CRITERIA

Clinical

» Unable to drink or breastfeed.
» Vomits everything.
» Renal failure.
» Cerebral malaria: manifests with convulsions, which may be subtle, and/or any change in mental state, ranging from irritability, lethargy to coma, stiff neck or bulging fontanelle.
» Respiratory distress and metabolic acidosis similar to pneumonia.
» Anaemia: can be severe and lead to cardiac failure and a depressed mental state.
» Shock: cold moist skin, low blood pressure and evidence of poor peripheral perfusion.
» Hypoglycaemia: can present with convulsions and a depressed mental state.
» Jaundice, bleeding, acute renal failure and ARDS are less common in children than adults.

Investigations

» Hyperparasitaemia: > 5% of RBCs infected indicates severe malaria but a lower parasite density does not exclude severe malaria.
» Low Hb (< 6 g/dL).
» Test glucose immediately with a fingerprick test. Low blood glucose (< 2.2 mmol/L).
» Acidosis: serum lactate (venous) > 5 mmol/L or bicarbonate < 15 mmol/L.
» Severe thrombocytopaenia: < 50 x 10^9/L.
» In severe cases, repeat smear after 72 hours and after the completion of the course of treatment.

GENERAL AND SUPPORTIVE MEASURES

» Check airway, breathing, circulation (ABC).
» Admit to high care or intensive care unit.
» Review the child at least twice daily, including holidays.
» Avoid overhydration.
» Control convulsions.
» Ventilatory support, if necessary.
» Agitation and respiratory distress can be as a result of severe metabolic acidosis. Treat shock and acidosis. See Chapter 1: Emergencies and Trauma, section 1.1.7: Shock.
» Nutritional support.

MEDICINE TREATMENT

Urgent:

- Prefered option: Artesunate, IVI, 2.4mg/kg at hours 0, 12 and 24, then daily until patient is able to tolerate oral treatment.
  Alternative option: Quinine, IV infusion, diluted in 5–10 mL/kg dextrose 5% or sodium chloride 0.9%.
  - Loading dose: 20 mg/kg over 4 hours (loading dose).
  - Follow with 10 mg/kg over 4–6 hours at 8 hourly intervals until able to take oral therapy.
  - ECG monitoring.
  - Monitor blood glucose levels.

2–3 days after initiating treatment with artesunate or quinine and able to swallow, switch to any of the 2 regimens:

Children > 5 kg:

- Artemether/lumefantrine 20/120 mg, oral, with fat-containing food/milk to ensure adequate absorption.
  - Give first dose immediately.
  - Follow with second dose 8 hours later.
  - Then 12 hourly for another 2 days (total number of doses in 3 days = 6).

Weight	Dose	Total tablets per course
5– ≤15 kg	1 tablet	6
15–≤25 kg	2 tablets	12
25– ≤35kg	3 tablets	18
over 35 kg	4 tablets	24

OR

Children < 5 kg

- Quinine, oral, 10 mg/kg/dose 8 hourly to complete 7–10 day course.

PLUS

- Clindamycin, oral, 10 mg/kg/dose 12 hourly for 7 days.

For concurrent bacterial sepsis:

- Ceftriaxone, IV, 100 mg/kg as a single daily dose once daily for 10 days.
  - Maximum dose: 4 000 mg/24 hours.

For fever:

- Paracetamol, oral, 15 mg/kg/dose, 6 hourly as required.

For hypoglycaemia:

- Dextrose 10%, IV, 4 ml/kg.

If Hb < 7 g/dL:

- Packed red cells, IV, 10 mL/kg over 3 hours.

Note:
Fluid loss is often underestimated in a febrile, vomiting, sweating child.

REFERRAL

» **Urgent**: Severe or complicated malaria.
» High-risk children under 2 years, splenectomised patients.
» Malaria not responding clinically to adequate treatment within 48–72 hours (possible resistance).

8.9.3 P. OVALE, *P VIVAX* AND P*. MALARIAE*

B53.0/B51.9/B52.9

- Chloroquine, oral, 10 mg base/kg as a single dose,
  - Follow with 5 mg base/kg given 6, 24 and 48 hours after the first dose.

PLUS (for P. Ovale and/or P. vivax)
To eradicate the organism:

- Primaquine, oral, 0.25 mg base /kg/day for 14 days (obtained using section 21 approval).
  - Continue chloroquine once weekly until primaquine is obtained.

Note: Exclude G6PD deficiency before prescribing primaquine for non-falciparum malaria.

8.9.4 MALARIA PROPHYLAXIS - SELF PROVIDED CARE

In the high-risk malaria areas from September to May in South Africa, malaria prophylaxis should be used, together with preventive measures against mosquito bites. State facilities do not provide prophylactic therapy. It is recommended that persons intending to travel to high-risk areas take the relevant prophylactic therapy.

Preventative measures against mosquito bites include:
» Use of treated mosquito nets, screens, coils or pads.
» Application of insect repellent to exposed skin and clothing.
» Wearing long sleeves, long trousers and socks if outside between dusk and dawn, as mosquitoes are most active at this time.
» Visiting endemic areas only during the dry season.

CAUTION
Pregnant women and children under 5 years should avoid visiting malaria-endemic areas, as they are more prone to the serious complications of malaria

For chemoprophylaxis refer to National Malaria Prevention Guidelines, 2009.

8.10 MEASLES

B05
* Notifiable condition

DESCRIPTION

The following case definition is an epidemiological and not a diagnostic tool:
» Fever and maculopapular rash with any one of the following:
  > cough,
  > coryza/runny nose,
  > conjunctivitis.

Suspect measles in any child fulfilling the case definition.

An acute, highly contagious, viral, childhood exanthem.
Incubation period: 8–14 days from exposure to first symptoms and 14 days between appearance of rash in source and contact.

Complications include:
» pneumonia,
» laryngotracheobronchitis (croup),
» encephalitis,
» stomatitis, and
» feeding difficulties,
» diarrhoea,
» otitis media,
» corneal ulceration.

Subacute sclerosing panencephalitis is a rare long-term complication.

DIAGNOSTIC CRITERIA

Clinical

» Prodromal (catarrhal) phase:
  > duration 3–5 days,
  > fever,
  > runny nose (coryza),
  > cough,
  > conjunctivitis.
» Koplik's spots, followed 3–5 days later with maculopapular rash.
» The rash begins to fade after 3 days in the order of its appearance leaving temporary darker staining.
» If fever is still present after the third day of the rash, a complication should be suspected.

Investigations

» Serum measles IgM antibodies for confirmation of diagnosis.

GENERAL AND SUPPORTIVE MEASURES

» Notify provincial EPI manager when case is suspected, prior to confirmation.
» Only admit high risk patients:
  > children less than 6 months old,
  > immune compromised/suppressed children,
  > children with severe malnutrition,
  > children with complications.

» Minimal exposure to strong light, if patient is photophobic.
» Isolate the patient in a separate room, if possible away from other children.
» All entering the room to wear mask, gloves and gown.
» Patient is infectious for 4 days after onset of rash, longer if HIV infected.
» Screen outpatient waiting areas for children with measles.
» If pneumonia with hypoxia, give humidified oxygen by nasal cannula.

MEDICINE TREATMENT

All patients

- Vitamin A, oral, as a single daily dose for 2 days.
  - If < 6 months of age: 50 000 units.
  - If 6 – 12 months of age: 100 000 units.
  - If > 1 year of age: 200 000 units.

For fever

- Paracetamol, oral, 10–15 mg/kg/dose, 6 hourly as required until fever subsides.

Pneumonia

Also see Chapter 15: Respiratory System - Section 15.1.1 Pneumonia.

Empiric antibiotics for suspected secondary bacterial infection:

To cover *S. pneumoniae* and Gram negative infection.
Total duration of therapy: 5–7 days.

- Amoxicillin/clavulanic acid, IV, 25 mg/kg/dose 8 hourly

When child improves follow with oral therapy to complete 5–7 days treatment:

- Amoxicillin/clavulanic acid, oral, 30 mg/kg/dose 12 hourly.

Penicillin allergy

See Chapter 24 Drug Allergy, section 23.4.1: Allergies to penicillins.

In very severe progressive or unresponsive pneumonia consider use of aciclovir for possible herpes infection.

Croup

See Chapter 15: Respiratory System, section 15.5.2: Laryngotracheobronchitis, acute viral (croup).

Diarrhoea

See Chapter 2: Alimentary Tract, section 2.2.4 Diarrhoea, acute.

Encephalitis

See section 8.13: Meningo-encephalitis/encephalitis, acute viral.

Convulsions

See Chapter 13: The Nervous System, section 13.3: Status epilepticus (convulsive).

Conjunctivitis

- Chloramphenicol ophthalmic ointment 1%, inserted 6 hourly for 5 days.

If corneal clouding/ulceration present obtain urgent ophthalmologic consultation.

Management of contacts

Immunise children older than 6 months if unvaccinated and less than 72 hours since exposure.

Between 3 and 6 days after exposure and for contacts less than 6 months old:

- Human Normal Immunoglobulin, IM, 0.25 mL/kg.

If immunodeficient:

- Human Normal Immunoglobulin, IM, 0.5 mL/kg.

Immunise all children > 6 months of age if outbreak occurs.

REFERRAL

» Children in need of intensive care unit.
» Children with depressed level of consciousness.
» Children with corneal ulceration/opacity.

8.11 MENINGITIS, ACUTE BACTERIAL

G00
* Notifiable condition. (*N. meningitidis and H. influenzae)*

This guideline applies to children > 60 days old. For the management of neonates, see Chapter 19: Prematurity and Neonatal Conditions, section 19.11: Meningitis bacterial, neonatal.

DESCRIPTION

Bacterial meningitis most commonly results from haematogenous dissemination of micro-organisms from a distant site, e.g. the nasopharynx.
In children, *S. pneumoniae* and *N. meningitides* are the usual pathogens.

Note:
Tuberculosis, cryptococcal and partially treated acute bacterial meningitis should be considered when the clinical and laboratory features are not typical of pyogenic meningitis, or when there is a slow onset of disease (> 2 days), especially in any high risk settings such as immune suppression, TB contact and malnourished children.

Differentiation of TB or cryptococcal meningitis from acute bacterial meningitis is not always easy on presentation.

Complications include:

» Raised intracranial pressure due to cerebral oedema, subdural effusion/empyema or hydrocephalus.

» Other acute complications include:
  > cerebral infarctions,
  > shock,
  > seizures,
  > metastatic infection, e.g. arthritis, pneumonia, pericarditis,
  > disseminated intravascular thrombosis,
  > inappropriate antidiuretic hormone (ADH) secretion.

Long-term neurological sequelae include deafness, blindness, mental retardation and motor paralysis, e.g. hemiparesis.

DIAGNOSTIC CRITERIA

Clinical

» Fever.
» Headache.
» Vomiting.
» Convulsions
» Feeding problems.
» Irritability.
» Lethargy.
» Photophobia.
» Signs of meningeal irritation. In young infants signs of meningism are often absent.
» Signs of increased intracranial pressure, e.g. bulging anterior fontanel.
» Papilloedema is not a useful sign in young children with meningitis. It is difficult to elicit and may be absent even with acutely raised ICP.

Investigations

» Lumbar puncture (LP) – send CSF for biochemistry, microscopy and culture.
  > In typical cases of bacterial meningitis: CSF glucose is low, CSF protein is raised, CSF pleocytosis with neutrophil predominance is found, and bacteria may be visualised on Gram stain. However, many cases do not have these typical CSF findings. All abnormal findings should lead to serious considerations of acute bacterial meningitis.

  If contra-indications to LP are present, defer LP and initiate treatment immediately. For contra-indications to LP see Chapter 13 The Nervous System, section 13.11: Lumbar Puncture.
» Clinical meningococcaemia (septicaemia) with petechiae/purpura.
  > Confirm with skin scrape, Gram stain and blood culture.

GENERAL AND SUPPORTIVE MEASURES

» Admit to high or intensive care unit, if appropriate.
» Monitor, where indicated:
  > neurological status,
  > heart rate,
  > blood pressure,
  > acid-base status,
  > blood glucose,
  > fluid balance, i.e. hydration,
  > respiration,
  > body tempera ture,
  > haematocrit,
  > electrolytes,
  > blood gases,
  > serum and uri ne osmolality.

» Ensure adequate nutrition by enteral feeding where possible.
  > Use a nasogastric tube if necessary.
  > If enteral feeding is not possible, give intravenous fluids: paediatric or neonatal maintenance solution with dextrose.

MEDICINE TREATMENT

Antibiotic therapy

Empiric treatment:

- Ceftriaxone, IV, 50 mg/kg/dose 12 hourly.

Adjust antimicrobial therapy according to culture and sensitivity.

Treatment duration in culture positive meningitis:

» N meningitides: 5 days
» S pneumoniae: 10 days
» H influenza: 10 days
» Other gram negative bacilli: 21 days

In stable patients with uncomplicated culture-negative meningitis, 5 days is adequate.

In complicated or non-responsive cases, a longer duration of therapy may be required.
Re-assess antimicrobial therapy when blood and CSF culture and sensitivity results become available, or when improvement is not evident within 72–96 hours.

Seek immediate advice on what treatment to start with when ventriculo-peritoneal shunt infection, spread from sinuses, mastoids, or direct penetrating source of infection is present.

For shunts:

- 3rd generation cephalosporin, e.g.:
- Ceftriaxone, IV, 50 mg/kg/dose 12 hourly.

PLUS

- Vancomycin, IV, 15 mg/kg/dose, 6 hourly infused over 1 hour.

PLUS

- Rifampicin, IV, 10 mg/kg 12 hourly, do not exceed 600 mg/dose (in patients where TB has been excluded).

Fever and headache:

- Paracetamol, oral, 15 mg/kg/dose, 6 hourly as required.

Convulsions

See Chapter 13: The Nervous System, section 13.3: Status epilepticus (convulsive).

Raised intracranial pressure or cerebral oedema

Elevate head of bed ± 30°.

Maintain $PaCO_2$ at 4–5 kPa (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.

Chemoprophylaxis for close contacts

A close contact is defined as someone living in the same household, dormitory, institution, children in the same crèche, or any other "kissing" contact. Health care workers who have intimate contact should receive prophylaxis.

N. meningitidis

- Ciprofloxacin, oral, as a single dose.
  - If < 12 years of age: 10 mg/kg.
  - If > 12 years of age: 500 mg.

  Note:
  If < 12 years of age and able to swallow, use a a single 250 mg tablet.

OR

- Ceftriaxone, IM, single dose
  - If < 12 years of age: 125 mg.
  - If > 12 years of age: 250 mg.

Close contacts who are pregnant:

- Ceftriaxone, IM, 250 mg.

H. influenzae prophylaxis for **all** contacts under 5 years who are household contacts (including index case) or day care contacts:

- Rifampicin, oral, 20 mg/kg/dose, once daily for 4 days.
  - Maximum dose: 600 mg
  - Neonatal dose: 10 mg/kg/dose, once daily for 4 days.

Check vaccination status of index case and all contacts; and update if necessary - Refer to Primary Health Care Standard Treatment Guidelines and Essential Medicines List, Chapter 13: Immunisation.

REFERRAL

» Where lumbar puncture is deferred due to suspected raised intracranial pressure and/or localising signs start bacterial and tuberculous meningitis treatment immediately.

» Meningitis with complications.

» All cases of suspected shunt infection. Start treatment immediately before referral.

8.12 MENINGITIS, CRYPTOCOCCAL

G02.1

DESCRIPTION

An uncommon childhood meningitis that may occur in older HIV infected children with severe CD4 T-cell depletion. Pulmonary and skin involvement can occur.

DIAGNOSTIC CRITERIA

Clinical

» Acute or chronic headache in an older HIV infected child. Meningism need not be present.
» Often presents with cranial nerve palsy.
» Can occur as result of Immune Reconstitution Inflammatory Syndrome (IRIS) after initiation of antiretroviral therapy.

Investigations

» Test all cerebrospinal fluid (CSF) specimens from HIV infected children with suspected meningitis.
» CSF: India ink stain, and/or cryptococcal antigen test (more sensitive than India ink stain). Measure CSF opening pressure.
» Fungal culture – CSF, blood and urine.

If indicated:

» Chest X-ray.
» Ophthalmological assessment.

GENERAL AND SUPPORTIVE MEASURES

» Admit to high or intensive care unit, if appropriate.
» Monitor, where indicated:
  > neurological status,
  > heart rate,
  > blood pressure,
  > haematocrit,
  > acid-base status,
  > fluid balance, i.e. hydration,
  > respiration,
  > body tempera ture,
  > electrolytes,
  > blood glucos e,
  > blood gases,
  > serum and uri ne osmolality.

» Ensure adequate nutrition by enteral feeding where possible. Use a nasogastric tube if necessary. If enteral feeding is not possible, provide appropriate intravenous fluids.

MEDICINE TREATMENT

Treatment

Initial treatment (2 weeks)

- Amphotericin B deoxycholate, IV, 1 mg/kg/day as a daily infusion in 5% dextrose water over 4 hours.

PLUS

- Fluconazole, IV, 12 mg/kg/day.
  - Maximum dose: 800 mg.

Prehydration before administering amphotericin B to prevent renal impairment:

- Sodium chloride 0.9%, IV, 15 mL/kg **plus** potassium chloride, 20 mmol/L infused over 2–4 hours.

THEN

Consolidation treatment (8 weeks)

- Fluconazole, oral, 12 mg/kg/day for 8 weeks.
  - Maximum dose: 800mg.

Secondary prophylaxis (maintenance treatment)

- Fluconazole, oral, 6 mg/kg/day.
  - Maximum dose: 400 mg.

Discontinue secondary prophylaxis:

» Children < 6 years on ART: CD 4 count > 25% for at least 6 months.
» Children > 6 year on ART: CD 4 count > 200 for at least 6 months. Adolescents on ART: CD4 count increases to between 100–200 cells/mm^3 for at least 6 months.
» Re-start prophylaxis if CD4 count drops below thresholds above.

For continued raised intracranial pressure:

» Daily therapeutic lumbar puncture is indicated if initial LP manometric pressure > 25 cm water in the lateral recumbent position.
» Continue until pressure stabilises below 25 cm water.
» Remove 10-20 mL daily and obtain a closing pressure.
» Refer for neurosurgical intervention if pressure persistent high and/or above 40 cm water.

REFERRAL

» All cases not responding to initial treatment.
» All patients with IRIS.

8.13 MENINGO-ENCEPHALITIS/ENCEPHALITIS, ACUTE VIRAL

A86

DESCRIPTION

A number of viruses cause infection of the brain and meninges. Herpes simplex is the most important because it is treatable. A high mortality and morbidity is associated with untreated herpes meningo-encephalitis.

Complications include:

» increased intracranial pressure,
» cerebral oedema,
» blindness,
» inappropriate antidiuretic hormone (ADH) secretion.
» permanent neurological deficits,
» seizures,
» deafness,

Clinical Features

» Severe headache, fever, nausea, vomiting, lethargy and abnormal behaviour.
» Alteration in level of consciousness, i.e. drowsiness, confusion, stupor or coma.
» Generalised and/or focal convulsions.
» Focal neurological deficits.
» Abnormal movements i.e. basal ganglia involvement.
» Cranial nerve palsies (brainstem involvement), loss of sphincter control, paresis of limbs and segmental sensory loss (spinal cord involvement).
» Some patients may have signs of meningeal irritation.
» Herpes encephalitis may have an acute and fulminant course. It can result from primary infection or reactivation.
» **Herpetic skin lesions are usually NOT present in children with HSV encephalitis.**

Investigations

» Laboratory tests are important in excluding bacterial, fungal or TB meningitis.
» CSF & blood for HSV PCR if the diagnosis is suspected.
» CSF, may be normal or reveal:
  > mildly raised protein,
  > normal glucose level, and
  > mild pleocytosis, mostly lymphocytes.
  > Red cells are commonly observed with herpes encephalitis.
» CT Brain, if focal signs or seizures, unexplained reduced level of consciousness, status epilepticus, diagnostic uncertainty
    - may reveal oedema.
  > Herpes simplex preferentially involves the temporal lobes and orbital surfaces of the frontal lobes.
  > CT findings may only be apparent after 3–5 days.
» EEG, if focal or prolonged seizures, diagnostic uncertainty, suspected non-convulsive seizures.
    - May demonstrate changes suggestive of herpes encephalitis.

GENERAL AND SUPPORTIVE MEASURES

» Admit to high or intensive care unit, if appropriate.
» Monitor, where indicated:
  > neurological status,
  > heart rate,
  > blood pressure,
  > haematocrit,
  > acid-base status,
  > fluid balance, i.e. hydration,
  > respiration,
  > body temperature,
  > electrolytes,
  > blood glucose,
  > blood gases,
  > serum and urine osmolarity.
  > Ensure adequate nutrition, nasogastric feeding if necessary.
  > If enteral feeding is not possible, give maintenance intravenous fluids.

MEDICINE TREATMENT

If herpes simplex virus or varicella zoster virus encephalitis suspected:

- Aciclovir, IV, 8 hourly administered over 1 hour.
  - If 0–12 years of age: 20 mg/kg/dose.
  - If > 12 years of age: 10 mg/kg/dose.
  - o Herpes simplex: 14 days.
  - o Varicella: 7 days.
  - o If an alternative diagnosis is made and CSF PCR is negative, stop acyclovir.

Note: CSF PCR may be negative in the first 3 days of illness.

Acute convulsions

See Chapter 13: The Nervous System, section 13.3: Status epilepticus (convulsive).

Provide adequate analgesia (see Chapter 20: Pain control).

Raised intracranial pressure or cerebral oedema

Elevate head of bed ± 30°.
Maintain P_aCO_2 at 4–5 kPa; intubate and ventilate, if necessary.
Avoid fluid overload.

- Mannitol, IV, 250 mg/kg administered over 30–60 minutes.
  - Do not repeat without consulting a paediatrician.

REFERRAL

» Deterioration of clinical condition despite adequate treatment.
» Meningo-encephalitis with complications or loss of consciousness.

8.14 MUMPS

B26

See Primary Health Care Standard Treatment Guidelines and Essential Medicines List, Chapter 10: Infections and Related Conditions, section 10.11 Mumps.

8.15 MYCOBACTERIUM AVIUM COMPLEX (MAC) INFECTION

A31.0

DESCRIPTION

Atypical mycobacterium, causing disease in extremely immunocompromised patients.
MAC infection in HIV-infected children usually presents with disseminated disease, often enlarged intra-abdominal lymph nodes and pancytopaenia.
Pulmonary, GIT or skin disease is less common.

DIAGNOSTIC CRITERIA

» MAC may be isolated from blood, bone marrow, lymph node, other sterile fluids and tissues.
» Confirm diagnosis with a biopsy for histology and culture **or** 2 culture-positive sputa or gastric aspirates. MAC commonly colonizes the lungs and when isolated is most frequently not of clinical relevance. When diagnosis is in doubt consult a paediatric infectious disease specialist or microbiologist prior to initiating therapy.
» PCR line probe test can be used for diagnosis.

GENERAL AND SUPPORTIVE MEASURES

» If MAC infection is localised to a single enlarged peripheral lymph node, an excision of the lymph node is therapeutic.

MEDICINE TREATMENT

Specialist initiated.
Identify and treat predisposing immune suppression.
Therapy consists of a combination of at least two medicines.

- Macrolide e.g.:
- Clarithromycin, oral, 7.5 mg/kg/dose 12 hourly.

OR

- Azithromycin, oral 10 mg/kg/day, if currently on efavirenz.

PLUS

- Ethambutol, oral, 20–25 mg/kg once daily.

REFERRAL

» Poor response to treatment should be referred for consideration of a quinolone, amikacin, or rifabutin.

8.16 PERTUSSIS

A37.9
* Notifiable condition

DESCRIPTION

A communicable respiratory infection classically causing a paroxysmal cough followed by an inspiratory whoop (absent in young infants) with associated vomiting. Subconjunctival haemorrhages may be present. The cough can persist for 3 months or longer with the infectious period being between 2 weeks and 3 months. The disease is more severe in young infants where it may present with apnoea rather than inspiratory whoop.
Classic pertussis is uncommon in the vaccine era and most cases present with non-specific respiratory symptoms.
Incubation period: 7–10 days. Range: 6– 21 days.

DIAGNOSIS

» A definitive diagnosis is often not possible and treatment should be initiated in suspected cases prior to microbiological confirmation.
» May have profound leucocytosis, predominantly lymphocytosis, although leucocytosis often absent, particularly in infants.
» PCR on naso-pharyngeal aspirates is the preferred diagnostic modality. Cultures are usually negative, even in confirmed cases. Serology of limited value early in disease.

GENERAL AND SUPPORTIVE MEASURES

» Standard and droplet precautions for 5 days whilst on appropriate antibiotic therapy, for 21 days if not.
» Appropriate respiratory support for apnoea or respiratory distress/failure.
» Encourage oral feeding. If unsuccessful provide nasogastric feeds.

MEDICINE TREATMENT

If hypoxic:

- Oxygen, 1–2 L/minute via nasal prongs.

▪ Macrolide e.g.:

- Azithromycin:
  - < 6 months: 10 mg/kg/day for 5 days.
  - ≥ 6 months: 10 mg/kg (max 500mg) on day 1, then 5 mg/kg/day (max 250 mg) on days 2 – 5.

Management of contacts

Prophylaxis for all household contacts and for health care workers with close contact:

- Azithromycin: as for treatment above.

REFERRAL

» Children with seizures or encephalopathy for further evaluation.
» Patients requiring intensive care, where none is available on site.

8.17 PNEUMOCYSTIS JIROVECI PNEUMONIA (PJP)

B20.6

See Chapter 15: Respiratory System, section 15.1.1.3: Pneumonia in HIV exposed or infected children.

8.18 POLIOMYELITIS (ACUTE FLACCID PARALYSIS)

A80.3
* Notifiable condition

Also see Chapter 13: The Nervous System, section 13.9.1: Inflammatory Polyneuropathy (Guillain-Barré Syndrome).

DESCRIPTION

Poliomyelitis is eradicated in South Africa. Most cases of acute flaccid paralysis (AFP) are caused by Guillain-Barré Syndrome, but all cases of AFP must be notified as the clinical signs are indistinguishable.

DIAGNOSTIC CRITERIA

Clinical

» Suspect in all children with acute flaccid paralysis, often asymmetrical with intact sensation.

Investigations

» Send two stool specimens (on ice) taken 24–48 hours apart to the NICD via the local laboratory.

GENERAL AND SUPPORTIVE MEASURES

» Isolate patient to prevent faecal-oral spread.
» Rehabilitative measures:
  > Most patients need physiotherapy and occupational therapy.

REFERRAL

» Discuss all cases with a specialist.
» Children requiring intensive care if none is available on site.

8.19 RABIES

A82.9
* Notifiable condition (Inform state veterinarian or local veterinary official)

DESCRIPTION

A viral infection of the central nervous system following transmission of the rabies virus from the saliva of affected animals through bites or contamination of mucosa or skin lesions.
Incubation period 2–8 weeks.

DIAGNOSTIC CRITERIA

Clinical

» Signs and symptoms may begin with:
  > fever,
  > headache,
  > nausea,
  > diarrhoea,
  > irritability.
» Early signs include paraesthesia or itching at site of bite in ⅓ of cases.
» The acute neurologic phase interspersed with lucid periods manifests with:
  > agitation,
  > mania,
  > hyperactivity,
  > hallucinations.
» Seizures may be precipitated by auditory or tactile stimuli.
» Hypersalivation, hydrophobia or aerophobia may occur.
» Death is usually due to cardio-respiratory failure.

Investigations

» Virus specific fluorescent antigen in brain tissue confirms diagnosis in animals.
» Preserve brain tissue of the dead animal.

GENERAL AND SUPPORTIVE MEASURES

» Symptomatic and supportive treatment.
» Prompt cleansing of the bite wound.
» Do not suture puncture wounds.
» Seek advice.

Telephone Hotline	
National Institute of Communicable Diseases	011 386 6337 or 011 386 6000
After hours	082 883 9920

Post exposure prophylaxis

Caution
Start post exposure prophylaxis immediately.
Do not wait for confirmatory laboratory tests in the animal.

Post exposure prophylaxis may be lifesaving and should always be given if there is a reasonable suspicion that the animal may have been rabid.
The decision to give post exposure prophylaxis is based on the risk of rabies transmission, the species and behaviour of the animal and the nature of the bite. Diagnosis is largely clinical.

MEDICINE TREATMENT TO PREVENT INFECTION

Treatment depends on the risk category.

Risk Category	Type of exposure	Action
1.	» touching or feeding animal » licking intact skin	» none if reliable history
2.	» nibbling uncovered skin » superficial scratch without bleeding » licking broken skin	» wound treatment » give rabies vaccine » do not give rabies immunoglobulin (RIG) Stop vaccination if laboratory tests of animal are negative for rabies or animal, i.e. dog or cat remains well after 10 days observation.

Risk Category	Type of exposure	Action
3.	» bites or scratches penetrating skin and drawing blood » licking of mucous membranes	» wound treatment » give rabies vaccine » give rabies immunoglobulin (RIG) » give tetanus toxoid vaccine and antibiotic Stop vaccination if laboratory tests of animal are negative for rabies or animal, i.e. dog or cat, remains well after 10 days observation.

Wound treatment
Local wound care:
Flush wound thoroughly and clean with soap and water or sodium chloride 0.9% or chlorhexidine 0.05%.

- Povidone iodine 10%, topical.

For penetrating wounds:
- Tetanus toxoid (TT), IM, 0.5 mL.

Pre-emptive antibiotic only if hand is bitten or for extensive wounds or human bites. Data does not support the use of antibiotics in minor animal bites.
- Amoxicillin/clavulanic acid, oral, 30 mg/kg/dose of amoxicillin component 8 hourly.

Rabies Vaccine
Must be given for category 2 and 3 bites.
Vaccine is administered on days 0, 3, 7, 14. Vaccine is ideally given as soon as possible after exposure, but should still be given if patient presents some time after the exposure. An additional dose on day 28 may be appropriate for immune compromised patients.
If vaccine administration is delayed > 48 hours, a double dose should be given initially.
Rabies vaccine is given IM but **never in the buttock**. Give into deltoid muscle in older children & adolescents and antero-lateral aspect of thigh in infants.

Rabies Immunoglobulin (RIG)
Must be given for all category 3 exposures.
In HIV infected children also give for category 2 exposures.
Give rabies vaccine first.
Immunoglobulin must be given as soon as possible after exposure, but may be administered up to 7 days after the first vaccine is given.

Do not give RIG if the patient has previously received pre- or post-exposure prophylaxis.

- Rabies immunoglobulin (RIG),
  - Human RIG: 20 IU/kg
    - » Infiltrate as much as anatomically feasible around wound Administer remaining immunoglobulin into deltoid muscle opposite to vaccine administration site.
    - » If multiple wounds, dilute in sodium chloride 0.9% to 2–3 times so that **all** wounds are infiltrated.
    - » **Do not** exceed maximum dose as antibody production to the vaccine is inhibited.
    - » If unavailable, **do not** delay active immunisation.

REFERRAL

» Where prophylactic treatment is not immediately available.
» All cases of human clinical rabies for appropriate palliative care.

8.20 TETANUS

A35
* Notifiable condition.

DESCRIPTION

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.

Complications include:

» asphyxia,
» dehydration,
» hyperpyrexia,
» inability to suck, chew and swallow.
» bronchopneumonia,
» respiratory failure,
» laryngospasm,

DIAGNOSTIC CRITERIA

The diagnosis is made on clinical grounds.

Clinical

» Unimmunised/incompletely immunised child.
» History of wound/trauma or unhygienic care of umbilical cord/stump.
» Trismus.
» 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.

GENERAL AND SUPPORTIVE MEASURES

» Admit to high or intensive care unit, if available.
» Ventilatory support, if needed.
» Monitor:
  > temperature,
  > respiration,
  > heart rate,
  > blood gases,
  > SaO_2.
  > blood pressure,
  > blood glucose,
  > electrolytes,
  > acid-base status,
» Protect the patient from all unnecessary sensory and other stimuli.
» Ensure adequate hydration and nutrition.
» Wound care and debridement/umbilical cord care.
» Educate parents/caregivers regarding prevention of tetanus by vaccination.

MEDICINE TREATMENT

For hypoxia:

- Oxygen 100% by nasal cannula.

- Tetanus immunoglobulin, IM, 3000 IU as a single dose.

- Tetanus toxoid (TT), IM, 0.5 mL
  - Not required in immunised patients who have received a booster within the past 5 years.

- Metronidazole, IV, 7.5 mg/kg/dose 8 hourly for 10 days duration.

For control of muscle spasms:

- Diazepam, IV, 0.1–0.2 mg/kg/dose 4–6 hourly, titrated according to response.
  - Do not exceed 10 mg/dose.
  - After improvement, use enteral form in high care setting.
  - For ventilation and muscle relaxants, see Chapter 22: Intensive Care and Anaesthetics, section 22.1.2: ICU sedation, infant and child.

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

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 not completely immunised:

- Tetanus immunoglobulin (TIG), IM.
  - If < 5 years of age: 75 IU.
  - If 5–10 years of age: 125 IU.
  - If > 10 years of age: 250 IU.

- Tetanus toxoid (TT), IM, 0.5 mL.
  - Not required in immunised patients who have received a booster within the past 5 years.

REFERRAL

» All cases.

8.21 TICK BITE FEVER

A79.9

DESCRIPTION

A tick-borne febrile illness caused by *Rickettsia conorii* or *africae.*

The rash appears on days 3–5 of the illness. It spreads from the extremities to the trunk, neck, face, palms, and soles within 36 hours.

The lesions progress from macular to maculopapular and may persist for 2–3 weeks.

Atypical cutaneous findings may occur.

Complications include:

» vasculitis,
» thrombosis,
» myocarditis,
» thrombocytopaenia.
» encephalitis,
» renal failure,
» pneumonitis, and

DIAGNOSTIC CRITERIA

The diagnosis is made on clinical grounds.

Clinical

» Fever, headache, malaise, myalgia and arthralgia.
» Maculopapular rash that may involve the palms and soles.
» Eschar at the site of the tick bite is associated with regional lymphadenopathy and splenomegaly.

Investigations

» Initiate treatment empirically.
» If diagnostic uncertainty: PCR on blood sample or on swab from base of eschar.
» Do not perform serology.

GENERAL AND SUPPORTIVE MEASURES

» Remove tick as soon as possible after detection.

MEDICINE TREATMENT

Antibiotic therapy

Treatment must be started before confirmation of diagnosis.
Doxycycline is the drug of choice for all children with tick bite fever (despite usually not being recommended for use in children < 8 years).

- Doxycycline, oral.
  - o If < 50 kg: 4 mg/kg/24 hours in 2 divided doses on the first day, then 2 mg/kg/24 hours in 2 divided doses for 7 days.
  - o If > 50 kg: 100 mg 12 hourly for 7 days.

If unable to take oral therapy:

- Azithromycin, IV, 10 mg/kg/day for 5 days.

REFERRAL

» Patients not responding to adequate therapy.
» Patients with complications.

8.22 TOXOPLASMOSIS

B58.9

DESCRIPTION

Rarely occurs in children.
Usually presents as encephalitis, with focal neurological abnormalities occurring in association with headache.
Ocular and pulmonary disease is also seen.

DIAGNOSTIC CRITERIA

Investigations

» Diagnosis may be made on blood and CSF serology.
» CSF PCR for toxoplasmosis may also be helpful.
» CT scan usually reveals multiple bilateral, focal hypodense ring-enhancing lesions.

REFERRAL

» All cases.

8.23 TYPHOID

A01.1
* Notifiable condition.

DESCRIPTION

A systemic disease caused by *Salmonella Typhi*.

DIAGNOSTIC CRITERIA

Clinical:

- » fever,
- » headache,
- » diarrhoea or constipation,
- » abdominal pain or tenderness,
- » cough,
- » delirium,
- » meningismus,
- » anorexia,
- » vomiting,
- » ileus,
- » epistaxis,
- » hepatomegaly and/or splenomegaly,
- » stupor.

Investigations:

- » Leucopaenia, anaemia and thrombocytopaenia.
- » Positive cultures from blood (1st week), stool (after 1st week), urine and bone marrow.
- » Serology not recommended.

GENERAL AND SUPPORTIVE MEASURES

- » Isolate patient until eradication confirmed.
- » Correct and maintain fluid and electrolyte status.

Collect 3 stool samples: 1 week after completion of treatment and every 48 hours thereafter

MEDICINE TREATMENT

Note:

Relapse and carrier state may occur despite adequate therapy.

Initiate therapy with:

- Ceftriaxone 100mg/kg daily for 10 days, consider 14 days for more severe cases.

Once patient is stable, consider switching to oral ciprofloxacin based on clinical response and susceptibility testing results:

- Ciprofloxacin 15 mg/kg/dose 12 hourly for 7-10 days.

Retreatment:

If any one of the 3 follow-up stool samples are positive for S Typhi: retreat and repeat stool sampling 1 week later.

If any of these 3 samples positive for S Typhi:

treat for carriage (ciprofloxacin x 4-6 weeks)
check stool cultures monthly

REFERRAL

- » Inadequate response to treatment.
- » Patients with complications.
- » Chronic carriers (stool positive x ≥12 months).

8.24 NON-TYPHOID SALMONELLA (NTS)

A02.9

DESCRIPTION

Present as:

» gastroenteritis, or
» extra-intestinal (invasive) disease.

DIAGNOSTIC CRITERIA

Clinical

» Self-limiting mucosal intestinal disease presenting with diarrhoea and vomiting in immunocompetent patients.
» Young infants (< 3 months) and immunodeficient children (especially HIV infected children) are prone to invasive, often recurrent disease.
» Invasive disease includes bacteraemia (fever), osteomyelitis and meningitis.
» There is also an association of invasive NTS with malaria and severe anaemia.

Investigations

» Positive blood cultures, less commonly, stool, urine and bone biopsy.

GENERAL AND SUPPORTIVE MEASURES

» Correct and maintain fluid and electrolyte status.

MEDICINE TREATMENT

Note:

Relapse may occur despite adequate therapy. Antibiotic therapy in NTS gastroenteritis may prolong excretion of Salmonella.

Antibiotic therapy is **not** generally recommended for non-invasive disease. However, in infants < 3 months of age and severely immunocompromised children at high risk of developing invasive disease treat as for invasive disease.

Invasive disease

If < 1 month of age:

- Cefotaxime, IV/IM, 50–75 mg/kg/dose 8 hourly.

OR

If > 1 month of age:

- Ceftriaxone, IV, 50–80 mg/kg once daily.
  Duration:
  - Bacteraemia: 10–14 days.
  - Acute osteomyelitis: 4–6 weeks.
  - Meningitis: 4 weeks.

If cephalosporin resistance reported treat according to sensitivity.

REFERRAL

» Inadequate response to treatment.
» Patients with complications.

8.25 VARICELLA (CHICKEN POX)

B01

DESCRIPTION

An acute, highly contagious, viral disease caused by herpes varicella-zoster. 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,
» necrotising 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.

GENERAL AND SUPPORTIVE MEASURES

» Isolate the patient.
» Maintain adequate hydration.

MEDICINE TREATMENT

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)

- Aciclovir, 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:

- Aciclovir, 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 encephalitis:
See section 8.13: Meningo-encephalitis/encephalitis, acute viral.

For mild pruritus:

- Calamine lotion, topical, applied 8 hourly.

For severe pruritus:

- Less than 2 years: Chlorphenamine, oral, 0.1 mg/kg 6–8 hourly for 24–48 hours.
- 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:

- Aciclovir, 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:

- Aciclovir, 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).

- Varicella-zoster vaccine, IM, 0.5 mL given within 72 hours of exposure.

OR

- Aciclovir, oral, 20 mg/kg/dose 8 hourly for 10 days given in the second week after exposure.

REFERRAL

» Patients with complications.

8.26 ZOSTER

B02

DESCRIPTION

A vesicular eruption in a dermatomal pattern, due to reactivation of varicella-zoster virus.

Occurs commonly in immunocompromised children and occasionally in immunocompetent children.

DIAGNOSTIC CRITERIA

Usually made on clinical grounds.

Investigations

» Confirm diagnosis by HSV viral culture or PCR.

GENERAL AND SUPPORTIVE MEASURES

» Isolate patient.

MEDICINE TREATMENT

Within 24 hours of the appearance of the rash for less severe cases:

- Aciclovir, oral, 20 mg/kg/dose 6 hourly for 7 days.
  - Maximum dose: 800 mg/dose.

If oral treatment cannot be taken and for severe cases:

- Aciclovir, IV, 8 hourly administered over 1 hour for 7days.
  - 0–12 years 20 mg/kg/dose.
  - > 12 years: 10 mg/kg/dose.

For post-herpetic neuralgia: see Chapter 20: Pain Control.

REFERRAL

» Disseminated zoster.

8.27 SEPSIS

A41.9

For Neonatal Sepsis see Chapter 19: Prematurity and Neonatal Conditions, section 19.17: Septicaemia of the Newborn.

DESCRIPTION

Severe sepsis is an uncontrolled inflammatory response as a result of suspected or proven infection.

DIAGNOSTIC CRITERIA

Clinical

» A 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,
  > elevated leucocyte count,

  PLUS, one of the following:
  > cardiovascular dysfunction,
  > acute respiratory distress syndrome, or
  > ≥ 2 other organ dysfunctions.

Investigations

» Blood culture and identify focus of infection e.g. osteomyelitis, abscess.
» Investigate for malaria especially in endemic areas or if there is a relevant travel history.
» Where meningitis due to meningococcus is suspected, i.e. with petechial rash, lumbar puncture is contraindicated (see Chapter 13: The Nervous System, section 13.11: Lumbar Puncture). Do petechial scrapes and blood culture to confirm diagnosis.

GENERAL AND SUPPORTIVE MEASURES

» For suspected meningococcemia: Notifiable condition and requires isolation for 24h after commencement of appropriate antibiotics.
» Admit to high care area.
» Early recognition and treatment of septic shock.
» Antimicrobials do not penetrate necrotic tissue or abscesses, so debridement, incision and drainage are essential aspects of care.

MEDICINE TREATMENT

Empiric antibiotic therapy

Choice of antibiotic depends on the severity of the condition and predisposing factors.

- Ceftriaxone, IV, 50 mg/kg/dose 12 hourly for 7 days.

Confirmed meningococcal septicaemia

- Benzylpenicillin (Penicillin G), IV, 100 000 units/kg/dose immediately, then 4 hourly for 7 days.

Suspected staphylococcal infection (e.g. osteomyelitis)

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

PLUS

- Ceftriaxone, IV, 50 mg/kg/dose, 12 hourly.

Reconsider choice of antibiotic, aiming for monotherapy where possible, when the results of cultures become available or if the child does not improve.

Continue IV antibiotics until there is a good clinical response and laboratory markers of infection improve (usually less than a week). Oral antibiotics are then appropriate.

See section 8.28: Staphylococcal Septicaemia, for management of invasive *S. aureus* infections.

Nosocomial sepsis: manage according to the background microbiological flora within your institution.

Septic shock

See Chapter 1: Emergencies and Trauma, section 1.1.7: Shock.

REFERRAL

» Septicaemia with complications.
» Patients requiring intensive care.
» Patients requiring debridement of necrotic areas or drainage of collections.

8.28 STAPHYLOCOCCAL SEPTICAEMIA

A41.2

DESCRIPTION

Staphylococci cause disease by direct invasion of tissues with liberation of toxins. Septicaemia may occur when haematogenous dissemination occurs from a focus of infection.

DIAGNOSTIC CRITERIA

Clinical

Features of septicaemia should raise an index of suspicion of staphylococcal infection.

Suggestive features of staphylococcal infection include:
» presence of abscesses,
» erythema of palms and soles,
» drip site infections,
» osteomyelitis,
» septic arthritis, and
» endocarditis.

Investigations
» Send pus for culture and sensitivity.
» Blood cultures are frequently negative in serious staphylococcal infection, a finding that highlights the need for performing cultures on other specimens.

GENERAL AND SUPPORTIVE MEASURES
» Surgical drainage or aspiration of pus.
» If infection is associated with a foreign body, such as an intravenous catheter, remove catheter and submit tip for culture and sensitivity.

MEDICINE TREATMENT
When *S. aureus* isolates are likely to be the cause of infection, the most appropriate agents to administer for empiric treatment are based on the relative frequency of CA-MRSA isolates in the particular community.

Sensitive staphylococcal bacteraemia:
- Cloxacillin, IV, 50 mg/kg/dose 6 hourly for at least 14 days, longer courses often required.

Sensitive staphylococcus (bone and joint)
- Cloxacillin, IV, 50 mg/kg/dose 6 hourly, can transition to oral therapy once there is sustained clinical improvement, resolution of fever and CRP < 30 mg/L.
  - Septic arthritis: 2-4 weeks of treatment.
  - Acute osteomyelitis: 4-6 weeks of treatment.
  - Infective endocarditis: see Chapter 4: Cardiovascular System, section 4.3 Endocarditis, infective.

Methicillin resistant staphylococci (proven/suspected):
- Vancomycin, IV, 15 mg/kg/dose, 6 hourly infused over 1 hour.
  - Where available, therapeutic drug level monitoring recommended:
    - » Check vancomycin trough level within one hour before 4th or 5th dose.
    - » Adjust dose to keep trough level within recommended range (severe infections 15-20 mcg/mL, less severe infections 10-15 mcg/mL).

REFERRAL

» Severe sepsis with organ dysfunction.
» Septic shock after resuscitation.
» Staphylococci resistant to above antibiotics.
» Patients requiring debridement of necrotic areas or drainage of collections.

8.29 ARTHRITIS, SEPTIC (PYOGENIC)

M00.9

DESCRIPTION

Septic arthritis may occur as a result of haematogenous seeding of the synovium during transient periods of bacteraemia.
Septic or pyogenic arthritis is often part of a generalised septicaemia which may involve more than one joint and is caused by pyogenic micro-organisms. The organisms involved vary:

» Neonates – *S. aureus*, Group B Streptococci, *E. coli*, fungi.
» Infants/children – *S. aureus*, *H. influenzae*, Group A Streptococci, *S. pneumoniae, Kingella kingae.*
» Adolescents (sexually active) – *N. gonorrhoea.*
» Chronic septic arthritis – *Brucella*, tuberculosis, atypical mycobacteria, fungi and other uncommon organisms.

DIAGNOSTIC CRITERIA

The diagnosis is largely clinical and confirmed by finding pus in the joint space.

CAUTION
Do not carry out needle aspiration in haemophiliacs.

Clinical

» Fever, local pain, loss of function and toxic looking child.
» Subtle, non-specific signs of sepsis early in the course of the disease, especially in neonates.
» Local tenderness, warmth, swelling at a joint with restriction of passive and active movement.
» Malaise, irritability, feeding problems and pseudo-paralysis.
» If lower extremities are involved, development of a limp or refusal to bear weight.

Investigations

» Blood cultures prior to antibiotic administration.
» Aspiration of pus from the joint space under ultrasound guidance, if possible, and submit for microscopy, Gram stain, culture and sensitivity.
» Raised CRP and white-cell count and/or ESR.

GENERAL AND SUPPORTIVE MEASURES

» Septic arthritis of the hip (emergency) requires prompt open surgical drainage at the time of presentation, in consultation with an orthopaedic surgeon.
» Manage most infections of other sites by repeated aspiration or open drainage (not antibiotic instillation), if frank pus is obtained on initial diagnostic aspiration.
» Immobilise affected limb in position of function.
» Identify other effects of septicaemia or haematogenous spread and treat appropriately.
» Supportive and symptomatic care.

MEDICINE TREATMENT

Antibiotic therapy

» Minimum duration of therapy: 4–6 weeks.

IV antibiotics

Initiate IV antibiotic treatment immediately.

Adjust antibiotic therapy based on culture results or if response to empiric antibiotic treatment is unsatisfactory.

Continue with IV antibiotics until there is evidence of good clinical response and laboratory markers of infection improve. Once clinical improvement and inflammatory markers are normalising, patients can be switched to oral antibiotic therapy.

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: 12 hourly.
  - If 1st week of life: 8 hourly.
  - If > 2 weeks old: 6 hourly.

1 month to < 3 months

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

PLUS

- Ceftriaxone, IV, 80 mg/kg/dose 12 hourly.

Infants > 3 months and children:

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

If Gram negative organisms are seen on Gram stain, or when clinically suspected, e.g. sickle cell disease:

ADD

- Ceftriaxone, IV, 80 mg/kg/dose 12 hourly.

Special Circumstances

If MRSA, replace cloxacillin with vancomycin.

- Vancomycin IV, 15 mg/kg/dose administered over 1 hour given 6 hourly. Where available, vancomycin doses should be adjusted on the basis of therapeutic drug levels.
  - Trough levels (taken immediately prior to next dose), target plasma level 15-20 mcg/mL.

Oral antibiotics

- Can transition to oral therapy once there is sustained clinical improvement, resolution of fever and CRP < 30mg/L.
  - Duration: 2-4 weeks of treatment.

Antibiotics according to sensitivities:

- Clindamycin, oral, 6 mg/kg/dose 6 hourly.

OR

For children able to swallow a capsule:

- Flucloxacillin, oral, 12.5–25 mg/kg/dose, 6 hourly.

PLUS

Corticosteroids

- Dexamethasone, IV, 0.15 mg/kg 6 hourly for 4 days.

LoE I[ii]

For pain and inflammation:
Refer to Chapter 20: Pain control.

REFERRAL

» Multi-organ involvement.
» Failure to achieve progressive improvement on treatment.

8.30 ARTHRITIS, JUVENILE IDIOPATHIC

M08.0

See Chapter 12: Rheumatology and Vasculitides, section 12.2: Juvenile idiopathic arthritis (JIA).

8.31 OSTEITIS/OSTEOMYELITIS, ACUTE

M86.1

DESCRIPTION

Most cases result from haematogenous deposition of organisms in the bone marrow after a transient bacteraemic 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.

The organisms involved vary:
» 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, leucopaenia: *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

Diagnostic
» Aspiration of pus for microscopy, Gram stain, culture and sensitivity.
» Blood culture and full blood count.
» Raised white cell count, CRP.

The following may be helpful:
» X-ray after 2 weeks.
» Bone scan (Tc99).
» MRI.

GENERAL AND SUPPORTIVE MEASURES

» Immobilise affected limb in position of function.
» Supportive and symptomatic care.

MEDICINE TREATMENT

Antibiotic therapy

Minimum duration of therapy: 4–6 weeks.

IV antibiotics

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 are normalising, patients can be switched to oral antibiotic therapy.

Ongoing fever suggests an undrained 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: 12 hourly.
  - If 1st week of life: 8 hourly.
  - If > 2 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 6 hourly.

Where available, vancomycin doses should be adjusted on the basis of therapeutic drug levels.

- Trough levels (taken immediately prior to next dose), target plasma level 15-20 mcg/mL.

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.

Where available, gentamicin doses should be adjusted on the basis of therapeutic drug levels.

- Trough levels (taken immediately prior to next dose), target plasma level < 1 mg/L.
- Peak levels (measured 1 hour after commencement of IV infusion or IM/IV bolus dose), target plasma level > 8 mg/L.

Oral antibiotics

- Can transition to oral therapy once there is sustained clinical improvement, resolution of fever and CRP < 30mg/L.
  - 4-6 weeks of treatment.

ANTIBIOTICS ACCORDING TO SENSITIVITIES:

- Clindamycin, oral, 6 mg/kg/dose 6 hourly.

OR

For children able to swallow a capsule:

- Flucloxacillin, oral, 25 mg/kg/dose, 6 hourly.

For pain and inflammation:
Refer to Chapter 20: Pain control.

REFERRAL

» Refer to specialist for confirmation of diagnosis, and consideration of surgical drainage.
» Multi-organ involvement.
» Failure to achieve progressive improvement on treatment.

References

[i] Fluconazole dose: South African Medicines Formulary. 12th Edition. 2016.
[ii] Dexamethasone: Odio CM, et. al. Double blind, randomized, placebo-controlled study of dexamethasone therapy for hematogenous septic arthritis in children. Pediatr Infect Dis J. 2003, 22:883-886; Harel L, et. al. Dexamethasone therapy for septic arthritis in children. J Pediatr Orthop. 2011; 31:211-215.

CHAPTER 9

HUMAN IMMUNODEFICIENCY VIRUS INFECTION

9.1 HUMAN IMMUNODEFICIENCY VIRUS INFECTIONS

B20–24

Comprehensive guidelines are available for ART and the care of children with HIV infection in the National consolidated guidelines for the prevention of mother-to-child transmission of HIV (PMTCT) and the management of HIV in children, adolescents and adults

DESCRIPTION

Human Immunodeficiency Virus (HIV) is a retrovirus infecting immune cells, especially CD4 T lymphocytes. In advanced HIV disease the body loses its ability to fight infections and this stage is characterised by severe damage to organs, opportunistic infections, malignancies and very low CD4 counts.

In infants most infections are transmitted from mother to child, while in adolescents and adults, sexual transmission is the usual route for new infections.

Infants born to HIV infected mothers may be:

» HIV infected,
» "HIV exposed":
  - At risk of being/becoming HIV infected,
  - HIV uninfected (no further exposure e.g. not breastfed/ breast-feeding discontinued).

For the purposed of the ART guidelines:

» Children and Adolescents <15yrs: follow the Paediatric antiretroviral therapy (ART) Guidelines.
» Late Adolescence (15yrs – 19yrs): follow the Adult ART Guidelines.

DIAGNOSTIC CRITERIA

Suspect HIV infection in the following situations:

» Mother HIV infected.
» Sexual abuse.
» Adolescents having unprotected sexual encounters.
» Parents with tuberculosis or HIV.
» Any child with tuberculosis.
» Clinical features of symptomatic HIV infection.
» Unexplained severe dermatoses.
» Persistent/recurrent ear discharge.
» Severe progressive pneumonia especially in the first 6 months of life.
» Confirmed *Pneumocystis jiroveci* (*carinii*) and/or Cytomegalovirus pneumonia.
» Low weight for age, unsatisfactory weight gain or stunting.

» Persistent or recurrent diarrhoea in the past three months.
» Enlarged lymph nodes in two or more of the following sites: neck, axilla or groin.
» Oral thrush outside the neonatal period.
» Parotid gland swelling.
» Liver enlargement.
» Spleen enlargement.
» Recurrent infections including pneumonia, ear infections, sinusitis, osteitis and arthritis.
» Digital clubbing.
» Progressive developmental delay.
» The combination of multiple problems.

All infants/children accessing care should have their HIV exposure status (recent maternal HIV status) and/or HIV status determined.

- Women who previously tested HIV positive should not be re-tested.
- Where mothers tested negative in pregnancy, maternal HIV status should be determined 3 monthly whilst breastfeeding.

Confirmation of HIV infection

Children < 18 months of age:

» **Birth:** Do HIV PCR at birth in ALL HIV exposed infants
» **10 Weeks:** Do HIV PCR at 10 weeks of age in all HIV exposed infants.
» **18 weeks:** Do HIV PCR at 18 weeks in HIV exposed infants receiving 12 weeks of infant prophylaxis.
» **Post cessation of breastfeeding:** If the child is breastfed and the birth and 10-week HIV PCR are negative, repeat testing 6 weeks after complete cessation of breastfeeding. (If the child is 18 months or older, do an ELISA or rapid test).
» **Symptomatic child/infant:** If at any time the child has evidence suggesting HIV infection, even if the child has had a previous negative PCR test, the child should be tested for HIV infection.
» If HIV PCR is positive at any time-point:
    o Confirm with a repeat HIV PCR test.
    o Initiate treatment while awaiting the second HIV PCR test result.

In children ≥ 18 months of age:

» Do HIV rapid/ELISA test.
» If 1st test is positive, confirm the result with a second test using a kit of a different manufacturer, and preferably on a different blood specimen.
Note:
Rapid tests may be less reliable in children with advanced disease. If clinical findings suggest HIV infection but the rapid test is negative, send a further specimen of blood to the laboratory for formal ELISA testing. If test results are still equivocal do an HIV PCR test.

Note:

» A child cannot be confirmed as HIV negative until at least 6 weeks after birth and 6 weeks after other potential HIV exposure (including cessation of breastfeeding). Also, exposure to ART through prophylaxis (NVP) or maternal ART may delay the diagnosis of HIV even further.

» Children with discordant or indeterminate HIV test results must be discussed with an expert.

Adapted WHO clinical staging of HIV and AIDS for infants and children

For persons aged under 15 years with confirmed laboratory evidence of HIV infection

Clinical Stage 1

» asymptomatic

» persistent generalised lymphadenopathy (PGL)

Clinical Stage 2

» unexplained persistent weight loss
» hepatosplenomegaly
» papular pruritic eruptions
» extensive human papilloma virus infection
» extensive molluscum contagiosum
» fungal nail infections
» recurrent oral ulcerations
» lineal gingival erythema (LGE)
» unexplained persistent parotid enlargement
» herpes zoster
» recurrent or chronic RTIs, i.e.
  > otitis media
  > otorrhoea
  > sinusitis

Clinical Stage 3

» moderate unexplained malnutrition (not adequately responding to standard therapy)
» unexplained persistent diarrhoea (14 days or more)
» unexplained persistent fever (above 37.5°C, intermittent or constant, for longer than one month)
» persistent oral candidiasis (after first 6-8 weeks of life)
» oral hairy leukoplakia
» acute necrotising ulcerative gingivitis/periodontitis
» lymph node TB
» pulmonary TB
» severe recurrent bacterial pneumonia
» chronic HIV-associated lung disease including bronchiectasis
» symptomatic lymphoid interstitial pneumonitis (LIP)
» unexplained anaemia (< 8 g/dL), and or neutropaenia (< 500/mm^3) and/or thrombocytopaenia (< 50 000/mm^3) for more than one month

Clinical Stage 4

» unexplained severe wasting, stunting or severe malnutrition not adequately responding to standard therapy
» pneumocystis pneumonia
» recurrent severe presumed bacterial infections, e.g.
  > empyema
  > pyomyositis
  > bone or joint infection
  > meningitis

  but excluding pneumonia
» chronic herpes simplex infection; (oro-labial or cutaneous of more than one month's duration or visceral at any site)
» extrapulmonary TB
» Kaposi's sarcoma
» oesophageal candidiasis (or candidiasis of trachea, bronchi or lungs)
» CNS toxoplasmosis (outside the neonatal period)
» HIV encephalopathy
» CMV infection (CMV retinitis or infections of organs other than liver, spleen or lymph nodes; onset at age one month of more)
» extrapulmonary cryptococcosis including meningitis
» any disseminated endemic mycosis, e.g.
  > extrapulmonary histoplasmosis
  > coccidiomycosis
» chronic cryptosporidiosis
» chronic isosporiasis
» disseminated non-tuberculous mycobacteria infection
» HIV associated recto-vaginal fistula
» cerebral or B cell non-Hodgkin lymphoma
» progressive multifocal leukoencephalopathy (PML)
» HIV-associated cardiomyopathy or HIV-associated nephropathy

9.1.1 THE HIV EXPOSED INFANT

Z20.6

DESCRIPTION

An infant whose mother is HIV infected and in whom infant HIV infection has neither been confirmed nor excluded.

Transmission of HIV infection from mother to child may occur during pregnancy, during delivery, or via breast feeding. Prevention of mother to child transmission (PMTCT) can be effectively carried out with a very high success rate by fully suppressing the mother's viral load with ART and giving prophylactic antiretroviral therapy to the infant. All attempts should be made to ensure that maternal viral loads are done, checked, recorded and acted upon during pregnancy, and that this information is available at time of delivery to ensure the correct PMTCT intervention is given to the infant.

With the effective use of antiretrovirals, the risk of HIV transmission through breast feeding is minimised. In situations where the viral load of the mother cannot be suppressed the risk of breast milk transmission remains significant.

The PMTCT plan starts with initiation of cART in the mother (either pre or post conception), thereafter, the HIV-exposed infant may be classified into one of the following categories which determines the appropriate infant prophylaxis regimen:

- Low Risk
- High Risk
- Unknown Risk

MANAGEMENT OF HIV-EXPOSED INFANTS

Situation**	Feeding advice	Comment
LOW RISK **NVP** at birth and then daily for 6 weeks.		
Mother on lifelong cART at time of conception. **or** cART started more than 4 weeks prior to delivery and VL < 1000 copies/ml	Encourage breast feeding.	• Do HIV PCR at birth. • Do HIV PCR at 10 weeks. • Do infant HIV testing 6 weeks post-cessation of breastfeeding (either HIV PCR or ELISA depending on age). Encourage maternal ART adherence.
HIGH RISK **NVP** daily **and AZT** twice daily, as soon as possible and for 12 weeks		
Mother newly diagnosed HIV-positive and did not start ART before or during delivery. **or** Breastfeeding mother diagnosed HIV positive > 72 hours after delivery.	Encourage breast feeding	• Immediate initiation of maternal cART. • Do infant HIV PCR at birth/ immediately, if infant tests HIV PCR+, do repeat HIV PCR test and initiate ART immediately. • Do HIV PCR at 10 weeks, and • Do HIV PCR at 18 weeks. • Do infant HIV testing 6 weeks post-cessation of breastfeeding (either HIV PCR or ELISA depending on age). • Encourage maternal ART adherence.

Situation**	Feeding advice	Comment
Mother started ART less than 4 weeks prior to delivery.	Encourage breast feeding.	• Do infant HIV PCR at birth, if infant tests HIV PCR+, do repeat HIV PCR test and initiate ART immediately. • Do HIV PCR at 10 weeks, and • Do HIV PCR at 18 weeks. • Do infant HIV testing 6 weeks post-cessation of breastfeeding (either HIV PCR or ELISA depending on age). • Encourage maternal ART adherence.
Mother on ART with latest viral load > 1000 copies/ml.	Infants of mothers failing on 1st line treatment: • Encourage breast feeding. Infants of mothers on 2nd or 3rd line regimens and VL >1000 copies/ml: • Advise not to breast feed. • Prescribe replacement feeding.	• Do HIV PCR at birth, if infant tests HIV PCR+, do repeat HIV PCR test and initiate ART immediately. • Do HIV PCR at 10 weeks, and • Do HIV PCR at 18 weeks. • Do infant HIV testing 6 weeks post-cessation of breastfeeding (either HIV PCR or ELISA depending on age). • If repeat maternal viral load > 1000 copies/ml continue NVP and AZT if breastfeeding, and refer/discuss. • Encourage maternal ART adherence.
Mother on ART with no HIV viral load available.	Encourage breast feeding.	• Do Maternal HIV VL and review result. • If VL <1000 copies/mL change prophylaxis to Low Risk protocol • If VL >1000 copies/mL manage as above.

***The infant prophylaxis stated in this table supersedes the National Consolidated guidelines for the Prevention of mother-to-child transmission of HIV (PMTCT) and management of HIV in children, adolescents and adults of 2015.*

Unknown maternal status for any reason, including orphans and abandoned infants: Give NVP immediately. Test infant with rapid HIV test. If rapid HIV test can be done within 2 hours, then wait for HIV results before commencing NVP. If rapid HIV test positive continue NVP for 6 weeks. If negative discontinue NVP. If the rapid HIV test is positive do an HIV PCR. If negative, repeat HIV PCR at 10 weeks. If HIV PCR positive, initiate baby on triple ART immediately and send confirmatory HIV PCR.

Non-breastfeeding mother diagnosed HIV positive > 72 hours after delivery: Do not start NVP. Perform an HIV test on infant and if positive initiate ART.

Note: *Remember to repeat the HIV PCR 6 weeks after breastfeeding cessation for all breastfed infants if < 18 months and repeat HIV rapid/ ELISA test if ≥ 18 months.*

LoE I [i]

Note: All HIV PCR results need to be followed-up as a matter of urgency.

Nevirapine (NVP) and Zidovudine (AZT) doses for infant on PMTCT

See table above.

» Give 1st dose as soon as possible after birth.
» Ideally the birth PCR test should be done before administration of infant NVP and AZT, but any delay in testing should not delay the NVP and AZT administration.
» Only one dose per 24-hour period; repeat dose once only if baby vomits.
» If infant HIV PCR is positive at any time, stop NVP and AZT, confirm with 2nd HIV PCR test and initiate cART. Continue normal breastfeeding.

- Nevirapine, oral, daily (syrup 10 mg/mL) and Zidovudine, oral, twice daily (syrup 10 mg/mL)
  - o Newborns ≥ 2 kg and term infants:

Infant Age/Wt	NVP Dose (**Daily**)	AZT Dose (**Twice daily**)
Birth to 6 weeks		
2.0 – 2.49 kg	1 ml (10 mg) daily	1 ml (10 mg) twice daily
>2.5 kg	1.5 ml (15 mg) daily	1.5 ml (15 mg) twice daily
6 weeks – 6 months		
	2 ml (20 mg) daily	6 ml (60mg) twice daily

Children > 6 months of age requiring prophylaxis should use treatment doses.

o Premature newborn < 2 kg:
» Nevirapine, oral, daily

Weight	1st 2 weeks after birth mg of NVP	After 1st 2 weeks after birth mg of NVP
500 to < 625 g	1 mg	2 mg
625 to < 850 g	1.5 mg	3 mg
850 to < 1 200 g	2 mg	4 mg
1.2 to < 1.5 kg	3 mg	5 mg
1 5 to < 1.9 kg	3.5 mg	6 mg
If infant at time of discharge is severely underweight for age (3 SD or 3 z-scores below the mean) give NVP according to weight, (i.e. 4 mg/kg/dose daily) until in the normal weight for age range.		

» Zidovudine, oral, twice daily

Gestational Age at birth	1st 2 weeks after birth	2-4 weeks after birth	4-6 weeks after birth	>6 weeks after birth
30-35 weeks	2 mg/kg	3 mg/kg	4 mg/kg	
<30 weeks	2mg/kg		3mg/kg	4mg/kg

LoE II[ii,iii,iv]

ART Prophylaxis for infants who are unable to tolerate oral medication

Infants who are unable to tolerate oral medication/feeds should be initiated on intravenous zidovudine (AZT). On re-establishment of oral feeds/medications, intravenous zidovudine should be stopped and the infant commenced on the appropriate oral infant prophylaxis regimen. Ideally gestational age should be used to determine optimal dose.

Gestational Age (weeks)	Approximate birth weight	AZT IV dosing for first 14 days (If Unable to Tolerate Oral Agents)
≥ 35 weeks	≥ 2.5 kg	3 mg/kg body weight IV every 12 hours
< 35 weeks	< 2.5 kg	1.5 mg/kg body weight IV every12 hours

HIV Testing

Recommended Intervals for Infant and Child Testing	
HIV PCR test	**Rapid HIV Antibody test**
At Birth » All HIV exposed neonates. Repeat HIV PCR testing at 10 weeks and 18 weeks (if applicable) should be done on all HIV exposed infants with a prior negative or indeterminate HIV PCR. Any infant with a positive birth PCR should be urgently initiated on ART as per section 9.1.2 **At 10 weeks** » All HIV-exposed infants. **At 18 weeks** » All infants who received 12 weeks of infant prophylaxis.	**At 18 months** » All HIV exposed infants. » Patients already on ART should not have a repeat HIV antibody test. **Breastfed infants: (6 weeks post cessation of breastfeeding)** » All HIV exposed infants - age appropriate: if < 18 months old - do HIV PCR ≥ 18 months old - do rapid HIV Antibody test **Family and social history (at all times)** » Parental request to test the child. » Primary caregiver is able to give consent for HIV testing in the best interests of the child. » Father or sibling with HIV infection. » Death of mother, father or sibling. » When the mother's HIV status is unknown, her whereabouts are unknown, or she is unavailable to be tested. **All children (at all times) with** » Clinical features suggestive of HIV infection. » Acute, severe illness. » IMCI classification of Suspected symptomatic HIV infection. » IMCI classification of Possible HIV infection. » TB diagnosis or history of TB treatment. » Risk of sexual assault. » Wet-nurse or breastfed by a woman with unknown or HIV-positive status. » Children considered for fostering of adoption.

If HIV PCR indeterminate or discordant refer to NHLS guideline.

Feeding advice

» Exclusive breastfeeding is strongly recommended for the 1st 6 months, after which the nutritional requirements of the child will require the introduction of complementary foods, in addition to breastfeeding.

» Except where a mother is shown to be failing cART, the advantages of breastfeeding exceed the risks of HIV transmission in a mother on cART and the mother should be encouraged to breast feed.

» The use of flash pasteurisation or Pretoria pasteurisation to reduce HIV transmission is supported but may pose significant barriers to successful breast milk feeding due to the effort involved. It can be used as an interim measure, for instance during maternal mastitis.

Co-trimoxazole prophylaxis

Indications:

» All HIV exposed infants starting from 4–6 weeks of age.

Discontinuation:

» If the child is shown to be HIV uninfected **and** has not been breastfed for the last 6 weeks; **or**

» If HIV infected, the immune system is fully reconstituted and > 1 year of age (i.e. child 1 to 5 years of age: CD4 > 25%, or child > 5 years of age: CD4 > 350 cells/mm^3 on 2 tests at least 3–6 months apart).

- Co-trimoxazole (sulfamethoxazole/trimethoprim), oral, once daily (everyday).

Recommended daily by weight band	Dose sulfamethoxazole/ trimethoprim	Suspension 200/40 mg per 5 mL	Single strength tablet 400/80 mg	Double strength tablet 800/160 mg
3 to 4.9 kg	100/20 mg	2.5 mL	¼ tablet	–
5 to 13.9 kg	200/40 mg	5 mL	½ tablet	–
14 to 29.9kg	400/80 mg	10 mL	1 tablet	½ tablet
> 30 kg	800/160 mg	–	2 tablets	1 tablet

9.1.2 THE HIV INFECTED NEONATE (< 1 month of age)

B20-B24

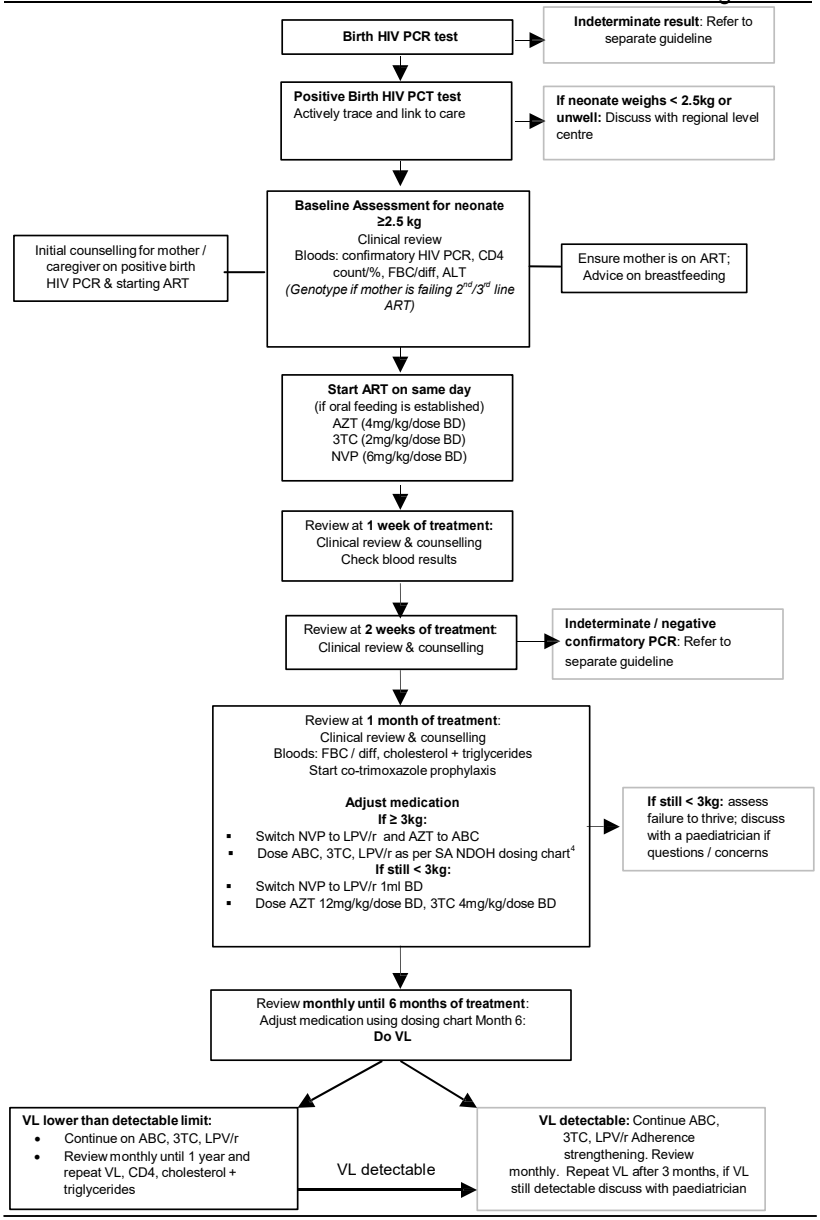
DESCRIPTION

An infant < 1 month of age, in whom HIV infection has been confirmed with 2 appropriate tests. For confirmation of HIV infection see section 9.1: Human immunodeficiency virus infections.

MEDICINE TREATMENT

This treatment protocol is meant as a guide, and there is allowance for flexibility after discussion with an expert.

Protocol for initiation of cART in HIV- infected term neonates ≥ 2.5kg at birth



ARV drug dosing chart:
for children < 28 days of age and weighing ≥ 2.5 kg at birth

	Lamivudine (3TC)		Zidovudine (AZT)		Nevirapine (NVP)	
Target dose	2 mg/kg/dose TWICE daily (BD)		4 mg/kg/dose TWICE daily (BD)		6 mg/kg/dose TWICE daily (BD)	
Available formulation	10 mg/ml		10 mg/ml		10 mg/ml	
Weight (kg)	**Dose in ml**	**Dose in mg**	**Dose in ml**	**Dose in mg**	**Dose in ml**	**Dose in mg**
≥2.5-<3.0	0.6ml BD	6mg BD	1.2ml BD	12mg BD	1.8ml BD	18mg BD
≥3.0-<3.5	0.7ml BD	7mg BD	1.4ml BD	14mg BD	2.1ml BD	21mg BD
≥3.5-<4.0	0.8ml BD	8mg BD	1.6ml BD	16mg BD	2.4ml BD	24mg BD
≥4.0-<4.5	0.9ml BD	9mg BD	1.8ml BD	18mg BD	2.7ml BD	27mg BD
≥4.5-<5.5	1.0ml BD	10mg BD	2.0ml BD	20mg BD	3.0ml BD	30mg BD
≥5.5-<6.5	1.2ml BD	12mg BD	2.4ml BD	24mg BD	3.6ml BD	36mg BD

Caregivers who will be administering ARV medication to the child must be supplied with a syringe (1ml or 2ml) for each of the 3 ARVs and shown how to prepare and administer the correct dose. If possible, bottles and syringes should be colour coded with stickers and a sticker of the relevant colour used to mark the correct dose on the syringe.

LoE III[N]

9.1.3 THE HIV INFECTED INFANT/CHILD

B20-24

DESCRIPTION

An infant or child in whom HIV infection has been confirmed with 2 appropriate tests.

For confirmation of HIV infection see section 9.1: Human immunodeficiency virus infections.

GENERAL AND SUPPORTIVE MEASURES

Counselling is a vital part of the successful care of children with HIV infection and their families. Specific matters requiring attention are:

» The implications of the disease to the family.
» Implications of treatment, non-adherence and understanding of the condition and its care.
» The disclosure process within the family and extended family/friends should be encouraged. Help from the family/friends is often useful.
» Disclosure to the child of appropriate age and maturity.

Treatment of mothers, caregivers and other family members:

» Always ask about the caregiver's health, and the health of other members of the family.
» Ensure that mothers and other family members have timeous access to medical care including cART.
» Encourage breastfeeding in all mothers with HIV infected children, with introduction of weaning foods from 6 months of age. Breastfeeding duration is recommended for 2 years or longer, as in HIV unexposed children.
» Always ask at every visit about TB contacts and TB symptoms in all children and their caregivers.

STANDARDISED NATIONAL MONITORING FOR INFANTS AND CHILDREN WITH HIV

At initial diagnosis of HIV	Purpose
Verify HIV status.	To ensure that national testing algorithm has been followed.
Document weight, height, head circumference (HC if < 2 years of age) and development.	To monitor growth and development.
Screen for TB symptoms.	To identify TB co-infection.
Do CD4 count.	Children < 5 years of age: Baseline. Do **not** wait for CD4 count to start ART.
	Children ≥ 5 years of age: To determine eligibility for co-trimoxazole prophylaxis.
Hb or FBC if available.	To detect anaemia or neutropenia.
At Initiation of cART (baseline)	**Purpose**
Hb or FBC .	If less than 8 g/dL, manage appropriately.
CD4 count (if not performed in last 6 months).	Baseline assessment.
Cholesterol + triglyceride if starting PI-based regimen.	Baseline assessment.
ALT (if jaundiced or on TB treatment).	To assess for liver dysfunction at baseline.

On cART	Purpose
Height, weight, head circumference (HC if < 2 years of age) and development.	To monitor growth and development stages. Adjust dosing at each visit as necessary according to weight gain.
Clinical assessment including drug-related adverse events.	To monitor response to ART and exclude adverse effects.
CD4 count: At 1 year on ART, and then every 12 months thereafter.	To monitor response to ART and stop co-trimoxazole prophylaxis as indicated.
Viral load (VL): At month 6, 1 year into ART, then every 12 months.	To monitor viral suppression on ART. To identify treatment failure and identify adherence problems.
Hb or FBC at month 1, 2, 3 and then annually if on AZT.	To identify AZT-related anaemia.
Cholesterol + triglyceride at 1 year of treatment and then every 12 months if on PI-based regimen.	To monitor for PI-related metabolic side effects.

MEDICINE TREATMENT

Co-trimoxazole prophylaxis

Indications:

» All HIV exposed infants starting from 4–6 weeks of age.

Discontinuation:

» If the child is shown to be uninfected **and** has not been breastfed for the last 6 weeks; **or**

» If HIV-infected, the immune system is fully reconstituted on cART and child > 1 year of age (i.e. child 1 to 5 years of age: CD4 > 25%, or child > 5 years of age: CD4 > 350 cells/mm^3 on 2 tests at least 3–6 months apart).

- Co-trimoxazole (sulfamethoxazole/trimethoprim), oral, once daily (everyday).

Recommended daily dosage by weight band	Dose sulfamethoxazole/ trimethoprim	Suspension 200/40 mg per 5 mL	Single strength tablet 400/80 mg	Double strength tablet 800/160 mg
3 to 4.9 kg	100/20 mg	2.5 mL	¼ tablet	–
5 to 13.9 kg	200/40 mg	5 mL	½ tablet	–
14 to 29.9 kg	400/80 mg	10 mL	1 tablet	½ tablet
> 30 kg	800/160 mg	–	2 tablets	1 tablet

Immunisation, deworming and vitamin A program
Continue deworming and vitamin A programme as in the HIV-negative child. Continue immunisation as in the HIV-negative child. See the Standard Treatment Guidelines and Essential Medicines List for Primary Health Care, Chapter 13: Immunisation.

Nutritional support
Specific nutritional conditions should be treated appropriately.

Antiretroviral therapy (ART)
Initiation of cART in well uncomplicated infants shown to be PCR positive should be at PHC level – see national NIMART guidelines (IMCI) and Standard Treatment Guidelines and Essential Medicines List for Primary Health Care.

The preparation of the child and family to start cART is critical to the success of the treatment. Failure to achieve adherence may lead to resistance and adversely affect the prognosis of the child.

Eligibility criteria for antiretroviral therapy
» Confirmation of diagnosis of HIV infection irrespective of CD4 count or WHO clinical staging.

and

» No medical contraindication (e.g. major organ dysfunction). If medical contraindications are present refer to hospital for rapid review and planning.

Children requiring fast track (i.e. to start cART within 7 days of being eligible with attention to social issues, counselling and adherence)
» Children < 1 year of age.
» CD4 count < 200 cells/ mm^3 or < 15%.
» WHO Clinical stage IV.
» MDR or XDR-TB infection unless TB meningitis is diagnosed.

Social issues that must be addressed to ensure successful treatment
These are extremely important for success as they impact on adherence.
Social challenges should be overcome and not be barriers to care.
Disclosure to another adult living in the same house is encouraged so that there is someone else who can assist with the child's treatment.
» Mandatory component: at least one identifiable caregiver able to supervise the child and/or administer medication. All efforts should be made to ensure that the social circumstances of vulnerable children, e.g. orphans, be addressed to facilitate treatment.
» Adherence:
  > high levels of adherence (> 95%) should be attained for adequate virological response and prevention of viral resistance. This can be achieved with regular education and support.
  > All efforts to encourage this level of adherence should be made.
  > Viral load measurements are useful for monitoring adherence.
» Sensitive, age-appropriate disclosure may facilitate adherence.

Requirements before cART is used

The child's family (parents, caregivers) should understand:

» that antiretroviral therapy is lifelong;
» the prognosis of the condition (treated and untreated);
» adverse effects of the medicines, their mode of action, and the risk and implications of developing resistance, if incorrectly used;
» that all medications should be given as prescribed.

ART Regimens

» Are chosen according to age, weight, expected adverse effects, efficacy and prior antiretroviral exposure.
» Adjust the dosage of antiretroviral therapy according to weight during follow up visits. Assess weight gain and need for adjustment at each visit.
» Do not change regimens or move to 2nd line therapy without clear guidance from an experienced practitioner in child ARV medicine as unnecessary loss of effective regimens can shorten life expectancy. Adherence problems need to be addressed thoroughly before switching to a 2nd or 3rd line regimen.
» Single drug substitution may only be made when drug-specific adverse effects are encountered, on condition that complete virological suppression is documented and the matter is discussed with an experienced practitioner in child ARV medicine first.

First Line Regimen	
All neonates (< 1 months of age)	AZT + 3TC + NVP See 9.1.2 The HIV Infected Neonate.
All infants and children (1 month - 3 years of age (or < 10 kg)	ABC + 3TC + LPV/r Note: Do **not** change regimen on reaching 3 years of age or 10 kg.
Children ≥ 3 – 10 years (and ≥ 10 kg) Adolescents 10-15 years or <40kg	ABC + 3TC + EFV. Do VL at 6 months on treatment to monitor viral suppression on ART.
Currently on d4T-based regimen	Change d4T to ABC if the viral load is undetectable. If detectable discuss with an experienced practitioner in child ARV medicine.
Second Line Regimen	
Failed first line NNRTI based regimen (Consult with a specialist before changing)	
	Recommended second line regimen
ABC + 3TC + EFV (or NVP)	AZT + 3TC + LPV/r
D4T + 3TC+EFV (or NVP)	AZT + ABC + LPV/r

<table>
<tr><th colspan="2">Failed first line protease inhibitor (PI)-based regimen
(Discuss with a specialist before changing)</th></tr>
<tr><td></td><td>Recommended second line regimen</td></tr>
<tr><td>ABC + 3TC + LPV/r</td><td rowspan="2">Referral to a specialist for assessment and genotype Drug Resistance (DR) testing. Patients who fail on a PI-based regimen for at least a year (first or second line) and have not achieved viral suppression (viral load >1000 copies/ml on at least 3 occasions) despite best attempts to improve adherence to medication would be eligible for genotype DR resistance test to determine if a third-line ART regimen is indicated.</td></tr>
<tr><td>Previously on a regimen with <u>unboosted</u> PI (e.g. ritonavir alone), or with rifampicin while on LPV/r.</td></tr>
<tr><td colspan="2">Third Line Regimens</td></tr>
<tr><td>Failure on a PI-based regimen with PI resistance on genotype DR tests.</td><td>Refer to a specialist for further management.
Access to third-line ART will be managed centrally by the National Department of Health. A full treatment history using the standard motivation form must be submitted to the 3rd line review committee via the National Department of Health (TLART@health.gov.za) for consideration. Once consensus is reached, a decision is conveyed to the provincial pharmacy and local facility with a recommended management plan. If third-line ART is indicated, the medication is ordered by the facility on a named patient basis.</td></tr>
</table>

General comments

Switch to tablets or capsules from syrups or solutions as soon as possible.
Use fixed dose combinations in preference to single agents.
If available, use daily dose regimens.

Weight (kg)	Abacavir (ABC)		Lamivudine (3TC)		Efavirenz (EFV)	Lopinavir/ritonavir (LPV/r)
Target dose	8 mg/kg 12 hourly **OR** ≥10kg: 16 mg/kg once daily		4 mg/kg 12 hourly **OR** ≥ 10kg: 8 mg/kg once daily		By weight band once daily	300/75 mg/m^2/dose LPV/r 12 hourly
Available formulations	Sol. 20 mg/ml Tabs 60 mg (scored, dispersible), 300 mg (not scored), ABC/3TC 600/300 mg		Sol. 10 mg/ml Tabs 150mg (scored), 300 mg; ABC/3TC 600/300 mg		Caps 50, 200 mg Tabs 50, 200, 600 mg (not scored)	Sol. 80/20 mg/ml Adult Tabs 200/50 mg, Paeds Tabs 100/25 mg
Currently available tablet formulations of abacavir (except 60 mg), efavirenz, LPV/r and AZT must be swallowed whole and **not** chewed, divided or crushed.						
< 3 kg: Refer to 9.1.2 (The infected neonate).						
3–4.9	2 ml 12 hourly		2 ml 12 hourly		**Avoid using when < 10 kg or < 3 years:** dosing not established	*1 ml 12 hourly
5–6.9	3 ml 12 hourly		3 ml 12 hourly			*1.5 ml 12 hourly
7–9.9	4 ml 12 hourly		4 ml 12 hourly			
	Choose only one option:		Choose only one option:			
10–13.9	6 ml **OR** 2 x 60 mg tabs 12 hourly	12 ml **OR** 4 x 60 mg tabs daily	6 ml 12 hourly	12 ml daily	200 mg at night (1x200 mg cap/tab)	2 ml 12 hourly

Weight (kg)	Abacavir (ABC)		Lamivudine (3TC)		Efavirenz (EFV)	Lopinavir/ritonavir (LPV/r)
	Choose only one option		Choose only one option			Choose one option
14–19.9	8 ml 12 hourly	1x300 mg tab **OR** 15 mldaily	8 ml **OR** ½x150 mg tab 12 hourly	1x150 mg tab **OR** 15 ml daily	300 mg at night: (200 mg cap/tab + 2x50 mg cap/tab)	2.5 ml **OR** 2 x 100/25 mg paeds tabs **OR** 1 x 200/50 mg adult tabs 12 hourly
20–24.9	10 ml 12 hourly	20 ml daily	1x150 mg tab **OR** 15 ml 12 hourly	30 ml **OR** 1x300 mg tab **OR** 2x150 mg tab daily	300 mg at night: (200 mg cap/tab + 2x50 mg cap/tab)	3 ml **OR** 2 x 100/25 mg paeds tabs **OR** 1 x 200/50 mg adult tabs 12 hourly
25–29.9	1x300 mg tab 12 hourly	2x300 mg tabs daily **OR** 1xABC/3TC 600/300 mg tab daily	1x150mg tab 12 hourly	2x150 mg tabs **OR** 1x300mg tab daily **OR** 1xABC/3TC 600/300 mg tab daily	400 mg at night: (2x200 mg caps/tab)	3.5 ml **OR** 3 x 100/25 mg paeds tabs **OR** 1 x 200/50 mg adult tabs[#] + 1x100/25 mg paeds tab 12 hourly
30–34.9						4 ml **OR** 3x100/25 mg paeds tabs **OR** 1x200/50 mg adult tabs[#] + 1x100/25 mg paeds tab 12 hourly
35–39.9						5 ml **OR** 2x200/50 mg adult tabs 12 hourly
> 40					600 mg tab at night	

* Avoid LPV/r solution in any full term infant <14 days of age and any premature infant <14 days after their due date of delivery (40 weeks post conception) or obtain expert advice. [#]Children 25–34.9 kg may also be dosed with LPV/r 200/50 mg adult tabs: 2 tabs am; 1 tab pm.

<table>
<tr><th>Weight
(kg)</th><th>Ritonavir (r)
boosting</th><th>Stavudine
(d4T)</th><th>Nevirapine
(NVP)</th><th>Zidovudine
(AZT)</th></tr>
<tr><td>Target dose</td><td>ONLY as booster for LPV/r when on rifampicin
12 hourly
(0.75 x LPV dose 12 hourly)</td><td>1 mg/kg/dose 12 hourly</td><td>160–200 mg/m^2 /dose 12 hourly (after once daily lead-in for 2 wks)</td><td>180–240 mg/m^2/dose 12 hourly</td></tr>
<tr><td>Available formulations</td><td>Sol: 80 mg/ml</td><td>Sol: 1 mg/ml
Caps: 15, 20, 30 mg</td><td>Sol. 10 mg/ml
Tabs 200 mg (scored)</td><td>Sol. 10 mg/ml
Caps 100 mg
Tabs 300 mg (not scored),
AZT/3TC 300/150 mg</td></tr>
<tr><td colspan="5">Currently available tablet formulations of AZT must be swallowed whole and not chewed, divided or crushed</td></tr>
<tr><td colspan="5">< 3 kg: Refer to 9.1.2 (The infected neonate)</td></tr>
<tr><td>3–4.9</td><td>1 ml 12 hourly</td><td>6 mL 12 hourly</td><td rowspan="2">5 ml 12 hourly</td><td rowspan="2">6 ml 12 hourly</td></tr>
<tr><td>5–5.9</td><td rowspan="3">1.5 ml 12 hourly</td><td rowspan="3">7.5 mg 12 hourly: open 15 mg cap into 5 mL water: give 2.5 mL</td></tr>
<tr><td>6–6.9</td><td rowspan="3">8 ml 12 hourly</td><td rowspan="2">9 ml 12 hourly</td></tr>
<tr><td>7–7.9</td><td rowspan="3">10 mg 12 hourly: open 20 mg cap into 5 mL water: give 2.5 mL</td></tr>
<tr><td>8–9.9</td><td rowspan="3">12 ml
OR
1 cap
12 hourly</td></tr>
<tr><td>10–10.9</td><td rowspan="2">15 mg 12 hourly: open 15 mg cap into 5 mL water: give 2.5 mL</td><td rowspan="2">10 ml 12 hourly</td></tr>
<tr><td>11–13.9</td><td rowspan="2">2 ml 12 hourly</td></tr>
<tr><td>14–19.9</td><td rowspan="2">20 mg 12 hourly: open 20 mg cap into 5 mL water (if child unable to swallow capsule)</td><td rowspan="2">15 ml 12 hourly
OR
1 tab morning
½ tab evening</td><td>15 ml 12 hourly
OR
2 cap morning
1 cap evening</td></tr>
<tr><td>20–24.9</td><td>2.5 ml 12 hourly</td><td>20 ml
OR
2 cap
12 hourly</td></tr>
<tr><td>25–34.9</td><td>3 ml 12 hourly</td><td rowspan="2">30 mg 12 hourly</td><td rowspan="2">1 tab 12 hourly</td><td rowspan="2">1 tab 12 hourly
OR
1xAZT/3TC
300/150 mg tab 12 hourly</td></tr>
<tr><td>> 35</td><td>4 ml 12 hourly</td></tr>
</table>

Specific information on ARVs		
	Storage	**Adverse effects**
Nucleoside reverse transcriptase inhibitors (NRTIs)		
Zidovudine (AZT)	room temperature	» Haematological, e.g. anaemia, neutropaenia
Stavudine (d4T)	refrigerate suspension	» Lactic acidosis; peripheral neuropathy, lipoatrophy
Lamivudine (3TC)	room temperature	» Uncommon
Abacavir (ABC)	room temperature	» Abacavir Hypersensitivity Reaction (HSR) > usually occurs in 1st 6 weeks of initiation of therapy, > symptoms and signs become worse with each subsequent dose, > multi-system manifestations, > fever, and rash common, > other systems include gastrointestinal signs (nausea, vomiting, abdominal pain) and respiratory symptoms (dyspnoea, sore throat and cough). » Laboratory abnormalities include raised transaminases and creatinine phosphokinase and lymphopaenia. » **Do not continue or rechallenge with abacavir.**

Specific information on ARVs		
Non-nucleoside reverse transcriptase inhibitors (NNRTIs)		
	Storage	**Adverse effects**
Nevirapine (NVP)	room temperature	» Skin rash usually occurs in 1st 6 weeks Do not increase dosage until rash resolves. » Beware of liver toxicity
Efavirenz (EFV)		» Give at night to avoid CNS side-effects: > dysphoria > vivid dreams > dizziness > distracted » Hepatotoxicity Possible teratogenicity Breast enlargement in males and females
Protease Inhibitors (PIs)		
Ritonavir (r)		» Bitter taste
Lopinavir/ritonavir (LPV/r)	Use tablets whole, without crushing, halving, biting or chewing	» Nausea » Vomiting » Diarrhoea

Important side effects of ARVs
(*Consult an expert before stopping ART)

	Continue ART with careful monitoring.	**Consult expert and/or stop treatment..**
Lactic acidosis	» lactate 2–5 mmol/L with no signs or symptoms	» lactate > 5 mmol/L, or » with signs or symptoms or acidosis
Anaemia	» Hb: 7.0–9.9 g/dL	» Hb < 7 g/dL or cardiac failure
Neutropaenia	» 0.4–1.2 x 10^9/L	» ≤ 0.399 x 10^9/L
Increase liver enzymes and hepatitis	» ≤ 9.9 x upper normal limit	» ≥ 10.0 x upper normal limit
Increased serum triglycerides	» 1.54–8.46 mmol/L	» ≥ 8.47 mmol/L*
Increased cholesterol	» 4.43–12.92 mmol/L	» ≥ 12.93 mmol/L*
Severe skin reactions	» diffuse maculo-papular rash, or » dry desquamation	» vesiculation, or » ulcers, or » exfoliative dermatitis, or » Stevens-Johnson syndrome, or » erythema multiforme, or » moist desquamation, or » with elevated ALT or AST
» peripheral neuropathy » myopathy » abdominal pain » nausea and vomiting » pancreatitis » headache » fatigue » sedative effect » sleep disturbance » confusion » abnormal thinking	Clinical evaluation: » Discuss all cases urgently with an HIV expert, before interrupting therapy	

Criteria for changing therapy

Adverse effects

Children may occasionally need to change a medicine from the first line regimen to one from the second line regimen because of intolerance or a serious adverse reaction. There is no need to change an entire regimen for a single adverse drug reaction.

Note: a single drug substitution can only be made if the viral load is undetectable or if the change is made in the first six months of starting a regimen.

The decision to swap must be made by a doctor with antiretroviral experience (this can be by telephonic consultation), as inappropriate choices of antiretrovirals may be ineffective or dangerous.

Treatment failure

The HIV viral load is the most sensitive method to detect failure of response to ART.

Virological failure can be defined as a measurable viral load despite optimal adherence and optimal dosage over a four-month period. Treatment failure is defined primarily by viral loads, as waiting for clinical or immunological failure enhances the chances of increasing viral resistance to other available anti-retroviral agents.

The most common cause of failure of first (and subsequent) line therapy is poor adherence. There is no point in changing to second line therapy before adherence has been addressed.

Viral load (VL)	Response
Lower than detectable limits	» Praise the patient and caregiver(s) and continue 12 monthly VL monitoring.
< 400 copies/mL	» 12 monthly VL monitoring and adherence support.*
400–1 000 copies/mL	» Begin step up adherence package*. » Repeat VL in 6 months.
> 1 000 copies/mL	» Begin step-up adherence package*. » Repeat VL in 3 months: > If < 400: return to routine 6–12 monthly monitoring. > If 400–1 000: continue step up adherence and repeat VL after 6 months. > If > 1 000 despite stepped up adherence, **and** child on NNRTI based regimen: switch to second line therapy after adherence ensured. > If the child is on a PI-based regimen and the VL is > 1 000 despite stepped up adherence: ▪ Where the HIV VL < 30 000 continue with same regimen while monitoring VL 3-monthly. Continue stepping up adherence and consult an expert. ▪ If the HIV VL is > 30 000 this requires referral to an expert for further management.

* For guidance on step-up adherence package refer to National adherence guidelines

REFERRAL

» Complicated or very ill children should be referred to a practitioner skilled in the care of such children.
» Attempts should be made to refer patients to accredited primary health care sites once stable on ART.

9.2 TUBERCULOSIS AND HIV

B20.0

DESCRIPTION

TB and HIV are often co-morbid conditions. Exclude TB by history of TB contacts, clinical examination, chest X-ray, tuberculin skin test (TST), *M. tuberculosis* PCR test and mycobacterial culture (where TB disease is suspected on clinical or radiological grounds) in all patients before starting ART. Every attempt should be made to obtain microbiologic specimens for TB testing (sputums, NGAs or other, as applicable), as this presents the opportunity to prove TB disease in the child.

Re-evaluate the risk for TB and TB contact at each visit on history (including contact history) and clinical examination.

MEDICINE TREATMENT

TB prophylaxis

Give TB prophylaxis to all HIV-infected children, and all uninfected children < 5 years, exposed to a close contact with an infectious pulmonary TB case (sputum microscopy smear-positive, culture-positive or *M. tuberculosis* PCR test positive), or who are newly found to be TST positive, **but** in whom no evidence of TB disease is present.

- Isoniazid, oral, 10 mg/kg/dose once daily for 6 months.
  - Maximum dose: 300 mg daily.

Repeat the course if an HIV-infected patient, irrespective of age, is re-exposed to a TB contact at any point after completing TB treatment or prophylaxis.

If patient has been exposed to a known MDR or XDR-TB source case or the contact case has failed standard TB treatment, refer for expert opinion. See Chapter 10: Tuberculosis, section 10.2: Tuberculosis, pulmonary.

TB treatment

<u>If the child is not yet on ART:</u>

» Commence TB treatment first. Follow with cART, usually after 2-4 weeks. In children with TB meningitis, start cART at 4 weeks regardless of CD4 count to avoid IRIS.
» Check ALT before commencing cART. If the ALT is raised discuss this with an expert as it may not be an absolute contraindication to treatment.

» Assess the child for possible disseminated TB disease.
» Be aware of the possibility of Immune Reconstitution Inflammatory Syndrome (IRIS).

If the child is already on cART:
» Commence TB treatment, taking into consideration possible drug interactions and need for cART dosage adaptations.

If the child needs to take concomitant cART and rifampicin-containing treatment:
» Efavirenz: use the normal recommended dosage as per dosing table.
» Abacavir and lamivudine: no adjustment of dosages.
» Lopinavir/ritonavir: refer to dosage table for the ritonavir boosting doses.
» Avoid using double-dose lopinavir/ritonavir solution in young children. If Lopinavir/ritonavir solution is not available, consult an expert.
» Give pyridoxine (vitamin B_6) to all children on TB and ARV treatment, due to shared toxicities of the regimens.

9.3 SPECIFIC ADVERSE EVENTS AND COMPLICATIONS

9.3.1 LIPODYSTROPHY

E88.1

DESCRIPTION

Both lipoatrophy and lipohypertrophy can occur as a complication or association of cART. The risk factors include virologic response to therapy and pubertal development during protease inhibitor therapy.

Lipodystrophy contributes to non-adherence to ART as a patient may be embarrassed by his/her physical appearance.

Stavudine, didanosine and zidovudine in decreasing order are the main causes of lipoatrophy.

The relationship between lipohypertrophy, hypercholesterolaemia, hypertriglyceridaemia, insulin resistance with puberty, body habitus and ART (especially protease inhibitors), is less clear but an association has been described.

DIAGNOSTIC CRITERIA

» Lipoatrophy:
  > Subcutaneous fat loss (lipoatrophy) of the face, extremities or buttocks.
» Lipohypertrophy:
  > Fat accumulation (lipohypertrophy) in the abdomen, or over the dorsocervical spine (buffalo hump) and breast enlargement.
  > Excessive breast enlargement during puberty (lipomastia).

» Insulin resistance may be suspected if there is:
  > fasting hyperglycaemia,
  > frank diabetes or acanthosis nigricans,
  > biochemical features include an elevated fasting C-peptide or an abnormal glucose/insulin ratio.
» Abnormal lipid profile: See Chapter 4: Cardiovascular System, section 4.10: Dyslipidaemia.
  > hypercholesterolaemia, i.e. total cholesterol level > 5 mmol/L; and
  > hypertriglyceridaemia, i.e. fasting triglyceride level > 1.7 mmol/L with possible consequences of premature atherosclerosis.

GENERAL AND SUPPORTIVE MEASURES

» Dietary modification and exercise for lipohypertrophy, insulin resistance and abnormal lipid profile.

MEDICINE TREATMENT

Modification of ART, e.g. replace stavudine with abacavir or tenofovir, depending on the age of the child/adolescent with lipoatrophy.

Note:
Viral suppression must be present for a single drug substitution. If viral suppression is not present obtain expert advice.

If hyperlipidaemia is confirmed,

- Refer to Chapter 4: Cardiovascular System, section 4.10 - Dyslipidaemia for medicine treatment recommendations.

REFERRAL

» All patients for confirmation of diagnosis and initiation of therapy.
See Chapter 7: Endocrine System, section 7.16: Obesity.

9.3.2 IMMUNE RECONSTITUTION INFLAMMATORY SYNDROME (IRIS)

D89.3

DESCRIPTION

Clinical deterioration can occur after starting cART due an improvement in the immune system response to organisms already causing infection, e.g.

- *M bovis BCG,*
- *M. tuberculosis (MTB),*
- *M. avium complex,*
- *M. leprae,*
- *P. jiroveci,*
- CMV,
- JC virus.
- *C. neoformans,*
- Aspergillus,
- *C. albicans,*
- Human Herpes virus,
- Human Papilloma virus,
- Hepatitis B and C viruses (HBV, HCV),

There are 2 manifestations of IRIS:
1. Unmasking occurs when a previously unsuspected condition manifests.
2. Paradoxical, i.e. known condition on appropriate treatment becomes worse.

DIAGNOSTIC CRITERIA
» Exclude other active or inadequately treated diseases (including MDR TB).
» Ensure adherence to the prescribed therapy.
» Presentation:
  > Usually during the first 6 weeks after starting cART.
  > Clinical presentation depends on the causative organism and the organ-system involved, e.g. TB presents with fever, lymphadenopathy, worsening of the original tuberculous lesion, and/or deteriorating chest radiographic manifestations such as miliary pattern or pleural effusion.

MEDICINE TREATMENT
Treat underlying disease aggressively.
Antimicrobial therapy for specific infections.

In severe reactions:
- Prednisone, oral, 1.5 mg/kg daily for 2 weeks followed by 0.75 mg/kg daily for 2 weeks.

Usually cART is continued, and the underlying condition managed.
Local IRIS with *M. bovis BCG* usually does not require antimicrobial therapy.

9.3.3 WASTING SYNDROME
B22.2

This syndrome appears to be a combination of the direct effects of advanced HIV infection and the occurrence of opportunistic infections.

TREATMENT
Nutritional advice. See Chapter 2: Alimentary Tract, section 2.4: Malnutrition.

cART may reverse some of the features of HIV wasting syndrome.
Exclude chronic infection, e.g. tuberculosis and *M. avium complex*, malabsorption and malignancy.

9.4 POST EXPOSURE PROPHYLAXIS FOLLOWING ALLEGED PENETRATIVE SEXUAL ABUSE

See Standard Treatment Guidelines and Essential Medicines List for Primary Health Care.

9.5 HIV IN ADOLESCENCE

B20-24

DESCRIPTION

Adolescence encompasses the period of physical and psychological development from the onset of puberty to maturity. HIV in adolescents may be due to:

1. Vertical infection in infancy that presents as long term non-progressors; or
2. Sexually acquired HIV from unprotected intercourse.

Increasing numbers of perinatally infected infants are surviving to adolescence.

Adolescence is a high risk period for non-adherence to therapy.
Mood disorders, denial, peer pressure, self-esteem and suicide risk are more common and patients may need to be referred for psychological support.

Education about sexual and reproductive health should be commenced early. Every encounter with the adolescent needs to be maximally utilised to discuss condom and contraception use to protect against unplanned pregnancies and STI transmission including HIV is essential. Schools should be taking an active role in this education. Sexually active youth need to be screened for STI symptoms and managed appropriately.

Consent

For testing, treatment and disclosure, the current acts and regulations should be followed.

Disclosure

All adolescents need to be aware of their HIV status. This should be handled sensitively. In addition, disclosure of diagnosis has ramifications for adherence. Disclosure should be planned with the caregiver and usually takes place over 2–3 visits. Disclosure should start in childhood using non-specific terms such as “germ” and “medicine”, building up to full disclosure around 10 years of age. Intervention by a social worker is useful where appropriate, although disclosure is often managed by skilled counsellors. Determine what the adolescent already knows and discuss with the caregiver about who should disclose and where.

Dosage of ARVs

In children over the age of 15 years and over 40 kg use adult dosage regimes – consult ART guideline.

Transition from Paediatric cART regimens to adolescent/adult regimens

» Adolescents with an undetectable VL (< 50 copies/mL) and no side effects on ABC + 3TC + EFV can remain on the same regimen until the patient becomes eligible for the TDF + FTC + EFV (FDC) at 15 years old and weighing ≥ 40kg.

» When an adolescent with an undetectable viral load (taken within the last 8 weeks) reaches 15 years of age and is ≥ 40kg, a creatinine level, calculate the estimated glomerular filtration rate (eGFR) using a standard formula, and urine strip test should be performed.

- If the eGFR is > 80mL/min and no proteinuria on urine strip test, then the patient can be switched to the FDC (TDF + FTC + EFV).
- If the eGFR is < 80mL/min or > 1+ proteinuria on urine strip test, then refer to an expert for advice before switching.

Transition from child-adolescent regimen

If the HIV VL is between 50-1000 copies/mL consult an expert for advice.
If the HIV VL is > 1000 copies/mL, exclude non-adherence then treat as virological failure.

Contraception in HIV infected adolescents on cART

Hormonal contraceptives and IUCDs do not prevent sexually transmitted infections. Additional use of condoms is required.

- Intra-uterine contraceptive device (IUCD): HIV is not a contraindication to IUCD use and may be used in adolescents on cART e.g. 380mm^2 copper – standard type.
- Progestogen-only subdermal implant contraceptive e.g. Levonorgestrel, 150mg, subdermal two-rod implant.
  Note: Progestogen-only subdermal implant should NOT be used in patients on efavirenz. Additional non-hormonal contraception is required during and for up to 28 days after discontinuation of enzyme-inducing agents including rifampicin, efavirenz, and many anticonvulsants (e.g. carbamazepine, phenobarbital, phenytoin)

LoE II[vi,vii]

- Injectable contraception: e.g. Medroxyprogesterone acetate (long-acting), IM, 150 mg, 12 weekly.
  Note: It is unnecessary to shorten the dosage interval for women taking concomitant enzyme-inducing drugs, e.g. rifampicin, antiretrovirals and anticonvulsants.
- Combined oral contraceptives (COCs) are indicated for motivated patients where adherence is more likely but are associated with drug-drug interactions.

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CHAPTER 10

TUBERCULOSIS

10.1 TUBERCULOSIS, PERINATAL

P37.0
*Notifiable condition

DESCRIPTION

Tuberculosis acquired in the first 3 months of life. Perinatal tuberculosis may be acquired in one of the following ways:

» Transplacental transmission – usually extrapulmonary or disseminated TB,
» Via the passage of swallowed maternal blood or amniotic fluid during delivery – usually extrapulmonary TB, or
» Inhalation of the bacilli during the neonatal period – usually pulmonary TB.

DIAGNOSTIC CRITERIA

» Hepatosplenomegaly, a suggestive chest X-ray, TB exposure via a mother or close contact with another source case.
» Positive smear or culture on any suitable sample e.g. gastric aspirate in the neonate or tissue histology suggestive of TB.
» Endometrial swabs or sputum samples in the mother positive for *M. tuberculosis*. See section 10.2: Tuberculosis, Pulmonary.

GENERAL AND SUPPORTIVE MEASURES

» Check drug sensitivity of source. If resistant, refer.
» Check HIV status of mother and, if positive, test baby with HIV PCR.
» Screen all household contacts for tuberculous infection or disease.
» Monitor the nutritional status of the neonate.
» Do not give BCG vaccine at birth.

MEDICINE TREATMENT

Treatment

Newborn infant of mother with tuberculosis with newborn having any signs suggestive of illness.

Intensive phase

- Rifampicin, oral, 10 mg/kg/dose once daily for 2 months.

PLUS

- Isoniazid, oral, 10 mg/kg/dose once daily for 2 months.

PLUS

- Pyrazinamide, oral, 35 mg/kg/dose once daily for 2 months.

Continuation Phase

- Isoniazid, oral, 10–15 mg/kg/dose once daily for 4 months.

PLUS

- Rifampicin, oral, 10–15 mg/kg/dose once daily for 4 months.

Prophylaxis

All asymptomatic neonates:

- Isoniazid, oral, 10 mg/kg/dose once daily for 6 months.

Weight band	Daily isoniazid (INH) 100 mg tablet
2–3.4 kg	¼ tablet
3.5–4.9 kg	½ tablet
5–7.4 kg	¾ tablet

During prophylaxis monitor the infant for active TB disease. After 6 months and HIV uninfected:

- BCG vaccine.

In severely immunosuppressed patients the tuberculin reaction test can be negative in the presence of active tuberculosis.

REFERRAL

» Patients not responding to adequate therapy.
» Perinatal TB with a drug resistant source.

10.2 TUBERCULOSIS, PULMONARY

A16.9
*Notifiable condition

DESCRIPTION

A chronic, granulomatous disease of the lungs caused by *M. tuberculosis*. Most children acquire tuberculosis from infected adults by inhalation.

Malnourished, immunosuppressed (HIV and AIDS) and children < 3 years of age with pulmonary tuberculosis (PTB) are always regarded as having a very serious disease.

Complications include:

» enlarged hilar and mediastinal lymphadenopathy with obstruction, e.g. tracheal or bronchial airway compression or occlusion with secondary atelectasis or hyperinflation;
» local spread of infection, e.g. TB bronchopneumonia, pleural effusion or cavitation;
» disseminated disease, e.g. miliary TB, TB meningitis and metastatic extrapulmonary involvement.

DIAGNOSTIC CRITERIA

Any child presenting with symptoms and signs suggestive of pulmonary TB is regarded as a case of TB if there is:

» a chest X-ray suggestive of TB,

and/or

» history of exposure to an infectious TB case and/or positive Tuberculin Skin Test (TST) e.g. Mantoux.

The diagnosis is supported by a positive *M. tuberculosis* PCR e.g. GeneXpert®. Culture, usually on gastric aspirates or induced sputum, is a confirmatory test.

» Signs and symptoms include:
  > unexplained weight loss or failure to thrive,
  > unexplained fever for ≥ 2 weeks,
  > chronic, unremitting cough for > 14 days,
  > lymphadenopathy (especially cervical, often matted),
  > hepatosplenomegaly,
  > consolidation and pleural effusion.

» The following may be evident on chest X-ray:
  > Direct or indirect evidence of hilar or mediastinal adenopathy with or without parenchymal opacification and/or bronchopneumonia,
  > miliary changes,
  > pleural effusions.

Note:

Miliary pattern on chest X-rays of HIV infected children may also be suggestive of a diagnosis of lymphoid interstitial pneumonitis (LIP). (The miliary pattern of TB extends into the periphery of the lungs whereas LIP usually does not).

» Exposure to an adult with pulmonary tuberculosis.

» Tuberculin skin test (TST) e.g. Mantoux.
  > A positive TST has an induration of ≥ 10 mm.
  > A TST may be falsely negative in the presence of:
    - malnutrition,
    - immunodeficiency, e.g. HIV and AIDS,
    - immunosuppression, e.g. steroid therapy, cancer chemotherapy,
    - following overwhelming viral infection, e.g. measles or post vaccination.

    In these circumstances a TST induration of ≥ 5 mm may be regarded as positive. Frequently, the TST will be non-reactive in these cases and a decision not to start TB treatment should not be based on a negative TST test.

» *M. tuberculosis* is suggested by positive PCR and confirmed by culture on the following specimens but most children will not have microbiological confirmation of TB:
  > early morning gastric aspirate (empty stomach, no oral food intake for ≥ 4 hours),
  > sputum (older children),
  > induced sputum,
  > CSF,
  > pleural and ascitic fluids,
  > fine needle aspirate biopsies of lymph nodes,
  > ear swabs for tuberculosis culture in chronic otorrhoea.
» **PCR sputum positive on molecular testing**.
  > The *M. tuberculosis* PCR has an inferior yield to liquid culture and therefore should not replace culture.
  > Where available, the molecular *M. tuberculosis* PCR test should be performed on sputum and gastric aspirates in preference to fluorescent smear for acid fast bacilli as it increases the diagnostic yield and allows early identification of rifampicin resistance.
» Microscopy and culture in all cases.

GENERAL AND SUPPORTIVE MEASURES

» Identify and treat the source case.
» In case of known contact with adult MDR TB case, the child requires referral for appropriate MDR TB prophylaxis or treatment.
» Screen all contacts for TB infection.
» Monitor the nutritional status of the child to assess response to treatment.
» Only symptomatic pleural effusions should be drained via pleural aspiration (in such cases consider adjunctive steroid therapy).
» Ensure household infection control practices.

MEDICINE TREATMENT

Tuberculosis control programme drug regimens (2013)

Directly observed therapy (DOT), short-course, using fixed medicine combinations is recommended to avoid the development of antimicrobial resistance.

Give treatment daily in both the intensive (initial) and the continuation phase.

HIV infected children with tuberculosis should be treated according to the standard treatment protocol with clinical, radiologic and microbiologic follow-up to determine response to treatment.

	Recommended dose ranges in mg/kg	
	Daily	**Max daily**
Isoniazid (H)	10-15	300 mg
Rifampicin (R)	10-20	600 mg
Pyrazinamide (PZA/Z)	30-40	2 g
Ethambutol (EMB/E)	15-25	1200 mg

Uncomplicated with low bacillary load

Children up to 8 years:

	Intensive phase 2 months			**Continuation phase 4 months**
	RH	PZA		RH
		Give one of the following:		
		150 mg* **OR** 150 mg/3 mL	500 mg	
2–2.9 kg	½ tablet	1.5 mL	expert advice on dose	½ tablet
3–3.9 kg	¾ tablet	2.5 mL	¼ tablet	¾ tablet
4–5.9 kg	1 tablet	3 mL	¼ tablet	1 tablet
6–7.9 kg	1½ tablet		½ tablet	1½ tablets
8–11.9 kg	2 tablets		½ tablet	2 tablets
12–14.9 kg	3 tablets		1 tablet	3 tablets
15–19.9 kg	3½ tablets		1 tablet	3½ tablets
20–24.9 kg	4½ tablets		1½ tablet	4½ tablets
25–29.9 kg	5 tablets		2 tablets	5 tablets

* For each dose, dissolve 150 mg dispersible (1 tablet) in 3 mL of water to prepare a concentration of 50 mg/mL (150 mg/3 mL)

Dosing recommendations for dispersible combinations tablets:

Weight	**Intensive phase 2 months**	**Continuation phase 4 months**
	RHZ 75/50/150 mg	**RH 75/50mg**
4- 7 kg	1 tablet	1 tablet
8 - 11 kg	2 tablet	2 tablet
12 - 15 kg	3 tablet	3 tablet
16 - 24 kg	4 tablet	4 tablet
25 kg +	*Adult dosages recommended*	

PLUS

If HIV infected or malnourished:

- Pyridoxine, oral, daily for 6 months:
  - o < 5 years of age: 12.5 mg daily,
  - o > 5 years of age: 25 mg.

Children > 8 years of age and adolescent:

	Two months intensive phase given daily	Four months' continuation phase given daily	
Weight	RHZE (150/75/400/275)	RH (150/75)	RH (300/150)
30–37 kg	2 tablets	2 tablets	
38–54 kg	3 tablets	3 tablets	
55–70 kg	4 tablets		2 tablets
≥71 kg	5 tablets		2 tablets

PLUS

If HIV infected or malnourished:

- Pyridoxine 25mg daily for 6 months.

Complicated TB, high bacillary load

All other forms of severe TB. i.e. extensive pulmonary TB, spinal or, osteo-articular TB or abdominal TB.

Children up to 8 years of age:

Intensive phase:

Standard dose 4–drug therapy daily (RHZE) for 2 months.

Follow with:

Continuation phase:

Standard dose 2 drug therapy daily (isoniazid + rifampicin).

	Intensive phase 2 months				**Continuation phase at least 4 months (up to 7 months***)**
	RH	PZA Give one of the following:		EMB	RH
	60/60	150 mg* **OR** 150 mg/3 mL	500 mg	400 mg tablet **OR** 400 mg/8 mL** solution	60/60
2–2.9 kg	½ tablet	1.5 mL	Expert advice on dose	1 mL	½ tablet
3–3.9 kg	¾ tablet	2.5 mL	¼ tablet	1.5 mL	¾ tablet
4–5.9 kg	1 tablet	3 mL	¼ tablet	2 mL	1 tablet
6–7.9 kg	1½ tablet		½ tablet	3 mL	1½ tablets
8–11.9 kg	2 tablets		½ tablet	½ tablet	2 tablets
12–14.9 kg	3 tablets		1 tablet	¾ tablet	3 tablets
15–19.9 kg	3½ tablets		1 tablet	1 tablet	3½ tablets
20–24.9 kg	4½ tablets		1½ tablet	1 tablet	4½ tablets
25–29.9 kg	5 tablets		2 tablets	1½ tablets	5 tablets

Notes:

*For each dose, dissolve 150 mg dispersible (1 tablet) in 3 mL of water to prepare a concentration of 50 mg/mL (150 mg/3mL).

**For each dose, crush 400 mg (1 tablet) to a fine powder and dissolve in 8 mL of water to prepare a concentration of 400 mg/8 mL. Discard unused solution.

***Continuation phase may be prolonged to 7 months in slow responders and children with HIV.

PLUS

If HIV infected or malnourished:

- Pyridoxine, oral, daily for 6 months:
  - o < 5 years of age: 12.5 mg daily,
  - o > 5 years of age: 25 mg.

Children > 8 years and adolescent:

	Two months intensive phase given daily	Four months continuation phase given daily	
Weight	RHZE (150/75/400/275)	RH (150/75)	RH (300/150)
30–37 kg	2 tablets	2 tablets	
38–54 kg	3 tablets	3 tablets	
55–70 kg	4 tablets		2 tablets
≥71 kg	5 tablets		2 tablets

PLUS
If HIV infected or malnourished:
- Pyridoxine 25 mg daily for 6 months.

Adjust treatment dosages to body weight.
If calculating dosages, rather give ½ tablet more than ½ tablet less.

Treatment of children who were previously successfully treated for TB (Retreatment)
A child, who was previously successfully treated for pulmonary TB, is at increased risk for re-infection with TB. It is imperative to exclude drug-resistant TB by carrying out sputum *M. tuberculosis* PCR plus culture with drug susceptibility testing (DST), and also determine DST of any known TB source case. If the above does not indicate resistant TB, treat as drug susceptible TB (high bacillary load) with close monitoring of response. Consider an extension of the duration of the continuation phase of therapy in these retreatment cases.

Drug resistant TB
Drug resistant TB single drug, multidrug (MDR), extensive drug resistant (XDR) is as infectious as drug susceptible TB.
Drug resistance can be primary or acquired.

MDR-TB disease indicates resistance to both rifampicin and isoniazid with/without resistance to any other antituberculosis medicine(s).
XDR-TB disease is defined as MDR-TB and in vitro resistance to any of the fluoroquinolones and any second-line injectable medicine.

Suspect DR-TB when any of the features listed below is present:
1. A known source case (or contact) with drug resistant TB or high-risk source case, e.g. on TB therapy who was recently released from prison.
2. A smear positive case after 2 months of TB treatment who failed (or deteriorated on) first-line anti-tuberculosis treatment to which they were adherent (treatment failure or relapse within 6 months of treatment).
3. Any severely ill child with TB that failed or got worse on TB treatment.
4. Defaulted TB treatment (> 2 months).

5. Treatment interruptions (< 1 month) or who relapsed while on TB treatment or at the end of treatment.
6. With recurrent TB disease after completion of TB treatment (retreatment case).

When DR-TB is suspected, submit appropriate microbiological specimens for genotypic drug sensitivity test **and** culture for phenotypic drug susceptibility testing. *M. tuberculosis* PCR tests for rifampicin resistance only while the line probe assay (LPA) tests for isoniazid and rifampicin susceptibility. Second-line LPA tests for other antimicrobial resistance including quinolones. All samples that test positive on molecular PCR testing must have samples submitted for culture and drug susceptibility testing but therapy for MDR-TB must be instituted while awaiting results. False positive results with both the *M. tuberculosis* PCR. and line probe assay have been recorded. Clinical and radiological correlation with molecular results must always be considered and discuss discordant results with an expert.

Manage confirmed DR-TB in a dedicated MDR-TB unit with appropriate infection control measures to prevent nosocomial transmission. Initiate treatment in consultation with a designated expert while awaiting referral to the designated MDR-TB centre. An uninterrupted medicine supply, direct supervision with proper education and counselling is necessary.

The standardised empiric treatment protocol for MDR-TB for children is 5 drugs for 6 months or more for at least 6 days a week during the intensive phase and 4 drugs for at least 6 days a week for 18 months or less during the continuation phase. Exact duration of therapy for the intensive phase is 4 months after the first date of sampling of a negative culture result while the total duration of therapy should be 18 months after the first date of sampling of a negative culture result.

<u>Children < 8 years with MDR-TB</u>
<u>Intensive phase:</u>

- Levofloxacin, oral.
  - 15–20 mg/kg/dose once daily.
  - Maximum dose: 1 000 mg.
- Amikacin, IV, 15–22.5 mg/kg daily.
- Terizidone, oral, 15–20 mg/kg daily.
- Ethionamide, oral, 15–20 mg/kg daily.
- Pyrazinamide, oral, 30–40 mg/kg daily

<u>Continuation phase:</u>
Same as initial phase but stop amikacin.

Children > 8 years with MDR-TB
Intensive phase:

- Moxifloxacin, oral, daily.
  - < 25 kg: 200mg
  - > 25 kg: 400 mg
- Amikacin, IV, 15–22.5 mg/kg daily.
- Terizidone, oral, 15–20 mg/kg daily.
- Ethionamide, oral, 15–20 mg/kg daily.
- Pyrazinamide, oral, 30–40 mg/kg daily.

Continuation phase:
Same as intensive phase but stop amikacin.

Other agents may be substituted in special situations and in consultation with a designated expert. Cases of DR-TB must be monitored clinically, with radiology and microbiologically for response to therapy. TB culture conversion occurs when 2 consecutive TB culture results on sputum/gastric aspirates taken 30 days apart are negative and thereafter remains negative.

Disseminated (Miliary) TB
Children < 8 years
A 6-month regimen of all 4 the following medicines:

- Rifampicin, oral, 20 mg/kg as a single daily dose.
  - Maximum dose, oral, 600mg daily.

PLUS

- Isoniazid, oral, 20 mg/kg as a single daily dose.
  - Maximum dose, oral, 400mg daily.

PLUS

- Pyrazinamide, oral, 40 mg/kg as a single daily dose.
  - Maximum daily dose: 2 000 mg.

PLUS

- Ethionamide, oral, 20 mg/kg as a single daily dose.
  - Maximum daily dose: 1 000 mg.

PLUS

- Pyridoxine 25 mg daily for 6 months.

Note:
All cases of miliary TB should have a lumbar puncture (LP) preformed. Any abnormal CSF results or where a LP is not performed, should be treated as a patient with TBM. See section 8.13: Meningitis, tuberculosis (TBM).

Preventive therapy for TB exposure/infection

Screen all children in close contact with an infectious pulmonary TB case for TB disease. Screening includes clinical history/examination and, if available, chest X-ray and tuberculin skin test (TST). Give antituberculosis treatment if the diagnosis of TB disease is confirmed or suspected.

Indications for Isoniazid Preventive Therapy (IPT):

» All asymptomatic children < 5 years of age, or HIV-infected irrespective of age, i.e. clinically normal, normal chest X-ray and TST positive or negative, in close contact with an infectious pulmonary TB case should receive isoniazid preventive therapy (IPT).

» Children < 5 years of age, or HIV-infected irrespective of age, who have had no previous TB treatment or preventive therapy, are asymptomatic without a history of close contact with an infectious pulmonary TB case but found to have a positive TST.

» Previous isoniazid preventive therapy or treatment does not protect the child against subsequent TB exposure/infection. If there is re-exposure to an infectious pulmonary TB case after completion of 6 months of chemotherapy, children (< 5 years or HIV-infected) should receive IPT after each episode of documented TB exposure for 6 months. In cases of re-exposure to infectious source cases while the child is on IPT, the duration of IPT should continue for as long as the source case remains infectious.

Preventive therapy in case of drug-susceptible TB contact:

- Isoniazid, oral, 10 mg/kg daily for 6 months.

Preventive therapy in case of drug-resistant TB contact:

Isoniazid monoresistance:

- Rifampicin, oral, 15 mg/kg daily for 4 months.

Rifampicin monoresistance:

- Isoniazid, oral, 10 mg/kg daily for 6 months.

MDR-TB:

- Isoniazid, oral, 15-20mg/kg daily for 6 months 300mg
- Ethambutol, oral, 20-25mg/kg daily for 6 months 400mg
- Levofloxacin 15-20mg/kg daily for 6 months 500mg

Refer case if simplification of prophylaxis regimen is required

XDR-TB:

- Close follow-up for two years.
- Ensure household infection control practices are observed.
- Refer all cases.

REFERRAL

» Poor response to standard TB treatment.
» Failure to exclude MDR-TB.
» Adverse drug reactions (ADR) requiring single drug combinations.
» MDR or MDR-TB contact.

10.3 MENINGITIS, TUBERCULOUS (TBM)

A17.0
* Notifiable condition.

DESCRIPTION

Tuberculous meningitis is an infection of the meninges caused by *M. tuberculosis*. Early diagnosis and treatment improves the prognosis.

Differentiation from acute bacterial meningitis may be difficult. If in any doubt, treat for both conditions.

Complications may be acute or long term:

» Acute:
  > raised intracranial pressure,
  > cerebral oedema,
  > hemi/quadriplegia,
  > hydrocephalus,
  > brain infarcts,
  > convulsions,
  > hyponatraemia due to inappropriate antidiuretic hormone (ADH) secretion or cerebral salt wasting.

  Syndrome of inappropriate antidiuretic hormone secretion (SIADH) and cerebral salt wasting both present with hyponatraemia; the former responding to fluid restriction and the latter to fluid replacement, i.e. sodium chloride 0.9%.

  SIADH has lower serum uric acid and low urine output. Cerebral salt wasting has a normal serum uric acid and high urine output.
» Long term neurological sequelae include: mental handicap, blindness and deafness.

DIAGNOSTIC CRITERIA

Clinical

» History of contact with an infectious tuberculosis case.
» Onset may be gradual with vague complaints of drowsiness (or fatigue), vomiting, fever, weight loss, irritability and headache.
» Later symptoms such as convulsions and neurological fall-out may occur.
» Older children may present with behavioural changes.
» Examination may reveal signs of meningeal irritation and raised intracranial pressure, convulsions, cranial nerve palsies, localising signs (such as hemiparesis), altered level of consciousness or coma and choroidal tubercles.
» The degree of involvement is classified into 3 stages. Prognosis relates to the stage of the disease.

Stage 1: non-specific signs, conscious, rational, no focal neurological signs, no hydrocephalus.
Stage 2: signs of meningeal irritation, confusion and/or focal neurological signs.
Stage 3: stupor, delirium, coma and/or neurological signs, i.e. hemiplegia.

Investigations

» CSF findings:
  > May vary depending on the stage.
  > Protein is usually raised.
  > Chloride and glucose are moderately low.
  > Lymphocytes usually predominate.
  > Gram stain is negative and acid-fast bacilli are seldom found.
  > In selected cases TB PCR based test on CSF should be done, where available. It may be helpful where it is positive, negative PCR does not exclude TB.
  > A negative result does not exclude TB and cultures must still be done. Bacilli may be cultured from the CSF but may take up to 4–6 weeks. If culture positive, also do drug susceptibility test.
  Always send for culture, do not perform stain as low diagnostic yield from low concentration of organisms wastes CSF sample.
» A Mantoux test and chest X-ray must be done, but are often unhelpful.
» If depressed level of consciousness or focal neurological signs are present, a CT scan is useful to determine if safe to LP (do CT first before LP in such cases).
» Electrolytes: check for hyponatraemia.

GENERAL AND SUPPORTIVE MEASURES

» Monitor neurological status on a regular basis. If rapid deterioration in level of consciousness, consider ventriculoperitoneal shunt.
» Attend to nutritional status. Initially nasogastric feeding is usually needed.
» Rehabilitative measures: most patients need physiotherapy and occupational therapy.
» Surgical treatment for non-communicating hydrocephalus, diagnosed by air encephalogram (VP shunt).
» Communicating hydrocephalus with severely raised pressure may be managed with medicines once hydration status stable and/or with serial lumbar puncture with specialist consultation.

MEDICINE TREATMENT

Differentiation from acute bacterial meningitis may be difficult.
If in doubt, treat for both conditions.

Antituberculosis treatment

» Requires therapy with a combination of 4 drugs as a special regimen.
» All treatment should be directly observed therapy.
» Single drugs may form part of the regimen to provide the total daily required dose for each medicine by supplementing the combination to give the necessary therapeutic dose per kilogram.

A 6-month regimen of all 4 the following drugs:

- Rifampicin, oral, 20 mg/kg as a single daily dose.
  - Maximum daily dose 600mg

PLUS

- Isoniazid, oral, 20 mg/kg as a single daily dose.
  - Maximum daily dose 400mg

PLUS

- Pyrazinamide, oral, 40 mg/kg as a single daily dose.
  - Maximum daily dose: 2 000 mg.

PLUS

- Ethionamide, oral, 20 mg/kg as a single daily dose.
  - Maximum daily dose: 1 000 mg.

Consider prolonging treatment for another 3 months if there are concerns about ongoing disease. Consult with a specialist.

In case of suspected/confirmed multidrug-resistant TBM, refer immediately for admission and treatment.

Steroid therapy

- Prednisone, oral, 2mg/kg as a single daily dose for 4 weeks.
  - Maximum daily dose: 60 mg.
  - Taper to stop over further 2 weeks.

Hydrocephalus

Avoid low sodium IV fluids in these patients, i.e. < 60 mmol/L.
To differentiate communicating from non-communicating hydrocephalus an air encephalogram is usually required. Communicating hydrocephalus is more common in this condition.
In children with a sudden deterioration of level of consciousness and other comatose children with TBM, inform the neurosurgeon before doing the air-encephalogram so that shunt surgery can immediately be done if the hydrocephalus is non-communicating. Air-encephalogram procedure: do a lumbar puncture, inject 5 ml of air with a syringe and do immediate lateral X-ray of the skull. Air in the lateral ventricles on skull X-ray indicates communicating hydrocephalus; air at base of brain (not in lateral ventricles), indicates non-communicating hydrocephalus.

Communicating hydrocephalus

If dehydrated, rehydrate with sodium chloride 0.9%, IV.

Start diuretics as soon as patient is well hydrated and serum electrolytes are within the normal range.

- Acetazolamide, oral, 20 mg/kg/dose 8 hourly.
  - Maximum daily dose: 1 000 mg.
  - Monitor for metabolic acidosis and serum potassium derangements.

PLUS

- Furosemide, oral, 0.3 mg/kg/dose 8 hourly for the first month of treatment.
  - Taper slowly over 2 weeks if the intracranial pressure has normalised, as indicated by clinical response or resolution of hydrocephalus on follow-up scan.
  - Do not restrict fluids once on diuretics.

Sudden deterioration of level of consciousness:

- Mannitol, IV, 250 mg/kg administered over 30–60 minutes.

REFERRAL

» TBM not responding to adequate therapy.
» TBM with complications.
» Suspicion of non-communicating hydrocephalus.
» Suspected drug-resistant TB (contact with drug-resistant TB case).

CHAPTER 11

SURGICAL PROPHYLAXIS

DESCRIPTION

Surgical prophylaxis is the pre- or intra-operative administration of antibiotics to patients to reduce the risk of postoperative wound infection. Specific epidemiological considerations may alter the choice of agents.

PRINCIPLES OF SURGICAL PROPHYLAXIS

» The need for prophylactic antibiotic therapy is based on the risk of wound contamination.
» The medication chosen should be active against the pathogens most likely to be associated with wound infections.
» Prophylaxis must be given within 60 minutes of the first incision, usually at induction of anaesthesia.

LoE II [i,ii,iii,iv,v]

Risk factors for developing surgical site infection

Classification of degree of contamination likely to be present during operation:

» Class I: Clean procedures, only microorganisms from skin or external environment are likely to be introduced (includes operations for blunt trauma).
» Class II: Clean procedures with limited contamination, exposure to micro-organisms colonising the epithelial surfaces and/or lumen of respiratory, gastrointestinal, urinary or genital tract. No evidence of infection.
» Class III: Contaminated, open fresh accidental wounds, operations with major breaks (e.g. open cardiac massage or gross spillage from gastrointestinal tract) and incisions in which non-purulent inflammation is encountered.
» Class IV: Dirty and/or infected surgical site indicates that the organism causing postoperative infection was in the operation area before surgery, traumatic wounds with devitalised tissue not immediately attended to, and wounds that involve existing clinical infection or perforated viscera.

These guidelines cover prophylaxis and not therapy for infective conditions.

Other risk factors include:

» Prolonged duration of operation.
» Medical characteristics of the patient (nutritional status, immunosuppression and co-existent infection at remote body site).

Consider antibiotic prophylaxis for class II procedures or if these risk factors are present.

For most class III and IV procedures, antibiotics are indicated for therapy rather than single dose prophylaxis. Additional procedures (some Class I) for which antibiotic prophylaxis is recommended include the following:

» Head and neck: CSF shunt and middle ear ventilation tube (grommet) insertion.
» Cardiothoracic: cardiac pacemaker insertion, interventional cardiac catheter device placement.
» Gastrointestinal: insertion of percutaneous endoscopic gastrostomy.

The prophylactic dose is a single dose equal to the standard therapeutic dose given within 60 minutes of starting the procedure.
A second dose is **ONLY** given if surgery is prolonged,
i.e. > 4 hours for cefazolin **OR** > 8 hours for metronidazole.

For Cardiac Surgery: post-operative dosing for up to 24 hours may be considered.

ANTIBIOTIC TREATMENT

See Table below to inform appropriate choice of antibiotic:

» Cefazolin, IV, 25 mg/kg (maximum dose 1000 mg).
» Metronidazole, IV, 7.5 mg/kg (maximum dose 500 mg).

Type of Surgery	Recommended Antibiotic(s)
Head & Neck	Cefazolin
Neurosurgery	Cefazolin
Ophthalmic *LoE III*[i]	Chloramphenicol ophthalmic drops 0.5%, instil in the affected eye, one drop every 5-15 minutes for a total of five doses in the hour before starting procedure.
Middle Ear Ventilation Tubes	Ofloxacin, ophthalmic drops, instil 1 drop, in the affected ear after the procedure.
Oropharyngeal mucosal	Cefazolin AND Metronidazole
Upper GIT	Cefazolin
Cardiothoracic	Cefazolin
Biliary	Cefazolin AND Metronidazole
Nephro-urological	Cefazolin
Colorectal & Appendix	Cefazolin AND Metronidazole
Pelvic	Cefazolin AND Metronidazole
Orthopaedic	Cefazolin
Lower Limb	Cefazolin AND Metronidazole

For Infective Endocarditis Prophylaxis: Refer to Chapter 4: Cardiovascular System, Section 4.3 Endocarditis, infective.

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CHAPTER 12
RHEUMATOLOGY AND VASCULITIDES

12.1 HENOCH SCHÖNLEIN PURPURA (HSP)
D69.0

DESCRIPTION
Henoch Schönlein Purpura (HSP) is an acute leucocytoclastic vasculitis of small blood vessels usually involving skin, gastrointestinal tract, joints and the kidney. Aetiology is unknown.

Complications include:
» acute severe abdominal pain, bowel infarction;
» nephritis with renal impairment or nephrotic syndrome;

DIAGNOSTIC CRITERIA
Clinical
Syndrome consisting of:
» Non-thrombocytopenic palpable purpuric skin rash with a very typical distribution on lower extremities and buttocks. The rash occurs in 100% of cases, but not necessarily present at time of initial presentation. Trunk and upper extremities may be involved. Angio-oedema of scalp, eyelids, lips and ears.
» **Arthralgia/arthritis** (60–70%): mostly of large joints, i.e. knees and ankles.
» **Abdominal pain** with colic (60-70%): may develop gastro-intestinal bleeding or intussusception or infarction.
» **Renal involvement** (25–50%) manifesting with haematuria or proteinuria.

Investigations
» No diagnostic test.
» FBC is usually normal but necessary to rule out other conditions with thrombocytopaenic purpura.
» Coagulation studies are normal.
» Urine test strip to evaluate renal involvement. Serum urea, creatinine, electrolytes and albumin with renal involvement.
» Check stools for occult or frank bleeding.

GENERAL AND SUPPORTIVE MEASURES
» Short period of immobilisation during acute arthritis.
» Soft diet for acute gastrointestinal involvement.
» Clinical review with blood pressure monitoring and urine test strip weekly for first 2 months, then monthly for the next year.

MEDICINE TREATMENT
For arthritis, oedema, fever, malaise:
- Ibuprofen, oral, 10 mg/kg/dose 6 hourly.
  - Reduce dose interval to 8 hourly after pain is managed.

For complicated HSP (severe extrarenal symptoms or renal disease):

- Prednisone, oral, 1–2 mg/kg/dose once daily for 10 days in the morning.
  - Reduce dose gradually over 2 weeks.

REFERRAL

HSP with complications, i.e. in patients with:

» Persistent proteinuria, persistent macroscopic haematuria or progressive nephritic syndrome (renal biopsy indicated).
» Persistent abdominal pain.

12.2 JUVENILE IDIOPATHIC ARTHRITIS (JIA)

M08.0

DESCRIPTION

Juvenile Idiopathic Arthritis (JIA) is defined as arthritis of unknown origin for at least 6 weeks with onset before the age of 16 years. Other causes of arthritis must be excluded e.g. infections, malignancy, trauma, other autoimmune disease. Different clinical subgroups are recognised according to the pattern of onset that manifests within the first 6 months.

DIAGNOSTIC CRITERIA

Systemic onset

» Arthritis in one or more joints.
» Plus 2 weeks of daily (quotidian) fever.
» With one of the following:
  > erythematous macular rash, or
  > serositis, i.e. pericarditis and pleuritis, or
  > hepatosplenomegaly, or
  > generalised lymphadenopathy.

Oligoarthritis

Always consider TB if only one joint is involved.

» Arthritis affecting one to four joints for first 6 months of disease.
» Two categories are recognised:
  > Persistent oligoarthritis: affects ≤ 4 joints throughout disease course.
  > Extended oligoarthritis: affects > 4 joints after the first 6 months.
» Occurs more commonly in girls than in boys.
» Has early onset before 6 years of age.
» Usually asymmetric arthritis that affects mainly large joints.
» High risk of developing chronic iridocyclitis.
» 65–85% of patients are anti-nuclear antibody (ANA) positive.

Polyarthritis (Rheumatoid factor negative)

» Arthritis affecting ≥ 5 joints in first 6 months of disease.

» Negative rheumatoid factor polyarthritis includes 2 subsets:
  > one that is similar to adult onset RF negative rheumatoid arthritis characterised by a symmetric synovitis of large and small joints, onset at school age and absence of ANA expression;
  > another that resembles oligoarthritis apart from the number of joints affected in the first 6 months of the disease.

Polyarthritis (Rheumatoid factor positive)
» Arthritis affecting ≥ 5 joints in first 6 months.
» Positive rheumatoid factor on 2 separate occasions at least three months apart.
» Involves large and small joints.

Enthesitis related arthritis
» Arthritis and enthesitis **or,**
» arthritis or enthesitis **and** 2 of the following:
  > sacroiliac joint involvement,
  > HLA-B27 positive,
  > one 1st or 2nd degree relative with HLA-B27 associated disease,
  > arthritis in a boy after the age of 8 years,
  > anterior uveitis associated with pain, redness or photophobia.

Psoriatic Arthritis
» Arthritis plus psoriasis in a child, **or**
» Arthritis **and** 2 of the following:
  > dactylitis,
  > nail pitting,
  > psoriasis in a first degree relative.

Undifferentiated arthritis
» Arthritis not meeting criteria for one of the above categories or fitting more than one of the above groups.

Differential diagnosis
JIA is a clinical diagnosis and depends on the persistence of arthritis or typical systemic manifestations and by exclusion of other diseases:
» Pyogenic and tuberculous joint infection and osteomyelitis.
» Arthritis associated with other acute infectious illnesses.
» Acute leukaemia and other malignancies.
» Acute rheumatic fever.
» Auto immune disorders, SLE or mixed connective tissue disease.
» Reiter syndrome, i.e. arthritis, urethritis and conjunctivitis.
» Arthritis associated with inflammatory bowel disease.

Investigations
Investigations must be tailored for each case, in consultation with a specialist, consider the following investigations:
» Full blood count with differential and platelet count.
» C-reactive protein and erythrocyte sedimentation rate.
» ALT for liver function screen before starting methotrexate.

» Serum urea, creatinine and electrolytes.
» Muscle enzymes, albumin, calcium, phosphate and alkaline phosphatase.
» Auto-antibodies and rheumatoid factor.
» X–ray or ultrasound of affected joints.
» Arthroscopy and synovial biopsies in cases of possible TB arthritis.
» Eye screen for uveitis.

GENERAL AND SUPPORTIVE MEASURES

» Occupational and physiotherapy programs may provide the following:
  > exercises to increase range of movements of joints and to maintain muscle strength;
  > hot water baths, swimming pool exercises;
  > splints, e.g. nocturnal splints, for pain relief and prevention of contractures;
  > shoe inserts/raises;
  > aids for activities of daily living.
» Orthodontic treatment if temporomandibular joints are involved.
» All children should have slit lamp examination initially, with follow up thereafter at the discretion of the ophthalmologist.

MEDICINE TREATMENT

There is no cure for JIA.
Goal of treatment is to eliminate active disease, to normalise joint function, to preserve normal growth, to prevent long-term joint damage and disease complications. Outcome is improved with early aggressive therapy. Treatment should be decided in consultation with a specialist.

Oligoarthritis
NSAID, e.g.:
- Ibuprofen, oral, 10 mg/kg/dose 6-8 hourly.

LoE III[i]

NSAIDs as monotherapy are given for 1-2 months in patients with low disease activity and without joint contractures.

If no improvement:
ADD Intra-articular steroids.
- Intra-articular corticosteroid injection for all active joints (rheumatologist or orthopaedic specialist):
- Methylprednisolone acetate, 1 mg/kg with lignocaine 1%, 0.5 mL.
  - If no response: repeat in 3 months.
  - Young children may require light sedation with midazolam and ketamine.
  - Large joints, if possible, should be aspirated at same time.
  - Can be repeated after 3 months if there was an initial response, but the disease is not yet in remission.
  - Intra-articular steroids can also be used as initial therapy.

If disease activity still present after 3 months:

ADD

- Methotrexate, oral, 10-15 mg/m^2/week as a single dose on an empty stomach. Specialist initiated.
  - Increase dose at monthly intervals up to 1 mg/kg/week until there is satisfactory response, continue maintenance at the same dose.
  - Maximum dose: 25 mg/week.
  - Adverse effects include: nausea, mood changes, raised liver enzymes, bone marrow toxicity and protein/haematuria.
  - Monitor: Pre-treatment FBC, liver transaminases and creatinine; then FBC and either ALT or AST 3 monthly. Serum Creatinine 6 monthly.

PLUS

- Folic acid, oral, 5 mg weekly, (on the day after methotrexate) for the duration of the treatment.

If no remission in 6 months, refer to a rheumatologist.

Note: Screen all patients early for uveitis (highest risk if ANA positive).

Polyarthritis – early

Start NSAID as soon as possible.

- NSAID, e.g.:
- Ibuprofen, oral, 10 mg/kg/dose 6-8 hourly.

LoE III[i]

If no significant improvement in 1 month, or if severe, at onset, start disease-modifying drugs (DMARDs):

- Methotrexate, oral, 10–15 mg/m^2/week as a single dose on an empty stomach. (Specialist initiated)
  - Maximum dose: 25 mg/week.

PLUS

- Folic acid, oral, 5 mg weekly (on the day after methotrexate) for the duration of the treatment.

Note:

Intra-articular steroids (IAS) may be used in conjunction with methotrexate.

For rapid relief of symptoms in severe early disease consider adding:

- Prednisone, oral, starting dose: 1 mg/kg/dose once daily.
  - Reduce dose gradually to 5 – 7.5 mg daily, depending on response.

Systemic onset JIA

Systemic JIA is an aggressive systemic disease. Refer to a rheumatologist early. Initiate treatment after consultation with a rheumatologist.

- NSAID, e.g.:
- Ibuprofen, oral, 10 mg/kg/dose 6-8 hourly.

LoE III[i]

For patients with mild disease begin with:

- Prednisone oral, 2 mg/kg as a single daily dose.
  - Once disease is controlled, reduce dose gradually.

Critically ill patients with internal organ involvement, such as pleuritis, pericarditis, myocarditis or evidence of early macrophage activation syndrome should be referred urgently:

- Methylprednisolone, IV, 30 mg/kg/day for 3 days.

Follow with:

- Prednisone oral, 2 mg/kg as a single daily dose until disease is controlled.
  - These patients may respond to methotrexate or cyclosporine in the long term, but the response is not as good as other JIA patients.

Psoriatic arthritis

Treat as for oligoarthritis if ≤ 4 joints, or polyarthritis if severe disease or >4 joints at onset.

Refer early as most children will require a DMARD.

Enthesitis related arthritis

Start NSAID as soon as possible.

- NSAID, e.g.:
  Ibuprofen, oral, 10 mg/kg/dose 6-8 hourly.

LoE III

If severe disease:

- Prednisone, oral, 1–2 mg/kg as a single daily dose for 2 weeks and wean over 2 weeks.
  - If no remission in 2–4 months, refer.

Uveitis management

Manage in consultation with an ophthalmologist.

REFERRAL

» **Urgent:** uncontrolled systemic disease.

» Paediatrician referral:
- All for confirmation of diagnosis.
- All patients requiring DMARD.
- Adverse reaction to NSAID.
- Suspected JIA not responding to NSAID therapy.

» Ophthalmology referral:
- For slit lamp examination.
- Patients with iridocyclitis and uveitis.

» For orthopaedic treatment, e.g. where intra-articular corticosteroids is indicated, or if TB oligoarthritis is suspected.

12.3 KAWASAKI DISEASE/MUCOCUTANEOUS LYMPH NODE SYNDROME

M30.3

DESCRIPTION

Kawasaki disease is an acute systemic vasculitis of unknown aetiology occurring predominantly in children. It involves the small and medium arteries. Most serious complication is coronary artery aneurysms.

DIAGNOSTIC CRITERIA

Clinical

» There is no diagnostic test.

» Confirm diagnosis by the presence of fever for ≥ 5 days, lack of another known disease process to explain the illness and the presence of 4 of the 5 criteria listed below:
  1. bilateral bulbar conjunctival injection without exudates;
  2. changes of the lips and oral cavity: reddening of the oral mucosa, pharynx, lips, strawberry tongue, cracking of lips;
  3. polymorphous rash, primarily on the trunk;
  4. cervical lymphadenopathy (lymph nodes >1.5 cm diameter);
  5. changes of the extremities, including reddening of the palms and soles, oedema of the hands and/or feet and desquamation of the finger tips and toes.

» A high index of suspicion is required especially in younger children who may present without all the above or may have incomplete/atypical Kawasaki.

» Important differential diagnosis:
  > aseptic/bacterial meningitis,
  > viral or drug eruption,
  > bacterial adenitis,
  > diseases mediated by staphylococcal or streptococcal toxins,
  > rickettsial diseases.

Investigations

» C-reactive protein.

» FBC: leucocytosis and thrombocytosis (thrombocytosis usually only occurs in second week of illness).

» Urine test strip: transient pyuria.

» ESR: elevated.

» Cardiology assessment, including echocardiography to detect coronary artery aneurysms: 100% sensitivity, 97% specificity, done at beginning and 6 weeks after disease improvement.

GENERAL AND SUPPORTIVE MEASURES

» Routine supportive care.

» Maintain hydration with oral fluids.

MEDICINE TREATMENT

As soon as diagnosed and preferably within first 10 days from onset of fever after specialist consultation.

- Immunoglobulin, IV, 2 g/kg as a single dose administered over 12 hours.
  - Repeat dose, if necessary, if temperature does not normalise or rash does not resolve within 24 hours.

If fever continues after 2 doses:

- Methylprednisolone, IV, 30 mg/kg/dose. Specialist consultation.

All children:

- Aspirin (high dose), oral, 20 mg/kg/dose 6 hourly for 72 hrs or until fever settles.

Follow with:

- Aspirin, oral, 3–5mg/kg/day until ESR and platelet count are normal if there are no coronary artery aneurysms.
  - If coronary aneurysms are present continue for at least 2 years after aneurysms have resolved or lifelong if coronary aneurysms persist.

REFERRAL

» All patients for confirmation of diagnosis.
» For echocardiography to confirm presence of coronary artery aneurysms.

12.4 SYSTEMIC LUPUS ERYTHEMATOSUS

M32

DESCRIPTION

Systemic lupus erythematosus (SLE) is a multisystem inflammatory disease characterised by the presence of auto-antibodies directed against various cellular components, particularly DNA. It is often associated with antiphospholipid-antibody-mediated hypercoaguability. In children it predominantly targets the kidneys (in 50–80%), central nervous system, skin and joints.

Treatment of acute lupus depends on severity of illness, with more aggressive treatment for CNS, renal and haematologic involvement.

DIAGNOSTIC CRITERIA

Clinical

Diagnosis may be elusive due to its variations in presentation and is confirmed with at least 4 of 11 criteria:

1. malar rash: rash over cheeks, sparing nasal folds;
2. discoid rash: erythematous patches heal with scarring;
3. photosensitivity: skin rash as a result of unusual reaction to sunlight;
4. oral or nasopharyngeal ulcers;
5. non-erosive arthritis: tenderness, swelling or effusion;
6. pleuro-pericarditis;
7. renal disease: proteinuria and/or cellular casts;

8. neurologic disorder: seizures or psychosis in the absence of precipitating circumstances;
9. haematologic disorder: haemolytic anaemia, leucopaenia, lymphopaenia, thrombocytopaenia;
10. immunologic disorder:
    a) anti-dsDNA antibody,
    b) anti-Sm (Smith) antibody,
    c) positive antiphospholipid antibodies (anticardiolipin, lupus anticoagulant),
    d) false positive antitreponemal test;
11. positive anti-nuclear antibody (ANA) test.

Investigations

Note: Normal urine analysis does not exclude renal disease.

» Urine test strip: haematuria and proteinuria.
» Urine microscopy: cellular casts.
» FBC: differential and platelet count.
» Complement, antinuclear antibodies, anti-dsDNA antibodies.
» Screen for thyroid involvement.
» Serum urea, creatinine, electrolytes, albumin and cholesterol.
» Clotting profile, anti-phospholipid antibody and lupus anti-coagulant.
» Electrocardiography and chest X-ray.

GENERAL AND SUPPORTIVE MEASURES

» Counselling, education and a team approach.
» Adequate rest and appropriate nutrition.
» Protect from sunlight, sunscreen, hats and avoidance of sunlight if unprotected.
» Physiotherapy to relieve arthralgia.
» Psychological support.
» Immunisation, especially pneumococcal vaccine.
» Prompt management of infections.
» Vitamin D and calcium supplementation.

MEDICINE TREATMENT

All children should be treated by a specialist.

All children:

- Chloroquine (as base), oral, 5 mg/kg/dose once daily.
  - Maximum dose: 150 mg.
  - 6-monthly eye examination necessary.

Chloroquine has a disease-modifying role and is particularly useful for skin and joint disease; some patients can be managed with chloroquine alone or with the addition of low dose steroids.

Induction therapy

The options depend on the severity of the disease and major organ involvement.

For general systemic disease, serositis or musculoskeletal disease:

- Corticosteroid treatment:
- Prednisone, oral 2 mg/kg/day; maximum daily dose 60 mg.
  - Reduce dose to 0.5 mg/kg once daily by 2 months

For major organ involvement (severe lupus nephritis class III or IV and neuropsychiatric lupus):

- Methylprednisolone IVI 30 mg/kg/day (maximum 1000 mg) for 3 days followed by oral prednisone 2 mg/kg/day;
  - Reduce dose to 0.5 mg/kg once daily by 2 months

AND

- Cyclophosphamide, IV, 500–750 mg/m^2/dose, administered over 2 hours
  - Repeat once a month for 6 months.
  - Cyclophosphamide must be given with pre-hydration and continue increased fluid intake for 24 hours after cyclophosphamide infusion,
  - Monitor vital signs during administration of cyclophosphamide.

Maintenance treatment (steroid sparing treatment)

For mild/moderate disease (vasculitic rash, cytopaenia, serositis):

- Azathioprine, oral, 2–3 mg/kg/dose as single daily dose.
  - Maximum dose: 150 mg.
  - Refer if contraindication to azathioprine or if patient develops adverse effects with treatment.

For musculoskeletal and skin disease:

- Methotrexate, oral, 10–15 mg/m^2/week as a single dose on an empty stomach. Specialist initiated.
  - Maximum dose 25 mg/week.

PLUS

- Folic acid, oral, 5 mg weekly (on the day after methotrexate) for the duration of the treatment.

REFERRAL

Specialist referral:

» All patients for confirmation of diagnosis and initiation/supervision of treatment.
» All patients receiving chloroquine treatment must be referred for ophthalmologic examination.
» Macrophage activation syndrome.
» For kidney biopsy if any evidence of renal disease (deteriorating renal function, significant proteinuria/haematuria or hypertension).

12.5 TAKAYASU ARTERITIS

M31.4

DESCRIPTION

Takayasu arteritis is a chronic inflammatory disease involving large vessels, including the aorta and its main branches and the pulmonary vasculature. Lesions are typically segmental – obliterative and aneurysmal. Symptoms reflect end organ ischaemia.

DIAGNOSTIC CRITERIA

Clinical

Angiographic abnormalities of the aorta or its main branches plus at least one of the following:

» Hypertension with no obvious kidney disease.
» BP difference in limbs >10 mm Hg.
» Decrease in peripheral arterial pulses/absent pulses.
» Vascular bruits, particularly over aorta or main branches, carotids, subclavian, abdominal vessels.

May be associated with:

» Congestive cardiac failure associated with aortic regurgitation/dilated cardiomyopathy/hypertension.
» Neurologic signs secondary to hypertension/ischaemia.
» Any signs of unexplained inflammatory activity.
» Strongly positive TST.
» Discrepancy in kidney sizes.

Investigations

» C-reactive protein.
» ESR.
» Plasma renin.
» Serum urea, creatinine and electrolytes.
» TST.
» Electrocardiography.
» Chest X-ray.

GENERAL AND SUPPORTIVE MEASURES

» Refer to Chapter 4: Cardiovascular System, section 4.11.1: Hypertension, acute severe.

MEDICINE TREATMENT

Treat hypertension – refer to Chapter 4: Cardiovascular System, section 4.11.1: Hypertension, acute severe.

Consider TB treatment if tuberculosis cannot be conclusively excluded.

- Aspirin soluble, oral, 5 mg/kg/day as single daily dose.

Induction therapy

- Prednisone, oral, 2 mg/kg/day for maximum of 4 weeks.
  - Reduce dose slowly over 12 weeks to 0.25 mg/kg on alternate days.

LoE II[ii]

Continue maintenance treatment with:

- Methotrexate, oral, 10–15 mg/m^2/week. Specialist initiated
  - Maximum 25 mg/week.

PLUS

- Folic acid, oral, 5 mg weekly (on the day after methotrexate) for the duration of the treatment.

REFERRAL

Specialist referral

» All patients for confirmation of diagnosis with conventional angiography or magnetic resonance imaging angiography.

» Poor response to initial therapy.

References

[i] British Society for Paediatric and Adolescent Rheumatology. Guidelines for Non-steroidal anti-inflammatory drug (NSAIDs) use in Paediatric Rheumatology. 2005. https://www.bspar.org.uk/DocStore/FileLibrary/PDFs/BSPAR%20Guidance%20on%20Non-steroidal%20AntiInflammatory%20Drug%20(NSAID)%20Use%20in%20Paediatric%20Rheumatology.pdf

[ii] Keser G, Direskeneli H, Aksu K. Management of Takayasu Arteritis: A Systematic Review. Rheumatology. 2014;53: 793-801.

CHAPTER 13

THE NERVOUS SYSTEM

13.1 SEIZURES

R56.8

DESCRIPTION

A seizure is a 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.

For recurrent seizures, see Section 13.4: Epilepsy.

Classification of seizures using International League against Epilepsy (ILAE)
Classification of seizures is aetiological and clinical.

Aetiology

» Genetic
» Structural-metabolic
» Unknown

The causes of seizures are multifactorial.

The commonest seizures in children are febrile convulsions but the history, examination and investigations must be aimed at excluding the following conditions:

Perinatal conditions	Infections	Poisoning
» congenital infection » hypoxic-ischaemic damage » trauma » cerebral haemorrhage or thrombosis	» meningitis » encephalitis » brain abscess	» accidental ingestion of medicines » medicine withdrawal » environmental toxins » toxicity of AED
Metabolic conditions	**Systemic disorders**	**Primary cerebral causes**
» hypoglycaemia » hypocalcaemia » hypomagnesaemia » hyponatraemia » hypernatraemia » inborn errors of metabolism	» vasculitis » hypertensive encephalopathy » uraemia (renal failure) » hyperammonaemia (liver failure)	» cerebral malformation » genetic/familial (syndromic) » tumour » idiopathic

Clinical

Within each of the above categories, generalised, focal or syndromic seizures occur.

Generalised seizures:

The epileptic focus arises at some point within and rapidly spreads to involve networks in both hemispheres of the brain.

Generalised seizures may be:

» tonic-clonic,
» absence (typical or atypical),
» clonic,
» tonic or atonic,
» myoclonic.

Generalised tonic-clonic seizures (GTCS) that continue or recur for more than 5 minutes in which there is incomplete recovery of consciousness are called Convulsive Status Epilepticus: See section 13.3: Status epilepticus (convulsive).

Focal seizures:

The epileptic activity arises at some point from a particular focus or networks limited to one hemisphere of the brain.

Focal seizures occur with:

» observable aura, motor or autonomic components.
» altered consciousness or awareness (previously termed) complex partial seizures.

The presentation of focal seizures depends on the site of origin and may be frontal lobe seizures, temporal lobe seizures, parietal lobe seizures and occipital lobe seizures.

Focal seizures may progress to generalised tonic-clonic seizures and this is known as secondary generalisation.

Epileptic Syndromes – See section 13.4: Epilepsy.

DIAGNOSTIC CRITERIA

Clinical

» Obtain a history:
  > eye witness account, aura, video recording.
  > perinatal history, drug history, developmental history, school record, family history and environment.

» Examine to exclude obvious aetiology, but in particular look for occult causes:
  > general: skin abnormalities, e.g. Sturge-Weber syndrome and tuberous sclerosis complex.
  > CNS examination for loss of consciousness, neck stiffness, localising signs, head growth, developmental milestones and fundoscopy.
  > CVS examination: check blood pressure.

Investigations
Investigations should be individualised according to clinical indication.

Always consider hypoglycaemia as a primary or aggravating cause of any seizure.

Basic investigations:
» Blood glucose in all children.
» Rapid test for malaria for those who have recently travelled to a malaria area.
» Electrolytes (Na, Ca, Mg) in sick and young children.
» Blood culture in febrile children.
» Full blood count.
» Lumbar puncture: if meningitis is suspected.
  It is difficult to clinically exclude meningitis in children under 12 months, therefore, a LP may be warranted.

Note:
If the seizure has progressed to established status epilepticus (i.e. lasted 20-30 minutes), then lumbar puncture is contraindicated until raised intracranial pressure is excluded. For contraindications to LP see section 13.11. Lumbar Puncture.
» Neuro-imaging: CT scan (brain) - if persistently reduced coma score (GCS < 12/15) without known cause, raised intracranial pressure or focal intracranial pathology is suspected.

GENERAL AND SUPPORTIVE MEASURES
» Ensure an open airway and administer oxygen.
» Position to prevent aspiration of vomitus, i.e. recovery position.
» Check glucose during the seizure and blood pressure after the seizure.
» Obtain intravenous access if seizure duration is > 5 minutes.
» Keep child nil per mouth and intravenous fluid volumes at maintenance rates.
» Aetiology will determine further management.

MEDICINE TREATMENT
(Of a first-time febrile related seizure.)

For fever:
- Paracetamol, oral, 15 mg/kg/dose 6 hourly, as required.

In an unconscious child, administer paracetamol rectally.

- Paracetamol suppositories, rectal, 6 hourly.

Weight	Dose
6 - 11 kg	125 mg
12 - 17 kg	250 mg
18 - 24 kg	375 mg
25 - 30 kg	500 mg
31 - 37 kg	625 mg
38 - 45 kg	750 mg
46 - 50 kg	875 mg

Note: Suppositories should not be divided, as the amount of paracetamol in each portion may not be consistent.

Urgent medicine treatment is indicated if the seizure is generalised and lasts more than 5 minutes or is causing systemic compromise. Treat as for Status epilepticus: See section 13.3: Status epilepticus (convulsive).

13.2 SEIZURES, FEBRILE

R56.0

DESCRIPTION

Seizures occurring in children between the ages of 3 months and 6 years associated with a fever but without evidence of intracranial infection 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, and
» 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 occur within 24 hours,
» have a focal (partial) onset,
» have post-ictal, focal neurological abnormalities.

Risk factors for recurrent febrile seizures include:

» seizure disorder in a first degree relative,
» onset before 12 months of age,
» initial complex seizures.

DIAGNOSTIC CRITERIA

Clinical

» Exclude intracranial, extracranial and biochemical causes of fever or seizure.
» Signs of meningism are unreliable in children < 2 years of age.
» If raised intracranial pressure or meningitis cannot be excluded, then the diagnosis of febrile seizures cannot be made. Treat children empirically for meningitis if suspected.

Investigations

Lumber puncture

» Lumbar puncture is indicated in:
  > all children with clinical features of possible meningitis,
» Lumbar puncture may be indicated in:
  > 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.
» 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

» All children with complex febrile seizures and persistent lethargy require neuro-imaging and then a lumbar puncture if raised intracranial pressure can be reliably excluded.
» Based on clinical findings, investigate complex febrile seizures for possible underlying conditions such as meningitis, focal brain lesions, and epilepsy.

Note:

» An EEG is of no value in simple febrile seizures, but consider in recurrent complex febrile seizures.

GENERAL AND SUPPORTIVE MEASURES

» Reassure parents and caregivers.
» Educate parents and caregivers regarding the first aid management of seizures.

MEDICINE TREATMENT

For fever related symptoms (temperature > 38.5˚C):

- Paracetamol, oral, 15 mg/kg/dose 6 hourly.
  - Paracetamol has no effect on seizure prevention.

If convulsing:
See section 13.3: Status epilepticus (convulsive).

Continuous anticonvulsant drug prophylactic therapy

Routine daily antiepileptic drug prophylaxis is not recommended for patients with simple febrile seizures.
For children with recurrent complex febrile seizures, discuss the treatment options with a specialist.

REFERRAL

» All patients with recurrent complex febrile seizures without an obvious cause of the seizure and/or not responding to initial management should be discussed with a specialist.
» Developmental delay/regression.

13.3 STATUS EPILEPTICUS (CONVULSIVE)

G41.9

DESCRIPTION

ILAE 2015

Convulsive status epilepticus (SE) is characterised by abnormally prolonged seizures lasting more than 5 minutes. It is a **medical emergency.**

After 30 minutes of generalised tonic-clonic seizures, the brain begins to suffer from hypoxia, acidosis, and depletion of local energy stores, cerebral oedema and structural damage.

Complications include:

» hyperpyrexia,
» respiratory depression,
» cerebral oedema,
» blood pressure disturbances,
» inappropriate antidiuretic hormone (ADH) secretion,
» hypoxic ischaemic damage to brain, myocardium and muscles.
» disturbances of blood glucose,
» renal failure,
» acidosis,

DIAGNOSTIC CRITERIA

Clinical

» Convulsive seizure lasting 5 minutes or longer to be managed as status epilepticus
» The causes of convulsive status epilepticus may be:
  - Cryptogenic
  - Symptomatic with a known cause:
    > Acute: secondary to an insult to the brain, e.g. encephalitis, hypoxic episode, trauma and complex febrile seizures; as a result of treatment non-adherence and changes in anticonvulsant therapy.
    > Remote: cerebral palsy, post-stroke.
    > Progressive: brain malignancy, neurodegenerative disease.
    > Epileptic syndromes.

GENERAL AND SUPPORTIVE MEASURES

» Maintain an open airway.
» Place patient on side.
» Admit to high or intensive care, if possible.
» If unconscious, consider catheterisation.

» Monitor:
  > heart rate,
  > respiratory rate,
  > blood pressure,
  > electrolytes,
  > blood glucose,
  > antiepileptic drug blood levels,
  > acid–base status,
  > blood gases,
  > SaO_2,
  > neurological status,
  > fluid balance,
  > osmolality.
» Look for a possible cause of the fever and treat appropriately.
» Cardiovascular and/or respiratory support if the patient is unable to maintain blood gases and blood pressure within the normal physiological range.
» Ventilate to maintain P_aCO_2 in the low normal range, i.e. 4.0–4.5 kPa.

Maintain $SaO_2 \geq 95\%$:
» Oxygen, by facemask or nasal cannulae.
» Measure antiepileptic drug blood levels if there are breakthrough seizures on medication, signs of toxicity, drug interactions or concerns about adherence.

MEDICINE TREATMENT

Status epilepticus

Follow ABCD approach.
See flow chart on next page for management of Status epilepticus.
For buccal midazolam and rectal diazepam, use the intravenous formulation.

For the purpose of rationalising the management of convulsive status epilepticus (SE), it helps to divide or classify it into different stages as below:
» Early SE (5-20 minutes).
» Established SE (20–30 minutes).
» Refractory SE (beyond 30 minutes).

Intravenous fluid:
- Dextrose 5% in sodium chloride 0.9%, IV.
  - Avoid over hydration. Keep fluid volume at maintenance.
  - Maintain normoglycaemia and electrolytes within the normal range.

Other biochemical disorders

Correct abnormalities, if present, e.g. glucose, calcium and sodium.

For fever related symptoms:

- Paracetamol, suppositories, rectal, 6 hourly.

Weight	Dose
6 - 11 kg	125 mg
12 - 17 kg	250 mg
18 - 24 kg	375 mg
25 - 30 kg	500 mg
31 - 37 kg	625 mg
38 - 45 kg	750 mg
46 - 50 kg	875 mg

Note: Suppositories should not be divided, as the amount of drug in each portion may not be consistent.

DRUG MANAGEMENT OF STATUS EPILEPTICUS		
PHASE	**MANAGEMENT**	**GOALS**
EARLY STATUS 0-5 minutes **EMERGENT INITIAL AED 5 minutes**	Early stabilisation phase • Immediate ABC • Diagnose hypoglycaemia • Establish IV access If IV access: Lorazepam, IV, 0.1 mg/kg If no IV access: Lorazepam, IM, 0.1 mg/kg **OR** Diazepam, rectal, 0.5 mg/kg **OR** Midazolam, buccal 0.5 mg/kg	• Maintain saturation, CPP (cerebral perfusion pressure) • Support haemodynamic status
ESTABLISHED STATUS 5-30 minutes *Urgent Status Control Therapy*	**If still convulsing after 5-10 minutes** Repeat Lorazepam, IV, 0.1 mg/kg **And load** Phenytoin, IV, 18 mg/kg *(infused in sodium chloride 0.9% over 20 minutes, not exceeding 1-3 mg/kg/min)* **OR** Phenobarbitone, IV, 20mg/kg **If still convulsing after 15-20 minutes** *(use alternative option to what was used above)* Phenytoin, IV, 18 mg/kg **OR** Phenobarbitone, IV, 20 mg/kg **Refer ICU**	• Stop seizure • Attain serum AED to control SE

PHASE	MANAGEMENT	GOALS
REFRACTORY STATUS 30-60 minutes	**ICU** **Consideration for:** • Midazolam infusion • Endotracheal intubation and thiopental infusion • Neuroprotection	• Stop seizure • Support haemodynamic status

Note:
Once intravenous access is attained, take blood for glucose, blood gas analysis, electrolytes, LFTs, FBC and antiepileptic drug levels if patient is a known epileptic.

Monitor carefully for drug related respiratory depression.

Intubation, ventilation and administration of thiopental sodium infusion should only be performed in a centre with trained anaesthetists and a paediatric intensive care unit.

Once convulsions are controlled, consider maintenance therapy.

Cerebral oedema
Treat when clinically proven.

Mannitol, IV, 250 mg/kg administered over 30–60 minutes.
- o Do not exceed two doses without consulting with a specialist.

OR
Under specialist supervision:
- Sodium chloride 5%, IV, 2 mL/kg infused over 30 minutes.

Cerebral oedema with associated space occupying lesion
- Dexamethasone, IV, 0.5 mg/kg 12 hourly.

REFERRAL

Caution:
Attempt to control seizures and stabilise the patient before referral.

» Failure to control seizures within 30 minutes.
» Where the primary cause is unknown, or if the primary cause itself requires referral.

13.4 EPILEPSY

G40.9

DESCRIPTION

Epilepsy is a disease of the brain characterised by any of the following conditions

- At least two unprovoked (or reflex) seizures occurring > 24 h apart.
- One unprovoked (or reflex) seizure and a probability of further seizures similar to the general recurrence risk (at least 60%) after two unprovoked seizures, occurring over the next 10 years.
- Diagnosis of an epilepsy syndrome.

An epileptic seizure *is defined as transient occurrence of signs and/or symptoms due to abnormal excessive or synchronous neuronal activity in the brain.*

Generalised epileptic seizures *originate within, and rapidly engage, bilaterally distributed networks in the cortical and subcortical structures.*

Focal epileptic seizures: *originate within networks limited to one hemisphere. These may be discretely localized or more widely distributed.*

Besides the classification according to types there are also specific seizure syndromes with specific treatment

1. Absence epilepsy of childhood.
2. Benign focal epilepsy of childhood.
3. Epileptic spasms (West syndrome).
4. Lennox-Gastaut syndrome.
5. Severe myoclonic epilepsy of infancy (Dravet syndrome).
6. Genetic epilepsy with febrile seizures plus (GEFS+).

Epileptic syndromes include:

Absence Epilepsy of Childhood

- Short spells of sudden onset of motor arrest and impairment of consciousness lasting between 5 and 30 seconds.
- Little or no associated automatic movements.
- No post-ictal effect.
- Onset from 5-7 years old until puberty.

Benign focal epilepsy of childhood

- Sleep related events of hemifacial clonic spasm.
- Inability to speak but retained awareness.
- Peak onset at ± 6–10 years.
- Usually resolves by late adolescence.

Epileptic spasms (West syndrome)

» An infantile onset encephalopathy with epileptic spasms associated with hypsarrhythmia on the EEG and developmental regression.
» Frequent age of onset 3-6 months old.
» It is a neurological emergency. Do not delay diagnosis, treatment and referral. Early intervention reduces subsequent neuro-disability.
» Clinically, the child appears to stare, gives a sudden flexion of the trunk and head, with the limbs in extension or flexion but held in this tonic spasm for a few seconds.
» Events occur in clusters and are most common when the infant is going to sleep or rousing.
» The episodes are distressing to the infant and he/she will often appear red in the face and may cry out.
» Events are often confused with colic.

Lennox-Gastaut syndrome (LGS)

» Combinations of GTCS, atypical absences, myoclonic seizures, tonic seizures, atonic drop attacks and occasionally complex partial seizures.
» May occur spontaneously but usually structural.
» Onset between 2–3 years of age.
» Behavioural problems and neuroregression occurs.

Severe Myoclonic Epilepsy of Infancy (SMEI) - Dravet Syndrome

» A severe form of myoclonic epilepsy with onset in children < 1 year of age with recurrent clusters of febrile convulsions, severe neuroregression and other non-febrile seizures by 2–3 years.

Genetic epilepsy with febrile seizures plus (GEFS+)

» Children with febrile convulsions that persist beyond 6 years.
» These children have epilepsy triggered by fever and may warrant antiepileptic drug intervention.
» There is often a family history of febrile convulsions.

Note:

West syndrome, Severe Myoclonic Epilepsy of Infancy and Lennox-Gastaut syndrome are regarded as epileptic encephalopathies and are associated with neuroregression and behavioural problems.

DIAGNOSTIC CRITERIA

A child may be diagnosed:

» with a specific anatomical or systemic cause for the seizure type (see table of possible causes);
» as having an epileptic syndrome, i.e. a specific seizure type associated with a characteristic EEG, natural history, response to anticonvulsant therapy and prognosis;
» with cryptogenic epilepsy.

Investigations:

» MRI of the brain is the preferred investigation for recurrent seizures in children. If not available, a CT scan of the brain is indicated.
» EEG: is indicated for recurrent or syndromic seizures where a diagnosis cannot be made on clinical grounds alone. Delay an EEG for at least one week after the convulsive episode.
» If atypical, a 12 lead ECG should be considered in diagnostic uncertainty – it is important to consider prolonged QT interval syndromes.

GENERAL AND SUPPORTIVE MEASURES

» Minimise the impact of the epilepsy by obtaining complete seizure control to maximise the child's full potential.
» Educate the patient and caregiver about epilepsy and associated complications and comorbidities, i.e. learning difficulties and ADHD.

MEDICINE TREATMENT

Acute:

Manage as per seizures/status epilepticus, see sections 13.1 Seizures, and 13.3: Status epilepticus (convulsive).

Maintenance therapy

» Monotherapy is preferred but combination therapy may be necessary.
» Combination therapy should be specialist initiated.
Caution: potential drug-drug interactions.
» As a general rule, start with small doses and titrate slowly upwards.
» Aim for low to mid-therapeutic dose range and accept the lowest dose at which seizures are controlled.
» If seizures continue, titrate to high therapeutic doses, if there are no unacceptable side-effects.
» Measuring drug levels is rarely indicated unless there is concern about toxicity or adherence and in polytherapy.

Maintenance medicine treatment choices for different types of epileptic seizures.

	1st line	2nd line (specialist advice)
Generalised tonic and/or clonic	• Valproate **OR** • Phenobarbitone (< 6 months old)	• Lamotrigine
Focal	• Carbamazepine	• Lamotrigine • Topiramate
Infantile epileptic spasms	Refer all	
Absence	• Valproate	• Lamotrigine
Myoclonic	Refer all for specialist investigation and initiation of therapy with valproate.	

- 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), in children under 2 years or if clinical suspicion of liver dysfunction or metabolic disease
  - Monitor at least clinically for hepatotoxicity.

- Carbamazepine, oral, 5 mg/kg/day (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.

- Lamotrigine, oral, 0.2 mg/kg/dose starting daily dose. (Specialist initiated.)
  - Increase slowly at 2 weekly intervals to 1–5 mg/kg/dose 12–24 hourly.
  - Rapid escalation associated with side adverse effect of skin rash.
  - Maximum total daily dose when given with valproate: 5 mg/kg/day.
  - Lamotrigine is given as add-on therapy for different seizure types and in drug-resistant paediatric epileptic syndromes, such as Lennox-Gastaut syndrome.
  - Double the maximum dose of lamotrigine when using carbamazepine or phenobarbitone and,
  - Lamotrigine must be given at a reduced dosage, of no more than half the above recommended dose in patients using valproate,

- Phenobarbitone, oral, 3–5 mg/kg/dose as single dose at night.
  - o May be used in children under six months of age.
  - o 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.
  - o Exacerbates absence seizures.

REFERRAL

» Suspected but undiagnosed secondary cause for seizures.
» Focal seizures for neuro-imaging (MRI preferred), if facilities or expertise not available.
» All seizures other than typical febrile convulsions in children < 2 years.
» Seizures that are not controlled within 2 months on one agent with minimal side effects.
» Neuroregression.
» Mixed seizure types in one patient.
» All myoclonic seizures and epileptic spasms at presentation.
» If need to add a second medicine.

13.5 ANTIRETROVIRAL THERAPY AND ANTIEPILEPTIC DRUGS

Co-administration of antiepileptic drugs in patients on antiretroviral therapy has not been well studied yet, and remains a therapeutic challenge. Drug interactions between antiepileptic drugs and antiretrovirals can arise from a number of mechanisms, including liver metabolism (increase or decrease), competition for protein binding and increase in viral replication. There is no strong evidence to guide clinicians at present.

The following points are important to remember when treating seizures and epilepsy in patients on ART:

» Great caution should be taken when using drugs metabolised in the liver by the cytochrome P450 enzyme system as this may cause alterations in levels of both AEDs and antiretrovirals leading to toxic or sub-therapeutic drug levels. This particularly pertains to the NNRTIs and more specifically to PIs.
» If clinically indicated, monitor AED levels in patients taking concurrent ART and AED therapy.
» Avoid prescribing carbamazepine, phenobarbital, and phenytoin for patients receiving NNRTIs or PIs, as there are serious P450 interactions involved. In this setting, consider lamotrigine and valproate. See section 13.4: Epilepsy.

» Treat children on antiretrovirals presenting to casualty with acute seizures or in status epilepticus according to the existing standard status epilepticus or acute seizure protocols.
» Although benzodiazepines, phenytoin and phenobarbitone may interact with antiretroviral metabolism, the acute management of acute seizures or SE takes precedence in these instances.

13.6 HEADACHES

R51

DESCRIPTION

Headache is the most common pain syndrome in children of all ages. Recurrent headaches are a common health problem and can be:

» primary, e.g. migraine, or
» secondary/symptomatic, e.g. raised intracranial pressure.

The actual perception of headache varies according to age and is influenced by factors such as experience, memory and cultural environment.

International Classification of Headache Disorders (ICHD)
Migraine (without aura)

Five or more headaches lasting 1–48 hours (duration in children is often shorter, lasting a few hours only) fulfilling at least 2 of the following:

» bilateral or unilateral, frontal or parietal in location,
» pulsating in character,
» moderate or severe,
» aggravated by routine activity,
» nausea and/or vomiting plus photophobia and/or phonophobia during headache.

Migraine (with aura)

At least 2 attacks fulfilling at least 3 of the following:

» one or more reversible aura symptoms,
» at least one aura developing over > 4 minutes or 2 or more successive symptoms,
» no aura lasting > 1 hour,
» headache follows aura in less than 1 hour.

Episodic tension-type headache

At least 10 prior episodes, occurring less than 15 times per month and lasting 30 minutes to 7 days with at least 2 of the following:

» pressing or tightening quality,
» mild or moderate intensity,
» bilateral location,
» no aggravation by routine physical activity,
» no nausea, vomiting, photophobia or phonophobia.

Cluster headache

» Severe unilateral sharp headache associated with conjunctival injection and lacrimation.
» Rare in childhood.

Paroxysmal Hemicrania Continua

» Cluster headache of shorter duration.

Each of the above can occur in combination in any patient, i.e. mixed/comorbid headache.
Headaches can also be sub-classified according to temporal patterns, i.e. acute, acute recurrent, chronic progressive/non-progressive, episodic or constant.

DIAGNOSTIC CRITERIA

» Exclude secondary causes of headache, e.g. raised intracranial pressure.
» Red flags in childhood headaches:
  > change in pattern (e.g. “worst headache ever”),
  > progressive course over time,
  > age younger than 3 years,
  > nocturnal/wakes child from sleep,
  > early morning vomiting,
  > ataxia,
  > focal neurological signs,
  > alteration of level of consciousness.

GENERAL AND SUPPORTIVE MEASURES

» Environmental and lifestyle changes, e.g. avoid precipitants such as bright lights, sleep deprivation and certain foods, excessive video games.
» Adequate hydration.
» Avoid skipping meals, excessive caffeine ingestion.
» Regular exercise.
» Stress alleviation and coping skills training where possible.
» Headache diary and identify possible triggers.

MEDICINE TREATMENT

Treat non-migraine headaches with analgesics.

- Paracetamol, oral, 15 mg/kg/dose 6 hourly as required.

For migraine:

- Ibuprofen, oral, 10 mg/kg/dose, 6 hourly.

Persistent vomiting and not tolerating oral feeds:

- Metoclopramide, oral, 0.15–0.3 mg/kg as a single dose.

OR

- Metoclopramide, IM/IV, 0.1 mg/kg as a single dose.

Migraine prophylaxis

Indicated when headaches occur frequently, impacting on the child's activity and requiring substantial relief medication.

Treat for six months then review.

- Propranolol, oral, 0.5–3 mg/kg/day in 2–3 divided doses.
  - Contraindicated in asthma and heart block.
  - Avoid in diabetes and depression.

In children who are unable to take propranolol, e.g. asthma:

- Topiramate, oral, 1–3 mg/kg/day in 1–2 doses. (Specialist initiated).
  - Starting dose: 0.5 mg/kg/day.
  - Titrate dose slowly every 1–2 weeks.
  - Reinforce behavioural management before considering topiramate.

REFERRAL

» Secondary intracranial cause suspected.
» Failure to respond to first-line treatment.
» No response to treatment.

13.7 NEUROCYSTICERCOSIS

B69.0

DESCRIPTION

Neurocysticercosis is caused by the cysticercal form, i.e. larval form of the pork tapeworm, *Taenia solium*. The larvae may locate in the brain parenchyma, intraventricular and meningeal areas, spinal canal/cord and eye, or a combination of these regions. Viable cysticerci incite little inflammatory response, but dead cysticerci elicit an increased inflammatory response.

Cysticerci in the brain may remain dormant or may cause complications such as:

» headache,
» behavioural disorders,
» visual disturbances,
» seizures,
» meningo-encephalitis,
» focal neurological deficits,
» increased intracranial press ure,
» hydrocephalus,
» meningitis,
» spinal cord compression.

DIAGNOSTIC CRITERIA

Clinical

» Location and stage of the life cycle of the parasite in the brain determines the clinical features.
» Suspect if child from endemic area, i.e. pig farming area, presents with neurological abnormalities such as:
  > seizures,
  > raised intracranial pressure/hydrocephalus,
  > focal neurological deficits,
  > cranial nerve palsies.
  > meningo-encephalitis,
  > meningitis,
  > behavioural disorders,
  > headache,

Investigations

» Computed tomography (CT scan) and/or magnetic resonance imaging (MRI scan) of brain showing cysts, granulomas, peri-lesional oedema or calcification of cysts.
» MRI scan may identify more lesions and viable cystic lesions than the CT scan.
» Soft tissue radiology of muscles of lower limbs may demonstrate calcified cysticerci, i.e. "rice grain" calcifications in muscles.
» Follow-up CT scans and/or MRI scans may help to assess the response to therapy.

GENERAL AND SUPPORTIVE MEASURES

Prevention:

» Prolonged freezing or thorough cooking of pork to kill the parasite.
» Thorough washing of fresh fruit and vegetables in *T. solium* endemic areas.
» Attention to personal hygiene.
» Proper sanitation facilities and safe water.
» Avoid the use of human excreta as fertiliser.
» Look for Taenia ova in the stools of the family members.

MEDICINE TREATMENT

Calcified cysticerci and a single dying lesion visible on CT scan require no anti-helminthic treatment.

Patients with multiple cysts usually have a mixture of live and dying cysts and are assumed to have active disease and require treatment.

- Albendazole, oral, 7.5 mg/kg/dose 12 hourly for 7 days.
  - Maximum dose: 400 mg/dose.

Prevention of neurological manifestations

In massive infestations, cysticidal therapy may trigger an inflammatory response. Delaying anti-helminthic therapy and adding corticosteroids may lessen the risk.

24 hours **prior** to albendazole therapy:

- Dexamethasone, IM, 0.15 mg/kg/dose 6 hourly.

Then follow with oral therapy as soon as possible:

- Prednisone 1 mg/kg/day for the duration of albendazole therapy, and then taper and discontinue.

Seizure control

See section 13.4: Epilepsy.
Treat according to the type of seizure.
AED treatment for 6–12 months after resolution of lesions on neuro-imaging.
Recurrent seizures require chronic treatment until seizure-free for 2 years.

REFERRAL

» Neurocysticercosis not responding to adequate therapy.
» Neurocysticercosis with complications, such as hydrocephalus.
» Intractable epilepsy.

13.8 NEUROMUSCULAR DISORDERS

13.8.1 INFLAMMATORY POLYNEUROPATHY (GUILLAIN-BARRÉ SYNDROME)

G61.0
* Notifiable condition,

DESCRIPTION

Guillain-Barré syndrome (GBS) is an acute autoimmune-mediated polyradiculoneuropathy which is precipitated by a preceding viral or other infection. It is the most common acquired polyneuropathy in children.

Different forms or **variants of** Guillain-Barré syndrome are described depending on the clinical and/or neurophysiological characteristics.

Acute Inflammatory Demyelinating Polyradiculoneuropathy (AIDP)

» This is the most common form, accounting for 80–90% of cases.
» Characterised mainly by:
  > symmetrical, ascending motor weakness,
  > areflexia, i.e. absence of tendon reflexes,
  > distal sensory alteration,
  > pain/paraesthesia.

Acute motor axonal neuropathy (**AMAN**)

» A purely motor form of GBS.
» It involves predominantly motor nerves and has an axonal pattern on electrophysiology (nerve conduction studies).
» Although there are similarities with AIDP, the clinical picture tends to be more severe with more patients suffering from respiratory failure.

Acute motor-sensory axonal neuropathy (**AMSAN)**

» Another axonal form of GBS but with sensory involvement.
» It is not frequently found in children.

Miller-Fisher Syndrome

» Patients have external ophthalmoplegia, sensory ataxia, weakness with areflexia.
» Electrophysiological and CSF studies are similar to AIDP.

Chronic Inflammatory Demyelinating Polyradiculoneuropathy (CIDP)

» May be considered a chronic variant of AIDP.
» Most often starts insidiously and progresses slowly, but can have onset like GBS.
» It is managed differently from GBS and should be referred.

DIAGNOSTIC CRITERIA

Clinical

» Preceding respiratory tract or gastrointestinal infection.
» Symmetrical, flaccid muscle weakness with early areflexia.
» The muscle weakness may ascend rapidly upwards to involve the trunk, arms, face and cranial nerves.
» Bulbar paralysis and respiratory failure may develop.
» Autonomic dysfunction.
» Relatively mild, or absence of, sensory signs.
» Exclude the following:
  > Acute disseminated encephalomyelitis (ADEM)
  > poliomyelitis, a rare cause of hypotonia with abrupt onset of weakness (usually asymmetrical) in association with a febrile illness,
  > transverse myelitis:
    - initial flaccid weakness and areflexia typically involving the lower limbs maximally,
    - occasionally with pain at the onset, but rapidly progressing to spasticity and hyperreflexia,
    - also, a sensory level on the trunk,
    - bladder and rectal sphincter involvement.
  > diphtheria,
  > botulism.

Investigations

Screen for AFP

» Send two stool specimens taken 24–48 hours apart to the National Institute of Virology via the local laboratory.
» The stool sample needs to be sent within 14 days of onset of paralysis to exclude poliovirus infection.

CSF

» CSF findings after 1 week show elevated protein and no cells or only a few cells, i.e. albumino-cytological dissociation.
» CSF glucose is normal.

GENERAL AND SUPPORTIVE MEASURES

» Notify as Acute Flaccid Paralysis.
» Admit to a high or intensive care unit.
» Monitor respiratory and autonomic functions closely:
  > peak expiratory flow rate,
  > respiratory rate,
  > forced vital capacity (FVC),
  > arterial blood gases.
  > blood pressure,
  > heart rate,
  > bulbar functions,

» Ventilation is recommended when:
  > PCO_2 levels start rising,
  > there is a progressive fall in the peak expiratory flow rate,
  > tachycardia and sweating occur,
  > inspiratory efforts are weak,
  > inability to talk.

Note:
These changes precede hypoxaemia detected on blood gas analysis, and ventilation should begin before frank hypoxaemia occurs.
Respiratory care must be meticulous.

» Shoulder weakness, head-lag, weak cough and swallowing difficulties are an indication for respiratory support.
» To determine fluid losses from autonomic instability, monitor urine output and degree of sweating.
» Provide adequate nutrition.
» Provide bladder and bowel care as well as pressure-point care.
» Routine physiotherapy for chest and limbs, keep ankles in neutral position (90^0) (may require foot/hand splints).
» Protect eyes and keep moist.
» Communicate with child as awareness is maintained. Staff should remember that children may be very frightened but unable to express their emotions and needs.

MEDICINE TREATMENT

Substantial pain is present (in up to 90%) in the severely affected patients.
Pain in this setting is often unrecognised and underestimated.
Pain management is essential. See section 20.1: Management of pain.

For neuropathic pain**:**

- Carbamazepine, oral, 5 mg/kg/dose 12 hourly.

- Immunoglobulin, IV, 1 g/kg/day, slowly over 12–16 hours on two consecutive days **or** 0.4 g/kg as a single daily dose on 5 consecutive days early in the disease process.
  - Use under specialist supervision.

REFERRAL

» Chronic inflammatory demyelinating polyradiculoneuropathy.
» Guillain-Barré syndrome with bulbar paralysis and/or early signs of respiratory failure.
» Patients who have lost or are losing ambulation for management in consultation with a paediatric neurologist.
» Patients with complex Guillain-Barré syndrome.

13.8.2 MYASTHENIA GRAVIS

G70.0

DESCRIPTION

An auto-immune disorder resulting in muscle fatigue. Mild cases involve the eyes alone, i.e. ptosis and ophthalmoplegia, and severe cases involve proximal muscle groups, respiratory and bulbar control.

DIAGNOSTIC CRITERIA

Clinical

» Muscle fatigability with exercise and demonstration of this in the clinic setting:
  > Lid-lag test, i.e. failure to maintain upward gaze for 1 minute.
  > Arm-raising test, i.e. failure to maintain the arms at 90° from the trunk for 1 minute.

Note:

Myasthenia gravis patients not uncommonly present in a myasthenic crisis, with bulbar and respiratory compromise. Sometimes this may be the first mode of clinical presentation.

MEDICINE TREATMENT

- Pyridostigmine, oral, 1–5 mg/kg/day in 4–6 divided doses. (Specialist initiated).

REFERRAL

» All for confirmation of diagnosis and initiation of treatment (consideration of steroids, immuno-modulation therapy).
» Myasthenic crisis.

13.9 SYDENHAM CHOREA

I02.9

DESCRIPTION

A movement disorder with rapid involuntary jerks affecting any part of the body often incorporated into a voluntary movement in an attempt to mask it. It is an acute post-streptococcal infection movement disorder and constitutes one of the major criteria for the diagnosis of rheumatic fever. Patient has the appearance of being restless with constant movement which improves with sleep. The movements are classically random in place and random in time.

DIAGNOSTIC CRITERIA

Clinical

» Exclude drug reactions, hyperthyroidism, systemic lupus erythematosus and neurodegenerative disorders.

Investigations

» Cardiac screening, i.e. ECG, echocardiogram.
» Serum ASOT, anti-DNAse B.
» Erythrocyte sedimentation rate.
» Anti-dsDNA, if clinically indicated.

GENERAL AND SUPPORTIVE MEASURES

» Emotional support.
» School support.
» Occupational therapy.

MEDICINE TREATMENT

Movement disorders:

- Haloperidol, oral, 0.025 mg/kg/day in 2–3 divided doses.
  - Increase dose slowly and incrementally to 0.05 mg/kg/day.

PLUS

If streptococcal infection:

- Phenoxymethylpenicillin, oral, 500 mg 12 hourly for 10 days.

OR

- Amoxicillin, oral, 45 mg/kg/dose 12 hourly for 10 days.

THEN

Until 21 years of age:

- Benzathine benzylpenicillin (depot formulation), IM, 1.2 million units every 28 days.

OR

- Phenoxymethylpenicillin, oral, 250 mg 12 hourly.

REFERRAL

» All patients for specialist assessment.

13.10 CEREBROVASCULAR DISEASE/STROKE

I67.9

DESCRIPTION

Cerebrovascular disease can be ischaemic (thrombotic or embolic) or haemorrhagic, arterial or venous.

Arterial ischaemic stroke must always be considered in any child with sudden onset of hemiparesis or other focal neurological disturbance.

The clinical features of cerebral venous thrombosis (CVT) include headache, papilloedema, focal neurological signs, seizures (often focal), and alteration of consciousness.

Risk factors:
» cardiac disorders;
» infections, e.g. meningitis, varicella, HIV, etc.;
» prothrombotic disorders, e.g. nephrotic syndrome, protein S/C deficiencies, etc.;
» haematologic disorders, e.g. sickle cell anaemia;
» vasculopathies, e.g. vasculitis, HIV, Moya Moya syndrome.

The initial evaluation in children includes the following:
CT/MRI brain to ascertain whether it is ischaemic or haemorrhagic infarct
» Electrocardiography, echocardiography.
» Full blood count, INR, PTT.
» CSF analysis as indicated.
» Infectious screening, including varicella, HIV, mycoplasma, TB.
» Connective tissue and vasculitic screening.
» Thrombophilia screening. See Chapter 3: Blood and Blood Forming Organs, section 3.11: Venous thrombo-embolic disease.

GENERAL AND SUPPORTIVE MEASURES

Acute supportive and neuroprotective care directed at preserving damaged but salvageable brain tissue includes the following:
» Maintain body temperature in the low to normal range.
» Maintain euglycaemia.
» Maintain O_2 saturation above 95%.
» Maintain adequate cerebral perfusion and manage raised intracranial pressure.
» Treat anaemia.
» Treat acute seizures promptly.

Haemorrhagic stroke requires referral to a centre with neurosurgical expertise and facilities.
Early disability assessment and management, includes physiotherapy, speech therapy, occupational therapy, etc.

MEDICINE TREATMENT

Arterial ischaemic stroke without haemorrhage
All patients with confirmed arterial ischaemic stroke:
- Aspirin soluble, oral 1–5 mg/kg as a daily dose.
  - Contraindicated in haemorrhagic stroke or bleeding tendency.

REFERRAL

» All patients to specialist paediatrician for investigation.
» Anticoagulation with enoxaparin and warfarin is best done in a specialised setting under cardiologist, haematologist and neurologist supervision.

13.11 LUMBAR PUNCTURE

CONTRAINDICATIONS TO LUMBAR PUNCTURE

» Focal neurological signs and depressed level of consciousness.
» Clinical signs of raised intracranial pressure, or impending cerebral herniation:
  > deep coma, i.e. GCS < 9, or sudden deterioration of level of consciousness,
  > decerebrate or decorticate posturing,
  > neurogenic hyperventilation,
  > unequal dilated or poorly reactive pupils,
  > absent doll's eye reflex,
  > papilloedema.
» Haemodynamic/respiratory unstable patients.
» Clinical meningococcaemia (septicaemia) with petechiae/purpura. (confirm with skin scrape, Gram stain and blood culture).
» Skin sepsis or abnormalities over the lumbar puncture site.
» Coagulopathy.
» Spinal anatomic abnormality.
» Acute paraplegia.
» Status epilepticus.

PROCEDURE

» Positioning and restraint are vital in determining the success of the procedure.
» The ability of the assistant in restraining is as important as the skill of the 'operator'.
» Preparation entails not only positioning, but attention to sedation/analgesia, 'patient comfort' and safety, as well as factors such as adequate lighting.
» Resuscitation equipment must be available at bed side.
» Pay attention to the sterility of the operating field.
» Local analgesia with/without sedation may be required. See Chapter 20: Pain Control, section 20.1.2: Management of pain.
» Ensure that all necessary equipment, e.g. needles, manometers and specimen tubes are close at hand.
» Only the interspaces below L3 (L3/L4 or L4/L5) are used in order to avoid damaging the conus medullaris.
» With the patient in the lateral recumbent position, the L3/L4 interspace is found at the level of the line joining the highest points of the two iliac crests.
» Turn the bevel of the needle (with stylet) to face the patient's side to avoid cutting the longitudinal dural fibres.
» As the needle is advanced, the first 'give' or loss of resistance is encountered with the piercing of the ligamentum flavum. A slight 'popping' sensation is felt as the needle penetrates the dura. Remove the stylet to allow CSF to drain out passively. If no fluid appears, then rotate the

needle a quarter turn (90°). If this does not help, replace the stylet and advance the needle a few millimetres and then check for fluid as before.

» Measure the opening pressure using a manometer, with the child relaxed in the lateral decubitus position. In a young relaxed child, the opening pressure is in the range of 60 –180 mm H_2O.

» At the end of the procedure, re-insert the stylet before removing the needle completely.

Note:

If intracranial infection is suspected, do a blood culture and initiate antimicrobial treatment immediately. Refer to Chapter 8: Infective/Infectious Diseases, section 8.11 Meningitis, Acute Bacterial.

Remember to catch a few drops of CSF on a labstick to check the glucose and for the presence of white cells which may give an indication of an infection.

CHAPTER 14

CHILD AND ADOLESCENT PSYCHIATRY

PRINCIPLES FOR THE SAFE AND EFFECTIVE PRESCRIBING OF PSYCHOTROPIC MEDICATION

Child and Adolescent Psychiatry patient management involves a systemic, holistic approach requiring a multidisciplinary team. A skilled clinician performs a thorough clinical diagnostic evaluation in keeping with a recognised classification system like DSM 5 and then includes the pharmacological management as part of a holistic treatment plan.

» Multiple aspects need to be considered when prescribing psycho-active medication for children and adolescents e.g. co-morbidities, home environment stability.
» Complicated cases, uncertain diagnoses and poor treatment response are indications for referral to a Child and Adolescent Psychiatrist for evaluation.
» Children and adolescents may require higher dosages of psychoactive medication per unit of body weight compared to adults to achieve similar blood levels and therapeutic efficacy.
» Psychoeducation of the patient and the family is vital.
» Regular monitoring of effectiveness and the need to continue medication should be done with the view to tapering and discontinuing medication after 6 months to a year, unless the medication is for a chronic condition e.g. ADHD, epilepsy.
» Baseline assessments require a medical history and physical examination. Baseline laboratory investigations, pregnancy testing, drug screening, EEG and ECG should be done where indicated.
» Psychotropic medication is generally well tolerated by children and adolescents. Lowest dosages should be initiated and increased as clinically indicated. Side effects and adherence should be monitored. Monotherapy is ideal. However, childhood-onset psychiatric disorders can be severe and may present with multiple co-morbidities needing polypharmacy. Preferably add one medication at a time to monitor side effects and effectiveness. Change medications one at a time.

COMMON MEDICATIONS USED IN PSYCHIATRY AND THEIR SIDE EFFECTS

Selective serotonin re-uptake inhibitors (SSRI) e.g. fluoxetine

Adverse effects in children and adolescents

» Agitation, behavioural disinhibition or 'activation', headache, skin rashes, GIT disturbances (decreased appetite, nausea, diarrhoea) and CNS effects e.g. insomnia, tremor, and sedation.

» Increased risk of suicidality associated with the use of SSRIs in depressed children and adolescents.
» Less common but potentially serious side effect is Serotonin syndrome, which presents in increasing severity as restlessness, tremor, shivering, myoclonus, confusion, convulsions and death.
» Less commonly can induce bleeding and mania and may reduce the seizure threshold.

Special precautions/ investigations/monitoring
» Adverse events may be dose related, reduce where indicated.
» Monitor for:
- suicidal ideation/agitation,
- 'manic switch' (SSRI may precipitate mania),
- serotonin syndrome symptoms (high dosages of SSRI or the simultaneous use of two SSRI's in cross tapering).

Tricyclic Antidepressants (e.g. amitriptyline)

Adverse effects in children and adolescents
» Sedation, anticholinergic, cardiac side effects, convulsions, coma.
» May be more cardio-toxic in children than in adults.

Special precautions/investigations/monitoring
» Dangerous and potentially fatal in overdose. Avoid in children and adolescents with pre-existing cardiovascular disease.
» Do not use in conjunction with other drugs that prolong the QT interval.
» Baseline and on-treatment ECGs should be performed in patients with pre-existing cardiovascular condition or positive family history.
» May precipitate mania.

Stimulant medications (e.g. methylphenidate)

Adverse effects in children and adolescents
» Common: loss of or decreased appetite, poor weight gain and insomnia.
» Common initially: headache, abdominal pain.
» Dysphoria or emotional blunting at high doses.
» May precipitate or worsen tics.
» May, at higher doses, lower the seizure threshold and precipitate seizures in children and adolescents suffering from epilepsy.

Special precautions/ investigations/monitoring
» Monitor blood pressure, pulse rate, height and weight.
» Monitor for mood changes and the development of tics.
» Use with caution in children who suffer from epilepsy.
» Exclude absence seizures prior to initiating stimulants (clinical/EEG).
» ECG prior to initiating stimulants where cardiac history or clinical cardiac pathology is present.

'Atypical' antipsychotics (e.g. risperidone, olanzapine)

Adverse effects in children and adolescents

» Common in children/adolescents: insomnia, agitation, anxiety, headache, sedation and extrapyramidal side effects (EPSE) e.g. acute dystonia, Parkinsonism, akathisia, tardive dyskinesia.
» Weight gain and metabolic syndrome.
» Sedation at higher dosages.
» Hyperprolactinaemia (gynaecomastia, galactorrhoea, menstrual disturbances) - particularly risperidone.
» Hyponatraemia due to polydipsia or SIADH – particularly risperidone.

Special precautions/investigations/monitoring

» Monitor weight.
» Monitor prolactin level, glucose and lipid profile in patients initiated on atypical antipsychotics.

'Typical' antipsychotics (e.g. haloperidol)

Adverse effects in children and adolescents

» EPSE: acute dystonia, akathisia, tardive dyskinesia, Parkinsonism.
» Life threatening side effect: Neuroleptic Malignant Syndrome (NMS): fever, altered mental status, muscle rigidity, autonomic dysfunction, raised creatinine kinase and white cell count.

Special precautions/ investigations/monitoring

» Monitor for EPSEs.
» Avoid long term use where possible due to risk of irreversible tardive dyskinesia.

Benzodiazepines (e.g. lorazepam, diazepam, clonazepam)

Adverse effects in children and adolescents

» Sedation, restlessness and paradoxical reaction of disinhibition, especially in children and adolescents with intellectual disability, neurological illnesses or brain trauma.

Special precautions/investigations/monitoring

» Not for long term use.

Mood stabilisers (e.g. lithium carbonate, sodium valproate/ valproic acid)

Lithium carbonate:

Adverse effects in children and adolescents

» Drug interactions – preferably avoid (or close monitoring): NSAIDS, ACE inhibitors, angiotensin receptor blockers, antithyroid agents, thiazide and loop diuretics, xanthines and SSRIs.
» Dose-related effects: ataxia, lethargy, thirst, GIT intolerance.
» *Toxicity: confusion, vomiting, tremor, convulsions, coma.*

» Non-dose dependent: GIT, tremor, weight gain, goitre (hypothyroidism), hypoparathyroidism, nephrogenic diabetes insipidus, EPSE, polyuria.

Special precautions/investigations/monitoring

» Blood investigations: FBC, urea, creatinine and electrolytes, CMP, TSH and BHCG.
» Cardiac investigation: ECG.
» Ongoing monitoring: lithium levels 1-3 monthly, TSH and creatinine 6-12 monthly.

Valproic acid/Sodium valproate:

Adverse effects in children and adolescents

» Common: GIT (nausea, vomiting, constipation, diarrhoea).
» Dose related: fatigue, sedation, ataxia.
» Uncommon: hair loss, skin rashes, increased appetite, tremor, amenorrhoea, aggression, depression.
» Rare: hepatotoxicity (potentially lethal), pancreatitis, hyperammonaemia
» Pregnancy: facial anomalies, neural tube abnormalities.

Special precautions/investigations/monitoring

» Check liver functions and ammonia levels prior to initiation and then 6 monthly.
» Blood levels must be done in the morning prior to morning dosage if there are concerns about compliance and toxicity. No routine indication.
» Monitor for signs of hepatotoxicity.

14.1 SEDATION OF AN ACUTELY DISTURBED CHILD OR ADOLESCENT

GENERAL AND SUPPORTIVE MEASURES

- Ensure safety of patient, caregivers, staff members and the environment.
- De-escalation techniques first-line to try to calm the patient.
- Physical restraint should only be used to protect the patient and caregivers; for the shortest period and should be monitored very 10-20 minutes.
- A thorough physical examination must be done.
- Exclude general medical causes e.g. intracranial pathology like encephalopathy, seizures, metabolic disease, medication adverse effects and intoxication.

Investigations to exclude medical causes:

- Baseline BMI.
- Baseline laboratory work-up: FBC, urea and creatinine, electrolytes, AST, ALT, TSH, fasting glucose.
- Monitor for extrapyramidal side effects e.g. acute dystonia.

MEDICATION TREATMENT

For children under the age of six years:

Sedation with psychotropic agents should only be considered in extreme cases and only after consultation with a specialist.

For children over the age of six years:

- Lorazepam, oral/IM.
  - 0.05 – 0.1 mg/kg/dose.
  - Onset of action: 20 - 40 minutes.

If sedation is inadequate:

- Haloperidol, IM.
  - 0.025–0.05mg/kg/day.
  - Onset of action 20 - 30 minutes.
  - Maximum dose: 0.15 mg/kg/day.

In case of an acute dystonic reaction secondary to haloperidol:

- Biperiden, IM/slow IV, 0.05–0.1 mg/kg.
  - 1 - 6 years: 2mg.
  - 7 – 10 years: 3 mg.
  - > 10 years: 5 mg.

14.2 ELIMINATION DISORDERS

F98.0; F98.1

DESCRIPTION

Enuresis and encopresis involve the inappropriate elimination of urine or faeces in childhood or adolescence. These disorders are based on developmental age (not chronological age) and may be voluntary or involuntary.

14.2.1 ENURESIS

F98.0

DESCRIPTION

Enuresis is bedwetting after the age or developmental level of 5 years.
Primary monosymptomatic (nocturnal) enuresis refers to incontinence during sleep only. It is of great importance to differentiate between monosymptomatic enuresis and enuresis with associated bladder dysfunction during daytime, as they are distinct conditions with different treatment modalities.

Enuresis is a benign condition with a 15% spontaneous annual resolution rate. Intervention must carry no risk or have minimal side effects. The cure rate of “treatment” should be significantly greater than the spontaneous cure rate before it can be considered effective.

DIAGNOSTIC CRITERIA (DSM 5)

» Enuresis involves the repeated voiding of urine into bed or clothing, whether involuntary or intentional.
» Occurs more than twice per week for 3 months or causes significant distress or impairment in social or academic functioning.
» Chronological or mental age of 5 years.
» Exclude medical illness, medication or substance usage.
» Classified as nocturnal, diurnal or both.

GENERAL AND SUPPORTIVE MEASURES

» Assess type of enuresis e.g. primary nocturnal enuresis (mono-symptomatic).
» Take a thorough history, including a family history of elimination disorders, aspects of toilet training, trauma, abuse, anxiety and current medications use e.g. SSRI's, risperidone, or diuretics.
» Perform medical examination and investigations (e.g. urine test strip) to exclude UTI, constipation, obstructive sleep apnoea, diabetes mellitus, diabetes insipidus, neurological and structural abnormalities.
» If sexual abuse is suspected refer to a social worker.
» Secondary enuresis may benefit from psychotherapy in cases where trauma is suspected or parent-child conflict appears to be prominent.
» Primary mono-symptomatic enuresis has a high rate of spontaneous resolution (about 15% per year).
» Management of primary nocturnal enuresis may involve one or a combination of interventions. Education and motivational therapies are usually tried initially. More active intervention is warranted as the child gets older, social pressures increase and self-esteem is affected.
» General education and advice about bedwetting should be provided to all children and families of children with mono-symptomatic enuresis. It is important to emphasize that enuresis is not the child's fault; provide practical suggestions to reduce the impact of bedwetting; encourage regular voiding during the day and just before going to bed; and provide guidelines about the timing and type of fluid intake.
» Motivational therapy (e.g. a star chart) is usually the first intervention for younger children (between five and seven years) who do not wet the bed every night and are mature enough to accept some responsibility for treatment. If motivational therapy fails to lead to improvement after three to six months, active interventions may be warranted.
» Address the manner in which the enuresis is managed at home. The parents should not be punitive but reward when the child remains dry. The child should assist in cleaning up the wet bedding or clothing.
» Ensure the child drinks 6-8 glasses of water daily.
» Ensure regular voiding 5-6 times per day.
» No diapers/nappies as these may lower self-esteem.
» Bladder training and lifting can also be used.

» Enuresis alarms are the most effective long-term therapy and have few adverse effects. They can be expensive and require a long-term commitment (usually three to four months).
» Bell and pad system is effective but only use in children > 7 years and who are well motivated.

MEDICATION TREATMENT

If general measures have failed after 6 months, consult with a specialist for consideration of desmopressin which is supported only for: short term use in low esteemed patient with enuresis:

- Desmopressin, oral, 200–400 mcg at night for 3 months. (Specialist consultation).
  - Adverse effects include fluid retention, hyponatraemia and cerebral oedema.

REFERRAL

» Suspected underlying systemic illness or chronic kidney disease.
» Persistent enuresis in a child > 7 years.
» Referral to psychiatry for secondary enuresis, or for primary enuresis in a child > 7 years where basic measures fail and general medical disorders has been excluded.

14.2.2 ENCOPRESIS

F98.1

DESCRIPTION

When the passage of faeces is involuntary, there is usually constipation, impaction and retention with subsequent overflow. The constipation may develop due to psychological reasons e.g. anxiety around defaecation that leads to avoidant behaviour or physiological reasons e.g. paradoxical contraction of external sphincter. Deliberate encopresis may be part of a disruptive behaviour disorder e.g. oppositional defiant disorder. Constipation can lead to enuresis, urinary reflux and chronic UTI's.

DIAGNOSTIC CRITERIA (DSM 5)

Involves the involuntary or intentional, repeated passage of faeces into inappropriate places. This occurs at least once each month for 3 months. The chronological or mental age of the child is at least 4 years. Substances, medications and medical illnesses need to be excluded. Encopresis is specified as either with or without constipation and overflow incontinence.

GENERAL AND SUPPORTIVE MEASURES

» History to include medical and psychological factors.
» Assess type of encopresis.
» Medical examination and investigations e.g. urine test strip.
» Refer to paediatrician for further work-up as needed.

» Treat constipation with diet and exercise.
» For the retentive subtype – educate child and parent about bowel function and use laxatives if necessary.
» Management requires educational, psychological and behavioural approaches e.g. timed daily intervals on the toilet with rewards.

14.3 ATTENTION DEFICIT HYPERACTIVITY DISORDER (ADHD)

F90.0-F90.9

DESCRIPTION

Children with ADHD display developmentally inappropriate degrees of inattention, impulsiveness and hyperactivity that interfere with their functioning.

DIAGNOSTIC CRITERIA (DSM 5)

May be mild, moderate or severe:
» predominantly inattentive
» predominantly hyperactive-impulsive, and
» combined

Inattention: (9 symptoms)
- Failing to give close attention to details or making careless mistakes.
- Having difficulty sustaining attention in tasks or play.
- Not listening when spoken to directly.
- Failing to complete tasks or follow through on instructions.
- Often losing things for tasks or activities.
- Often having difficulty organising tasks and activities.
- Being forgetful in daily activities.
- Being easily distracted by extraneous stimuli.
- Avoiding or being reluctant to engage in tasks requiring sustained mental effort.

Hyperactivity: (6 symptoms)
- Often fidgeting, squirming or tapping.
- Leaving his/her seat.
- Running or climbing inappropriately.
- Is “on the go”, or behaves as if “driven by a motor”.
- Is unable to play quietly.
- Talking excessively.

Impulsivity: (3 symptoms)
- Blurts out answers.
- Has difficulty waiting his/her turn.
- Interrupts or intrudes on others.

» Onset of several symptoms before 12 years.
» Requires 6 symptoms of inattention or hyperactivity/impulsivity.
» Symptoms have persisted for 6 months to a degree inconsistent with their developmental level.
» Symptoms present in two or more settings.
» Interferes with or reduces the quality of social, academic or occupational functioning.
» Exclude psychotic or other psychiatric disorders.

Note:
» Common co-morbid conditions include oppositional defiant disorder, conduct disorder, depression (particularly in girls) and substance use disorders (SUDs), as well as HIV and epilepsy.
» Certain conditions may 'mimic' ADHD such as, developmental disorders, motor coordination problems, intellectual disability, post-traumatic and post infectious encephalopathy as well as anxiety and mood disorders.
» Girls may more commonly present with inattentive-type ADHD. The diagnosis may therefore be missed.

GENERAL AND SUPPORTIVE MEASURES

Identify and treat co-morbidities such as depressive disorders early, as this may prevent the onset of substance misuse (to 'self-medicate') and other risk-taking behaviours during adolescence.

- Parent counselling:
  - rules and limit-setting
  - positive reinforcement of pro-social behaviour
  - consistent routine
  - restrictive diets and OTC medications are of no proven value
- Behaviour-based interventions:
  - reward positive behaviour
  - improve social awareness and adjustment
- Social skills groups.
- Identify learning difficulties and refer to educational support services.

MEDICATION TREATMENT

For children under the age of six years:

Refer for diagnostic assessment by a child and adolescent psychiatrist or paediatrician.

For children over the age of six years:

Initiate treatment using the short-acting methylphenidate formulation until effective dosage achieved. Reduce the dose or withdraw methylphenidate if a paradoxical increase in symptoms occurs.

- Methylphenidate, short-acting, oral, 1 mg/kg/day.
  - Initial dose: 5 mg, 2–3 times daily, at breakfast, lunch and no later than 14h30 (approximately every 3 to 3½ hours).
  - Increase the dose at weekly intervals by 5–10 mg until symptoms are controlled. Use the lowest effective dose.
  - Maximum daily dose: 60 mg (adult dose). Any dose greater than 60 mg/day should be prescribed by a child psychiatrist or paediatrician.

Contraindications to methylphenidate

Absolute**:**

» Hyperthyroidism
» Glaucoma
» Concomitant mono-amine oxidase inhibitor therapy
» No absolute contraindication to the concomitant use of methylphenidate with antiepileptic drugs (AEDs) or antiretroviral therapy (ART). However, exercise caution with the prescribed dosages, be aware of potential drug-drug interactions and monitor for adverse effects.

Relative**:**

» Hypertension
» Cardiac abnormality – need ECG and cardiology assessment
» Anxiety
» Agitation
» Epilepsy
» Tics

Discontinuation of treatment

» If no objective improvement of symptoms has been observed e.g. using an ADHD Rating Scale, after appropriate dosage adjustments over a two-month period.
» To establish whether on-going treatment is indicated in a child on long-term stimulant therapy, trial periods off treatment should be part of the management plan.
» Indications for a trial off treatment:
  - treatment duration in excess of 2-3 years,
  - adolescent age (particularly late adolescence), and
  - a substantial reduction in core ADHD symptoms, evident in more than one setting.
» Trials off treatment should be planned at times least disruptive to the child's academic and social functioning i.e. time the treatment withdrawal outside of major commitments such as examinations.

» Duration of treatment withdrawal can be for one week to a month, depending on whether stability is maintained.
» Treatment can be withdrawn abruptly, with no need to taper dosages.
» Obtain feedback from teachers and parents (verbal feedback, completion of parent and teacher ADHD rating scales), before and during the trial off treatment.
» Assess the child and document the mental state (symptoms of ADHD), before and during the trial off treatment.
» Monitor 3 monthly for one year.
» Re-initiate treatment (at last dosage prescribed), if:
  - there is a significant re-emergence of symptoms after one week off treatment and/or during the month off medication, or
  - after a longer trial off medication, e.g. at 3 monthly follow up visits, there is evidence of symptom re-emergence.

Note:
Adolescents are more likely to present with poor concentration, inattentiveness or impulsivity, rather than hyperactivity.
» Hyperactivity symptoms usually decrease but inattention symptoms may persist during adolescence.
» Remission is achieved in 30% of patients during adolescence.

REFERRAL
» No response to treatment after 8 weeks.
» Presence of comorbid psychiatric conditions with severe functional impairment: oppositional defiant disorder, mood disorders, anxiety disorders, debilitating tics.
» Presence of uncontrollable seizures.
» HIV infected status.

14.4 MOOD DISORDERS
F31–F34

14.4.1 DEPRESSION IN CHILDHOOD AND ADOLESCENCE
F32-34

DESCRIPTION
The clinical picture of a child and adolescent with major depressive disorder is similar to that of adults except that there are some developmental differences i.e.:
» mood is often irritable rather than sad
» failure to gain weight, rather than weight loss
» somatic complaints e.g. headaches and abdominal pain
» behavioural and academic/school problems occur frequently
» withdrawal from social activities
» vegetative symptoms are less common than in adults

» suicide attempts increase in number, tend to be more lethal and
» impairment of functioning worsens with increasing age

The first episode of bipolar disorder can present with depression in adolescents. Bipolar depression is often associated with a more sudden onset, psychomotor retardation, anxiety symptoms, and in some instances, psychotic symptoms and a family history of bipolar disorder.

A number of depressed children and adolescents have co-morbid psychiatric disorders. The most frequent co-morbid diagnoses are:
» Anxiety disorders
» ADHD
» Oppositional defiant disorder,
» Conduct disorder and
» Substance misuse, particularly in adolescents

Conduct problems may develop as a complication of the depression and persist after the depression remits. It is important to assess and manage conditions that occur together with depression.

DIAGNOSTIC CRITERIA (DSM 5)

The clinical presentation of major depressive disorder includes 5 symptoms present for a period of 2 weeks and represents a change from previous functioning. Changes in either mood or interests must be present:
» depressed mood reported or observed by others
» decreased pleasure or interest in activities
» vegetative symptoms including sleep/appetite disturbances
» fatigue/loss of energy
» poor concentration/indecision
» psychomotor agitation/retardation
» excessive, inappropriate guilty ruminations or feelings of worthlessness
» thoughts of death and suicide, suicide attempt or suicide plan

Symptoms causes distress or impairment in functioning.
Exclude other psychiatric disorders, medical conditions, the effects of substances and manic/hypomanic episodes.

A suicide attempt is self-inflicted harm where the intention is to die.
Increased suicide risk is associated with the following:
- male gender
- adolescence
- previous attempts and lethality of method used
- family history of suicide
- presence of a psychiatric or chronic medical illness
- social isolation and poor family support
- associated substance abuse or physical aggression

Consider the following in a child presenting with depressed mood:

» Exclude underlying medical conditions such as:
- infections, e.g. HIV, cerebral cysticercosis, encephalitis and tuberculous meningitis;
- neurological conditions, e.g. temporal lobe epilepsy, brain tumours;
- endocrine disorders, e.g. thyroid conditions, diabetes mellitus.

» Exclude medication-induced mood disturbances e.g. corticosteroids, antiretroviral (zidovudine, efavirenz), high doses of stimulant medication and barbiturates.

» Exclude substance abuse, including alcohol and methamphetamine ('tik').

» Assess for suicide risk.

GENERAL AND SUPPORTIVE MEASURES

» Psychological interventions are considered 'first line' for mild to moderate depression and should be administered by a suitably skilled clinician:
- cognitive behavioural therapy (CBT): to address distorted, negative cognitions, maladaptive patterns of behaviour and communication;
- Psychodynamic/play therapy: to identify feelings, improve self-esteem and social interactions.

» Additional interventions:
- family counselling: to address family disharmony, stressors and provide psycho-education;
- input to school: to address academic issues and psycho-education;
- Social worker: to investigate suspicion of child abuse or neglect.

MEDICATION TREATMENT

» If there is a failure to respond to psychotherapeutic interventions after 4–6 weeks or if the severity of symptoms increases, consider a trial of antidepressant medication, while still continuing with psychotherapy and other interventions. Initiate treatment in consultation with a psychiatrist. Children 12 years and under should be referred to a child psychiatrist for the initiation of medication.

» Response to treatment should bring about a meaningful reduction in symptoms and improvement in functioning.

» Once remission is achieved continue medication therapy for at least a further 6–12 months.

<u>First line:</u>
- Fluoxetine, oral, 0.5 mg/kg/day.

However, fluoxetine may only be available in 20mg capsules, in which case citalopram tablets can be used initially, titrated to 20mg and then changed to fluoxetine 20mg if that dose has been reached.
- o Dose range: 20–40 mg daily
- o Recommended average dose: 20 mg/day

If there is a poor response to fluoxetine after an adequate trial of treatment i.e. 4–6 weeks, or if significant symptoms of anxiety are present or if the child is HIV infected; consider an alternative SSRI.

- Citalopram, oral, 0.4 mg/kg/day
  - Dose range: 5–40mg daily
  - Recommended average dose: 10–20 mg/day

A trial of treatment is considered to be ineffective if the patient presents with ongoing, significant depressive symptoms and/or suicidal ideation and where the patient has not achieved an improvement in overall level of functioning.

Be aware of the risk of bipolar 'switch' or precipitation of mania in patients with a family history of bipolar disorder.

Tricyclic antidepressants are not recommended in children, due to insufficient evidence of efficacy, potential adverse cardiovascular side effects and lethality in overdose.

REFERRAL

» Poor response to an adequate trial of treatment i.e. medication trial of 6–8 weeks in combination with psychological treatment and psychosocial interventions.
» Presence of co-morbid conditions.
» Psychotic symptoms such as delusions or hallucinations.

14.4.2 BIPOLAR DISORDER

F31

DESCRIPTION

The bipolar disorder presentation in children and adolescents differs from the adult discrete manic or depressive episodes. They usually present with mixed mood states and significant mood lability that fluctuates within a day resembling a rapid cycling pattern and rage attacks or 'affective storms'.

Short-lived episodes of exuberance are normative in children and adolescents, while temper outbursts and mood lability can present in many other psychiatric disorders e.g. anxiety disorders, autism spectrum disorder (ASD). There is a risk of misdiagnosis or 'over-diagnosis' of bipolar disorder in children and adolescents presenting with severe aggression and 'dysregulated' moods.

DIAGNOSTIC CRITERIA (DSM 5)

Manic Episode

A distinct period of abnormally and persistently elevated, expansive or irritable mood and abnormally and persistently increased goal-directed activity or energy. This should represent a significant change in the patient's baseline

mental status, last for at least 1 week and be present, most of the day, nearly every day.
During the period of mood disturbance, the patient should display the following symptoms:
» Elevated self-esteem or grandiosity
» Decreased need for sleep
» More talkative than usual or pressured speech
» Flight of ideas or feeling that thoughts are racing
» Distractibility
» Increased goal-directed activity (socially, at school or hyper-sexuality) or psychomotor agitation
» Involvement in activities with potentially painful consequences e.g. sexual indiscretions

Depressive episode
Similar to symptoms of major depressive episode except that the onset may be more rapid and may be associated with psychomotor retardation, anxiety symptoms and/or psychotic symptoms.

Mixed mood state
This includes the presence of a major depressive episode with at least 3 manic/hypomanic symptoms present during the depressive episode. These are more common in children and adolescents.

Causes distress or impairment in functioning.
Exclude other psychiatric disorders, medical conditions, the effects of substances and manic/hypomanic episodes

MEDICATION TREATMENT
Acute phase treatment
» Refer patients with a suspected manic episode or suicidal ideation to a psychiatrist immediately for assessment and possible admission.
» Sedate before transfer. Refer to section 14.1: Sedation of an acutely disturbed child or adolescent.
» If no previous medication used, while awaiting admission and in consultation with a psychiatrist, initiate atypical antipsychotic and mood stabilizer:

Atypical antipsychotic:
- Risperidone, oral.
  5-12 years (under 50kg):
  - Starting dose: 0.01 mg/kg/day.
  - Maintenance dose: 0.02 - 0.04 mg/kg/day.

13-17years:
- Starting dose: 0.5 mg daily.
- Maximum dose: 3 mg daily.
- Use lowest effective dose to limit adverse long-term side effects and to facilitate adherence.
- Increase dose by 0.25–0.5 mg daily every 1–2 weeks, depending on tolerability and age.

Mood stabiliser: lithium carbonate or sodium valproate:

- Lithium carbonate: oral (for patients aged 12-17 years).
  - Initial dose 20 mg/kg/day in 2-3 divided dosages. Lithium level after 5 days. Increase accordingly. Therapeutic range 0.6-0.8 mmol/l. Be careful of narrow therapeutic margin-risk of toxicity.
  - Ensure investigations prior to initiation of treatment.
  - Blood investigations: FBC, U&E, CMP, TSH and BHCG.
  - Cardiac investigation includes: ECG.
  - Ongoing monitoring: lithium levels 1-3 monthly: TSH and creatinine 6-12 monthly.

- Sodium valproate: oral.
  - 20 mg/kg/day: divided 12 hourly.
  - Usual range: 20-30 mg/kg/day.

Maintenance treatment

» If previously on maintenance medication: re-initiate treatment in consultation with a psychiatrist.
» Ongoing psycho-education regarding the illness, medication, compliance etc.
» Once stabilised, the patient can be referred for individual psychotherapy.
» The family may benefit from referral for family therapy.

REFERRAL

- Refer all patients with suspected bipolar disorder for an assessment by a psychiatrist.
- Sedate or stabilise prior to transfer.

14.4.3. DISRUPTIVE MOOD DYSREGULATION DISORDER (DMDD)

F34.81

DESCRIPTION

This is a new addition to DSM 5. Children and adolescents present with a history of chronic, severe, persistent irritability. The irritability presents as frequent temper outbursts with an underlying angry, irritable mood. The onset of symptoms is before 10 years and should not be applied to children with a

developmental age less than 6 years. Conversion of non-episodic irritability to bipolar disorder is low. They are at higher risk of developing depressive and anxiety disorders in adulthood.

Important to consider the differential diagnoses. These include:
> Mood disorders e.g. MDD, bipolar disorder
> Behavioural disorders e.g. oppositional defiant disorder (ODD); anxiety disorders
> Neurodevelopmental disorders e.g. ADHD, autism spectrum disorder (ASD) and
> Impulse control disorders e.g. intermittent explosive disorder.

DIAGNOSTIC CRITERIA (DSM 5)
» Temper outbursts that are severe and recurrent that manifest verbally or behaviourally, are out of proportion in intensity and duration to the situation or provocation, are inconsistent with the developmental level and occur > 3 times per week.
» The mood between the temper outbursts is persistently irritable or angry for most of nearly every day and is observable by others.
» Symptoms must be present for > 12 months with symptom-free periods that do not exceed 3 months.
» Occurs in > 2 settings and is severe in at least one setting.
» Age of diagnosis: 6-17 years.
» Age of onset of symptoms <10 years.
» Exclude psychiatric disorders, medical conditions and the effects of substance use.
» There are high rates of comorbidity that include disruptive behavioural disorders, mood disorders, anxiety disorders and autistic spectrum disorders. If children meet the oppositional defiant disorder or intermittent explosive disorder criteria with DMDD, then only the DMDD diagnosis is given.

Functional consequences
DMDD is associated with significant functional impairment in all areas of their lives due to their extremely low frustration tolerance. This has a severe impact on family and peer relationships, academic performance and participation in extra-mural activities.

MEDICATION TREATMENT
Currently no specific treatment guidelines exist due to the lack of studies.
Many patients present with ADHD and DMDD. The ADHD can be treated with methylphenidate but worsening of the mood may occur with severe aggression.

REFERRAL
- Co-morbid DMDD should be referred to a psychiatrist.

14.5 ANXIETY DISORDERS

F41.9

DESCRIPTION

Separation anxiety disorder and selective mutism are diagnostic categories previously exclusive to childhood, while social anxiety disorder (social phobia), specific phobia, panic disorder, agoraphobia and generalised anxiety disorder (GAD) present across the lifespan. Anxiety disorders are common in children and adolescents affecting 6-20%.

Medication does not form part of the primary management of separation anxiety disorder and selective mutism.

Anxiety in a child can be misdiagnosed as ADHD, as both conditions may present with increased levels of activity and problems with concentration.

14.5.1 GENERALISED ANXIETY DISORDER (GAD)

F41.1

DESCRIPTION

Excessive anxiety or worry about a number of factors or events, occurring on most days for at least 6 months. The intensity, frequency or duration of the anxiety is out of proportion to the actual likelihood or impact of the anticipated event. The individual finds it hard to control the worry and to keep worrisome thoughts from interfering with attention to tasks. During the course of the disorder the focus of the worry may shift from one concern to another. The worries interfere with psychosocial functioning, are pervasive and distressing and often have no precipitants.

DIAGNOSTIC CRITERIA (DSM 5)

Excessive anxiety or worry that is both difficult to control and associated with 1 of the following 6 symptoms for 6 months:

» restlessness or a feeling keyed up or ‘on edge’
» difficulty concentrating or ‘mind going blank’
» irritability
» muscle tension
» sleep disturbance
» being easily fatigued

GAD causes significant distress or impairment in functioning.

Exclude other psychiatric disorders, general medical conditions or effects of substances.

GENERAL AND SUPPORTIVE MEASURES

These interventions should be performed by a suitably qualified clinician.

» Cognitive behavioural therapy (CBT): aimed at changing pessimistic, anxiety-based cognitions and developing strategies to reduce anxieties and avoidant behaviour patterns.

» Behaviour therapy: relaxation, desensitisation by imagining or exposure to anxiety-provoking situations.
» Psychodynamic/supportive psychotherapy: aimed at promoting self-esteem, assertiveness and autonomy.

MEDICATION TREATMENT

- Fluoxetine, oral, 0.5 mg/kg/day.
  - Dose range: 20–40 mg daily.
  - Recommended average dose: 20 mg/day.

However, fluoxetine may only be available in 20mg capsules, in which case citalopram tablets can be used initially, titrated to 20mg and then changed to fluoxetine 20mg.

If there is a poor response to fluoxetine after an adequate trial of treatment, i.e. 4–6 weeks consider an alternative SSRI.

- Citalopram, oral, 0.4 mg/kg/day.
  - Dose range: 5–40mg daily.
  - Recommended average dose: 10–20 mg/day.

REFFERRAL

- 12 years and under.
- Failure to respond after 6–8 weeks to an adequate trial of therapy and medication.
- Adverse events to fluoxetine/citalopram.

14.6 OBSESSIVE COMPULSIVE DISORDER (OCD)

F42.9

DESCRIPTION

Obsessions:
These are persistently recurring thoughts, impulses or images that are experienced as intrusive, inappropriate and not simply excessive worries about realistic problems. Children may not experience these as distressing but the obsessions may interfere with day-to-day functioning. The child may try to suppress, ignore or neutralise them with another thought or action. Obsessions are not pleasurable or voluntary.

Compulsions:
Repetitive behaviours or mental acts that a person feels driven to perform in response to an obsession or according to a rigidly applied rule in order to reduce distress or to prevent some dreaded outcome. The behaviour or mental acts are not connected in a realistic way with what they are supposed to prevent or are excessive.

Compulsions are easier to diagnose than obsessions in children as they are observable. Most children have both obsessions and compulsions. Adult symptoms are stable over time whereas children's may be variable. The content differs and may reflect the different developmental stages. Adolescents have higher rates of sexual and religious obsessions than children and children and adolescents have more harm obsessions e.g. death or illness to self or loved ones, than adults.

» Comorbid conditions:
  - o rheumatic fever;
  - o streptococcal throat infection [paediatric autoimmune neuropsychiatric disorders associated with streptococcal infections (PANDAS)];
  - o tic disorders, ADHD, anxiety and depressive disorders, ODD, impulse-control disorders.

DIAGNOSTIC CRITERIA (DSM 5)

This requires the presence of obsessions, compulsions or both that are time-consuming or cause distress or functional impairment. General medical illnesses, other psychiatric disorders and the effects of substances should be excluded. Specifiers include the degree of insight and presence of tic disorders.

GENERAL AND SUPPORTIVE MEASURES

» Provide cognitive behavioural therapy (CBT), if available and appropriate.
» Exposure-based interventions (e.g. contact with "dirt" in a child with contamination fears), thought stopping techniques, "response prevention" (i.e. blocking of rituals).

These interventions should be carried out by a suitably qualified professional.

MEDICATION TREATMENT

OCD in children and adolescents is often resistant to treatment and high dosages of medication are often needed for long periods. Full therapeutic effect may take up to 8 – 12 weeks. Dosages should be gradually increased.

- Fluoxetine, oral, 0.5 mg/kg/day.
  - o Dose range: 20–40 mg daily.
  - o Recommended average dose: 20–40 mg.

However, fluoxetine may only be available in 20 mg capsules, in which case citalopram tablets can be used initially, titrated to 20 mg and then changed to Fluoxetine 20 mg.

OR

- Citalopram, oral, 0.4 mg/kg/day.
  - o Dose range: 5–40 mg daily.
  - o Recommended average dose: 10–20 mg/day.

Duration of treatment: 6 months after resolution of OCD symptoms.

REFERRAL

- 12 years and under.
- Poor response to adequate trial of cognitive behavioural therapy and medication i.e. persistence of obsessions and/or compulsions, with impairment in functioning after 12 weeks.
- Co-morbid conditions.

14.7 POST TRAUMATIC STRESS DISORDER (PTSD)

F43.1

DESCRIPTION

The core features of experiences which place patients at risk of PTSD are:

» exposure to a traumatic event (directly, witnessing or learning of it happening to someone else).
» there is threat of serious injury or death.
» violent personal assault, such as sexual violence.

DSM 5 DIAGNOSTIC CRITERIA

» Intrusive symptoms:
» Persistently re-experiencing:
  - o Recurrent memories and dreams of the traumatic event
  - o Dissociative reactions e.g. flashbacks, reliving experiences
  - o Physiological or psychological distress to traumatic cues
» Marked avoidance:
  - o Avoiding memories, thoughts or feelings related to trauma
  - o Avoiding external reminders
» Negative alterations in mood and cognitions e.g. amnesia, detachment
» Marked alterations in arousal and reactivity e.g. hypervigilance, sleep disturbance
» Significant distress/impairment
» Duration more than a month

GENERAL AND SUPPORTIVE MEASURES

Debriefing in the immediate aftermath of the trauma is not recommended, often having worse outcomes.

Psychological interventions should be made available, including:

» general supportive counselling
» cognitive behavioural strategies
» group and family interventions

MEDICATION TREATMENT

Consider medication when other interventions have not been effective or there is severe impairment in functioning

- Fluoxetine, oral, 0.5 mg/kg/day.
  - o Dose range: 20–40 mg daily.

However, fluoxetine may only be available in 20 mg capsules, in which case citalopram tablets can be used initially, titrated to 20 mg and then changed to Fluoxetine 20 mg.

If poor response, consider higher doses in consultation with a child psychiatrist.

OR

- Citalopram, oral, 0.4 mg/kg/day.
  - Dose range: 5–40 mg daily.
  - Recommended average dose: 10–20 mg/day.

REFERRAL

- Persistent symptoms despite therapy.

14.8 FEEDING AND EATING DISORDERS

F50/F98

DESCRIPTION

These disorders are characterised by a persistent disturbance of eating or eating-related behaviour that results in the altered consumption or absorption of food and has an impact on physical health or psychosocial functioning. The more common types include pica, avoidant/restrictive food intake disorder, anorexia nervosa, bulimia nervosa and binge-eating disorder.

14.8.1 PICA

F98.3

DESCRIPTION

This is the persistent eating of non-nutritive, non-food substances for more than a month, inappropriate to developmental level. The ingestion is out of keeping with cultural and social norms.

GENERAL AND SUPPORTIVE MEASURES

» Vitamin and mineral deficiencies e.g. zinc, iron should be excluded.
» Physical examination.
» Explore co-morbid conditions e.g. autism spectrum disorder(ASD), intellectual disability, schizophrenia, OCD, impulse control disorders.

14.8.2 AVOIDANT/RESTRICTIVE FOOD INTAKE DISORDER

F50.8

DESCRIPTION

This is an eating or feeding disturbance that manifests by a persistent failure to meet appropriate nutritional and/or energy requirements. There may be lack of interest in food, food avoidance due to sensory sensitivity or concerns about the aversive consequences of eating. Criteria include one or more of: failure to make the expected weight gains, nutritional deficiency, dependence on enteral feeding or nutritional supplements or marked interference with psychosocial functioning. There is no lack of food, socially acceptable practice present or perceptual disturbance of body weight or shape.

GENERAL AND SUPPORTIVE MEASURES

» Exclude medical, neurological or neuromuscular disorders.
» Exclude other psychiatric disorders e.g. OCD, MDD, factitious disorder imposed on another (previously termed Munchausen's by proxy).

14.8.3 ANOREXIA NERVOSA

F50.01/F50.02

DESCRIPTION

This disorder presents with restricted energy intake relative to requirements leading to a low body weight, an intense fear of gaining weight or becoming fat or behaviour that limits weight gain and a disturbance in body weight/shape perception, with poor insight into the seriousness of the low body weight. Children and adolescents may fail to make expected weight gains or maintain normal growth patterns e.g. increased height without weight gain. The Centre for Disease Control has used Body Mass Index (BMI)-for-age below the 5th percentile as being underweight. Physiological disturbances should also be considered.

The semi-starvation and purging can result in medical sequelae, even medical emergencies e.g. arrhythmias.
Co-morbid psychiatric disorders are common e.g. MDD, OCD.

GENERAL AND SUPPORTIVE MEASURES

» A thorough physical examination.
» Blood investigations including FBC, U&E, CMP, TSH.
» Cardiac investigation: ECG.
» Suicide risk assessment.

MEDICATION TREATMENT

» Supportive measures for medical complications.
» Refer to paediatrician for severe medical complications.

» Refer to psychiatrist for psychiatric management.
» Medication such as fluoxetine and olanzapine should be initiated by a psychiatrist.

14.8.4 BULIMIA NERVOSA

F50.2

This disorder is characterised by recurrent episodes of binge eating in which the individual eats large amounts of food in a short period with a sense of lack of control over the eating. Compensatory behaviours then follow e.g. self-induced vomiting or laxative usage. These behaviours occur at least once a week for three months. The individual's self-evaluation is influenced by body shape and weight and their BMI may be within the normal to overweight range.

GENERAL AND SUPPORTIVE MEASURES

» A thorough physical examination.
» Blood investigations including FBC, U&E, CMP, TSH.
» Cardiac investigation: ECG.
» Suicide risk assessment.
» Supportive measures for medical complications.

REFERRAL

» Refer to a paediatrician for severe medical complications.
» Refer to a psychiatrist for psychiatric management.

14.9 CHILDHOOD PSYCHOSIS

F09

DESCRIPTION

It is important to note that children who present with symptoms such as hallucinations, confusion and intensely aggressive or disturbed behaviour may not be psychotic or suffer from schizophrenia. Delirium should be the first diagnosis to consider, before a psychotic disorder is suspected. Failure to recognise a delirium may delay the diagnosis of the underlying medical condition or drug-related delirium and place the child at risk.

Delirium is a non-specific neuropsychiatric disorder which indicates global encephalopathic dysfunction in medically ill patients. The core features consist of attentional disturbances, an altered level of consciousness and diffuse cognitive deficits. It is fluctuating in nature and may present with perceptual disturbances, commonly visual hallucinations.

Any child presenting with an apparent psychosis is considered a medical emergency and should have a medical work-up before being referred to a

psychiatrist. This should include FBC, U&E, LFT, TSH, drug screen, EEG and brain CT scan.

Sedate before transfer if behaviourally disturbed. Refer to section 14.1: Sedation of an acutely disturbed child or adolescent.

14.9.1 SCHIZOPHRENIA

F20.9

DESCRIPTION

Schizophrenia is a chronic psychotic disorder characterised by disturbances in thinking, perceptions, emotions and behaviour and is associated with significant functional impairment. Childhood and adolescent schizophrenia are rare.

» Very Early Onset Schizophrenia (VEOS) is defined as the onset before age 13 years.
» Early Onset Schizophrenia is defined as the onset before age 18 years.
» Onset during childhood and adolescence confers a poorer prognosis for the illness, treatment refractoriness and significant impairment in functioning.
» Similar diagnostic criteria for adults are used. However, in children, the delusions are not as bizarre or systematised as in adults. The clinical presentation in adolescents more closely resembles that in adults. The child or adolescent may not reach expected levels of interpersonal, academic or occupational functioning.

DIAGNOSTIC CRITERIA (DSM 5)

» Two or more of the following symptoms need to be present for a significant portion of time during a 1-month period. At least one of these must be (1), (2) or (3):
    1. delusions
    2. hallucinations
    3. disorganised speech
    4. grossly disorganised or catatonic behaviour
    5. negative symptoms i.e. affective flattening or avolition
» The level of functioning declines or there is failure to achieve expected levels of interpersonal, academic or occupational functioning.
» The disturbance has lasted at least 6 months with a 1-month period of previously mentioned symptoms. Prodromal, attenuated or residual features may be included in the time period.
» Exclude other psychiatric disorders, general medical conditions or effects of substances.

GENERAL AND SUPPORTIVE MEASURES

» Supportive individual and family counselling is an important part of the comprehensive treatment plan.

» The aim of individual counselling is to develop understanding of the illness, to improve coping strategies, to provide structure and limit regression.
» Family interventions focus on psycho-education and facilitating acceptance of the diagnosis to ensure adequate compliance and support for the patient.
» Educational issues include transitioning back into school after a psychotic episode and academic support.

MEDICATION TREATMENT

Pharmacotherapy is the first line treatment for psychosis in children and adolescents.

Acute phase treatment

Sedate before transfer. Refer to section 14.1: Sedation of an acutely disturbed child or adolescent.

If previously prescribed antipsychotic medication:

- Re-initiate treatment, in consultation with a psychiatrist.

If no previous medication (while awaiting admission and in consultation with a psychiatrist)

- Risperidone: oral.
  5 – 12 years (under 50 kg):
  - Starting dose: 0.01 mg/kg/day.
  - Maintenance dose: 0, 02-0,04 mg/kg/day.

  13 – 17 years:
  - Starting dose: 0.5 mg daily.
  - Maximum dose: 3 mg daily.
  - Use lowest effective dose to limit adverse long-term side effects and to facilitate adherence.
  - Increase dose by 0.25–0.5 mg daily every 1–2 weeks, depending on tolerability and age.
  - Refer if doses in excess of 3 mg are required.

Maintenance phase: (12–24 months)

- Gradually lower the dose of risperidone from that needed to treat the acute psychotic phase to that needed to prevent relapse and to ensure adequate adherence.

REFERRAL

» All children and adolescents for assessment and initial management.
» Urgent: young children, individuals responding to command hallucinations or behaviourally-disturbed psychotic children or adolescents.

14.10 TIC DISORDERS

F95.9

DESCRIPTION

A tic is a sudden, rapid, recurrent, non-rhythmic stereotyped motor movement or vocalisation and includes the following subtypes:

» Chronic motor or vocal tic disorder
» Transient tic disorder
» Tourette's disorder

Tourette's disorder is a chronic neuropsychiatric disorder that is characterised by both vocal and motor tics, and related somatosensory urges. It is commonly associated with a number of co-morbid conditions such as OCD, ADHD as well as disturbances of mood.

GENERAL AND SUPPORTIVE MEASURES

» Psycho-education of patient, parents, teachers and peers: to reduce the stigma and social consequences of tics.
» Supportive psychotherapy: to assist the individual to cope with the stigma/teasing, improve self-esteem and improve social skills.
» Family therapy: to assist the family in managing associated symptoms and to reduce stress.

MEDICATION TREATMENT

Medication is used when the tics impair functioning and ideally for short periods only in order to reduce severe symptoms. The natural course of tics is to 'wax and wane'.

- Risperidone, oral.
  - Starting dose: starting at 0.25 mg/day (< 20kg) and 0.5 mg/day (> 20kg).
  - Recommended average dosage 1 mg/day.
  - Dosage range: 0.25 mg - 3 mg.

REFERRAL

- Tourette's syndrome not responding to therapy.
- Tourette's syndrome with comorbid psychiatric or medical conditions.

14.11 PSYCHIATRIC PRESENTATIONS IN HIV INFECTED CHILDREN AND ADOLESCENTS

F06.0; F06.2; F06.31-34; F06.4; F06.8

DESCRIPTION

» HIV infected children and adolescents are at increased risk of psychopathology, such as ADHD, depression and anxiety disorders. Psychosis and mania are less common than in the adult population.

» The increased risk of psychopathology is due to the virus itself, side effects of antiretroviral therapy (ART) and psychosocial stressors.
» Symptom presentation of psychiatric disorders in HIV positive children is the same as in the general paediatric population.
» ADHD often co-occurs with significant learning difficulties, despite treatment with antiretroviral therapy (ART).
» Psychotic disorders are rare in HIV infected children. Consider a delirium or partial seizures if an HIV infected child presents with psychotic symptoms. A full medical workup including CSF and HIV viral load is required before assuming that the symptoms are due to a psychiatric disorder.

GENERAL AND SUPPORTIVE MEASURES

» Psychological interventions are similar to those for HIV negative children.
» Issues specific to the child's HIV status may need specific intervention e.g. for problems related to disclosure of HIV status, stigma, grief counselling, adherence issues, orphanhood and living with a chronic illness.
» Refer to the hospital social worker to address social issues.

MEDICATION TREATMENT

» Start all medications at lower doses and then titrate up slowly.
» Initiate treatment according to guidance in this chapter.

Note: due to drug-drug interactions between fluoxetine and some antiretroviral medication, initiate treatment with citalopram when an SSRI is required.

REFERRAL

» All HIV infected children on ART who present with severe psychiatric symptoms such as severe depression, psychosis and/or mania for general medical evaluation, and if no general medical cause is found, for psychiatric evaluation and initiation of psychotropic medication.

14.12 AUTISM SPECTRUM DISORDER (ASD)

F84

DESCRIPTION

ASD presents with persistent deficits in social communication and interaction, e.g. deficits in socio-emotional reciprocity and restricted, repetitive patterns of behaviour, interests and activities, e.g. inflexibility when confronted with change.

GENERAL AND SUPPORTIVE MEASURES

» Social skills and family interventions.
» Education and school placement.
» Behaviour modification, specifically adapted for autism spectrum disorders.
» Early intervention is important for optimal outcome.

MEDICATION TREATMENT

Not for core autistic symptoms.

For irritability, severe aggression and self-injurious behaviour:

- Risperidone, oral.

5 – 12 years under 50 kg:

- Starting dose: 0.01 mg/kg/day.
- Maintenance dose: 0.02 - 0.04 mg/kg/day.

14.13 SUBSTANCE USE DISORDER

F10–19

DESCRIPTION

The essential feature of a substance use disorder (SUD) is a cluster of cognitive, behavioural and physiological symptoms that indicate that the individual continues to use the substance despite significant substance-related problems.

Age of onset of substance abuse can be as early as 8 years. Illicit drugs such as cocaine, amphetamines and cannabis, as well as alcohol abuse are associated with a greater risk for psychosis. Behavioural disturbance in the context of a SUD may be due to intoxication, withdrawal, or due to a substance-induced mood or psychotic disorder. Initial treatment of SUDs begins with medical stabilisation of the patient ideally in a medical facility. About one third of youth with SUDs, present with a 'dual diagnosis' i.e. a co-occurring psychiatric disorder. Be aware of the mental state changes associated with illicit drugs.

DIAGNOSTIC CRITERIA (DSM 5)

» Substance is used in larger amounts or for longer period than intended
» A persistent desire or unsuccessful efforts to cut down or control use
» A great deal of time is spent in activities to obtain, use or recover from the substance
» Cravings or strong urges to use the substance
» Failure to meet obligations at work, home or school
» Continued use despite social and interpersonal problems caused by effects of the substance
» Use results in decreased or stopping social or recreational activities

» Continued use in hazardous situations
» Ongoing use despite knowing of a physical or psychological problem caused by substance
» Withdrawal
» Tolerance

14.13.1 SUBSTANCE-INDUCED PSYCHOTIC DISORDER

» Prominent hallucination or delusions.
» Symptoms occur during or within one month of proven substance abuse or intoxication.
» A psychiatric disorder such as schizophrenia or a general medical condition is not the cause of the psychosis.
» The disturbance does not occur in the course of a delirium, which must be excluded.

14.13.2 SUBSTANCE-INDUCED MOOD DISORDER

» A significant and sustained disturbance in mood i.e. depressed, irritable, expansive or elevated.
» Symptoms occur during or within one month of proven substance abuse or intoxication.
» A psychiatric disorder such as bipolar or a general medical condition is not the cause of the mood disturbance.

GENERAL AND SUPPORTIVE MEASURES

» Conduct a medical assessment (pulse rate, temperature, blood pressure, ECG) and laboratory investigations (FBC, U&E, LFT, BHCG, urine toxicology), depending on the specific drug of abuse.
» Manage withdrawal states, depending on substance of abuse.
» Refer to a social worker for an evaluation of the family circumstances and for brief motivational interviewing.

MEDICATION TREATMENT

Several medications have been approved by the FDA for treating addiction to opioids, alcohol or nicotine in adults, but not in adolescents. Only preliminary evidence exists for the effectiveness and safety of these medications in individuals under 18 years and no evidence exists for the neurobiological impact of these medications on the developing brain. There are currently no FDA-approved medications to treat addiction to cannabis, cocaine or methamphetamine in any age group.

14.13.3 SUBTANCE WITHDRAWAL

MEDICATION TREATMENT

Consult with a psychiatrist or specialised referral unit. Mild withdrawal states can be managed as an outpatient whereas more severe cases should be referred to the local casualty for medical stabilisation. Children under 6 years old should be referred immediately to casualty.

Alcohol, Benzodiazepines, Stimulants (Cocaine, Methamphetamine) and less commonly Cannabis/Mandrax withdrawal

Management of mild withdrawal:

- Diazepam, oral,
  - 6 – 14 years: 2 – 10 mg daily in 2–3 divided doses.
  - > 14 years up to 20 mg daily in 2–3 divided doses.
  - Taper dose over 3–5 days

Hallucinogens/Volatile solvents

No detoxification indicated.

14.13.3.1 ALCOHOL WITHDRAWAL

F10.239

GENERAL AND SUPPORTIVE MEASURES

Refer children under 6 years old and patients with:

» convulsions
» psychiatric illnesses: psychosis, intellectual impairment
» suicidal ideation
» significant medical comorbidity such as heart disease; pregnancy
» inadequate social support
» history of withdrawal delirium

Assess for comorbid infections and other pathology.

Ensure adequate hydration. Overhydration is a common error made in this setting.

MEDICATION TREATMENT

Alcohol detoxification may be managed on an outpatient basis in cases of mild, uncomplicated alcohol withdrawal.

- Thiamine: oral.
  - Children: 0.5 – 1 mg/kg daily for 14 days.
  - Adults: 50 mg daily for 14 days.
- Diazepam: oral.
  - 1 – 6 years: 1 – 6 mg/day.
  - 6 – 14 years: 2 – 10 mg daily in 2–3 divided doses.
  - > 14 years: up to 20 mg daily in 2–3 divided doses.
  - Wean dose from 8 hourly, to 12 hourly, to daily every 3-5 days.

14.13.3.2 ALCOHOL WITHDRAWAL DELIRIUM

F10.232

DESCRIPTION

Although the typical delirium occurs 2–3 days following cessation of prolonged alcohol intake, reaching a peak at around 5 days, some withdrawal symptoms, such as the typical tremor, may start within 12 hours.

Typical clinical features include:

» predominantly visual hallucinations, may have delusions
» disorientation, fluctuating level of consciousness
» agitation
» seizures (tonic-clonic)
» hypertension, tachycardia

A low-grade fever may be present. Withdrawal tonic-clonic seizures may occur between 24 and 48 hours following cessation of alcohol intake. General medical conditions, e.g. meningitis and other substance use e.g. sedative-hypnotics should be excluded.

Mortality 1-5%.

GENERAL AND SUPPORTIVE MEASURES

» Monitor vital signs regularly.
» Cardiac monitoring and oximetry should be used when administering large doses of benzodiazepines.
» Correct dehydration and abnormalities of electrolytes and nutrition.
» Consider parenteral fluids to compensate for severe losses i.e. in hyperthermia.

MEDICATION TREATMENT

Adult management can be applied to adolescents (for young children, management and dosing to be determined in conjunction with a specialist):

- Thiamine: IV
  - Thiamine must be given prior to glucose to prevent Wernicke-Korsakoff syndrome.
  - 500 mg 8 hourly, diluted in 100ml normal saline or 5% glucose infused over 30 minutes for 3 days.
  - Followed by 250 mg 8 hourly.

- Thiamine: oral
  - 100 mg daily once stable.

Benzodiazepines:

- Diazepam: slow IV: 10 mg (Not IM due to erratic absorption).
  - Repeat dose after 5–10 minutes if required.
  - If this dose is not sufficient, use 10 mg every 5–10 minutes for another 1–2 doses.
  - If patient is not yet sedated, continue with doses of 20 mg.
  - Usual initial dose is 10–20 mg, but up to 60 mg is occasionally required.

Where intravenous access is not possible:

- Clonazepam: IM: 1 – 2 mg as a single dose.
  - If no response, repeat dose after 60 minutes.
  - Maximum daily dose: 10 mg.

OR

- Lorazepam: IM: 1 – 4 mg every 30–60 minutes until the patient is sedated.
  - Repeat doses hourly to maintain mild sedation.
  - Maximum daily dose: 6 mg.

Once patient is sedated, i.e. light somnolence; maintain mild sedation with:

- Diazepam, oral, 5–20 mg 2–6 hourly.

Severe agitation and restlessness:

- Haloperidol, IV/IM, 0.5 – 5 mg.
  - Repeat after 4–8 hours as required to a maximum of 10 mg daily.
  - Once patient has responded and is able to take oral medication: Haloperidol, oral, 0.5 – 5 mg 6–8 hourly.

Note: haloperidol, may reduce the seizure threshold. Consider only for severe agitation and restlessness and give in combination with one of the sedative-hypnotic agents above.

For children with hyperactive delirium:

» Medication may be considered to reduce symptoms such as anxiety, agitation, hallucinations and disturbed sleep. Pharmacokinetics in children is different from adults. Before starting pharmacological treatment, the risk of side effects and interactions with other medications and the route of administration have to be considered and weighed against the potential benefits of treatment.

- Diazepam, IV:
  - 0.2 mg/kg, very slowly over 3 minutes.
  - This may be repeated over 24 hours to a maximum of 5mg for < 5 years and 10mg for > 5 years.
  - The IV solution can be given rectally if IV route is inaccessible. Maximum dose over 24 hours of 5 mg for < 3 years and 10mg for > 3 years.

- Haloperidol, IV for hyperactive paediatric delirium:
  Age: 0 – 1 year (weight: 3.5 – 10 kg)
  - Maximum loading dose (IV): 0.05 mg in 30 minutes.
  - Maintenance dose (IV): 0.01-0.05 mg/kg/day, divided into 2-4 times daily.

  Age: 1 – 3 years (weight: 10 – 15 kg)
  - Maximum loading dose (IV): 0.15 mg in 30 minutes
  - Maintenance dose (IV): 0.025 mg/kg/day divided into 2-4 times daily

  Age: 3 – 18 years (weight: > 15 kg)
  - Maximum loading dose (IV): 0.3-0.5 mg in 30 minutes
  - Maintenance dose (IV): 0.05 mg/kg/day divided into 2-4 times daily
  - Maximum dose (IV): adolescents aged 16 years or older: 5 mg per day divided into 2-4 doses

Oral therapy

Oral doses of haloperidol and risperidone are the same for hyperactive paediatric delirium.

- Risperidone/haloperidol, oral:
  Weight: < 45 kg
  - Loading dose: 0.02 mg/kg.
  - Maintenance dose: 0.01-0.08 mg/kg/day divided into 2 to 4 doses.
  - Maximum dose: 4 mg/day divided into 2 to 4 doses.

  Weight: > 45 kg
  - Loading dose: 0.5-1 mg.
  - Maximum 2 mg/day divided into 2 to 4 doses.
  - Maintenance dose: 0.01-0.08 mg/kg/day divided into 2 to 4 doses.
  - Maximum dose: 6 mg/day divided into 2 to 4 doses.
  - Dosages > 6 mg have not been studied.

  - Extrapyramidal symptoms are seen frequently, particularly if antipsychotics are increased rapidly. Start low and go slow is an important principle. It can take 24 to 48 hours before an adequate response is achieved. Recognizing and treating adverse effects is important.
  - Treatment consists in reducing the dose of antipsychotic and administration of an anticholinergic medication such as biperiden (50 mcg/kg IV over 15 minutes).
  - In adult patients lengthening of the QTc interval has been reported with the possibility of Torsade's de Pointes. This has not been reported in children. An ECG is required before starting treatment with haloperidol.
  - Risperidone has fewer adverse effects than haloperidol and is thus the treatment of choice when symptoms are not extreme and oral administration is possible.
  - When no benefit is obtained with one medication, a switch to the other should be considered.

- A paediatric delirium rating scale should be used at least three times daily to score delirium when medication is started and for as long as the patient receives medication.
- It is not known for how long treatment should continue. Experts advice to continue treatment at least until symptoms have disappeared and until risk factors that possibly led to the delirium have lessened. Medication should be weaned gradually, over a few days.

REFERRAL

» Refer all children and adolescents with suspected alcohol withdrawal delirium immediately once stabilised.

14.13.3.3 OPIOID WITHDRAWAL

F11.23

DESCRIPTION

The illicit use of prescription medication and opioids in children and adolescents has risen significantly. Behavioural manifestations of withdrawal include anxiety, agitation, insomnia, and tremors. Physiological changes linked to withdrawal include increased muscle tone, nausea, vomiting, diarrhoea, decreased appetite, tachycardia, fever, sweating, and hypertension.

Most patients who take an opioid for less than a week do not experience withdrawal and can have their medication discontinued quickly.

However, a prevention approach is preferred for those exposed for longer than 14 days. These children will usually need to be weaned, by gradually decreasing the opioid dose with time.

The only validated tool to assess withdrawal symptoms in children is the Sophia Observation Withdrawal Symptoms Scale.

MEDICATION TREATMENT

Mild withdrawal may be managed as an outpatient.

Symptomatic treatment:

- Diazepam: oral
  - 6 – 14 years: 2 – 10 mg daily in 2–3 divided doses.
  - > 14 years up to 20 mg daily in 2–3 divided doses.
  - Wean dose from 8 hourly, to 12 hourly, to daily every 3-5 days.

For stomach cramps:

- Hyoscine butyl bromide: oral
  - 1 – 3 years: 5 – 10 mg 8 hourly.
  - 3 – 6 years: 10 mg 8 hourly.
  - 6 – 18 years: 10 – 20 mg 8 hourly.

For diarrhoea:

- Loperamide: oral
  - Over 2 years: initially 1mg/12.5kg body mass. Followed by 0.5 mg/12.5kg after each loose stool. Alternatively, 0.08-0.24 mg/kg/day in 2 - 3 divided doses.
  - 12 – 18 years: initially 4 mg. Followed by 2 mg after each loose stool. Maximum dose of 6mg in 24 hours.

The weaning protocol should take into account the length of opioid exposure and total daily opioid dose. The generally approach is to transition to a longer-acting opioid formulation, such as extended-release morphine. Weaning is usually accomplished by steps of a 10% to 20% decrease in the original dose every 24 to 48 hours.

- Morphine:
  - Oral: 0.05 mg/kg/dose 3 hourly.
  - IV: 0.02 mg/kg/dose 3 hourly.

  Weaning after 48 hours:
  - Oral: 0.01 mg/kg/dose 3 hourly.
  - IV: 0.005 mg/kg/dose 3 hourly.

For CNS disturbances (e.g. seizures):

- Phenobarbitone: oral
  - 5 mg/kg/dose 12 hourly or daily.

  OR
- Phenytoin: oral
  - 5 mg/kg/day in 2-3 divided doses.
  - Maximum dose: 300mg daily.
  - Maintenance dose: 5-8 mg/kg/day.

Patients with moderate to severe withdrawal should be admitted.
Substitution treatment is reserved for a specialist rehabilitation centre.

14.13.3.4 STIMULANT/METHAQUALONE (MANDRAX)/ CANNABIS WITHDRAWAL

F14.23; F15.23

GENERAL AND SUPPORTIVE MEASURES

Patients do not usually require admission but assess for depression and suicide risk.

MEDICATION TREATMENT

No substitution medication available for detoxification.

For symptomatic treatment of anxiety, irritability and insomnia:

- Diazepam: oral
  - o 6 – 14 years: 2 – 10 mg daily in 2–3 divided doses.
  - o > 14 years up to 20 mg daily in 2–3 divided doses.
  - o Wean dose from 8 hourly, to 12 hourly, to daily every 3-5 days.

14.13.3.5 BENZODIAZEPINE WITHDRAWAL

F13.239; F13.232

GENERAL AND SUPPORTIVE MEASURES

Psycho-education about dependence including withdrawal and tolerance within a close therapeutic relationship will assist with compliance. Encourage the patient and caregivers not to seek medication from other doctors and negotiate each reduction with the patient and caregivers. Withdrawal from benzodiazepines takes time. The patient will require regular monitoring and motivation.

MEDICATION TREATMENT

Replace short-acting benzodiazepines with an equivalent long acting benzodiazepine (diazepam) dose. Patients may present with medicines that are unavailable in the public sector.

Approximate equivalent doses to diazepam 5 mg are:

- lorazepam 1 mg
- alprazolam 0.5 mg
- bromazepam 1.5 mg
- flunitrazepam 0.5 mg
- nitrazepam 5 mg
- oxazepam 15 mg
- temazepam 10 mg
- zopiclone 7.5 mg
- zolpidem 10 mg

Decrease the dose of diazepam every 2 weeks by 2.5 mg. If symptoms reappear increase the dose a little and reduce more slowly.

MEDICATION TREATMENT OF COMORBID PSYCHIATRIC CONDITIONS

» Treat according to the primary psychiatric condition, as per treatment guidelines. Refer to section 14.1: sedation of acutely disturbed child or adolescent; section 14.4: mood disorders; and section 14.9: psychosis.

» Beware of adverse interactions between illicit drugs and psychotropic medication i.e. drug levels of both illicit drugs and psychotropic medications are altered.

REFERRAL

» All for psychotherapeutic interventions or drug rehabilitation.
» Outpatient treatment: refer to SANCA (South African National Council on Alcoholism and Drug Dependence.

Tel: 011 8923829 or toll free: 0861472622.

» In-patient treatment: refer for in-patient drug rehabilitation.
» Patients with severe and persistent behavioural disturbance, psychotic or manic symptoms to an in-patient child and adolescent psychiatric facility, for ongoing containment and management of psychiatric symptoms.

14.14 BEHAVIOURAL PROBLEMS ASSOCIATED WITH INTELLECTUAL DISABILITY

F81.9

DESCRIPTION

Co-occurring psychiatric, neurodevelopmental, medical and physical conditions are frequent, some with rates 3-4 times higher than the general population. The most common co-occurring psychiatric and neurodevelopmental disorders are ADHD, bipolar and depressive disorders, anxiety disorders, ASD, stereotypic movement disorder with/without self-injurious behaviour and impulse-control disorders. Severe intellectual disability may present with aggression including harm to others and property destruction. Inappropriate sexual behaviour may also occur. Epilepsy is associated with increased rates of ADHD, behavioural dysregulation and psychosis.

DIAGNOSTIC CRITERIA

Diagnostic criteria for psychiatric disorders in children with intellectual disability are the same as those for the general paediatric population. However, symptom expression may vary with developmental stage or level of intellectual functioning.

GENERAL AND SUPPORTIVE MEASURES

» Exclude medical conditions in children presenting with behavioural disturbances, particularly in children who are not able to communicate symptoms verbally (e.g. seizures, dental caries, covert infections, poisoning, foreign bodies, space occupying brain lesions and drug side effects).
» Exclude emotional, physical or sexual abuse in a child presenting with persistent adverse behaviour and emotional distress (especially in non-verbal children).
» Parental guidance is an important part of the management of children presenting with behavioural problems (psycho-education, behaviour management).

» Behaviour modification principles form the basis of psychosocial intervention.

MEDICATION TREATMENT

» Psychotropic medication treatment should only occur as part of a multidisciplinary diagnostic and therapeutic intervention.
» Treat according to the primary psychiatric condition, as per treatment guidelines.

For disruptive behaviour disorders in intellectual disability:

- Risperidone is registered for children with developmental disorders > 5 years old:
  - Dose 5 – 12 years: 0.01 mg/kg/day.
  - Maintenance 0.02 - 0.04 mg/kg/day.
- Do baseline blood tests and ECGs, particularly in children with underlying medical conditions.
- Start with the lowest doses possible.
- Increase dosages cautiously as children with intellectual disability may be more susceptible to adverse effects such as extrapyramidal side effects (EPSEs), neuroleptic malignant syndrome (NMS) or the disinhibiting effects of benzodiazepines.

REFERRAL

» Children who fail to respond to initial treatments should be referred to a paediatrician for further assessment and management.
» Children presenting with severe aggression, inappropriate sexual behaviour or significant self-injurious behaviour should be referred for a diagnostic assessment or admission to an intellectual disability service (if such a service exists in the region) or to a tertiary level child psychiatry service.
» Children presenting with psychosis or a manic episode should undergo medical work-up and be referred to a paediatrician or child psychiatrist as appropriate.
» Refer to a social worker or child protection services if abuse is suspected.

CHAPTER 15

RESPIRATORY SYSTEM

ACUTE LOWER RESPIRATORY TRACT INFECTIONS IN YOUNG CHILDREN

The term acute lower respiratory tract infection is used here to embrace acute viral bronchiolitis as well as acute viral and bacterial pneumonia. Antibiotics are indicated in the empiric treatment of pneumonia and are not usually indicated for the treatment of bronchiolitis. However, the decision to prescribe or omit antibiotics is influenced by several factors:

1. The ability to clinically distinguish acute viral bronchiolitis from pneumonia.
2. Laboratory and radiological findings cannot provide confident differentiation of viral bronchiolitis from bacterial pneumonia.
3. The knowledge that a variable proportion of children diagnosed with bronchiolitis will have bacterial co-infection. This will be influenced by the local epidemiology of acute lower respiratory tract infections.
4. The ability of the caregiver to monitor the child.
5. The ease with which healthcare may be accessed in the event of clinical deterioration.

The sections below provide evidence-based recommendations for the treatment of bronchiolitis and pneumonia. Much of this evidence has been generated in developed countries.

If it is not possible to confidently diagnose acute viral bronchiolitis clinically or if there are concerns about bacterial co-infection it is recommended that the WHO treatment guidelines should be followed and that antibiotics should be given to young children with an acute onset of cough associated with wheeze, tachypnoea and chest indrawing as described in the section on pneumonia.

Nebulize all wheezing children with a β2 agonist and if a good clinical response is noted and wheezing is recurrent, consider asthma.

15.1 COUGH WITH PREDOMINANT FEVER AND TACHYPNOEA

15.1.1 PNEUMONIA

J18.9

DESCRIPTION

Infection of the lung parenchyma characterized by inflammation and consolidation of lung tissue. Management depends on the clinical assessment and classification of severity.

Empiric antibiotics are indicated in all cases of pneumonia, as delay in treatment is associated with poor outcome. Antibiotic choice is based on an assessment of severity and likely aetiology.

Common bacterial causes of pneumonia include:
Neonates:
» Group B beta-haemolytic Streptococci.
» *Klebsiella spp.*
» *E. coli.*
» Chlamydia.
» *S. aureus.*

Children:
» *S. pneumoniae.*
» *H. influenzae.*
» *S. aureus.*
» *M. catarrhalis.*
» *M. pneumoniae.*

Common viral causes in infancy and early childhood include:
» influenza virus,
» measles virus,
» respiratory syncytial virus,
» para-influenza virus,
» cytomegalovirus,
» adenovirus.

Measles is recognized by its other systemic manifestations. Staphylococcal pneumonia should be suspected if there is empyema, pulmonary cavitation or pneumatocoele formation or the presence of extrapulmonary pyogenic infections. Other than these two instances it is not usually possible to clinically determine the underlying pathogen.

Complications of pneumonia include:
» respiratory failure,
» empyema,
» pleuritis,
» pleural effusion,
» pneumothorax,
» bronchiectasis.

DIAGNOSTIC CRITERIA

» Tachypnoea: age dependent:

Age	Respiratory rate
< 60 days	> 60/minute
2–12 months	> 50/minute
1–5 years	> 40/minute

Pneumonia (non-severe)

» Cough and fast breathing (tachypnoea).

Severe pneumonia

Above plus one of the following:

» lower chest wall in-drawing;
» nasal flaring;
» grunting.

Very severe pneumonia

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);
» < 60 days old.

Note:

All infants aged up to 60 days with pneumonia must be considered as having very severe disease.

Investigations

» Perform a chest X-ray when there is failure to respond to therapy, in children with severe pneumonia in whom complications or tuberculosis are suspected, and in children with very severe pneumonia. Perform a lateral and AP or PA view if possible. A chest X-ray is not essential in all cases with severe pneumonia and is unnecessary in cases with non-severe pneumonia.
» TB work up if tuberculosis suspected (e.g. TB contact) see Chapter 10: Tuberculosis, section 10.2 Tuberculosis, Pulmonary.
» In children with very severe pneumonia perform blood culture, preferably before initiating antibiotics.

GENERAL AND SUPPORTIVE MEASURES

» Bed rest.
» Clear nasal and oral passages of thick secretions.
» Monitor:
  > respiratory rate,
  > heart rate,
  > SaO_2,
  > temperature,
  > hydration,
  > blood pressu re,
  > hypercapnia and/or hypoxia are indications for ventilatory support.

» Maintain nutrition: Continue breast and oral feeds.
  > Consider small frequent feeds by oro/nasogastric tube or IV fluids if respiratory rate > 60/minutes or enteral feeds are not tolerated.

MEDICINE TREATMENT

- Oxygen, humidified, by nasal prongs is preferred.
  - Continue oxygen until respiratory distress and hypoxia resolves (a saturation of ≥ 92% off oxygen).

To relieve discomfort:
- Paracetamol, oral/NGT, 15 mg/kg, 6 hourly as required.

If significant degree of wheezing is present:
- Salbutamol, inhalation, 100–200 mcg, as required using a metered-dose inhaler with a spacer device or a nebulizer until symptoms are relieved.

Empiric antibiotic therapy
Choice of antibiotic depends on the severity of the condition, the age of the child and the presence of co-morbidity.
Reconsider choice of antibiotic when the results of cultures become available or the child does not improve.

Pneumonia (non-severe):
- Amoxicillin, oral, 45 mg/kg/dose, 12 hourly for 5 days.

Severe pneumonia:
- Amoxicillin, oral, 45 mg/kg/dose, 12 hourly for 5 days.

If child is unable to swallow or is vomiting:
- Ampicilllin, IV, 25 mg/kg/dose, 6 hourly (change to oral as soon as able).

Very severe pneumonia
Assume child is HIV infected until proven otherwise.
See Chapter 9: Human Immunodeficiency Virus Infections.
- Ampicillin, IV, 50 mg/kg/dose 6 hourly.

PLUS
- Gentamicin, IV, 6 mg/kg as a single daily dose for 5–10 days.

Switch to oral as soon as there is a response:
- Amoxicillin/clavulanate, oral, 45 mg/kg/dose of amoxicillin component 12 hourly to complete 10 days total.

Measles Pneumonia
Treat as severe pneumonia, and refer to Chapter 8: Infectious Diseases, Section 8.10 Measles.

MODIFICATION OF ANTIMICROBIAL THERAPY

If there is a poor response to first line empiric therapy and in the absence of positive cultures consider the possibility of infection with Staph aureus, penicillin resistant pneumococcus or mycoplasma. Think of pertussis and evaluate for tuberculosis. If nosocomial pneumonia suspected, refer to section 15.1.1.4 Nosocomial Pneumonia. Re-evaluate for possible co-morbidity (foreign body, immunodeficiency, heart disease).
If staphylococcal pneumonia is a consideration at presentation immediately start treatment with intravenous cloxacillin.
If mycoplasma is considered do either a bedside test for cold agglutinins or send blood for mycoplasma IgM and IgG levels. Both tests lack sensitivity.

Change to:

- Ceftriaxone, IV, 80mg/kg/dose daily for 10 days.

PLUS

- Cloxacillin, IV, 50 mg/kg/dose every 6 hours.

If there is evidence of good clinical response, change to:

- Flucloxacillin, oral, 12.5–25 mg/kg/dose 6 hourly to complete at least 21 days of treatment.

OR *(if flucloxacillin is unavailable)*

- Cephalexin, oral, 6.25–12.5 mg/kg/dose 6 hourly.

MRSA pneumonia:

- Vancomycin, IV, 15 mg/kg/dose 6 hourly infused over 1 hour for 14 days.

Mycoplasma pneumonia:

Mild disease

- Macrolide, e.g.:
- Azithromycin, PO, 10 mg/kg/dose daily for 1 dose then 5 mg/kg/dose daily for 4 days.

Severe atypical pneumonia

- Macrolide, e.g.:
- Azithromycin, IV, 10 mg/kg/dose daily for 2 days.

THEN

- Azithromycin, oral, 5 mg/kg/dose daily for 3 days.

SURGICAL TREATMENT

» To relieve a tension pneumothorax, do needle aspiration followed by intercostal drain placement.

» Small or asymptomatic pneumothoraces in infants and children (excluding neonates) usually do not require treatment other than close observation, but identify and treat the underlying cause for the pneumothorax.

» For symptomatic pleural effusion, do needle aspiration; if empyema, insert large bore chest tube drainage. See Section 15.2.1: Effusion and Empyema.

REFERRAL

» Patients not improving within 48 hours of initiating second line therapy should be discussed with a paediatrician.
» For possible ICU care if not maintaining saturations in normal range on oxygen or if clinical features of fatigue.

15.1.1.1 PNEUMONIA, VIRAL INFECTION

J12.9

DESCRIPTION

The commonest cause of pneumonia in children is viral infection. Respiratory syncytial virus, adenovirus, cytomegalovirus, influenza, parainfluenza, adenovirus, herpes, human metapneumovirus and measles are the common viruses responsible for infections of the respiratory tract, Children present with fever, cough, rhinorrhea and chest in-drawing. Scattered fine crackles may also occur.

DIAGNOSTIC CRITERIA

» As for pneumonia, see Section 15.1.1 above,
» It is not possible to discriminate viral from bacterial pneumonia on clinical or radiological grounds,
» Chest X-ray is not routinely indicated.

GENERAL AND SUPPORTIVE MEASURES

» Maintain nutrition.
» Maintain hydration.

MEDICINE TREATMENT

Only if saturation < 92%:

- Oxygen, humidified, 1–2 L/min via nasal prongs or nasal cannula.

To relieve discomfort:

- Paracetamol, oral, 15 mg/kg/dose 6 hourly.

There is no role for routine antiviral therapy.

Empiric antibiotic therapy

Monitor for secondary bacterial infection. In most instances children will be treated with empiric antibiotics for pneumonia as in the section above.

REFERRAL

» Patients not improving within 48 hours of admission should be discussed with a paediatrician.
» For possible ICU care if not maintaining saturations in normal range on oxygen or if clinical features of fatigue.

15.1.1.2 PNEUMONIA DUE TO ANAEROBIC INFECTION

DESCRIPTION

Often seen in comatose patients with aspiration syndromes.

MEDICINE TREATMENT

Empiric antibiotic therapy for at least 7 days.

- Ampicillin, IV, 25 mg/kg/dose, 6 hourly.

PLUS

- Gentamicin, IV, 6 mg/kg/day as a single daily dose.

PLUS

- Metronidazole, IV, 7.5 mg/kg/dose, 8 hourly.

Change antibiotics according to culture and sensitivity results.

15.1.1.3 PNEUMONIA IN HIV EXPOSED OR INFECTED CHILDREN

DESCRIPTION

In additional to common bacterial, fungal and viral pathogens causing pneumonia, opportunistic micro-organisms in a 'polymicrobial mix' are common in these children. Many of these children may fail to respond to the standard antibiotic treatment for pneumonia. Micro-organisms commonly involved are:

» *P. jiroveci* (PJP),
» Mycobacteria, e.g. *M. tuberculosis*
» *S. aureus,*
» *S. pneumonia,*
» cytomegalovirus,
» Non-typhoidal Sal monella,
» *Klebsiella pneumo nia,*
» Candida.

S. pneumonia, S. aureus and gram negative bacteria e.g. *Klebsiella pneumoniae* and Non-Typhoid Salmonella cause a significant proportion of HIV-related pneumonia in early childhood.

P. jiroveci (PJP)

» PJP is a common fungal infection of the lung in infants from 2–6 months.
» Presents as an acute onset of respiratory distress with minimal/absent chest signs in a child who is HIV exposed or infected.
» Hypoxaemia and cyanosis are common features in severe disease.

» Chest X-ray shows a range of abnormalities including bilateral perihilar interstitial changes.

Perinatal acquired cytomegalovirus associated pneumonia in HIV infected infants

» Presents as an interstitial pneumonitis with acute hypoxic respiratory failure.
» It may present as a multisystem sepsis-like syndrome, with hepatitis, neutropenia, pneumonitis, colitis and thrombocytopaenia.
» Often occurs in children who are severely immunosuppressed (CDC Immune category 3) and carries a significant mortality.
» The risk of CMV transmission through breastfeeding is low and therefore not a contraindication to breast feeding,
» CMV co-infection occurs commonly as polymicrobial infection with PJP and bacteria.

Tuberculosis in HIV infected children

» Occurs in children at all ages.
» The diagnosis is difficult to confirm.
» A Mantoux test of ≥ 5 mm induration is indicative of tuberculosis infection.

Fungal pneumonia

» In addition to PCP described above various fungi, most commonly Candida and Aspergillus may cause pneumonia in immunocompromised children.
» Confirmation of the diagnosis relies on microscopy and culture.
» Serum markers may be useful in some cases.

HIV infected children with chronic lung disease

» Often presents with lymphoid interstitial pneumonitis and bronchiectasis.
» Secondary infection with bacteria similar to those seen in acute pneumonia are commonly isolated from these children.

DIAGNOSTIC CRITERIA

Investigations

» Chest X-ray.
» Screen for HIV infection:
  > In children < 18 months utilising HIV PCR testing.
  > In children > 18 months HIV ELISA (screening and confirmatory).
» Investigate for PCP:
  > Immunofluorescence and silver methenamine staining on induced sputum sample.
» Screen children with very severe pneumonia immediately for CMV using CMV viral load, where available.
  > A viral load of > 10 000 copies/mL suggests CMV disease: treat.
  > A viral load below 10 000 copies/mL is regarded as CMV infection: no therapy recommended.

» Fungal infection:
  > Request MCS for fungi (blood or sputum).
» Tuberculosis:
  > Refer to Chapter 10: Tuberculosis.

GENERAL AND SUPPORTIVE MEASURES

» Avoid exposure to infectious agents.
» Adequate nutrition.
» Monitor oxygen saturations.
» Restrict fluid intake.

MEDICINE TREATMENT

If saturation < 92%:

- Oxygen, via nasal prongs or nasal cannula.

Treat for very severe bacterial pneumonia. See section 15.1.1: Pneumonia.

In all infants between 2 and 6 months with pneumonia consider PJP.

ADD

- Co-trimoxazole, IV/oral, 5 mg trimethroprim/25 mg sulphamethoxazole /kg/dose, 6 hourly for 21 days.
  - Continue co-trimoxazole prophylaxis at the end of this treatment period until CD4 count recovers to normal.

Children who remain hypoxic on oxygen with proven or highly suspected PJP:

- Prednisone, oral, 1–2 mg, daily for 7 days.
  - Taper dose over the next 7 days.

For confirmed CMV disease:

- Ganciclovir, IV, 5 mg/kg 12 hourly until oral is tolerated;

THEN

- Valganciclovir, oral, 16 mg/kg 12 hourly to complete the first 21 days of therapy;

THEN

- Valganciclovir, oral, 16 mg/kg daily to complete 42 days of therapy.

For suspected or confirmed fungal pneumonia (other than PJP):

- Amphotericin B deoxycolate, IV, 0.6–1.0 mg/kg as a single daily dose infused over 4 hours for at least 14 days.

Prehydration before administering amphotericin to prevent renal impairment:

- Sodium chloride 0.9%, IV, 20 mL/kg **plus** potassium chloride, 20 mmol/L infused over 2–4 hours.

OR

- Fluconazole, IV/oral, 10 mg/kg as a single daily dose for at least 14 days.

REFERRAL

» Not responding to medicine therapy.
» In cases of CMV disease for follow up for hearing deficit.

15.1.1.4 PNEUMONIA, NOSOCOMIAL

J18.9

DESCRIPTION

Children acquiring pneumonia 48–72 hours after hospitalisation.
The common pathogens are:

» ß-lactamase producing pathogens,
» extended spectrum ß-lactamase producing *Klebsiella pneumoniae*,
» *P. aeruginosa*,
» multidrug resistant Acinetobacter species,
» methicillin resistant *S. aureus*,
» respiratory viruses e.g. respiratory syncytial virus, adenovirus, influenza, herpes, measles, parainfluenza.

GENERAL AND SUPPORTIVE MEASURES

» Sepsis screen including blood cultures.

MEDICINE TREATMENT

Empirical antibiotic therapy

» Broad spectrum antibiotics according to local susceptibility patterns.
» Manage children with underlying predisposing factors according to the susceptibility of the most likely pathogen.
» Review antibiotic choice once culture and sensitivity results become available.

For bacterial infections

Empiric therapy in the absence of local data:

- Piperacillin/tazobactam, IV, 100 mg/kg/dose 8 hourly.

PLUS

- Amikacin, IV, 15 mg/kg/dose, daily.

Adjust therapy according to sensitivities.

For methicillin resistant *S. aureus* pneumonia:

- Vancomycin, IV, 15 mg/kg/dose 6 hourly infused over 1 hour.

15.1.2 BRONCHIOLITIS

J21.9

DESCRIPTION

Bronchiolitis is an acute viral infection of the small airways of the lower respiratory tract affecting children between 4 months and 2 years of age.
The most common pathogen is the respiratory syncytial virus.
Recurrent episodes of wheeze associated with bronchiolitis may occur, and some of these children may develop asthma.

Risk factors for severe bronchiolitis:

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

DIAGNOSTIC CRITERIA

» 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:

Age	Respiratory rate
< 60 days	> 60/minute
2–12 months	> 50/minute
1–5 years	> 40/minute

Bronchiolitis (mild)

» Cough and fast breathing (tachypnoea).

Bronchiolitis (moderate)

Above plus one of the following:

» lower chest wall in-drawing;
» nasal flaring;
» grunting.

Bronchiolitis (severe)

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).

Mild cases, without risk factors are managed as outpatients. Provide counselling to the caregiver and devise a plan for the eventuality that the child deteriorates or does not improve. Mild cases with risk factors, moderate and severe cases require admission.

GENERAL AND SUPPORTIVE MEASURES

» Isolate from other infants, if possible.
» Patients with signs of moderate or severe disease or associated complications or underlying cardiorespiratory disorders should be hospitalised for monitoring of:
  > breathing pattern (apnoea monitoring if < 3 months of age),
  > heart rate and respiratory rate,
  > temperature,
  > SaO_2,
  > hydration and nutrition,
  > IV maintenance fluid if oral/nasogastric feeds/fluids are not tolerated. Avoid overhydration.

MEDICINE TREATMENT

For all hospitalised patients

Only if saturation < 92%:

- Oxygen, humidified, 1–2 L/min via nasal prongs or nasal cannula.
  - o Ensure clear nasal passages and correctly position the nasal prongs.

In children with recurrent wheezing, nebulise with a β2 agonist, if there is a response consider asthma, see section 15.4 Conditions with predominant wheeze.

Antibiotic therapy

Routine antibiotic therapy is not indicated. Only use antibiotics if there is concern about bacterial co-infection.

For bacterial co-infection:

- Amoxicillin, oral, 45 mg/kg/dose, 12 hourly for 5 days.

REFERRAL

» Discuss all severe cases with a paediatrician.

15.2 PLEURAL DISEASE

15.2.1 EFFUSION AND EMPYEMA

J90

DESCRIPTION

A pleural effusion is an accumulation of an exudative or transudative fluid between the visceral and parietal pleura. Common causes for exudates are infections, inflammation and malignancy. Common causes of a transudate are cardiac failure, renal failure and hepatic failure. A straw-coloured or haemorrhagic effusion is indicative of tuberculosis. A cloudy or frankly purulent fluid indicates an empyema.

DIAGNOSTIC CRITERIA

» Decreased breath sounds and stony dull on percussion.
» Pleural rub early in disease.
» Chest X-ray shows uniform opacities in a lamellar distribution at the costophrenic angles.

GENERAL AND SUPPORTIVE MEASURES

» Treat small effusions conservatively.
» Drain other effusions by either chest drain (preferably valved) or needle aspiration.
» Send samples for protein, glucose, cytology, microscopy and culture. If pus is identified insert chest drain.
» Transudates do not require drainage unless respiration is significantly compromised by the size of the effusion.
» More aggressive surgical procedures such as open drainage or decortication are rarely indicated in children.

MEDICINE TREATMENT

For purulent effusion:

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

PLUS

- Ampicillin, IV, 25mg/kg/dose 6 hourly for 10 days.

If there is evidence of good clinical response, change to:

- Flucloxacillin, oral, 12.5–25 mg/kg/dose, 6 hourly for a total of 21 days.

OR *(if flucloxacillin is unavailable)*

- Cephalexin, oral, 6.25–12.5 mg/kg/dose 6 hourly.

If pathogens are cultured in blood from sanctuary sites e.g. bone, heart valves, etc. treat according to sensitivity for prolonged period of 21 - 42 days.

For straw-coloured or haemorrhagic effusion:

» Start antituberculosis therapy.

REFERRAL

If no response, to any of the above therapy.

15.3 CHRONIC LUNG INFECTIONS

15.3.1 BRONCHIECTASIS

J47

DESCRIPTION

Irreversible dilatation of the subsegmental airways, inflammatory destruction of bronchial and peribronchial tissue, and accumulation of exudative material in dependent bronchi that occurs as a result of recurrent bacterial infections and aspiration pneumonia. There is bronchial luminal obstruction; ciliary dyskinesia; thick, tenacious secretions and lung tissue damage.

Complications include pulmonary hypertension, cor pulmonale and respiratory failure. Predisposing conditions include HIV, TB, cystic fibrosis, primary ciliary dyskinesia and primary immunodeficiency syndromes.

DIAGNOSTIC CRITERIA

» Chronic cough, usually with mucopurulent sputum and occasional haemoptysis.
» Clubbing and halitosis.
» Recurrent and persistent lower respiratory tract infections.
» A bout of coughing on physical activity or change in posture, particularly while reclining.
» Fever, malaise, anorexia, poor weight gain.
» Respiratory failure, cyanosis
» Pulmonary hypertension and cor pulmonale.
» Chest X-ray showing cystic dilatation and tram tracking.
» If diagnosis is uncertain or where localised disease on chest X-ray is suspected, perform high-resolution computed tomography. Features include cystic dilatation, signet ring sign and tram tracking.

GENERAL AND SUPPORTIVE MEASURES

» Identify and treat the underlying disorder or bacterial source.
» Clear secretions effectively with postural drainage and physiotherapy.
» Eliminate all foci of infection.
» Nutritional support.

Method of sputum induction

Precaution: If undertaking procedure in acutely sick child with respiratory compromise, be prepared to manage acute bronchospasm as this may be an associated adverse effect.

» Nebulise with sodium chloride 0.9% or sodium chloride 3% (hypertonic saline) to aid sputum expectoration.
Mix 3 mL of 5% sodium chloride with 2 mL water to make 3% solution.

In the acutely sick child:
Nebulise with a bronchodilator:
- Salbutamol, solution, 0.15–0.3 mg/kg/dose in 2–4mL of sodium chloride 3% delivered at a flow of 5 L/minute with oxygen for 20 minutes.

» Perform physiotherapy.
» Encourage patient to cough up sputum or if infant or small child obtain nasopharyngeal aspirate post physiotherapy.
» Send sample for culture and cytology as indicated.

SURGICAL TREATMENT

Consider in localised severe disease or progressive disease despite adequate medical treatment.

MEDICINE TREATMENT

Acute lung infections: worsening cough accompanied by increased dyspnoea or tachypnoea and/or signs of sepsis.
Empiric antibiotic therapy for acute lung infections:

- Ampicillin, IV, 25 mg/kg/dose, 6 hourly.

PLUS

- Gentamicin, IV, 6 mg/kg once daily.

Change antibiotics according to culture and sensitivity results.

If poor response and no culture to guide antibiotic choice, consider infection due to *S. aureus*, TB or fungal infection.

If there is evidence of good clinical response, change to:
- Amoxicillin/clavulanic acid, oral, 45 mg/kg/dose of amoxicillin component 12 hourly.
  - Total antibiotic duration of 14 days.

Note: These antibiotic regimens **do not** apply to children with cystic fibrosis, seek specialist advice.

In the acute phase if wheeze is present:
- Salbutamol solution, 5 mg/mL, nebulise 4 hourly.
  - 5 mg salbutamol in 2–4 mL sodium chloride 0.9%.
- Annual influenza vaccination.
- Pneumococcal vaccine (conjugated), 2 additional doses 8 weeks apart.

REFERRAL

» All patients for confirmation of the diagnosis, assessment of severity and evaluation of underlying condition.
» Poor response to therapy, increased frequency of exacerbations, poor lung function.
» For early surgical intervention of localised disease.

15.3.2 LUNG ABSCESS

J85

DESCRIPTION

A suppurative process that results from destruction of the pulmonary parenchyma and formation of a cavity. The cavity may be single, e.g. after aspiration or multiple, e.g. staphylococcal disease and cystic fibrosis.
Lung abscess may follow pneumonia caused by:

- *S. aureus,*
- anaerobic organisms,
- *H. influenza,*
- *K. pneumoniae,*
- *S pneumoniae,*
- *M. tuberculosis.*

Metastatic lung abscesses due to septicaemia or septic emboli may also occur.

Complications include:

- bronchiectasis,
- rupture into the bronchial tree or pleural cavity or vessels,
- bronchopleural fistula.
- empyema,
- pulmonary osteo-arthropathy,
- brain abscess,

DIAGNOSTIC CRITERIA

- Intermittent or recurrent fever, malaise, weight loss, anorexia and clubbing.
- Productive, purulent cough with halitosis and haemoptysis.
- Amphoric breathing over the cavity may be present.
- Chest X-ray will confirm cavity/cavities with or without an air-fluid level.

GENERAL AND SUPPORTIVE MEASURES

- Identify underlying cause.
- Physiotherapy and postural drainage.
- Correct anaemia.
- Nutritional support.

MEDICINE TREATMENT

Empiric antibiotic therapy for at least 14 days.

- Ampicillin, IV, 25 mg/kg/dose, 6 hourly.

PLUS

- Gentamicin, IV, 6 mg/kg/day as a single daily dose.

PLUS

- Metronidazole, IV, 7.5 mg/kg/dose, 8 hourly.

Change antibiotics according to culture and sensitivity results.
Poor response and no culture to guide antibiotic choice:

ADD

- Cloxacillin, IV, 50 mg/kg/dose, every 6 hours.

If there is evidence of good clinical response, change to:

- Amoxicillin/clavulanic acid, oral, 45 mg/kg/dose of amoxicillin component 12 hourly.

SURGICAL TREATMENT

Consider surgical drainage of abscess and/or resection if medical treatment fails.

REFERRAL

» Complicated lung abscess not responding to therapy.
» Lung abscess where the underlying cause has not been established.

15.4 CONDITIONS WITH PREDOMINANT WHEEZE

15.4.1 ASTHMA ATTACK, ACUTE

J46

DESCRIPTION

Acute exacerbation of wheezing that is unresponsive to bronchodilator therapy that is usually effective in a child who had been previously diagnosed with asthma.

DIAGNOSTIC CRITERIA

Clinical signs include:

» intense wheezing,
» hyperinflation,
» tachypnoea,
» hypoxaemia,
» restlessness,
» difficulty or inability to talk or feed,
» decreased air entry,
» dyspnoea,
» tachycardia,
» anxiety,
» palpable pulsus paradoxus,
» reduced peak flow rate.

The following are danger signs in acute, severe asthma and require referral:

» restlessness,
» disturbance in level of consciousness,
» rising $PaCO_2$,
» silent chest with auscultation,
» PEFR < 60% of predicted value,
» decreasing oxygen saturation < 85%,
» palpable pulsus paradoxus,
» chest pain (air leaks).

Classification of Severity of Acute Asthma Exacerbations

	Mild	Moderate	Severe
Oxygen saturation	> 95%	92–95%	< 92%
PEFR*	70–90%	50–70%	< 50%
Arterial $PaCO_2$	< 35 mmHg	< 40 mmHg	> 40 mmHg
Pulsus paradoxus	< 10 mmHg	10–20 mmHg may be palpable	20–40 mmHg palpable
Wheezing	expiratory	expiratory and inspiratory	breath sounds soft
Respiratory rate	< 40	> 40	> 40
Additional signs		» speaks normally » difficulty with feeding » chest indrawing	» unable to speak » confusion » cyanosis » use of accessory muscles
Management	• Short-acting ß$_2$ agonist, e.g. salbutamol, inhalation **PLUS** • Prednisone, oral	• Oxygen, • Short-acting ß$_2$ agonist, e.g. salbutamol, inhalation • ± ipratropium bromide inhalation • Prednisone, oral	• Oxygen, • Short-acting ß$_2$ agonist, e.g. salbutamol inhalation stat • Ipratropium bromide inhalation, • Hydrocortisone, IV If no response: ± $MgSO_4$, IV bolus stat **OR** ± Salbutamol, IV bolus stat **AND** consider ICU care

* Peak expiratory flow rate (PEFR) – as percentage of predicted value.

GENERAL AND SUPPORTIVE MEASURES

» Admit child to a high care unit, if available.
» Monitor:
  > heart rate,
  > respiratory rate,
  > PEFR,
  > pulse oximetry.
  > blood pressure,
  > acid-base status,
  > blood gases,

» Ensure adequate hydration:
  > Encourage intake of normal maintenance volume of oral fluids, avoid overhydration.
» If unable to drink, give 0.45% sodium chloride/5% dextrose IV. Patients with prolonged severe asthma may become dehydrated as a result of poor intake or vomiting. It is however inadvisable to overhydrate patients with acute asthma: do not exceed the recommended IV fluid volume in children, i.e. 50 mL/kg/24 hours.

Note:
» Physiotherapy, antihistamines, antibiotics and sedation are not beneficial in the acute setting.
» Agitation and restlessness are signs of severe hypoxia.

MEDICINE TREATMENT Mild and moderate asthma Bronchodilator, i.e. short-acting ß$_2$ agonist.

- Salbutamol, inhalation, using a metered-dose inhaler with a spacer device.
  - 200–400 mcg (2–4 puffs) repeated every 20–30 minutes depending on clinical response.

OR

- Salbutamol, solution, 0.15–0.3 mg/kg/dose nebulise at 20 minute intervals for 3 doses.
  - Maximum dose: 5 mg/dose.
  - 5 mg salbutamol in 4 mL sodium chloride 0.9% delivered at a flow of 5 L/minute with oxygen.

PLUS

- Prednisone, oral, 1–2 mg /kg, daily immediately up to a maximum of:
  - 20 mg: Children < 2 years for 5 days.
  - 30 mg: Children 2–5 years for 5 days.
  - 40 mg: Children 6–12 years for 5 days.

Moderate or severe asthma

Step 1:

To maintain arterial oxygen saturation ≥ 95%:

- Oxygen, 100%, at least 4–6 L/minute by facemask **or** 1–2 L/minute by nasal cannula.

PLUS

- Short-acting ß$_2$ agonist:
- Salbutamol, inhalation, using a metered-dose inhaler with a spacer device. Up to 10 puffs (1mg) per administration for severe asthma.
  - 400–600 mcg (4–6 puffs) up to 10 puffs repeated every 20–30 minutes depending on clinical response.

OR

- Salbutamol, solution, 0.15–0.3 mg/kg/dose nebulise at 20 minute intervals for 3 doses.
  - Maximum dose: 5 mg/dose.
  - 5 mg salbutamol in 4 mL sodium chloride 0.9% delivered at a flow of 5 L/minute with oxygen.

PLUS (if severe)

- Ipratropium bromide, solution, 0.25 mg, nebulise immediately.
  - If severe, follow with 0.25 mg every 20–30 minutes for 4 doses over 2 hours.
  - Maintenance dose: 0.25 mg 6 hourly.
  - 0.25mg (2 mL) ipratropium bromide in 2 mL sodium chloride 0.9%.
  - Ipratropium bromide may be mixed with a $ß_2$ agonist.

PLUS

- Prednisone, oral, 1–2 mg /kg, immediately up to a maximum of:
  - 20 mg: children < 2 years for 5 days.
  - 30 mg: children 2–5 years for 5 days.
  - 40 mg: children 6–12 years for 5 days.

Step 2:

Assess response to treatment in step 1 by using the following table:

	Responder	Non-responder
PEFR	improvement >20% OR > 80% (best/predicted)	improvement < 20% OR < 80% (best/predicted)
Respiratory rate	< 40/minute	> 40/minute
Retraction	absent	present
Speech	normal	impaired
Feeding	normal	impaired

Responder: patient who maintains an adequate response for at least 1 hour.
Non-responder: patient who fails to respond adequately to treatment in step 1.

Proceed to step 3.

Step 3:

Responder:

Review current treatment, possible precipitating or aggravating factors and commence:

- Prednisone, oral, 2 mg/kg as a single daily dose for 7 days.

If oral corticosteroids are not available:

- Hydrocortisone, IV, 2 mg/kg/dose, 6 hourly.

PLUS

- Short-acting $ß_2$ agonist:
- Salbutamol, inhalation, 200 mcg (2 puffs) as required using a metered-dose inhaler with a spacer device.

Review maintenance asthma therapy at follow up.

Non-responder:
Intensify treatment as follows:
- Short-acting ß2 agonist:
- Salbutamol, solution, 0.15–0.3 mg/kg/dose nebulise at 20 minute intervals for 3 doses.
  - Maximum dose: 5 mg/dose.
  - 5 mg salbutamol in 4 mL sodium chloride 0.9% delivered at a flow of 5 L/minute with oxygen.

AND
- Ipratropium bromide, solution, 0.25 mg, nebulise immediately.
  - If severe, follow with 0.25 mg every 20–30 minutes for 4 doses over 2 hours.
  - Maintenance dose: 0.25 mg 6 hourly.
  - 0.25mg (2 mL) ipratropium bromide in 2 mL sodium chloride 0.9%.
  - Ipratropium bromide may be mixed with a ß2 agonist.

PLUS
Continue corticosteroid:
- Prednisone, oral, 2 mg/kg as a single daily dose.

OR
- Hydrocortisone, IV, 2 mg/kg/dose 6 hourly.

Failure to respond - consult paediatrician
- Magnesium sulphate, IV bolus, 25–75 mg/kg administered over 20 minutes.

OR
- Salbutamol, IV, 15 mcg/kg as a single dose administered over 10 minutes.

Consider need for intensive care.

Step 4: *(Assess response to treatment in Step 3):*
If non-responsive, admit to intensive care unit for consideration of:
- Magnesium sulphate, IV bolus, 25–75 mg/kg administered over 20 minutes (if not already given).

AND
- Salbutamol, IV.
  - Loading dose: 15 mcg/kg (do not give if stat dose already given).
  - Follow with: 1 mcg/kg/minute.
  - If necessary, increase dose by 1 mcg/kg every 15 minutes.
  - Maximum dose: 5 mcg/kg/minute.
  - Monitor electrolytes and side effects.

No further response
In cases of life threatening asthma in the intensive care unit:
- Aminophylline, IV, 5 mg/kg, loading dose administered over 20–30 minutes. Omit loading dose in children receiving maintenance oral theophylline.
  - Follow with: 1 mg/kg/hour continuous infusion.
  - ECG monitoring.

REFERRAL

» Acute exacerbation not responding to treatment.

15.4.2 ASTHMA, CHRONIC

J45

DESCRIPTION

Asthma is a chronic inflammatory airways disease in which many cells and cellular elements play a role. Susceptible individuals present with recurrent episodes of wheezing, breathlessness, chest tightness and cough particularly in the early morning. There is widespread variable airflow obstruction that is reversible either spontaneously or with treatment. A variety of stimuli, e.g. allergens, viral infections, weather changes, emotional upsets or other irritants precipitate inflammation that is associated with increased bronchial hyper-responsiveness.

DIAGNOSTIC CRITERIA

» Chronic, persistent/recurrent cough and/or wheezing that responds to a bronchodilator.
» Objective evidence of reversible airway obstruction, as measured by > 15% improvement of the peak flow or > 12% improvement in the FEV_1 20 minutes after administration of an inhaled bronchodilator confirms the diagnosis. (FEV_1 = forced expiratory volume in 1 second).
» A family history of atopy, night or exercise-induced coughing and/or wheezing.

Control of asthma

The severity of asthma can vary with time and regular reassessments (at least every 3 months) are necessary.

On treatment chronic asthma is classified as:

» controlled,
» partially controlled, or
» uncontrolled.

The following criteria are used to classify control:

	Controlled	Partially controlled (Any present in any week)	Uncontrolled
Daytime symptoms	None (2 or less/week)	More than twice/week	
Limitations of activities	None	Any	
Nocturnal symptoms/ awakening	None	Any	
Need for rescue/ "reliever" treatment	None (2 or less/week)	More than twice/week	
Lung function (PEF or FEV_1)	Normal	< 80% predicted or personal best (if known) on any day	
Exacerbation	None	One or more/year.	

Partially controlled or uncontrolled cases requires escalation in therapy while cases controlled for > 4 months requires gradual reduction in therapy.

Assessment of severity and classification of chronic asthma

Before initiating treatment, classify the grade of severity of patient illness according to the presence of the most severe feature. This assists in choosing the most appropriate initial maintenance therapy.

Infrequent asthma: less than one acute exacerbation in 4–6 months.
Persistent asthma: mild, moderate or severe.

Criteria	Mild	Moderate	Severe
Day time symptoms	2–4/week	> 4/week	continuous
Night time symptoms	2–4/month	> 4/month	frequent
Prior admission to hospital for asthma	None	one previous admission	> one previous admission or admission to ICU
PEFR*	> 80	60–80	< 60

* Peak expiratory flow rate (PEFR) – patient's best as percentage of predicted value.

GENERAL AND SUPPORTIVE MEASURES

» Environmental control, avoid triggers, e.g.:
  > exposure to cigarette smoke,
  > preservatives such as sulphites and benzoates,
  > house pets such as cats and dogs,
  > house dust mites sensitisation: use plastic mattress covers, and remove bedroom carpets.
» Wash bedding covers in hot water (> 70 °C).
» Educate children, parents, caregivers and teachers.

MEDICINE TREATMENT

Medicine delivery systems

Use spacer devices with a metered dose inhaler. Prime all spacers with 2 doses of inhaled medication prior to first use. The size of the spacer is dependent on tidal volume of the child:

	Spacer volume	Face mask/ mouthpiece	Valve
Infants	150–250 mL	facemask	mandatory
Children < 5 years Children > 5 years	500 mL	facemask mouthpiece	recommended
Adolescents	750 mL	mouthpiece	not necessary

The technique of using the spacer varies with age:

» Infants and young children: use tidal breathing of 10 long, deep, slow breaths.
» Older children and adolescents: breathe out fully, actuate the inhaler, then inhale the entire contents in one long slow breath. Hold breath for 10 seconds.

Inhaled corticosteroid use

Inhaled corticosteroids are indicated for all cases of persistent asthma. Spacer devices increase the efficacy of inhaled corticosteroids.
Rinse the mouth after inhalation of inhaled corticosteroids to reduce systemic absorption and adverse effects.
Wash face if a face mask is used.
Use the lowest possible effective dose of steroids.

15.4.2.1 INFREQUENT ASTHMA

To relieve symptoms:

- ß$_2$ agonist (short-acting), e.g.:
- Salbutamol, inhalation, 100–200 mcg, as required 3–4 times daily using a metered-dose inhaler with a spacer device until symptoms are relieved.

Note: Failure to respond to 2 doses of an inhaled bronchodilator given 20 minutes apart is an indication of an **acute exacerbation** of asthma. See section 15.4.1: Asthma, acute attack.

15.4.2.2 PERSISTENT ASTHMA

Mild persistent asthma

When needed for acute exacerbations:

- ß2 agonist (short-acting), e.g.:
- Salbutamol, inhalation, 100–200 mcg, as required 3–4 times daily using a metered-dose inhaler with a spacer device until symptoms are relieved.

PLUS

Low dose inhaled corticosteroids, e.g.:

- Beclomethasone **or** budesonide, inhalation, 50–100 mcg, 12 hourly using a metered-dose inhaler with a spacer device.

Moderate persistent asthma

To relieve symptoms:

- ß2 agonist (short-acting), e.g.:
- Salbutamol, inhalation, 100–200 mcg, as required 3–4 times daily using a metered-dose inhaler with a spacer device until symptoms are relieved.

PLUS

Regular anti-inflammatory treatment with medium-dose inhaled corticosteroids:

- Beclomethasone **or** budesonide, inhalation, 100–200 mcg, 12 hourly using a metered-dose inhaler with a spacer device.

OR

In children > 6 years with multiple allergies on other steroid formulations, low-dose inhaled corticosteroids plus long-acting beta agonist (LABA) e.g.:

- Fluticasone plus salmeterol by inhalation, 12 hourly. Specialist initiated.
  Metered dose inhaler:
  - Fluticasone/salmeterol, 25/50 MDI, 2 puffs 12 hourly.

  OR
  - Fluticasone/salmeterol 25/125 MDI, 2 puffs, 12 hourly.

  OR

  Accuhaler:
  - Fluticasone/salmeterol 50/100, 1 inhalation, 12 hourly.

  OR
  - Fluticasone/salmeterol 50/250, 1 inhalation, 12 hourly.

Severe persistent asthma

To relieve symptoms:

- ß2 agonist (short-acting), e.g.:
- Salbutamol, inhalation, 100–200 mcg, as required 3–4 times daily using a metered-dose inhaler with a spacer device until symptoms are relieved.

PLUS

Low-dose inhaled corticosteroids plus LABA, e.g.:

- Fluticasone plus salmeterol, inhaled, 12 hourly. Specialist Initiated.
  Metered dose inhaler:
  - Fluticasone/salmeterol, 25/50 MDI, 2 puffs 12 hourly.

  OR
  - Fluticasone/salmeterol 25/125 MDI, 2 puffs, 12 hourly.

  OR

  Accuhaler:
  - Fluticasone/salmeterol 50/100, 1 inhalation, 12 hourly.

  OR
  - Fluticasone/salmeterol 50/250, 1 inhalation, 12 hourly.

REFERRAL

» Diagnostic uncertainty.
» After a life-threatening episode.
» Unstable or difficult to control asthma.
» Asthma interfering with normal life, despite treatment.
» Severe persistent asthma not responding to therapy.

Suggested reference peak expiratory flow (PEF) values for children:

Height (cm)	PEF		PEF	
	Caucasian		African	
	Male	Female	Male	Female
100	127	142	120	126
101	131	145	124	130
102	135	149	128	133
103	138	152	131	137
104	142	156	135	140
105	146	159	139	144
106	150	163	143	148
107	154	166	147	151
108	158	170	151	155
109	162	174	155	159
110	166	178	159	163
111	170	182	163	167
112	175	185	168	171
113	179	189	172	175
114	184	193	176	179
115	188	197	181	184
116	193	202	186	188
117	197	206	190	192
118	202	210	195	197
119	207	214	200	201
120	212	218	205	206
121	217	223	210	210
122	222	227	215	215
123	227	232	220	220
124	232	236	226	225
125	237	241	231	230
126	243	245	236	235
127	248	250	242	240
128	254	255	248	245
129	259	259	253	250
130	265	264	259	255
131	271	269	265	260
132	276	274	271	266
133	282	279	277	271
134	288	284	283	277
135	294	289	289	282
136	300	294	295	288
137	307	299	302	293

Height (cm)	PEF		PEF	
	Caucasian		African	
	Male	Female	Male	Female
138	313	304	308	299
139	319	309	315	305
140	326	315	322	311
141	332	320	328	317
142	339	325	335	323
143	345	331	342	329
144	352	336	349	335
145	359	342	356	342
146	366	348	363	348
147	373	353	371	354
148	380	354	378	361
149	387	365	386	368
150	395	371	392	374
151	402	377	401	381
152	410	382	409	388
153	417	388	417	395
154	425	394	425	402
155	433	401	433	409
156	440	409	441	416
157	448	413	442	423
158	456	419	458	430
159	464	426	466	437
160	473	432	475	445
161	481	438	484	452
162	489	445	492	460
163	498	451	501	468
164	506	458	510	475
165	515	465	520	483
166	524	471	529	491
167	533	478	538	499
168	542	485	548	507
169	551	492	557	515
170	560	499	567	523
171	569	506	577	532
172	578	513	587	540
173	588	520	597	548
174	597	527	607	557
175	607	534	617	566
176	617	541	627	574
177	626	549	638	583
178	636	556	648	592
179	646	563	659	601
180	657	571	670	610

For optimal control, 80% of the predicted peak flow is required.

15.5 UPPER AIRWAY DISEASES

15.5.1 EPIGLOTTITIS

J05.1

DESCRIPTION

Life-threatening upper airway obstruction at the level of the supraglottic structures (epiglottis and arytenoids).
The condition is rare since *H. influenzae* type b vaccination has been introduced.

DIAGNOSTIC CRITERIA

» Acute onset, high fever, sore throat, dysphagia, refusal to eat or swallow, drooling and muffled voice.
» Position of comfort to protect the upper airway: sitting upright, head forward, open mouth, neck in extension.

GENERAL AND SUPPORTIVE MEASURES

» Do not interfere with the protective mechanism of the patient. Allow the child to remain sitting up.
» Avoid all measures that could agitate the patient:
  > make no attempt to see the epiglottis,
  > do not routinely perform X-rays of neck and chest,
» Secure airway before IV line insertion and blood sampling.
» Monitor oxygen saturation (pulse oximeter).

Acute airway obstruction

Caution
Epiglottitis is an upper airway emergency. Total upper airway obstruction is imminent by the time stridor appears. Prepare equipment for bag-mask ventilation, endotracheal intubation, needle cricothyroidotomy and tracheostomy.

» If airway obstructs completely or respiratory arrest occurs, attempt to establish an airway: ventilate with bag and mask.
» If unable to ventilate: intubate.
» If unable to intubate: perform needle or surgical cricothyroidotomy.

Total airway obstruction may occur suddenly and quite unpredictably; the patient should ideally be intubated before referral. Intubation should preferably be performed under general anaesthesia in an operating theatre.

If intubation prior to referral is not possible, transfer patient as an emergency advising transfer staff to avoid lying the child down. Inform the receiving hospital before departure.
During transport, if the child decompensates, attempt bag and mask ventilation.

After an open airway has been secured:
» take blood for cultures,
» swab epiglottis for microscopy, culture and sensitivity,
» monitor heart rate, respiratory rate, blood pressure and SaO_2,
» ensure adequate nutrition and hydration.

MEDICINE TREATMENT
- Oxygen, humidified, if needed.

- Ceftriaxone, IV, 50 mg/kg/dose, once daily for 7 days.

REFERRAL
» All, once airway is secured.

15.5.2 LARYNGOTRACHEOBRONCHITIS, ACUTE VIRAL (CROUP)
J05.0

DESCRIPTION
Potentially life-threatening airway obstruction in children and one of the most common causes of stridor in children aged between 6 months and 2 years.
The most important viruses causing laryngotracheobronchitis (LTB) include:
» para-influenza virus (most common),
» measles,
» herpes simplex,
» adenovirus.

DIAGNOSTIC CRITERIA
Clinical
» a previously healthy child who, a day or two after the onset of an upper respiratory tract infection, develops progressive airway obstruction with a barking cough and stridor,
» a mild fever may be present,
» stridor becomes softer as airway obstruction becomes more severe.

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, retro-pharyngeal abscess, bacterial tracheitis),
» recurrent upper airways obstruction (laryngeal papilloma).

Assessment of severity of airway obstruction in LTB

Severity	Inspiratory obstruction (Stridor)	Expiratory Obstruction (Stridor)	Pulsus paradoxus
Grade 1	+		
Grade 2	+	+ passive expiration	
Grade 3	+	+ active expiration using abdominal muscles	+
Grade 4	cyanosis, apathy, marked retractions, impending apnoea		

GENERAL AND SUPPORTIVE MEASURES

» Monitor the nutritional status and fluid requirements.
» Monitor oxygen saturation, heart rate and respiratory rate.
» Avoid arterial blood gas estimations. Clinical criteria are more effective in determining severity.
» Depending on severity, admit child to high care or intensive care ward.

MEDICINE TREATMENT

Grade 1 obstruction

- Prednisone, oral, 2 mg/kg as a single dose.

OR

- Dexamethasone, IV/IM, 0.5 mg/kg as a single dose.

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

Grade 2 obstruction

As above
PLUS

- Adrenaline (epinephrine), 1:1000, nebulise with oxygen, every 15–30 minutes until expiratory obstruction is abolished.
  - 1 mL adrenaline (epinephrine) 1:1 000 diluted in 1 mL sodium chloride 0.9%.

Grade 3 obstruction

As above:
» if improvement, treat as in grade 2 but reduce frequency of adrenaline (epinephrine) nebulisations with time,
» if no improvement within 1 hour, intubate, preferably under general anaesthetic,
» Refer.

Grade 4 obstruction

As above and:

» continue steroids,
» continue with adrenaline (epinephrine) nebulisation with 100% warm humidified oxygen,
» emergency intubation or intubation under general anaesthesia, if circumstances permit,
» If unable to intubate, bag and mask ventilate and refer urgently.

For suspected herpes:

- Aciclovir IV, 10–15 mg/kg/dose 8 hourly for 5–7 days.

For suspected bacterial infection in children < 20 kg:

- Ampicillin, IV, 12.5–25 mg/kg/dose 6 hourly for 5–10 days.

For suspected bacterial infection in children > 20 kg:

- Ampicillin, IV, 250–500 mg, 6 hourly for 7 days.

AND

If bacterial tracheitis is suspected:

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

REFERRAL

» Intubated children for ICU care. Intubate all children with grade 3 airway obstruction not responding to adrenaline nebulisations and all children with grade 4 airway obstruction before referral.
» Children with an uncertain diagnosis.

CHAPTER 16

EYE CONDITIONS

16.1 EYE INFECTION, COMPLICATED (SEVERE EYE INFECTION)

H44

DESCRIPTION

Intensely painful eye infection characterised by red eye with or without a discharge (excluding simple or non-painful conjunctivitis).

Assess clinically for:

» Herpes conjunctivitis indicated by vesicles on skin next to eye
» Loss of vision
» Irregularity of pupil
» Haziness of the cornea

Investigations

Swab eye for microbiological culture.

GENERAL AND SUPPORTIVE MEASURES

Patient education on personal hygiene to avoid spread. Educate patient on correct application of ophthalmic drops. Advise patient:

» to wash hands thoroughly before applying ophthalmic ointment,
» not to share ophthalmic ointments or drops,
» not to rub eyes, and
» never to use urine or milk to wash the eyes.

MEDICINE TREATMENT

If herpes infection suspected, treat as outlined in section 16.3: Herpes keratitis and conjunctivitis. If bacterial cause demonstrated or suspected:

During the day:

- Gentamicin, ophthalmic drops, instill 1 drop 4–6 hourly.

OR

- Chloramphenicol 0.5%, ophthalmic drops, instill 1 drop 4–6 hourly.

AND

Apply at night:

- Chloramphenicol 1%, ophthalmic ointment.

REFERRAL

To ophthalmologist within 24 hours if associated with any of the following:

» Reduced vision.
» A cloudy cornea.
» A corneal opacity or a staining corneal ulcer.
» Pus and blood level in the anterior chamber (hypopion and hyphaema).
» Cloudiness in the anterior chamber (poor view of iris details.
» An irregular or dilated (including partially dilated) pupil.
» A cloudy or poor view of the retina.
» A poor or greyish red reflex.
» Proptosis.
» Restricted ocular movements.
» Severe ocular pain.

Non-urgent referral

» A unilateral red eye for more than one day.
» No improvement after 5 days of treatment.

16.2 CONJUNCTIVITIS

H10.1

See Primary Healthcare Level Standard Treatment Guidelines and Essential Medicines List, Chapter 18: Eye Conditions, Sections:

- 18.1 Conjunctivitis
  - 18.1.1 Conjunctivitis, allergic.
  - 18.1.2 Conjunctivitis, bacterial (excluding conjunctivitis of the newborn).
  - 18.1.3 Conjunctivitis of the newborn.
  - 18.1.4 Conjunctivitis, viral (pink eye).

16.3 HERPES KERATITIS AND CONJUNCTIVITIS

B00.5

DESCRIPTION

Herpes infection of the cornea and/or conjunctiva.

DIAGNOSTIC CRITERIA

There are three most common forms of this disease.

Blepharoconjunctivitis

» Primary ocular infection involving the eyelids, and/or conjunctivae.
» The condition is benign and self limiting.
» May be associated with keratitis: tiny punctuate stains on the cornea when stained with fluorescein and viewed with the cobalt blue light of the direct ophthalmoscope.

Disciform keratitis

» Immune response to herpes virus.
» Decreased visual acuity and corneal sensation.
» Round dull swollen area in the central cornea.
» Decreased sensation when compared to the other eye. (Use a thread of cotton from a cotton bud and touch the cornea from the side, away from the visual axis.)
» Refer to ophthalmologist.

Dendritic ulcer

» A linear branching ulcer (dendritic ulcer) when stained with fluorescein and viewed with the cobalt blue light of the direct ophthalmoscope.
» Decreased sensation when compared to the other eye. (Use a thread of cotton from a cotton bud and touch the cornea from the side, away from the visual axis).

GENERAL AND SUPPORTIVE MEASURES

» Pad the eye.

MEDICINE TREATMENT

- Aciclovir, ophthalmic ointment, applied five times per day for 10 days.

If cilliary spasm present:

- Cyclopentolate, ophthalmic drops, instil 1 drop 8 hourly.

REFERRAL

Urgent within 24 hours:

» If corneal lesion is not clean/clear or has whitish areas within the bed of the epithelial ulcer.
» If area of corneal staining is not smaller within 24 hours of treatment.
» If there is a history of recurrence.
» Disciform keratitis for assessment and treatment.

16.4 CYTOMEGALOVIRUS (CMV) RETINITIS

B25.8

DESCRIPTION

Characteristic appearance: opacification of the retina with areas of haemorrhage, exudate and necrosis.
Occurs in immunocompromised patients and could be an important cause of visual impairment in HIV infected patients.

DIAGNOSTIC CRITERIA

» Confirm retinitis with ophthalmological assessment.
» Confirm CMV disease with DNA PCR.

MEDICINE TREATMENT

- Ganciclovir, intravitreal, 2 mg once a week (Opthalmologist treatment). Once immune function has been restored with antiretroviral therapy, i.e. CD4 > 100 cells/mm^3, maintenance ganciclovir can be stopped but monitor for recurrence.

REFERRAL

» All patients to confirm diagnosis and manage treatment.

16.5 CHEMICAL BURN TO THE EYE

T26.9

DESCRIPTION

Damage to one or both eyes caused by contact with irritating chemical substances, either alkali or acid.
Presentation:

» pain
» inability to open eye
» blurred vision
» excessive tearing

DIAGNOSTIC CRITERIA

» To assess extent of epithelial loss, after irrigating the eye/s, stain the cornea with fluorescein 2%.

Note:
If the entire cornea stains, then all the epithelium has been removed by the chemical substance. Compare fluorescein staining in the other eye.

GENERAL AND SUPPORTIVE MEASURES

Try to ascertain the exact nature of the chemical agent (without causing a delay in management and referral) by the checking of the pH of the conjunctival sac with litmus paper. (Alternatively the pH square of a urine test strip may be used) Normal tear pH: 6.5–7.6.
Irrigate affected eye/s immediately and continuously with copious amounts of sterile water (at least 2L). Use an eye speculum and an IV fluid delivery set.

If chemical agent is alkaline, prolong irrigation.
Note: Do not attempt to neutralise alkali with acid or vice versa.

MEDICINE TREATMENT

Anaesthetise eye/s after rinsing the eye and before instilling fluorescein

- Topical anaesthetic, e.g. Amethocaine ophthalmic drops, instil 1 drop. Repeat every 15 minutes, if necessary.

For pain:

- Paracetamol, oral, 15 mg/kg/dose, 6 hourly as required.

REFERRAL

Urgent

» Any severe chemical burn producing any epithelial loss or cloudiness of the cornea and/or conjunctival blanching.

16.6 PENETRATING EYE INJURY WITH/WITHOUT A FOREIGN BODY

S05.5/S05.6

DESCRIPTION

Penetration through the cornea or sclera to deeper structures with/without a foreign body still present.

DIAGNOSTIC CRITERIA

Urgently refer patient with a penetrating eye injury or a severely contused eye to an ophthalmic specialist to avoid endophthalmitis and loss of the eyeball**.**

GENERAL AND SUPPORTIVE MEASURES

Note:

Use only preservative-free sterile eye drops if there is a possibility of an open eye injury.

Apply a clean sterile eye shield that does not cause pressure on the globe and transfer patient to the nearest specialist eye unit. If no eye shield is available, the bottom $^1/_3$ of a paper cup may be used.

In cases of high velocity injury with radio-opaque material (metals, certain glass types), an orbital X-ray will reveal a suspected retained intra-ocular foreign body.

SURGICAL TREATMENT

Should be done by an ophthalmic specialist with an operating microscope.

REFERRAL

Urgent

» Any severe blunt trauma to the eye.
» A penetrating eye injury with/without foreign body.
» Corneal or scleral laceration.
» Distorted pupil.
» Flat, shallow or deep anterior chamber (comparative to the other eye).
» Blood inside the eye.

16.7 NON-PENETRATING EYE INJURY

S05.1

DESCRIPTION

An intact cornea and sclera, but severely contused eye.
Foreign body on or embedded in the cornea of an intact eye.

DIAGNOSTIC CRITERIA

Signs depend on site affected and nature of non-penetrating trauma.

Corneal injury
» Contusion: hazy oedematous cornea.
» Foreign body embedded on/in cornea.

Iris injury
» Sphincter rupture: dilated or irregular pupil margin.
» Hyphaema: blood in the anterior chamber due to rupture of the blood vessels.

Lens injury
» Cataract: reduced red reflex.

Lens suspensory ligaments
» Subluxed or dislocated lens: abnormal lens position.

Retinal injury
» Blood vessel injury: blood in vitreous, blood on/in the retina.
» Retinal breaks and tears.

Choroidal injury
» Choroidal break: blood visible under the retina.

Optic disc
» Disc swelling or pallor.

MEDICINE TREATMENT

Corneal injury

A superficial corneal foreign body may be removed with a bud or hypodermic needle.

To anaesthetise the cornea for removal of foreign body:
- Topical anaesthetic:
  - E.g. Amethocaine ophthalmic drops, instil 1 drop. Repeat every 15 minutes, if necessary.

To relieve discomfort caused by iris spasm:
- Cyclopentolate 0.5–1%, ophthalmic drops, 1 drop instilled immediately.

Until epithelialisation is complete:

- Chloramphenicol, ophthalmic ointment, applied 8 hourly for 5–10 days.

Iris injury

Sphincter rupture

Manage conservatively. Follow-up in four days to exclude hyphaema.

Hyphaema

Bed rest for five days.

Monitor for complications, i.e. increased intraocular pressure, corneal staining, secondary bleed.

- Atropine 1%, ophthalmic drops, instil one drop 12 hourly for 5 days.

PLUS

Topical steroid drops:

- Dexamethasone, ophthalmic drops, instil one drop 4 hourly for 5 days.

REFERRAL

» A deeply embedded or full thickness corneal foreign body.
» Hyphaema if unable to monitor for complications or if complications develop.
» Any eye with severe trauma and decreased visual acuity.
» Lens, retina and choroidal injuries – refer within 12 hours.

16.8 RETINOPATHY OF PREMATURITY (ROP)

H35.1

DESCRIPTION

ROP is a potentially preventable cause of blindness.

ROP is classified into five stages, ranging from mild (stage I) to severe (stage V):

Stage I – Mildly abnormal blood vessel growth.

» Many children who develop stage I improve with no treatment and eventually develop normal vision.
» The disease resolves on its own without further progression.

Stage II – Moderately abnormal blood vessel growth.

» Many children who develop stage II improve with no treatment and eventually develop normal vision.
» The disease resolves on its own without further progression.

Stage III – Severely abnormal blood vessel growth.

» The abnormal blood vessels grow toward the centre of the eye instead of following their normal growth pattern along the surface of the retina.

» Some infants who develop stage III improve with no treatment and eventually develop normal vision.
» However, when infants have a certain degree of Stage III and "plus disease" develops, treatment is considered.
» "Plus disease" means that the blood vessels of the retina have become enlarged and twisted, indicating a worsening of the disease.
» Treatment at this point has a good chance of preventing retinal detachment.

Stage IV – Partially detached retina.
» Traction from the scar produced by bleeding, abnormal vessels pulls the retina away from the wall of the eye.

Stage V – Completely detached retina and the end stage of the disease.
» If the eye is left alone at this stage, the baby can have severe visual impairment and even blindness.

TIMING OF SCREENING
» Screening should be done at: 4-6 weeks chronological age or 31-33 weeks post conceptional age (whichever comes later.

MEDICINE TREATMENT
Dilation of the pupils for ROP screening by ophthalmologist:
- Cyclopentolate 0.5%/phenylephrine 2.5%, ophthalmic drops, instil one drop every five minutes for three doses one hour before examination.

REFERRAL
» All neonates weighing less than 1 250 g OR ≤30 weeks gestational age OR those 1250g - 1500g with high risk for ROP (on prolonged oxygen) should be screened for ROP by ophthalmological examination.

16.9 CONGENITAL GLAUCOMA
Q15.0

DESCRIPTION
Congenital glaucoma is caused by abnormal development of the draining angle of the eye.

DIAGNOSTIC CRITERIA
Symptoms:
» Tearing
» Photophobia
» Blepharospasm

Signs:
» Enlarged eye (buphthalmos or “cow eye” appearance)
» Corneal haziness (due to corneal oedema or scarring)
» Optic disc cupping
» Raised intraocular pressure

REFERRAL
Urgent (to ophthalmologist):
» All patients.

16.10 LEUCOCORIA
H44.53

DESCRIPTION
Common causes of leucocoria (white pupil) include:
» retinoblastoma
» cataract
» persistent foetal vasculature
» end-stage ROP

DIAGNOSTIC CRITERIA
» A white appearance of the pupil instead of the usual black colour.
» An absent or diminished red reflex of the fundus of the eye when examined with a direct ophthalmoscope or on a photograph of the child.

REFERRAL
Urgent (to ophthalmologist):
» All patients.

16.11 STRABISMUS
H50.9

DESCRIPTION
Strabismus (squint) is a misalignment of the two eyes.
A non-paralytic squint (concomitant strabismus): will not have restrictions of ocular movements in any of the eye positions.

A paralytic squint (incomitant strabismus): will have a restriction in one or more of the six cardinal eye positions. Consider cranial nerve palsy (III, IV or VI). Do a full neurological examination.

Complications of strabismus

» Amblyopia: a sensory state of an eye where abnormal visual development occurs if that eye is not being used by the brain. Untreated amblyopia leads to permanent visual impairment.
» Diplopia: when a strabismus occurs after the development of binocularity, the child will perceive a sensation of double vision (diplopia). Binocularity develops during the 1st decade.

DIAGNOSTIC CRITERIA

» The corneal light reflex: Patient asked to fixate on light held by the examiner at a distance of 33 cm. The light glistening on the cornea is displaced relative to the pupil.
» The cover test: Cover one eye and then the other. This elicits a re-fixation movement of the non-fixating eye.

REFERRAL

» All children with a squint.
» Urgent: any acute onset of strabismus.
» Within 24 hours: incomitant strabismus.
» Within 1 week: if complications of strabismus present.
» Within 1 month: concomitant strabismus.

16.12 LOSS OF VISION

H53.1

DESCRIPTION

Causes of sudden loss of vision in an outwardly normal eye include:

» retinal detachment
» occlusion of the retinal artery or retinal vein/s
» vitreous haemorrhage
» optic and retrobulbar neuritis
» choroiditis

Causes of gradual loss of vision in an outwardly normal eye include:

» refractive errors
» cataracts
» retinopathies
» malignancies
» optic nerve and chiasmal disease

Loss of vision may also be associated with trauma, inflammation or other abnormalities.

REFERRAL

» Urgent: all children with sudden visual loss for full ophthalmic assessment and management.
» As soon as possible: all children with gradual visual loss, which is not fully corrected by refraction.

16.13 PRESEPTAL AND ORBITAL CELLULITIS

H05.019/H05.012

DESCRIPTION

Preseptal cellulitis (cellulitis of the tissues anterior to the orbital septum) is generally a mild condition that rarely leads to serious complications, whereas orbital cellulitis (involving the tissues posterior to the orbital septum, including the fat and muscle within the bony orbit) may cause loss of vision and even loss of life.

DIAGNOSTIC CRITERIA

Patients with local tenderness (lid erythema/oedema only) and a normal eye examination can be treated for preseptal cellulitis with oral antibiotics.

However, care should be taken to identify those at risk of orbital cellulitis, who require admission and intravenous antibiotics. CT scan is warranted in patients with central signs (drowsiness, vomiting, headache, seizure or cranial nerve lesion), where vision cannot be accurately assessed, gross proptosis, opthalmoplegia, deteriorating visual acuity or colour vision, bilateral oedema, no improvement or deterioration at 24 hours, or a swinging pyrexia not resolving within 36 hours.

MEDICINE TREATMENT

Initial management:

- Ceftriaxone, IV, 50mg/kg once daily.

OR

If one month old or younger:

- Cefotaxime, IV, 50mg/kg/dose, 6 - 8 hourly

If diagnosis of **preseptal cellulitis is confirmed**, switch to:

- Amoxicillin/clavulanic acid, oral, 30 mg/kg/dose of the amoxicillin component 8 hourly for 10 days.

If diagnosis of **orbital cellulitis is confirmed**, continue on intravenous antibiotics.

REFERRAL

» Patients with central signs.
» Patients where vision cannot be accurately assessed.
» Patients with gross proptosis, opthalmoplegia, deteriorating visual acuity or colour vision.
» Patients with bilateral oedema.
» No improvement of deterioration after 24 hours of therapy.
» Swinging pyrexia not resolving within 36 hours.
» Orbital cellulitis secondary to chronic sinusitis (may be risk of multiple abscesses).

CHAPTER 17

EAR, NOSE AND THROAT

17.1 ABSCESS, RETROPHARYNGEAL

J39.0

DESCRIPTION

An infective process of the retropharyngeal space either due to:

» abscess formation in a retropharyngeal lymph node (lymphadenitis),
» rarely, extension of infection from surrounding tissues, or
» rarely, local injury.

Always consider cold abscess of TB as a possible cause.

DIAGNOSTIC CRITERIA

Clinical

» In severe cases stridor and difficulty in breathing,
» more common fever with dysphagia and drooling,
» may have extension of the neck, or torticollis and,
» swelling usually in the midline of posterior pharyngeal wall.

Investigations

» Lateral X-ray of the neck may show the retropharyngeal space to be more than one-half of the width of the adjacent vertebral bodies when the neck is extended, air may be seen in the retropharynx and there is loss of the cervical lordosis.
» Blood cultures.

GENERAL AND SUPPORTIVE MEASURES

» Referral to ENT for surgical drainage of abscesses.
» Protect the airway.
» Ensure adequate hydration, IV fluids or by NGT.

MEDICINE TREATMENT

Empirical antibiotic therapy

» Initiate antibiotic treatment immediately even if transfer of the patient is anticipated.
» Adjust antibiotic therapy based on culture results, if available.
» Early cases may be treated with antibiotic therapy alone.

- Third generation cephalosporin, e.g.

Ceftriaxone, IV, 80 mg/kg/dose once daily.

PLUS

- Metronidazole, IV, 7.5 mg/kg/dose 8 hourly.

As soon as there is a response and patient can tolerate oral medication:

- Amoxicillin/clavulanic acid, oral, 30 mg/kg/dose of the amoxicillin component 8 hourly.

Note:
S. aureus and *M. tuberculosis* are also etiological agents. Adjust antibiotics once culture and sensitivity results are available.

Penicillin allergy
See Chapter 24: Drug Allergies, section 24.4.1: Allergies to penicillins.

For pain and fever:

- Paracetamol, oral, 15 mg/kg/dose 6 hourly as required.

REFERRAL

» All children.

17.2 TONSILLITIS AND PHARYNGITIS

J03

Refer to Primary Healthcare Standard Treatment Guidelines and Essential Medicines List, Chapter 19: Ear, Nose and Throat Conditions, Section 19.6 Tonsillitis and Pharyngitis.

17.3 TONSILLITIS, COMPLICATED (PERITONSILLAR CELLULITIS, PERITONSILLAR ABSCESS)

J03.9

DESCRIPTION

An infective process involving the tonsils with spread of infection into the adjacent tissue. It must be differentiated from hypertrophy of the tonsils without infection and a viral upper respiratory tract infection (these are associated with rhinorrea, nasal congestion and cough).
Local complications include peritonsillar abscess (quinsy), and parapharyngeal extension.
Systemic complications include glomerulonephritis, rheumatic fever and bacterial endocarditis.

DIAGNOSTIC CRITERIA

Clinical

» Pyrexia, malaise.
» Sore throat, dysphagia, drooling, trismus.
» Enlarged, inflamed tonsils, often with superficial pus visible in crypts.
» Earache (referred to as otalgia).
» Tender and enlarged cervical lymph nodes.

Signs of peritonsillar abscess/cellulitis:
» Usually unilateral.
» Soft palate and uvula on the infected side are oedematous and displaced medially towards the uninvolved side.
» Trismus.

Investigations
» Blood microscopy, culture and sensitivity.

GENERAL AND SUPPORTIVE MEASURES
» If necessary, maintain the airway.

MEDICINE TREATMENT
Empiric antibiotic therapy
» Initiate antibiotic treatment immediately even if transfer of the patient is anticipated.
» Adjust antibiotic therapy based on culture results, if available.

Early complications may be treated with antibiotic therapy alone.
- Amoxicillin/clavulanic acid, IV, 25 mg/kg/dose of the amoxicillin component 8 hourly.

As soon as there is a response and patient can tolerate oral medication:
- Amoxicillin/clavulanic acid, oral, 30 mg/kg/dose of the amoxicillin component 8 hourly for 10 days.

Adjust antibiotics once sensitivity results are obtained.

Penicillin allergy
See Chapter 24: Drug Allergies, section 24.4.1: Allergies to penicillins.

For pain and fever:
- Paracetamol, oral, 15 mg/kg/dose 6 hourly as required.

REFERRAL
» Tonsillitis with local complications not responding to adequate treatment.
» All cases where drainage may be required and is not available locally.

17.3.1 ACUTE BACTERIAL TRACHEITIS
J04.1

DESCRIPTION
An acute infective process characterised by marked subglottic oedema, with ulceration, erythema, pseudomembranous formation on the tracheal surface, and thick, mucopurulent secretion that frequently obstructs the lumen. Commonly due to *S. aureus*.

DIAGNOSTIC CRITERIA

Clinical

» Severely ill and toxic with airway obstruction and respiratory distress.
» Insidious onset, brassy cough, neck pain, dysphagia, no drooling.
» Associated co-infection, e.g. pneumonia.

Investigations

» Raised white cell count with left shift.
» Lateral neck X-ray: hazy tracheal air column.
» Upper airway endoscopy.
» Bacterial cultures on blood and pharyngeal secretions.

GENERAL AND SUPPORTIVE MEASURES

» Intubate and suction secretions if features of severe upper airway obstruction are present.
» Mechanical ventilation if associated pneumonia present.

MEDICINE TREATMENT

- Ceftriaxone, IV, 80 mg/kg once daily.

OR

If one month old or younger:

- Cefotaxime, IV, 50 mg/kg/dose, 6–8 hourly.

Adjust antibiotics according to sensitivity results.

For pain:

- Paracetamol, oral, 15 mg/kg/dose 6 hourly.

Give 3 doses of corticosteroids to intubated patients prior to extubation:

- Dexamethasone, IV, 0.15 mg/kg/dose 8 hourly.

REFERRAL

» All cases requiring intubation.

17.4 EPISTAXIS (NOSE BLEED)

R04.0

DESCRIPTION

Nose bleed may be caused by local or systemic diseases, or local trauma, especially nose picking and contact sports. It occurs from an area anterior and inferior on the nasal septum. Recurrent nose bleeds should alert one to possible systemic diseases e.g. hypertension and bleeding tendency. Persistent or severe bleeds may require hospital care.

Complications include anaemia and hypovolaemic shock.

DIAGNOSTIC CRITERIA

» History of spontaneous and/or recurrent nose bleeds.
» Underlying problems include bleeding disorders and local intranasal pathology.
» Examine child for nasal lesions and signs of haematological disease and coagulopathies.

GENERAL AND SUPPORTIVE MEASURES

Digital pressure

» Squeeze the nasal wings (alae) of the nose between the thumb and forefinger to apply pressure to the nasal septum and maintain pressure for about 10 minutes.
» The child should sit up and lean forward so as not to swallow the blood, and should breathe through the mouth.
» If digital pressure fails, remove blood clots from the nose. The child may be able to do this by blowing his nose.

MEDICINE TREATMENT

Vasoconstrictor

If digital pressure fails:

- Oxymetazoline 0.025%, nose drops, instil 1–2 drops into the affected nostril(s) and repeat digital pressure as above.

Nasal pack

If bleeding continues and appears to originate from the anterior nasal cavity, pack the nasal cavity (rather than the apex) with cotton gauze tape impregnated with:

- BIPP (bismuth iodoform paraffin paste)

Topical anaesthesia prior to packing:

- Lidocaine spray 2% solution.
  - Do not exceed 3 mg/kg dose.

Anaemia

If symptomatic anaemia:

» haemoglobin is less than 8 g/dL and/or haematocrit is < 25% with ongoing epistaxis, or
» there is an underlying disorder in which severe re-bleeding is likely.

- Packed red cells, IV, 10–15mL/kg.

Treat the underlying disorder appropriately.

REFERRAL

» Epistaxis caused by a serious underlying disorder.
» Epistaxis that is not controlled by the above measures.
» Recurrent epistaxis.

17.5 ACUTE MASTOIDITIS

H70.9

DESCRIPTION

A serious condition involving acute infections of mastoid antrum that could spread to the adjacent brain and could occur secondary to an ear infection. Is usually due to bacterial infections but also consider tuberculosis in this condition.

DIAGNOSTIC CRITERIA

Clinical

» Fever, severe pain, hearing impairment, tenderness over mastoid antrum.
» Swelling in post-auricular area. Pinna is pushed down and forward.
» Tympanic membrane is often perforated with otorrhoea.
» Occasionally, pus breaks through the mastoid tip and forms an abscess in the neck.
» If seizures, headache, LOC and neck stiffness, do CT scan.

Investigations

» CT brain scan to exclude intracranial spread.
» Collect blood and pus for Gram stain, microscopy, culture and sensitivity tests before initiation of antibiotic therapy.

GENERAL AND SUPPORTIVE MEASURES

» Dry mopping of the external auditory canal.

MEDICINE TREATMENT

Antibiotic therapy

As soon as there is clinical improvement and patient can tolerate oral medication, change to oral antibiotics based on culture and sensitivity.

Total duration of therapy: at least 14 days.

- Ceftriaxone, IV, 80 mg/kg once daily.

Note: Adjust antibiotic therapy based on culture results or if response to antibiotic therapy is unsatisfactory.

As soon as there is a response and patient can tolerate oral medication:

- Amoxicillin/clavulanic acid, oral, 30 mg/kg/dose of amoxicillin component, 8 hourly.

For pain:

- Refer to Chapter 20: Pain Control, section 20.1.2: Management of Pain.

REFERRAL

Urgent

» To ENT surgeon after initiation of antibiotics.

17.6 OTITIS EXTERNA

H60.9

Refer to Primary Healthcare Standard Treatment Guidelines and Essential Medicines List, Chapter 19: Ear, Nose and Throat Conditions, Section: 19.4.1 Otitis Externa.

REFERRAL

» Suspected Necrotising: to ENT specialist.

17.7 OTITIS MEDIA, ACUTE

H66.9

DESCRIPTION

Inflammation of the middle ear that may be complicated by perforation and a purulent ear discharge, which usually resolves spontaneously within 14 days.

DIAGNOSTIC CRITERIA

» Frequently preceded by a viral upper respiratory tract infection.
» Fever and earache (not due to referred pain).
» Acute purulent otorrhoea may develop with associated relief of otalgia.

OR at least one of the following:

» Distinct fullness or bulging of the tympanic membrane.
» Marked redness of the tympanic membrane.
» Needs to be distinguished from otitis media with effusion.

Signs and Symptoms	Otitis Media with Effusion	Acute Otitis Media
Impaired hearing	Mild-to-moderate	Mild-to-moderate
Pain (otalgia)	No	Moderate-to-severe
Tenderness	No	No
Purulent drainage (otorrhea)	No	Only after perforation of tympanic membrane
Bacterial infection	No	Yes
Systemic symptoms (ie, fever, malaise)	No	Yes

GENERAL AND SUPPORTIVE MEASURES

» Avoid getting the inside of the ear wet.

MEDICINE TREATMENT

- Amoxicillin, oral, 45 mg/kg/dose12 hourly for 5–10 days.

Note: For poor response to amoxicillin therapy, or in patients who have received amoxicillin in the last 30 days:

- Amoxicillin-clavulanic acid, oral, 15-25mg/kg/dose of amoxicillin component, 8 hourly for 5-10 days.

LoE I

For pain:

- Refer to Chapter 20: Pain Control, section 20.1.2: Management of Pain.

17.8 OTITIS MEDIA, WITH EFFUSION

H66.0

DESCRIPTION

A sequeale of acute middle ear infection, an entrapment in the middle ear cleft of mucus or mucopus. An intact tympanic membrane. No otalgia, no fever. May be associated with mild hearing loss and speech delay. May be associated with clumsiness.

DIAGNOSTIC CRITERIA

» Bubbles or air-fluid interfaces.

OR at least two of following:

» Abnormal color of tympanic membrane: white, yellow, amber, blue.
» Opacification not due to scarring and retraction.
» Decreased or absent mobility.

GENERAL AND SUPPORTIVE MEASURES

» Avoid getting the inside of the ear wet.
» Advice parents and caregivers that most cases resolve spontaneously with no medication required. Review after 12 weeks.

In the absence of acute inflammation, antibiotics and antihistamines are not indicated.

REFERRAL

» All cases lasting longer than 3 months should be referred to Audiology for hearing testing and ENT specialist review.
» OME with delayed speech development or poor school performance.

17.9 OTITIS MEDIA, CHRONIC, SUPPURATIVE

H66.3

DESCRIPTION

A purulent discharge from the middle ear with perforation of the ear drum for more than two weeks.

Note:
TB is a rare cause of a chronic discharge from the ear.

Persistent or chronic otitis media is also associated with HIV infection in children.

GENERAL AND SUPPORTIVE MEASURES

» Dry mopping is the most important part of the treatment. It should be demonstrated to the child's caregiver or patient if old enough.
» Continue with dry mopping for 4 weeks.
» Then dry canal as much as possible with paper towel twisted into a wick.
» Then frequently instil acetic acid 2% ear drops 4 drops 4 times daily for 5 days.
» Avoid getting the inside of the ear wet during swimming and bathing by using earplugs only during these activities.

MEDICINE TREATMENT

- Fluoroquinolone eardrops, e.g.:
- Ofloxacin drops, instil 2 drops 8 hourly into the affected ear after dry mopping.

REFERRAL

Emergency

» All with suspected intracranial complication.

Elective

» Suspected cholesteatoma
» Large central perforation.
» No improvement after 4 weeks.

17.10 RHINITIS, ALLERGIC/ALLERGIC RHINOSINOSITIS

J30.4

DESCRIPTION

Recurrent inflammation of the nasal mucosa due to hypersensitivity to inhaled allergens. May present with a running, itchy nose and eyes, and excessive sneezing (runner) and/or with nasal obstruction (blocker). Look for salute sign and allergic "shiners". Recurrent symptoms or lasting longer than 14 days.

GENERAL AND SUPPORTIVE MEASURES

» Avoid allergens and irritants.

MEDICINE TREATMENT

During periods of exacerbation of symptoms, a short course of antihistamine can help:

- Cetirizine, oral, as a single dose at night if the predominant symptoms are sneezing, nasal itching and rhinorrhoea:
  - Children 3–12 years: 5 mg.
  - Children older than 12 years: 10 mg.

If poorly controlled/severe:

- Corticosteroid aqueous nasal solution, e.g.:
- Budesonide, 100 mcg, 1 spray into each nostril 12 hourly.

17.11 SINUSITIS, ACUTE BACTERIAL

J01

DESCRIPTION

Inflammation or infection of one or more of the sinuses that occurring most often after a viral infection or with allergic rhinitis.

DIAGNOSTIC CRITERIA

Child with an acute upper respiratory tract infection presenting with:

- persistent illness (nasal discharge or daytime cough or both lasting more than 10 days without improvement),
- a worsening course (worsening or new onset of nasal discharge, daytime cough, or fever after initial improvement), OR
- severe onset (concurrent fever [temperature ≥39°C] and purulent nasal discharge for at least 3 consecutive days).

GENERAL AND SUPPORTIVE MEASURES

» Steam inhalation to liquefy and remove secretions blocking the nose.

MEDICINE TREATMENT

For infection:

- Amoxicillin, oral, 45 mg/kg/dose 12 hourly for 10 days.

Note: For poor response to amoxicillin therapy, or in patients who have received amoxicillin in the last 30 days:

- Amoxicillin-clavulanic acid, oral, 25mg/kg/dose of amoxicillin component, 8 hourly for 5-10 days.

LoE III [ii]

For pain:

- Refer to Chapter 20: Pain Control, section 20.1.2: Management of Pain.

If allergic rhinitis is suspected, refer to section 17.10 Rhinitis, Allergic/Allergic Rhinosinositis.

17.12 SINUSITIS, COMPLICATED

J32.9

DIAGNOSTIC CRITERIA

Clinical

» Signs and symptoms of complications:
  > Peri-orbital swelling and fever.
» Signs of meningeal irritation:
  > Neck stiffness, positive Kernig's and Brudzinski's signs.
» Signs of increased intracranial pressure:
  > Hypertension, bradycardia, papilloedema and headache.
» Signs of involvement of orbital structures:
  > Periorbital oedema, erythema, chemosis, proptosis, vision loss and ophthalmoplegia.
» Signs of brain involvement:
  > Neurological signs, ataxia, paresis, paralysis, convulsions and altered level of consciousness.

Investigations

» CT scan of brain, sinuses and orbits may show opacities and complications.
» CT scan will show if there is involvement of intracranial structures, e.g. brain abscess and intraorbital involvement.
» Pus, CSF and blood for culture and sensitivity tests. Microscopy and Gram-staining of pus and CSF specimens may give some indication of the micro-organism/s involved.

MEDICINE TREATMENT

Empiric antibiotic therapy

» Initiate empiric antibiotic therapy and reassess as soon as culture and sensitivity results become available or if there is no clinical improvement within 48–72 hours.

Total duration of therapy: 14 days.

- Ceftriaxone, IV, 50–80 mg/kg once daily

Refer to Chapter 16: Eye Conditions, Section 16.13 Preseptal and Orbital Cellulitis.

As soon as there is a response and patient can tolerate oral medication:

- Amoxicillin/clavulanate, oral, 30 mg/kg/dose of amoxicillin component, 8 hourly.

Penicillin allergy

See Chapter 24: Drug Allergies, section 24.4.1: Allergies to penicillins.

For pain:

- Paracetamol, oral, 15 mg/kg/dose 6 hourly as required.

REFERRAL

Urgent

» Spread of infection to eye/orbital structures or intracranial structures/brain.

References

[i] Lieberthal AS, et. al. Clinical Practice Guideline: The Diagnosis and Management of Acute Otitis Media. American Academy of Pediatrics. Pediatrics. 2013; 131:e964-e999.

[ii] Wald ER, et. al. Clinical Practice Guideline for the Diagnosis and Management of Acute Bacterial Sinusitis in Children Aged 1-18 Years. American Academy of Pediatrics. 2013;132:e262-e280.

CHAPTER 18

POISONING

For advice contact:

Poisons Information Helpline:	**0861 555 777**

The Afritox database is available free of charge to public hospitals in South Africa: see www.afritox.co.za for information on how to access the database.

18.1 POISONING

DESCRIPTION

Frequently encountered poisonings in children include:

- analgesics,
- hydrocarbons,
- pesticides,
- plant material,
- household cleaning products.
- vitamins and minerals,
- anticonvulsants,
- phenothiazines,
- sedatives and antidepressants,

Suspect intentional ingestion in older children and adolescents.

DIAGNOSTIC CRITERIA

Clinical

Can be divided into 'toxidromes':

Cholinergic: e.g. organophosphates

- salivation,
- lacrimation,
- urination,
- defaecation,
- miosis (pinpoint pupils).
- diarrhoea,
- vomiting,
- bronchorrhoea,
- bradycardia,

Salicylism: e.g. aspirin

- tachypnoea,
- metabolic acidosis,
- seizures.
- agitation,
- coma,

Anticholinergic: e.g. antihistamines, amanita pantherina, atropine

- fever,
- ileus,
- flushing,
- tachycardia,
- urinary retention,
- dry/warm skin,
- blurred vision,
- mydriasis (dilated pupils),
- coma,
- hallucinations and seizures.

Sedative-hypnotic: e.g. alcohol, benzodiazepines

- obtundation or coma.

Opiates: e.g. morphine
» miosis,
» respiratory depression,
» bradycardia,
» hypotension.
» decreased bowel sounds,
» hypothermia,
» altered (decreased) mental status,

Dystonic reaction**:** e.g. haloperidol
» torticollis,
» opisthotonus,
» intermittent spasms and tongue thrusting.

Sympathomimetic: e.g. cocaine, amphetamines
» hypertension,
» tachycardia,
» hyperthermia,
» agitation,
» sweating,
» dilated pupi ls.

Sympathomimetic toxidrome resembles anticholinergic toxidrome, i.e. fight, flight and fright response.

Toxic alcohols: e.g. ethylene glycol, methanol
» metabolic acidosis,
» increased osmolar gap,
» visual disturbances (methanol),
» depressed level of consciousness.
» hypoglycaemia,
» convulsions,
» renal failure (ethyl ene glycol),

TREATMENT

- If the ingestion has definitely occurred: establish whether toxicity is expected and act accordingly.
- If the possibility of ingestion was remote: only observation is necessary.

Principles of treatment
» Stabilise patient if necessary.
» Decontaminate patient if indicated (see below) and contra-indications are not present.
» Give antidote if available.
» Enhance elimination if possible.
» Monitor hydration status carefully.

Decontamination

1. Gastric lavage
» Indicated only if patient has ingested a potentially life-threatening poison and the procedure can be undertaken within 60 minutes of ingestion (can be performed after one hour if enteric-coated and sustained-released formulations have been ingested).

» Contra-indications:
> if a corrosive substance (e.g. phenols, acids, alkalis) or volatile hydrocarbon (e.g. paraffin, turpentine) has been ingested,
> if patient is unconscious (unless the airway is protected).

2. Activated charcoal

» Should be administered within one hour of ingestion of a potentially toxic amount of a poison known to be adsorbed by charcoal. There is insufficient data to support or exclude its use after one hour of ingestion.

» For enteric-coated/sustained release/enterohepatically metabolised substances (e.g. theophylline), repeated doses of activated charcoal can be given.

- Activated charcoal, oral, given as a slurry:
  - o If < 6 years of age: 10 g in 50–100 mL water.
  - o If > 6 years of age: 20–50 g in 100–300 mL water.

» Contra-indications:
  > if patient is unconscious and the airway is not protected.

Poisons where charcoal is ineffective and should not be given	Charcoal may be useful if these poisons are taken in toxic dose
» ethanol » methanol » brake fluid » petrol or paraffin » iron salts » lithium » bleach and caustic alkalis » boric acid	» carbamazepine, barbiturates, phenytoin » dapsone, quinine » theophylline » salicylates » mushroom poisoning (Amanita phalloides) » slow release preparations » digoxin » beta-blockers » NSAIDs

3. Whole bowel irrigation

» Use only for poisoning due to iron, lithium or lead.

» Contra-indications:
  > if patient is unconscious and the airway is not protected.

- Polyethylene glycol balanced electrolyte solution, oral, 30 mL/kg/hour.
  - o Maximum dose: 1.8 L/hour.
  - o Continue until rectal effluent is clear.

REFERRAL

» Severely ill patient for ventilatory/circulatory support.

» If relevant diagnostic testing is not available, e.g. paracetamol levels.

» If relevant medication/antidotes are not available.

» If dialysis/haemoperfusion is required.

» For psychiatric evaluation where deliberate self-harm is suspected.

18.1.1 ANTICHOLINERGIC POISONING

T44.3

DESCRIPTION

Various plant species and pharmaceutical preparations can cause anti-cholinergic toxicity.

Plants: *Datura stramonium*, e.g. ‘stinkblaar' and 'malpitte.

Medicines: atropine, diphenoxylate with atropine and diphenhydramine. Other classes of medicines include antiparkinsonism agents, antispasmodics, antipsychotics, antihistamines and tricyclic antidepressants.

DIAGNOSTIC CRITERIA

Clinical

» Alteration of mental status, including delirium, hallucinations, agitation and seizures.
» Peripheral anticholinergic effects include:
  > mydriasis,
  > tachycardia and arrhythmias,
  > flushing,
  > urinary retention,
  > decreased GIT motility,
  > dry skin and mucous membranes.

Investigations

» ECG and continuous cardiac monitoring.
» Pulse oximetry.

GENERAL AND SUPPORTIVE MEASURES

» Stabilise patient, i.e. airway, breathing and circulation.
» Cooling for hyperthermia.
» Perform decontamination depending on route of exposure.

MEDICINE TREATMENT

- Activated charcoal, see section 18.1 Poisoning, Treatment.

For agitation:

- Diazepam, IV/oral, 0.1–0.2 mg/kg.
  - Maximum dose: 10 mg.

For seizures:

See Chapter 13: The Nervous System, section 13.3: Status epilepticus (convulsive).

REFERRAL

» Cardiac dysrhythmia.
» No response to treatment.

18.1.2 ANTICOAGULANT POISONING

T45.5

*Notifiable condition (if due to poisoning by agricultural or stock remedies).

DESCRIPTION

Warfarin and 'super-warfarin' (long-acting) poisoning with pellets marketed as rodent pesticides. These may be accidentally ingested by toddlers or young children. Bleeding tendencies may be delayed.

Beware: some rat poisons may also contain other poisons such as carbamates or organophosphates.

DIAGNOSTIC CRITERIA

Clinical

» Signs and symptoms depend on the potency. May be asymptomatic if a small quantity has been ingested.
» Bruising or bleeding.

Investigations

» Measure prothrombin time.
  > Obtain baseline INR if symptoms/signs present.
  > A baseline or repeat INR should be done in all cases at 36-72 hours post-ingestion, as the onset of coagulopathy may be delayed.

GENERAL AND SUPPORTIVE MEASURES

» Observe asymptomatic child: may be as outpatient depending on history (amount ingested) and ability to return if symptoms develop.

MEDICINE TREATMENT

ONLY if INR deranged:

- Vitamin K_1, IV/oral, 1– 5 mg/dose administered slowly 6 hourly.
  - Repeat if large doses were administered.

Note: Intravenous solution can be used orally.

Oral vitamin K_1 is usually preferred to intravenous vitamin K_1 unless more rapid reversal is required (e.g. the patient is bleeding). Intravenous vitamin K_1 may cause hypersensitivity reactions.

If significant bleeding present:

ADD

- Lyophilised plasma IV, 20 mL/kg.

OR

- Fresh frozen plasma, IV, 20 mL/kg.

Ingestion of long-acting warfarin may be refractory to large doses of vitamin K_1 and therapy may be required for several weeks after ingestion.

18.1.3 TRICYCLIC ANTIDEPRESSANT POISONING

T43.0

DESCRIPTION

Poisoning with tricyclic antidepressants (TCA) represent a large portion of poisoning fatalities. There is a high risk of tricyclic antidepressant toxicity in children because of its narrow therapeutic index. Serious toxicity may occur with low doses in children.

DIAGNOSTIC CRITERIA

» TCA medication at 10–20 mg/kg will cause significant toxicity in most children.
» Can cause anticholinergic syndromes.
» Mainly affects the cardiovascular system, autonomic nervous system, and central nervous system, leading to:
  > conduction delays,
  > dysrhythmias,
  > hypotension,
  > altered mental status,
  > seizures.

GENERAL AND SUPPORTIVE MEASURES

» Gastric lavage for large ingestions or patients presenting within a few hours post ingestion, unless the patient is unconscious and the airway is not protected.
» Circulatory and respiratory support as needed.
» Cardiac and ECG monitoring for 48 hours.

MEDICINE TREATMENT

- Activated charcoal, given as a slurry.
  - If < 6 years of age: 10 g in 50–100 mL water
  - If > 6 years of age: 20–50 g in 100–300 mL water

  Placement of a nasogastric tube may be necessary for prompt administration.

For cardiac arrhythmias:

- Anti-arrhythmic agents. Only under specialist supervision.

For hypotension:

- Sodium chloride 0.9% or Ringer's Lactate, IV bolus, 20 mL/kg.

Alkalinisation for metabolic acidosis

Alkalinisation up to an arterial pH of 7.45:

- Sodium bicarbonate 4.2%, IV, 2 mL/kg as a bolus.
  - May be repeated.
  - Follow with a continuous infusion in consultation with specialist.

For circulatory and respiratory support:
See Chapter 1: Emergencies and Trauma, section 1.1.4: Cardiorespiratory arrest.

REFERRAL
» Any cardiac arrhythmia.

18.1.4 CAUSTIC OR CORROSIVE AGENTS, INGESTION
T54

DESCRIPTION
Caustic agents, e.g. sodium hydroxide or potassium permanganate, Corrosive agents, e.g. hydrochloric acid.
Acids and alkali do not differ in their severity.
Note: Battery acid causes significant corrosive damage, whereas household bleach seldom has a corrosive effect.

DIAGNOSTIC CRITERIA
Clinical
» Chief symptom is pain.
» Young children may present with:
  > crying, > refusal to swallow,
  > drooling, > vomiting.
» Stridor or hoarseness indicates laryngeal injury.
» The presence of oral or pharyngeal burns does not predict the presence of oesophageal or gastric injury.
» Oesophageal or gastric injury can cause perforation or subsequent fistula formation.
» Asymptomatic patients are unlikely to have significant oesophageal or gastric injury.

GENERAL AND SUPPORTIVE MEASURES
Asymptomatic
» Monitor for development of symptoms.
  > A 12-hour symptom-free period usually indicates that no intervention is necessary.

Symptomatic
» Gastric lavage/emesis is contraindicated in all cases.
» Keep patient nil per mouth.
» Airway injury may necessitate endotracheal intubation.
» Endoscopic evaluation for patient with caustic injury.

MEDICINE TREATMENT

» Prophylactic antibiotics are not indicated.
» Consider steroid therapy only if endoscopy has shown a 2nd or 3rd degree oesophageal injury to reduce oedema and fibrosis. In the setting of GIT bleeding or perforation, steroids are contra-indicated.

For pain control:
See Chapter 20: Pain Control, section 20.1.2: Management of pain.

REFERRAL

» All symptomatic cases for endoscopic evaluation.

18.1.5 VOLATILE SOLVENTS

T53

DESCRIPTION

Inhalants include: spray paint, glue and paint thinners that may contain toluene and/or n-Hexane. If these are ingested hydrocarbon poisoning must also be considered.

DIAGNOSTIC CRITERIA

» distinctive odour,
» discolouration around mouth/nose,
» palpitations,
» dizziness,
» cardiac arrhythmias,
» euphoria,
» headaches,
» progressive CNS depression,
» syncope,
» hypokalaemia,
» mucous membrane irritation, i.e. sneezing, coughing and tearing,
» GIT complaints, i.e. nausea, vomiting and abdominal pain,
» distal renal tubular acidosis, i.e. hyperchloraemic metabolic acidosis with a normal anion gap,
» complications include peripheral neuropathy and hepatotoxicity.

GENERAL AND SUPPORTIVE MEASURES

» Stabilise airway, breathing and circulation.
» Perform a chest X-ray if respiratory symptoms present.
» Monitor patient for respiratory symptoms: if absent after 6 – 8 hours child can be discharged.
» Correct fluid and electrolyte abnormalities.

MEDICINE TREATMENT

For agitation:

- Diazepam, IV/oral, 0.1–0.2 mg/kg.
  - Maximum dose: 10 mg.

For cardiac dysrhythmias, e.g.: ventricular fibrillation, see Chapter 4: Cardiovascular System, section 4.1: Cardiac dysrhythmias.

REFERRAL
» Cardiac dysrhythmia.

18.1.6 ETHANOL POISONING
T51.0

DESCRIPTION
Ethanol is a selective CNS depressant at low concentrations, and a generalised depressant at high concentrations.

DIAGNOSTIC CRITERIA
Clinical
» lack of co-ordination,
» ataxia,
» slurred speech,
» gait disturbances,
» drowsiness.
» stupor,
» coma,
» hypoglycaemia,
» convulsions,

Investigations
» Monitor blood glucose levels.

MEDICINE TREATMENT
Obtunded patients:
- Dextrose 10%, IV, 2 mL/kg followed by 10% dextrose maintenance infusion. Titrate until blood glucose is controlled.
  If patients respond to glucose administration, perform serial glucose levels to detect recurrent hypoglycaemia.

REFERRAL
» Persistent hypoglycaemia despite treatment.
» Depressed level of consciousness despite treatment.

18.1.7 IRON POISONING
T45.4

DESCRIPTION
Iron is widely available as an over-the-counter product and is commonly ingested accidentally by toddlers.

DIAGNOSTIC CRITERIA
» Toxicity is related to the ingested dose of elemental iron.
» Single dose of elemental iron > 20 mg/kg requires hospital assessment and management.

Clinical

» gastrointestinal features,
» shock and metabolic acidosis,
» coma,
» hepatic necrosis.

Elemental iron per preparation

Iron product	Strength	Elemental content	Elemental content per mL or tablet
Ferrous gluconate syrup	350 mg/5 mL	40 mg elemental iron per 5 mL	8 mg elemental iron per mL
Ferrous lactate drops	125mg/ mL	25 mg elemental iron per mL	25mg elemental iron per mL
Ferrous sulphate compound tablets	170 mg	55 mg elemental iron per tablet	± 55 mg elemental iron per tablet

Categories of iron toxicity:

Low risk	Medium risk	High risk
» No history of: > abdominal pain, > nausea, > vomiting, or diarrhoea. » Asymptomatic for 6 hours. » < 20 mg/kg of elemental iron ingested	» Clinical features of toxicity and serum iron >300 µg/dl (60 µmol/L)	Any of these features present » Lethargy/decreased level of consciousness » Acidosis » Shock/hypotension » Evidence of haematemesis or melaena. » Serum iron >500 µg/dL (90 µmol/L) irrespective of clinical features)

» Low risk patients are unlikely to have ingested enough iron to lead to serious poisoning and can be discharged.
» Admit high and medium risk patients.

Investigations

Medium and high risk

» Abdominal X-ray.
» Arterial blood gas.
» Serum electrolytes.
» Liver function test.
» Serum iron levels within 2–6 hours after ingestion.

GENERAL AND SUPPORTIVE MEASURES

General supportive treatment, including airway management if required.

MEDICINE TREATMENT

Medium and high risk

Fluid resuscitation:

- Sodium chloride 0.9%, IV, 20 mL/kg as an initial bolus followed by maintenance therapy.

If no signs of gastrointestinal dysfunction e.g. perforation/haemorrhage:

- Whole bowel irrigation.

Chelation therapy

All medium and high-risk cases (see table above).
For iron ingestion > 60 mg/kg of elemental iron:

- Desferrioxamine, IV, 15 mg/kg/hour as a continuous infusion until acidosis is resolved and urine is no longer pink.
  - Beware of hypotension.

REFERRAL

» All medium and high-risk cases should be managed in a high care unit or ICU with access to serial serum iron measurement. Chelation therapy should be initiated prior to urgent referral/transfer.

18.1.8 NEUROLEPTIC POISONING

T43.5

DESCRIPTION

Neuroleptic overdose may cause a depressed level of consciousness, hypotension, tachycardia and cardiac dysrhythmias and seizures.
Commonly used neuroleptics include chlorpromazine, haloperidol and phenothiazine anti-emetics (e.g. promethazine).

Acute dystonic reactions/extrapyramidal symptoms are distressing adverse reactions (sustained muscle spasms) occurring after an overdose or during chronic therapy with neuroleptics. A typical dystonic reaction includes hyperextension or hyperflexion of the limbs with abnormal posturing of the trunk. Other extrapyramidal symptoms may occur.
The neuroleptic malignant syndrome is uncommon following an overdose and is an idiosyncratic life threatening reaction, presenting with:

» temperature dysregulation,
» autonomic instability,
» altered mental state,
» diaphoresis,
» musculoskeletal effects (pipe like rigidity).

DIAGNOSTIC CRITERIA

» Dystonic reactions.
» Other extrapyramidal symptoms.

GENERAL AND SUPPORTIVE MEASURES

» Observe asymptomatic patients for a minimum of 6 hours.
» Admit all symptomatic patients for continuous cardiac monitoring.
» Test the urine of patients who are hypotensive, have muscular rigidity or seizures for myoglobin (urine test strip for haemoglobin) and serum creatinine monitored because of the risk of rhabdomyolysis.

MEDICINE TREATMENT

- Activated charcoal, see section 18.1 Poisoning, Treatment.

For acute dystonic reactions:

- Biperidin, IV, slow injection.
  - o If < 1 year of age: 1 mg
  - o If 1–6 years of age: 2 mg
  - o If 6–10 years of age: 3 mg

  If concomitant significant anticholinergic findings are present, such as fever and dry skin and mucous membranes, a benzodiazepine is preferred.

REFERRAL

» Patients with neuroleptic malignant syndrome.
» Patient with conduction abnormalities (prolonged QT).
» Patients with acute kidney injury.

18.1.9 ORGANOPHOSPHATE POISONING

T60.0
* Notifiable condition

DESCRIPTION

Organophosphates are potent inhibitors of acetylcholinesterase.

DIAGNOSTIC CRITERIA

Clinical

» Cholinergic toxidrome.
» Cholinergic symptoms include:
  Muscarinic effects:
  > diarrhoea,
  > urination,
  > miosis,
  > salivation.
  > vomiting.
  > lacrimation.
  > bronchorrhoea/bronchoconstriction,

  Central nicotinic effects:
  > confusion,
  > coma,
  > convulsions.
» Cardiac effects include bradycardia or tachycardia depending on whether muscarinic or nicotinic effects predominate.

» Signs depend on dose and route of exposure (vapour or liquid) as well as the time exposed (vapour).

Investigations

» Decreased levels of pseudocholinesterase.
  > Use for confirmation only.
  > Do not wait for levels before treating.

GENERAL AND SUPPORTIVE MEASURES

» Ensure use of personal protective equipment.
» Remove all patient's clothing and wash clothes thoroughly.
» Wash affected skin with soap and water.
» Suction secretions frequently.
» Monitor respiratory function closely and ventilate if necessary.
» Also monitor heart rate, pupillary size and level of consciousness.

MEDICINE TREATMENT

For bradycardia, bronchorrhoea or bronchospasm:

- Atropine, IV, 0.05 mg/kg.
- Reassess after 3 – 5 minutes and if necessary repeat atropine bolus.
  - If no response, give double the dose.
  - If some response, give the same or reduced dose.
- Give repeat boluses until adequate response achieved, i.e. reduced bronchial secretions, dry mouth, increasing heart rate and dilating pupils (Note: pupil reversal may be delayed).
- Follow with infusion. Calculate the total dose of atropine given as boluses (as described above). Give 10 – 20% of this dose per hour.
- Reassess frequently and adjust atropine infusion as follows:
  - Bronchial secretions, bronchospasm or bradycardia recur – increase dose.
  - Good control of bronchial secretions and signs of atropine overdose (tachycardia, mydriasis, agitation, pyrexia, reduced bowel sounds and urinary retention): decrease dose.
  - No recurrence of bronchial secretions and no signs of atropine overdose: reduce dose slowly.

Note: Do not stop atropine infusion abruptly, but wean over at least 24 hours. Tachycardia and mydriasis are not contraindications for giving atropine in the acute resuscitation setting.

Treat convulsions.

See Chapter 13: The Nervous System, section 13.3: Status epilepticus (convulsive).

REFERRAL

» All severe cases for ICU care.

18.1.10 OPIOID POISONING

T40.2

DESCRIPTION

Codeine is a common drug of abuse.

The duration of action of morphine is 3–6 hours. Other oral agents, e.g. codeine and long acting morphine, demonstrate a delayed effect of up to 4–12 hours.

DIAGNOSTIC CRITERIA

» Altered level of consciousness.
» Classic triad of CNS depression, respiratory depression and miosis.
» Hypotension, hypothermia, bradycardia and hyporeflexia.
» Vomiting is common with the risk of aspiration, especially in patients with depressed level of consciousness.

Note: symptoms may take time to develop. May be awake and alert in early phase 1 – 2 hours after ingestion.

GENERAL AND SUPPORTIVE MEASURES

» Supportive care, ventilate with bag-mask device.
» Monitor oxygen saturation constantly.
» Observe for urinary retention.
» Airway protection is a priority.

MEDICINE TREATMENT

- Activated charcoal.

If respiratory depression or depressed level of consciousness,

- Provide airway support
- Ventilate until PCO_2 normal
- Naloxone, IV, 0.1 mg/kg.
  - If no response after 5 minutes, repeat dose and titrate according to response.
  - Duration of action of naloxone is 20–30 minutes.
  - If repeated doses are naloxone are necessary, a continuous IV infusion of naloxone can be instituted.

CAUTION

All patients treated with naloxone should be observed for at least 12 hours for relapse, especially if a long acting opioid has been ingested.

REFERRAL

» Patients requiring multiple doses of naloxone.

18.1.11 PARACETAMOL POISONING

T39.1

DESCRIPTION

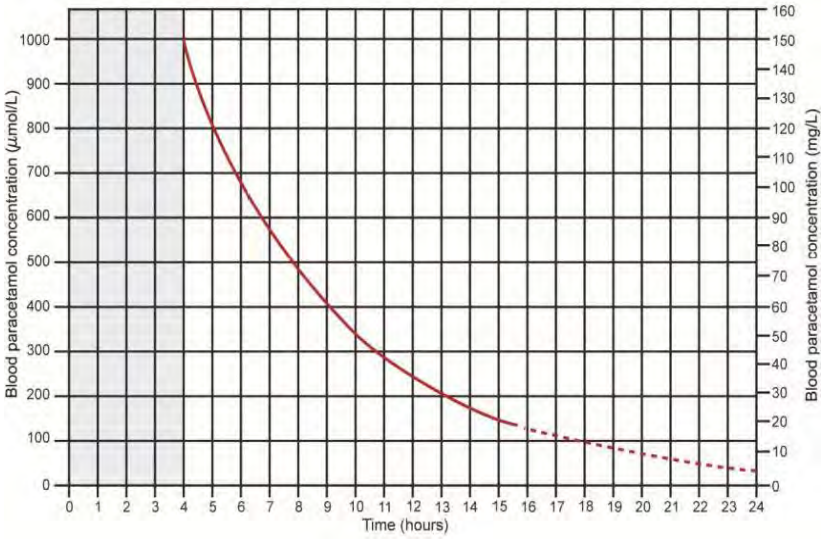
Poisoning due to paracetamol by adolescents is generally due to intentional ingestion. The accidental ingestion of paracetamol elixir preparations by toddlers very rarely causes toxicity. Toxicity can be due to acute ingestions or repeated supratherapeutic ingestion (RSTI). Toxicity due to IV paracetamol may also occur.

High-risk patients (glutathione deficiency, liver disease, use of enzyme-inducing drugs, patients with recent illness or dehydration) may experience toxicity at lower doses.

DIAGNOSTIC CRITERIA

» An acute ingestion in excess of 150 mg/kg per 24-hour period in healthy children is potentially toxic.
» Serum paracetamol concentration must be measured at least four hours following ingestion.
» Use nomogram to assess risk of toxicity.

Paracetamol treatment nomogram



Source: Daly FF, Fountain JS, Murray L, Graudins A, Buckley NA; Panel of Australian and New Zealand clinical toxicologists. Guidelines for the management of paracetamol poisoning in Australia and New Zealand -explanation and elaboration. A consensus statement from clinical toxicologists consulting to the Australasian poisons information centres. Med J Aust. 2008 Mar 3;188(5):296-301.

» Cautions for use of this chart:
  > The time co-ordinates refer to time since ingestion.
  > Serum levels drawn before 4 hours may not represent peak levels.
  > Use the graph only in relation to a single acute ingestion.
  > Do not use when there is a history of RSTI, a history of ingestion of extended release formulation or delayed presentation (> 24 hours post-ingestion).

Repeated supratherapeutic ingestions
RSTI defined as:
- >200 mg/kg or 10 g (whichever is less) over a single 24-hour period.
- >150 mg/kg or 6 g (whichever is less) per 24-hour period for the preceding 48 hours.
- >100 mg/kg or 4 g/day (whichever is less) in patients with predisposing risk factors.

This nomogram is not designed for use in RSTI.

Investigations
If toxic dose ingested or patient symptomatic, do:
> Serum paracetamol level
> Baseline urine and electrolytes
> ALT
> INR

GENERAL AND SUPPORTIVE MEASURES
- Gastric lavage and activated charcoal, see section 18.1 Poisoning, Treatment.

MEDICINE TREATMENT
Acute ingestion
» For acute ingestion, initiate treatment with N-acetyl cysteine (NAC) if the blood paracetamol concentration for the time since ingestion falls to the right of the curved line on the nomogram.
» Administer without waiting for plasma paracetamol levels in substantial overdose, defined as ≥10 g (20 tablets) or ≥150 mg/kg, whichever is smaller. Discontinue if plasma levels are in the non-toxic range.
» If patients present > 8 hours post-ingestion AND has taken a potentially toxic dose, start on NAC without waiting for the paracetamol levels.
» If the time of ingestion is unknown, start treatment for any detectable level of paracetamol or any elevation of AST or ALT.

Repeated supratherapeutic ingestions (RSTI)
Obtain a second paracetamol level and ALT 4–6 hours after the original 4 hour concentration. If either second paracetamol (above the treatment line) or ALT are abnormal, proceed with NAC infusion and repeat serum paracetamol level and ALT after 8 hours.

N-Acetylcysteine, IV.

First 24 hours

- Loading dose: 150 mg/kg in dextrose 5%, 5 mL/kg given over 1 hour.
- 50 mg/kg in dextrose 5%, 5 mL/kg over the next 4 hours; then 100 mg/kg in dextrose 5%, 10 mL/kg over 16 hours.

Second 24 hours

- 100 mg/kg in dextrose 5%, 10 mL/kg over 24 hours.

REFERRAL

Patients with severe hepatotoxicity as indicated by any of the following:

» INR > 2 at 24 hours or > 3 at any time after overdose
» pH < 7.3 or bicarbonate < 18 mmol/L
» hypovolaemia
» encephalopathy
» creatinine > 200 µmol/L

18.1.12 PETROCHEMICAL POISONING

T53.6

DESCRIPTION

Accidental ingestion of paraffin, particularly by toddlers, is common in South Africa.

DIAGNOSTIC CRITERIA

Clinical

» Paraffin is volatile and inhalation of the fumes or aspiration of liquid can cause respiratory distress due to chemical pneumonitis.
» CNS symptoms: depressed level of consciousness.

Investigations

» Chest X-ray if respiratory distress present.

GENERAL AND SUPPORTIVE MEASURES

CAUTION
Do not attempt gastric lavage.

» Observe patient for up to 6 – 8 hours if asymptomatic.
» Administer oxygen, if necessary.
» Education and counseling regarding prevention.

MEDICINE TREATMENT

If infection develops 48 hours after ingestion:

- Amoxicillin, oral, 30 mg/kg/dose 8 hourly for 5 days.

REFERRAL

» For ventilatory support.

18.1.13 SALICYLATE POISONING

T39.0

DESCRIPTION

Salicylate poisoning may result from oral and/or topical exposure. Salicylate products vary widely in concentration e.g. oil of wintergreen is 100% methylsalicylate. As little as 4 mL of oil of wintergreen may be fatal in a child.

DIAGNOSTIC CRITERIA

Clinical

» Ingestion of less than 150 mg/kg of aspirin will not cause toxicity except in a child with hepatic or renal disease.
» Ingestion of 150 – 300 mg/kg of aspirin may result in mild to moderate toxicity.
» Ingestion of > 300 mg/kg of aspirin may result in severe toxicity.
» Ingestion of > 500 mg/kg of aspirin should be considered a potentially lethal dose.
» Features include:
  > fever,
  > nausea,
  > epigastric pain
  > vomiting,
  > tinnitus
  > hyperventilation,
  > renal failure,
  > hypoglycaemia,
  > CNS depression,
  > respiratory alkalosis (initially) followed by metabolic acidosis.
» Monitor blood gases, urine output and urine and electrolytes.
» Monitor salicylate level: (do not always correlate with clinical severity)
  - Asymptomatic: peak plasma salicylate level of < 20 mg/dL (< 30 mg /dL in adolescent).
  - Mild toxicity: Peak plasma salicylate level 20 – 45 mg/dL in child (30 – 60 mg/dL in adolescent adolescents).
  - Moderate toxicity: Peak plasma salicylate 45 – 70 mg/dL in child (60 – 80 mg/dL in adolescent adolescents).
  - Severe toxicity: Peak plasma salicylate level >70 mg/dL in child (>80 mg/dL in adolescent).
» Serial monitoring until declining levels are documented.
» Monitor and treat hypoglycaemia.

GENERAL AND SUPPORTIVE MEASURES

» Consider gastric lavage, see section 18.1 Poisoning, Treatment.
» Correct hydration.

MEDICINE TREATMENT

After gastric lavage:

- Activated charcoal.
  - o May be used for up to 12 hours: due to delayed gastric emptying or if sustained-release/enteric-coated preparations were ingested.

Metabolic Acidosis
If arterial pH <7.3, give sodium bicarbonate 8.4% IV 1 mL/kg to increase pH to 7.4.
Monitor potassium levels

Urine alkalinisation
If salicylate levels are high and/or metabolic disturbances are present:
- Sodium bicarbonate 8.4%, IV, 1 mL/kg to increase pH to 7.4. and administered over 3 hours (with maintenance fluid).
  - Increase, if necessary, to maintain urine pH above 7.5.

For hydration:
- ½ Darrows/dextrose 5%, IV.

For bleeding:
Vitamin K_1, IV/oral, 1– 5 mg/dose administered slowly 6 hourly.

> **Note:** Intravenous solution can be used orally.

REFERRAL
» Severe cases for ICU care: If arterial pH remains <7.2, refer for urinary alkalinisation and possible haemodialysis.

18.1.14 BENZODIAZEPINE POISONING
T42.4

DESCRIPTION
Young children or toddlers are typically involved in accidental exposure and ingest small amounts of sedatives.
Adolescents may ingest large amounts during suicide, suicidal gesture or for recreational use.

DIAGNOSTIC CRITERIA
Clinical
» Cardiorespiratory depression.
» Decreased level of consciousness.

Investigations
» Serum drug levels are of no value in the acute treatment phase.
» Urine test: may have medico-legal implications.

GENERAL AND SUPPORTIVE MEASURES
» If there is respiratory depression, intubate, ventilate and transfer.
» Supportive treatment only is necessary in most patients.

MEDICINE TREATMENT
If significant overdose is suspected:
- Activated charcoal, see section 18.1 Poisoning, Treatment.

REFERRAL
» Respiratory depression.

18.1.15 SULFONYLUREA POISONING
T38.3

DESCRIPTION
Sulfonylureas may cause severe and protracted hypoglycaemia. The half-life of the sulfonylureas varies:
» Glibenclamide: $T_{1/2}$ = 10 hours
» Gliclazide: $T_{1/2}$ = 10-12 hours
» Glimepiride: $T_{1/2}$ = 5-8 hours

DIAGNOSTIC CRITERIA
Clinical
» Coma and seizures.
» Profound hypoglycaemia, usually within 4 hours of ingestion.

Investigations
» Glucose monitoring is the mainstay of diagnostic testing.

GENERAL AND SUPPORTIVE MEASURES
» Observe for at least 24 hours even if a single tablet is ingested.
» Glucose-containing fluid orally.

MEDICINE TREATMENT
- Activated charcoal.
- If symptoms of hypoglycaemia present or blood glucose below 2.6 mmol/L.
  - Dextrose 10% (2 mL/kg), IV bolus followed by 10% dextrose maintenance infusion. Titrate until blood glucose is controlled.

If desired response not achieved,
ADD
- Octreotide 1 – 1.5 mcg/kg IV or SC

Note:
Corticosteroids are not indicated.

REFERRAL
» Patients not responding to intravenous glucose.

18.1.16 SYMPATHOMIMETIC AGENT POISONING

T43.6/F14

DESCRIPTION

Pseudoephedrine in decongestants, methylphenidate and illicit drugs such as cocaine and amphetamines (Tik) are sympathomimetic agents. These agents are frequently abused as recreational drugs.

DIAGNOSTIC CRITERIA

Clinical

- » Hypertension,
- » Tachycardia,
- » Tachypnoea,
- » Agitation.
- » Psychosis,
- » Mydriasis,
- » Diaphoresis,
- » Hyperthermia: effects of sympathomimetics that predispose to hyperthermia include:
  - > peripheral vasoconstriction and impaired cutaneous heat loss,
  - > agitation,
  - > seizures,
  - > increased muscle activity,
  - > impaired behavioral responses.
- » With cocaine toxicity, cardiovascular manifestations predominate, including:
  - > supraventricular and ventricular dysrhythmias,
  - > myocardial ischaemia.
- » Neonates of mothers addicted to cocaine may present with withdrawal signs, manifested by jitteriness.

Investigations

- » ECG monitoring to evaluate dysrhythmias.

GENERAL AND SUPPORTIVE MEASURES

- » Admit all seriously ill children to ICU.
- » Maintain hydration.
- » Cooling for hyperthermia.
- » Mildly toxic patients require no specific treatment.

MEDICINE TREATMENT

- Activated charcoal, see section 18.1 Poisoning, Treatment.

<u>For agitation and tachycardia</u>:

- Diazepam, IV/oral, 0.1–0.2 mg/kg.
  - o Maximum dose of 10 mg.

<u>For severe hypertension</u>:

See Chapter 4: Cardiovascular System, section 4.11.1: Hypertension, acute severe.

For seizures:
See Chapter 13: The Nervous System, section See section 13.3: Status epilepticus (convulsive).

REFERRAL
» Status epilepticus requiring ICU.
» Hypertensive crisis.

18.1.17 ISONIAZID POISONING
T37.1

DESCRIPTION
INH interferes with pyridoxine and niacin metabolism, leading to impaired synthesis of gamma aminobutyric acid (GABA). Acute poisoning, which may follow intentional or accidental ingestions, may be severe.

DIAGNOSTIC CRITERIA
Clinical
Triad of refractory seizures, metabolic acidosis and coma within 2-3 hours of ingestion. Hyperthermia and rhabdomyolysis can develop after prolonged seizure activity.

Investigations
» Metabolic acidosis - high anion gap due to lactate accumulation.
» INH levels can be measured to confirm the diagnosis in an acute ingestion. Acute toxicity can be defined as INH concentration:
  - o > 10 mg/L one hour after ingestion, or
  - o > 3.2 mg/L two hours after ingestion, or
  - o > 0.2 mg/L six hours after ingestion.

GENERAL AND SUPPORTIVE MEASURES
» Respiratory and circulatory support

MEDICINE TREATMENT
- Activated charcoal, see section 18.1 Poisoning, Treatment.
- For seizures:
  - o Pyridoxine is the primary treatment of seizures and coma, which once controlled, should help resolve metabolic acidosis.
    - > Asymptomatic patients presenting within 2 hours, give an initial prophylactic dose of 70 mg/kg of pyridoxine up to a maximum dose of 5 g.
    - > Symptomatic patients with significant symptoms or seizures: replace INH with pyridoxine gram for gram, up to a maximum of 5 g.

> Oral pyridoxine 25 mg tablets can be crushed and given with fluids via nasogastric tube.
> If seizures recur, repeated doses of pyridoxine may be given up to a maximum daily dose of 15-30 g.

o **Note**: Benzodiazepines and phenobarbitone may be used to control seizures (whilst pyridoxine is being prepared/given). Avoid phenytoin.

- Metabolic acidosis should improve with seizure control, but additional sodium bicarbonate may be required.

REFERRAL

» Refractory seizures

18.1.18 THEOPHYLLINE POISONING

T48.6

DESCRIPTION

Agents such as aminophylline and caffeine have similar features in overdose. Sustained release preparations can cause prolonged toxicity. Toxicity can occur with therapeutic dosing.

DIAGNOSTIC CRITERIA

Clinical

» Mainly affects the gastrointestinal, cardiovascular and central nervous systems.
» Central nervous system: agitation, tremor, seizures, coma, hyperventilation.
» Gastrointestinal tract: nausea and vomiting.
» Cardiovascular: tachycardia, arrhythmias, hypotension.

Investigations

» Serum levels – a theophylline level >20 mg/L is considered toxic
» Hyperglycaemia
» Hypokalaemia
» Respiratory alkalosis and/or metabolic acidosis

GENERAL AND SUPPORTIVE MEASURES

» Observe all patients who have ingested 10mg/kg or more of theophylline for at least 4 hours for a normal release preparation and at least 12 hours for a sustained release preparation.
» Manage hypotension. Cardiac monitoring.
» Potassium levels should be monitored and replaced if required.

MEDICINE TREATMENT

- Activated charcoal. Repeated doses may be required. See section 18.1 Poisoning, Treatment.
- Phenytoin should NOT be used.

REFERRAL

Severe poisoning as evidenced by:
» serum theophylline >100 mg/L,
» seizures,
» refractory shock,
» life-threatening dysrhythmias,
» rising theophylline level and/or clinical deterioration despite optimal care.

18.1.19 AMITRAZ POISONING

T60.9
*Notifiable condition.

DESCRIPTION

Amitraz is pesticide used in tick dips for animals and as an insecticide in crop sprays. Liquid formulations often contain solvents that may cause additional clinical effects. Significant skin contact may lead to systemic effects.

DIAGNOSTIC CRITERIA

Clinical

Symptoms occur between 30 minutes to 4 hours.
» Gastrointestinal: vomiting.
» Central nervous system: ataxia, drowsiness (leading to coma), seizures. No excessive secretions. Miosis or mydriasis may be present.
» Cardiovascular: bradycardia, hypotension (or hypertension).
» Respiratory depression, or tachypnoea, aspiration and chemical pneumonitis.
» Hypothermia and hyperglycaemia are common.

Investigations

» Acidosis (respiratory or metabolic)
» Liver enzymes
» Chest x-ray, if respiratory symptoms

GENERAL AND SUPPORTIVE MEASURES

» Activated charcoal, see section 18.1 Poisoning, Treatment.
» Monitoring (blood pressure, pulse, respiration, level of consciousness, temperature, blood gas, blood sugar)

Asymptomatic: observe for 4 hours
Symptomatic: supportive treatment as required

MEDICINE TREATMENT

Specific treatment should only be used if there is inadequate response to standard resuscitation measures.

- Atropine may be used for severe bradycardia.

REFERRAL

» Severe cases requiring intensive care.

18.2 ENVENOMATION

18.2.1 SCORPION STINGS

T63.2

DESCRIPTION

Some scorpion species can cause serious systemic toxicity.

Thick-tailed scorpions with small pincers are extremely toxic, resulting in both local and systemic features. Thin-tailed scorpions with large pincers are much less toxic and usually cause local symptoms only.

DIAGNOSTIC CRITERIA

» Pain and paraesthesia occur immediately after envenomation.
» Autonomic and motor findings may differentiate scorpion bites from other causes of pain.
» The pain can be exquisitely accentuated by tapping on the affected region, i.e. “tap test”.
» In severe cases cranial nerve dysfunction, blurred vision, pharyngeal muscle incoordination, drooling and respiratory compromise can occur.
» Excessive motor activity may present as restlessness, or uncontrollable jerking of extremities.
» Other serious effects include cardiac dysfunction, pulmonary oedema, pancreatitis, bleeding disorders and skin necrosis.
» Nausea, vomiting, tachycardia and severe agitation can also occur.

GENERAL AND SUPPORTIVE MEASURES

» General supportive care.
» Monitor airway, breathing and circulation.

MEDICINE TREATMENT

For muscle cramps:

- Calcium gluconate 10%, IV, 0.5 mL/kg by slow intravenous injection.
  - Give 0.5–1 mL/minute.
  - Monitor ECG.

For pain:

- Paracetamol, oral, 15 mg/kg/dose, 6 hourly as required.

Very painful scorpion stings

- Lidocaine (lignocaine) 2%, 2 mL injected around the bite as a local anaesthetic.

If not immunised in the past 5 years:

- Tetanus toxoid, IM, 0.5 mL.

Complete course in previously unvaccinated patients.

Antivenom therapy

Antivenom therapy is recommended only in cases with systemic signs and is rarely required:

- Scorpion antivenom, slow IV, 10 mL administered over 3–5 minutes.

REFERRAL

» Severe cases requiring intensive care.

18.2.2 SNAKEBITE

T63.0

DESCRIPTION

The effects of snakebites may be cytotoxic, neurotoxic and/or haemotoxic. The overall effect is determined by the predominant toxin in the snake venom.

In the majority of cases, the species of snake is unknown. The patients can be divided into:

» no evidence of bite, no envenomation,
» evidence of bite, minor envenomation, i.e. fang marks, minimal pain, minimal swelling and no systemic signs,
» evidence of serious envenomation.

DIAGNOSTIC CRITERIA

Cytotoxic venom

» Puff adder, spitting cobra, gaboon adder.
» Venom causes severe local damage to tissues and vascular endothelium.
» Severe swelling and local necrosis occurs.

Neurotoxic venom

» Mamba, non- spitting cobra, rinkhals, berg adder.
» Venom causes a paresis and paralysis of skeletal muscles.
» Paralysis of respiratory muscles with respiratory failure may occur.
» Preceded by severe pain and paraesthesias.
» Ophthalmoplegia occurs when ocular muscles become paralysed.
» Speech and swallowing may be affected.
» Signs and symptoms start within 15–30 minutes.

Haemotoxic venom

» Boomslang, vine snake.
» Venom may cause:
  > haemolysis of red blood cells,
  > anaemia,
  > consumptive coagulopathy,
  > bruises,
  > ecchymosis,
  > epistaxis,
  > haemoptysis
  > haematuria.

GENERAL AND SUPPORTIVE MEASURES

» Patients with no evidence of bite and patients with evidence of bite but only minor envenomation should be admitted for observation. No anti-venom is indicated.
» Do not suck or cut the wound.
» Do not apply tourniquet.
» Where serious envenomation is suspected, **immediate treatment includes:**
  > minimising movement of affected limb,
  > emergency treatment by bandaging affected limb with crepe bandage without compromising blood supply,
  > rapid transportation to a facility with antivenom available is the most important principle of pre-hospital care,
  > optimal therapy consisting of placing the patient at rest with the affected body part raised to the level of the heart,
  > stabilising circulation and blood pressure.
» For cytotoxic envenomation, surgical intervention, i.e. decompression surgery for established compartment syndrome and debridement of necrotic tissue should only be done when absolutely necessary and as conservatively as possible.
» For neurotoxic envenomation, ventilatory and cardiovascular support may be needed in an ICU.

MEDICINE TREATMENT

All patients not immunized within the past 5 years:

- Tetanus toxoid, IM, 0.5 mL.

If children with penetrating wound and who are not completely immunised:

- Tetanus immunoglobulin, IM.
  - If < 5 years of age: 75 IU.
  - If 5–10 years of age: 125 IU.
  - If > 10 years of age: 250 IU.

Clean wound:

- Chlorhexidine 0.05% solution in water.

Antivenom therapy

Indications:

» Consider antivenom in children who are persistently and severely affected even after the first day.
» Painful swelling of the whole hand/foot within 1 hour, spreading to elbow/knee in 3–6 hours.
» Swelling of head, neck or chest.
» Significant envenomation e.g. overt neurological signs or bite in close proximity to airway structures.
» Platelet count less than 100 x 10^9/L.
» Fibrinogen less than 100 mg/dL.

The dose of antivenom is the same for adults and children.

CAUTION
Never administer antivenom without being fully prepared to manage acute anaphylaxis.

Give pre-treatment with adrenaline (ephinephrine):

- Adrenaline (ephinephrine) 1:1000, SC, 0.01 mL/kg, to a maximum of 0.25 ml

CAUTION

Polyvalent antivenom is only effective for the following common snake bites:

» Cape cobra
» Mamba
» Puff adder
» Gaboon adder
» Rinkhals
» Spitting cobras

Boomslang requires specific antivenom.

Antivenoms are available from the South African Vaccine Producers (SAVP).
SAVP emergency number: 011 386 6000.
Snakebite antivenoms may be available from specific hospitals in each province.

For cobras, mambas, rinkhals, puff adders and Gaboon viper:

- Polyvalent snake antivenom, IV.
  - 60–120 mL antivenom diluted in 50 - 100 mL sodium chloride 0.9%, administered slowly over 30 minutes.

For boomslang bites:

- Boomslang antivenom, slow IV, 10 mL administered over 3–5 minutes.

OR

- Boomslang antivenom, IV infusion, 10–20 mL diluted in sodium chloride 0.9% or dextrose 5%, 50–100 mL administered over 5–10 minutes.
  - After administration, observe patient.

Correct anaemia and bleeding tendency.

REFERRAL

» Snakebite with neurotoxic or haemotoxic manifestations may need intensive care.

18.2.3 SPIDER BITES

T63.3

The vast majority of spiders are not harmful to humans.

18.2.3.1 SPIDER BITES, NEUROTOXIC (WIDOW/BUTTON SPIDERS)

DESCRIPTION

The term latrodectism is used to describe the systemic symptoms and signs following envenomation by the bite of the Latrodectus spider species (widow spiders). Most cases are caused by the bite of a black widow spider; brown widow spider bites are usually milder and characterized by local swelling.

DIAGNOSTIC CRITERIA

» Bites are felt immediately as a pinprick sensation, followed by increasing local pain that may spread to include the entire extremity.
» Typical target lesions, i.e. erythematous ring surrounding a pale center.
» Spasms in large muscle groups, abdominal pain or rigidity, progressing to generalised pain involving the trunk and abdomen have been described.
» Paraesthesia of hands and feet.
» Sweating and anxiety may occur.

GENERAL AND SUPPORTIVE MEASURES

» Supportive care of airway, breathing and circulation.

MEDICINE TREATMENT

For pain and muscle cramps:

- Calcium gluconate 10%, IV, 0.5 mL/kg by slow intravenous injection.
  - Give 0.5–1 mL/minute.
  - Monitor ECG and respiration.

For severe envenomation (if systemic symptoms are present):

- Spider antivenom, IV infusion, 5–10 mL diluted in sodium chloride 0.9% or dextrose 5%, 50–100 mL administered over 5–10 minutes.

18.2.3.2 SPIDER BITES, NECROTIC ARACHNIDISM

T63.3

DESCRIPTION

Violin/recluse (*Loxosceles)* spiders can produce local necrotic skin lesions that are mediated by enzymes.

DIAGNOSTIC CRITERIA

» Bites are initially painless.
» Skin lesions can vary from mildly erythematous lesions to severe local reaction, i.e. blistering, bluish discolouration progressing to frank necrosis.
» Systemic effects include nausea, vomiting, fever, chills, arthralgia, haemolysis, thrombocytopaenia, haemoglobinuria and renal failure.

GENERAL AND SUPPORTIVE MEASURES

» Supportive care.
» Surgical debridement may be required once the clear margins around the necrotic lesions are established.

MEDICINE TREATMENT

For pain:

- Paracetamol, oral, 15 mg/kg/dose, 6 hourly as required.

If severe pain:

- Morphine, IV, 0.1 mg/kg/dose 4 hourly.
  - Monitor for respiratory depression.

Antibiotic therapy for septic lesions.

CHAPTER 19

PREMATURITY AND NEONATAL CONDITIONS

Note: Always assess gestational age as accurately as possible. See appendix: Ballard Scoring Assessment.

19.1 APNOEA, NEONATAL

P28.3

DESCRIPTION

A neonate presenting with episodes of cessation of breathing.
Apnoea episodes in a previously asymptomatic well neonate may be the first indication of a serious underlying disease.
Apnoea episodes in an already unwell neonate indicate deterioration in the condition of the neonate.

DIAGNOSTIC CRITERIA

» Cessation of respiration for longer than 20 seconds, with/without cyanosis, pallor or bradycardia.
» Cessation of respiration for less than 20 seconds with cyanosis, pallor and/or bradycardia.

Central apnoea
Causes include:

» IRDS,
» prematurity,
» hypoxia/hypercarbia,
» sepsis,
» acidosis,
» meningitis,
» temperature disturbances,
» hypotension,
» medicines (sedatives, anticonvulsants, analgesics).
» pneumonia,
» intraventricular haemorrhage,
» patent ductus arteriosus,
» hypoglycaemia,
» hypermagnesaemia,
» atypical convulsions,
» anaemia,
» rough or excessive handling, and

Obstructive apnoea
Neonates are obligatory “nose breathers”. Obstruction of the nares make neonates prone to apnoea.
Causes of obstructive apnoea include:

» choanal atresia,
» micrognathia,
» secretions (milk, meconium, blood, mucus) lodged in the upper airway, and
» neck flexion or extension.
» gastro-oesophageal reflux,
» macroglossia,

Reflex apnoea or vagally mediated apnoea
Is due to:
» endotracheal intubation, » passage of a nasogastric tube,
» gastro-oesophageal reflux, » overfeeding, and
» suction of the pharynx or stomach.

Mixed apnoea
Apnoea caused by a combination of the above causes.

GENERAL AND SUPPORTIVE MEASURES

For all forms of neonatal apnoea:
» Identify and treat the underlying cause.
» Frequent gentle physical stimulation e.g. rubbing of soles of feet.
» Nurse preterm neonates in the prone position.
» Maintain ambient temperature at the lower range of neutral thermal environment.
» Maintain axillary temperature or anterior abdominal wall temperature at 36.2–36.8°C.
» Maintain haematocrit at 40%.
» Maintain nasal CPAP of 4 cm water. (Nasal CPAP – not for central apnoea except for apnoea of prematurity.)
» Monitor vital signs and parameters relating to the underlying cause.

MEDICINE TREATMENT

To maintain oxygen/haemoglobin saturation of 90-94% or an oxygen tension in the blood at 60–80 mmHg:

- Oxygen via nasal cannula, headbox, or mask.

Only for apnoea of prematurity (not term infants):

- Caffeine base, (anhydrous), oral/IV (dose expressed as caffeine base)
  - Loading dose: 10–12.5 mg/kg.
  - Maintenance dose: 2.5–5 mg/kg/24 hours. Start maintenance dose 24 hours after the loading dose.
    (Caffeine citrate 20mg = caffeine base 10 mg)

OR

- Aminophyline, IV/oral.
  - Loading dose: 8 mg/kg. (If IV infusion, administer over 30 minutes).
  - Maintenance dose: 1.5–3 mg/kg/dose 8 hourly. Start maintenance dose 8 hours after loading dose.

Maintain aminophylline blood levels at 10–12 mcg/mL.
If neonate responds favourably to caffeine/aminophyline continue until neonate is apnoea free for 7 days.

REFERRAL

» Recurrent life-threatening episodes of apnoea, not responding to adequate treatment and requiring ventilation.

19.2 CYANOTIC HEART DISEASE IN THE NEWBORN

Q24.9

DESCRIPTION

Blue or grey discoloration of skin and tongue in room air, with an oxygen saturation of less than 85% in the presence of a cardiac lesion.

Note:

Strongly suspect cyanotic cardiac disease if centrally cyanosed, not in respiratory distress and normotensive.

DIAGNOSTIC CRITERIA

- Rule out non-cardiac causes of central cyanosis:
  - Respiratory conditions, e.g. hyaline membrane disease, pneumonia and pneumothorax. Signs of respiratory distress usually improve with oxygen administration. Chest X-ray may be helpful.
  - Central nervous system involvement, e.g. sedation and asphyxia, which usually improves with oxygen administration.
  - $PaCO_2$ may be increased in cyanosis due to respiratory and central nervous system causes.
  - Methaemoglobinaemia.
- To confirm cardiac cause:
  - Do hyperoxia test.
  - Tachypnoea, but usually no retraction.
  - Heart murmur (may be absent).
- Hyperoxia Test (Nitrogen wash out test):
  - Administer 100% oxygen via a nasal cannula for 10 minutes.
    Unnecessary if saturation is under 85% in a head box or nasal cannulae delivering 100% oxygen.
  - Obtain arterial blood from the right radial artery (preductal flow).

PaO_2 mmHg	Interpretation
< 100	Most likely to be a cyanotic heart lesion, persistent foetal circulation or severe lung disease. $PaCO_2$ will be increased with severe lung disease.
≥ 100–200	Unlikely to be cyanotic heart lesion.
≥ 200	Excludes cyanotic heart lesion.

- Chest X-ray may show cardiomegaly or abnormal cardiac silhouette and/or reduced pulmonary blood flow.
  - Confirm diagnosis with echocardiography.

GENERAL AND SUPPORTIVE MEASURES

- Nurse in neutral thermal environment.
- Monitor and maintain within physiological range for age:
  - heart rate,
  - respiration,
  - blood pressure,
  - body temperature,
  - electrolytes.
  - calcium, magnesium,
  - blood glucose,
  - blood gases,
  - acid-base status, and
- Provide adequate hydration and nutrition.

MEDICINE TREATMENT

Referral is needed in all patients.

Prior to referral:

To keep ductus arteriosus open if a duct dependent cyanotic heart lesion is suspected:

- Prostaglandin therapy, i.e.:
- Alprostadil, IV, 0.05–0.1 mcg/kg/minute, initial dose, (under specialist consultation).
  - Maintenance dose : 0.01–0.1 mcg/kg/minute.

OR

- Dinoprostone, via naso/orogastric tube, (under specialist consultation).
  - For babies < 2.5 kg: 0.125 mg 1–2 hourly ($^1/_4$ tablet suspended in 2 mL sterile water), **or** 50 mcg/kg/dose 1–2 hourly.
  - For babies > 2.5 kg: 0.25 mg hourly (½ tablet suspended in 2 mL water).

Continue with prostaglandin therapy until corrective or palliative surgery can be done or until patency of the duct is not deemed essential for survival of the infant.
If ductal dependant lesion suspected maintain oxygen saturation just above 75%.

Serious side effects of prostaglandins to be aware of may include:
Apnoea, fever, diarrhoea, hypotension and seizures

If pH ≤ 7.2, correct metabolic acidosis:

» Sodium bicarbonate 4.2 %, IV.
HCO_3 needed (mmol) = base excess x 0.3 x body mass (kg).
2 mL sodium bicarbonate 4.2% = 1 mmol HCO_3.

SURGICAL TREATMENT

» Corrective or palliative surgery.

REFERRAL

» All cyanotic infants with an underlying cardiac cause for central cyanosis.

19.3 ENTEROCOLITIS, NECROTISING

P77

DESCRIPTION

Neonate presenting with the consequences of bowel wall injury or necrosis.
Risk factors include:

» prematurity,
» sepsis,
» early formula feedings,
» patent ductus arteriosus, and
» hypotension/shock,
» high feeding volumes,
» perinatal asphyxia (hypoxia),
» polycythaemia.

DIAGNOSTIC CRITERIA

» Early signs are often non-specific, i.e.:
  > feeding intolerance,
  > significant gastric aspirates,
  > vomiting,
  > body temperature instability,
  > apnoea and lethargy.
» Non-specific signs may progress to more specific signs including:
  > abdominal distention with ileus,
  > bloody stools,
  > peritonitis,
  > red-purple discolouration of the abdominal wall with abdominal wall cellulitis, and
  > bowel perforation.
» X-ray of abdomen may show:
  > distended loops of intestines,
  > bowel-wall thickening (oedema),
  > pneumatosis intestinalis,
  > hepatic portal venous gas, and
  > free intraperitoneal air due to perforation.
» Blood samples for culture and sensitivity testing before starting antibiotic therapy.

GENERAL AND SUPPORTIVE MEASURES

» Admit to neonatal high-care unit or intensive care unit.
» Nurse in neutral thermal environment.
» Insert oro/nasogastric tube and apply free drainage.
  > Suspected cases should be nil per mouth for 72 hours.
  > Confirmed cases should be nil per mouth for at least 7 days.
» Provide adequate parenteral nutrition as soon as diagnosis is confirmed.
» Provide cardiovascular and ventilatory support, if necessary.

MEDICINE TREATMENT

Depending on age, weight and hydration status:

- Neonatal maintenance solution, IV.
  Add volume of gastric aspirates to daily maintenance fluid volume.

If coagulopathy or septic shock:

- Plasma (lyophilised or fresh frozen), IV, 20 mL/kg over 2 hours.

If haematocrit < 40%:

- Packed red cells, IV, 10 mL/kg.

Until blood pressure is stabilised:

- Dopamine, IV, 5–15 mcg/kg/minute.

Empiric antibiotic therapy

- Ampicillin, IV, 50 mg/kg/dose for 7 days.
  - If age < 7 days: 50 mg/kg 12 hourly.
  - If 7 days – 3 weeks of age: 50 mg/kg 8 hourly.
  - If > 3 weeks of age: 50 mg/kg 6 hourly.

PLUS

- Gentamicin, IV, 5 mg/kg once daily for 7 days.

Where available, gentamicin doses should be adjusted on the basis of therapeutic drug levels.

- Trough levels (taken immediately prior to next dose), target plasma level < 1 mg/L.
- Peak levels (measured 1 hour after commencement of IV infusion or IM/IV bolus dose), target plasma level > 8 mg/L.

PLUS

- Metronidazole, IV, for 7 days.
  - Loading dose: 15 mg/kg over 60 minutes.
  - Post natal age < 4 weeks: 7.5 mg/kg/dose 12 hourly.
  - Postnatal age ≥ 4 weeks: 7.5 mg/kg/dose 8 hourly.

Reassess choice of antibiotics when the culture and sensitivity results become available.

Adjust antibiotic regimen according to local susceptibility patterns and suspicion of nosocomial infection, where possible in consultation with a microbiologist or infectious diseases specialist.

SURGICAL TREATMENT

Surgical intervention is required when there is progressive deterioration of the clinical condition despite maximal medical support and/or bowel necrosis with/without bowel perforation.

» Prior to transport to a tertiary hospital for definitive surgery, insert/place a peritoneal drain in babies presenting with severe abdominal distension, due to free air and/or fluid in the peritoneal cavity, compromising respiration and/or blood pressure.
» Perform the procedure in a theatre, intensive care or high care unit where facilities for monitoring vital signs, resuscitation, ventilation and temperature control of the environment are available.
» Obtain consent to perform the surgical procedure.

Method of inserting/placing a peritoneal drain

» Procedure is sterile; the doctor should be gowned and gloved.
» Clean and drape the abdomen.
» Administer an appropriate analgesic (e.g. ketamine, IV) immediately before the start of the procedure.

» Identify a site in either one of the fossae iliaca, ensuring that it is lateral to the inferior epigastric artery.
» At the intended surgical incision site, inject:
  - Lignocaine (lidocaine) 1%, SC, 0.5 mL.
» Make a small skin incision over the "bubble" of lignocaine (lidocaine) (no. 11 blade).
» Use a mosquito forceps or clamp to dissect down to the peritoneum, pierce the latter with a gentle stab using the closed forceps and slightly stretch the peritoneal puncture site with the forceps.
» Note what drains from the peritoneal cavity and send a sample for microscopy and culture.
» Insert a pencil drain of ± 5 mm width with the mosquito clamps or forceps into the peritoneal cavity through the peritoneal stab wound. About 1.5–2 cm of the pencil drain should be inside the peritoneal cavity.
» Fix the drain to the skin with a size 4 – 0 stitch (e.g. PDS).
» Cover the drain with a gauze pad or urine collecting bag.

REFERRAL
» All confirmed cases for specialist care.
» Deterioration of clinical condition, despite adequate treatment.
» Signs and symptoms of intestinal perforation and peritonitis requiring surgical intervention.
» Recurrent apnoea episodes and/or signs of respiratory failure, requiring respiratory support.

19.4 HAEMORRHAGIC DISEASE OF THE NEWBORN
P53

DESCRIPTION
This is due to a deficiency of vitamin K-dependent clotting factors II, VII, IX and X. All newborns who did not receive vitamin K_1 at birth, especially preterm babies and breastfed babies, are at risk.

Spontaneous bleeding may be from any site but is usually gastro-intestinal, producing haematemesis or melaena. Bleeding from the umbilical stump, epistaxis and a cephalohaematoma or subgaleal haemorrhage are also relatively common. Complications may include anaemia, hypovolaemic shock and intracranial haemorrhage with neurological damage.

There are three forms of the disorder.
Early form: presents within 24 hours of birth in newborns of mothers on treatment with anticonvulsants, e.g. phenytoin and phenobarbitone, or oral anticoagulants.
Classical form: presents during the first week of life, usually on the second to seventh day.

Late form: presents during the first to fourth month of life usually with intracranial haemorrhage in exclusively breastfed babies who did not receive vitamin K prophylaxis at birth.

DIAGNOSTIC CRITERIA

Special investigations

» Prolonged prothrombin time (PT).
» Normal partial prothrombin time (PTT).
» Increased international normalised ratio (INR) with a normal platelet count.
» Normal fibrinogen levels.
» Normal thrombin time.

Note:

- Exclude other causes of bleeding in the neonate.
- Exclude swallowed blood of mother during delivery in babies with melaena. (Apt test or haemoglobin electrophoresis).

GENERAL AND SUPPORTIVE MEASURES

» Nurse in neutral thermal environment.
» Provide adequate nutrition.
» Monitor:
  > blood pressure,
  > heart rate,
  > respiratory rate,
  > body temperature,
  > coagulation parameters.
  > hydration,
  > SaO_2,
  > haematocrit,
  > blood gluco se, and

MEDICINE TREATMENT

- Oxygen, if needed.

- Fresh frozen plasma or lyophilised plasma, IV, 20 mL/kg over one hour.

If anaemic (haematocrit < 40% or Hb < 13 g/dL):

- Packed red cells, IV, 10 mL/kg over 1 hour.
  o May be repeated if necessary.

- Vitamin K_1, IM, 1 mg as a single dose.

Prophylaxis

- Vitamin K_1, IM, single dose at birth.
  Full term newborns: 1 mg
  Preterm newborns: 0.5 mg

Prophylaxis with oral vitamin K formulation is not recommended.

REFERRAL

» Deterioration of clinical condition despite adequate treatment.
» Suspected intracranial haemorrhage.

19.5 HEART FAILURE IN NEONATES

P29.0

DESCRIPTION

Clinical syndrome reflecting the inability of the myocardium to meet the oxygen, nutritional or metabolic requirements of the body. Heart failure may be acute or chronic.

The main causes of heart failure are:

- Congenital heart abnormalities:
  - Left-sided outflow obstruction, e.g. interrupted aortic arch, co-arctation of the aorta and aortic valve stenosis.
  - Left to right shunts, VSD and PDA.
  - Hypoplastic left heart.
  - Complex congenital heart lesions.
- Acquired conditions:
  - fluid overload,
  - hypoglycaemia,
  - acidosis,
  - dysrhythmias,
  - pneumopericardium,
  - hypertension.
  - sepsis,
  - hypoxia,
  - severe anaemia,
  - cardiomyopathy,
  - hyperthyroidism,

DIAGNOSTIC CRITERIA

Diagnosis relies on history, physical examination and a chest X-ray.

Clinical

- Acute heart failure may present with shock, i.e. cardiogenic shock.
- Heart failure is usually associated with fluid retention and congestion.
- History of recent onset of:
  - poor feeding,
  - tachypnoea (> 60 breaths/minute),
  - sweating, and
  - poor or excessive weight gain in excess of 30 g/24 hours.
- Physical findings:
  - tachycardia (> 180 beats/minute),
  - gallop rhythm (with/without a cardiac murmur),
  - cardiomegaly,
  - features of cardiogenic shock, i.e. cold wet skin, weak pulses, hypotension,
  - reduced urinary output,
  - pulmonary venous congestion and fluid retention,
  - systemic venous congestion,
  - hepatomegaly, and
  - signs and symptoms of underlying condition/disease.
- Always check the femoral pulses.

Special Investigations

» Radiology: cardiomegaly is usually present, cardiothoracic ratio > 60%. Caution - thymic shadow may be present.
» Electrocardiogram may show evidence of hypertrophy of one or more heart chambers and/or dysrhythmias.
» Echocardiography may show a reduced ejection fraction or shortening fraction of left ventricle.

GENERAL AND SUPPORTIVE MEASURES

» Nurse in a neutral thermal environment.
» Restrict fluids, but ensure adequate nutrition.
  > Administer 75% of estimated daily fluid requirements.
  > Use breast milk or low-salt milk formulae.
  > Tube feeding.
» Treat the underlying condition, e.g. sepsis and cardiac tamponade.

MEDICINE TREATMENT

First treat shock, if present.

To prevent hypoxia:

- Oxygen via face mask, nasal cannula or head box.

Combination medicine therapy is usually indicated,

Afterload reduction: ACE inhibitor or vasodilator

Monitor blood potassium levels and stop potassium supplements while patient is on an ACE inhibitor.
ACE inhibitors are contraindicated in renal failure, bilateral renal artery stenosis or a single functioning kidney.

Consider ACE inhibitors in persistent heart failure where left sided outflow obstruction has been excluded, other measures have failed and only after consultation with a paediatrician or paediatric cardiologist.

- Captopril, oral, 0.01–0.05 mg/kg/dose, 8–12 hourly, initially.
  - Adjust dose and interval based on response.
  - Administer 1 hour before feeding.
  - Continue as long as needed to control the heart failure

Diuretics

Continue diuretic therapy as long as needed to control heart failure.
Monitor blood potassium levels.

Potassium supplements may be necessary if furosemide is used without spironolactone.
Hypokalaemia and hypochloraemic alkalosis may increase digitalis toxicity.

- Furosemide, IV/oral, 1–3 mg/kg/24 hours as a single daily dose, or in 4 divided oral doses.

WITH/ WITHOUT

- Spironolactone, oral, 1–3 mg/kg/dose, once daily.

Inotropic support

May help to stabilise patients with severe myocardial dysfunction, hypotension or low cardiac output.
May be lifesaving in severe myocarditis or cardiogenic shock.

- Dobutamine, IV infusion, 2.5–15 mcg/kg/minute.
  - Continue until myocardial function and blood pressure improve.
  - Ensure normovolaemia.
  - Monitor blood pressure.

Acute left-heart failure: acute pulmonary oedema or pulmonary venous congestion

- Oxygen 100%, via nasal cannula.

- Furosemide, IV, 1–3 mg/kg, immediately.

For patients not responding to furosemide:

- Morphine, IV, 0.1 mg/kg.

- Inotropic support, as above.

- Afterload reduction, as above.

To raise the alveolar pressure above pulmonary capillary pressure, intubate with intermittent positive ventilation.
Titrate oxygen according to saturation, 90–94%.

SURGICAL TREATMENT

Palliative or corrective surgery for certain congenital heart lesions.

REFERRAL

» Deterioration despite adequate treatment.
» For determination of the underlying cause, and initiation of specialised, after stabilisation.

19.6 HYPOCALCAEMIA, NEONATAL

P71.1

DESCRIPTION

Acute symptomatic hypocalcaemia may present within the first 72 hours of birth (early hypocalcaemia) or after 72 hours of birth (late hypocalcaemia) with apnoea, irritability, seizures, jitteriness or prolonged QTc interval on ECG.

Causes of early hypocalcaemia include:

» Prematurity.
» Respiratory distress syndrome.
» Asphyxia/hypoxia.
» Neonate of diabetic mother.
» Sepsis.

Causes of late hypocalcaemia include:

» Maternal hyperparathyroidism.
» Congenital hypoparathyroidism.
» Renal failure.
» Hypomagnesaemia.
» High phosphate feeds.
» Vitamin D deficiency.

DIAGNOSTIC CRITERIA

» Total serum calcium < 1.8 mmol/L, or
» Ionised calcium < 0.7 mmol/L.

MEDICINE TREATMENT

Symptomatic hypocalcaemia:

- Calcium gluconate 10%, IV, 100–200 mg/kg/dose 6–8 hourly.

1 mL of calcium gluconate 10% = 100 mg calcium gluconate
= 10 mg elemental calcium
= 0.23 mmol calcium

Do not administer ceftriaxone, within 48 hours of administering calcium.

Correct hypomagnesaemia before administering 10% calcium gluconate.

- Magnesium sulphate 50%, IV, 0.25 mL/kg.
  - Monitor levels until deficits are reduced.

Exchange transfusion

- Calcium gluconate 10%, IV infusion, administered over 10 minutes.
  - 100mg for every 100 mL citrated blood exchanged.

Acute hypocalcaemia with seizures

- Calcium gluconate 10%, IV infusion, 100–200 mg/kg, administered over 10 minutes. Repeat in 15 minutes if necessary.
  - Dilute 1:1 with dextrose 5% or sodium chloride 0.9%.
  - Do not use calcium chloride.

Note: Rapid infusion causes bradycardia/dysrhythmias. Electrocardiographic monitoring is advised. Monitor the heart rate.

CAUTION

Do not mix calcium gluconate with bicarbonate or fluids containing phosphate as precipitation may occur. Extravasation of calcium can cause tissue necrosis. Do not give intra-arterially or via umbilical venous catheters placed near the heart or inside the liver.

REFERRAL

» Persisting or recurrent unexplained hypocalcaemia.

19.7 HYPOGLYCAEMIA, NEONATAL

P70.4

DESCRIPTION

Neonate presenting with whole blood glucose below 2.6 mmol/L.

Risk factors include:

» prematurity,
» small for gestational age,
» neonate of diabetic mother,
» sepsis,
» hypothermia/hyperthermia,
» birth asphyxia,
» respiratory distress,
» rhesus iso-immunisation,
» hyperinsulinism,
» post maturity,
» feeding difficulties,
» polycythaemia, and
» hereditary defects in carbohydrate or amino acid metabolism.

DIAGNOSTIC CRITERIA

Clinical

Asymptomatic: Hypoglycaemia detected when screening neonates at risk.
Symptomatic:

» lethargy,
» hypotonia,
» apnoea,
» jitteriness,
» irritability,
» coma.
» poor feeding,
» respiratory distress,
» cardiac failure,
» convulsions,
» metabolic acidosis, and

Investigations

» Whole blood glucose (heel prick) < 2.6 mmol/L.

Monitor the blood glucose of all neonates who are at risk of hypoglycaemia regularly, at least 2 hourly, to prevent the development of hypoglycaemia.

GENERAL AND SUPPORTIVE MEASURES

» Determine and treat the underlying cause.
» Enteral feeding, oral or via oro/nasogastric tube, after exclusion of vomiting, ileus or obstruction.

MEDICINE TREATMENT

- Dextrose 10%, bolus IV, 2.5 mL/kg (250 mg/kg).
  - Dextrose 10% = 10 g dextrose in 100 mL.
  - Do not repeat dextrose bolus.

To raise heel prick blood glucose to a level of 2.6 mmol/L or more, follow with:

- Dextrose 10%, continuous IV infusion, 6–12 mg/kg/minute or more.

$$\text{Dextrose dose (mg/kg/min)} = \frac{\text{(\% dextrose solution x rate in mL/hour)}}{\text{(weight x 6)}}$$

If heel prick blood glucose remains below 2.6 mmol/L:

- Dextrose 15%, IV, 15 mg/kg/minute or more.
  - Dextrose 15% = 15 g dextrose in 100 mL.

If heel prick blood glucose is above 2.6 mmol/L after IV infusion has been started continue infusion at maintenance rate.

Monitor blood glucose at least 2 hourly until blood glucose level stabilises at 2.6 mmol/L or above. To avoid rebound hypoglycaemia, reduce IV dextrose infusion gradually.

Before the IV infusion is finally discontinued, the neonate should receive all milk feeds orally or via nasogastric tube. If enteral feeds are not tolerated TPN should be given.

Suspect other serious underlying metabolic or biochemical abnormality if the neonate requires > 12 mg/kg/minute of dextrose to maintain a heel prick whole blood glucose > 2.6 mmol/L.
Use a central venous line for high concentrations of dextrose.

Prior to referral give the following, if available:

- Glucagon, IM/IV/SC, 0.2 mg/kg single dose.

REFERRAL

» Hypoglycaemia not responding to adequate treatment.
» Recurrent or persistent hypoglycaemia.

Also see Chapter 7 Endocrine system, section 7.6 Hypoglycaemia in children.

19.8 NEONATAL ENCEPHALOPATHY

P21.9

It is important to exclude other causes of neonatal encephalopathy.

19.8.1 HYPOXIA/ISCHAEMIA OF THE NEWBORN (PERINATAL HYPOXIA/HYPOXIC-ISCHAEMIC ENCEPHALOPATHY)

P21.9

DESCRIPTION

Ischaemia and decreased oxygen delivery to the foetus/baby during the prepartum, intrapartum or immediate postpartum period, with hypoxic-ischaemic damage to the central nervous system and to other body systems.

Complications include:

- Cardiovascular: heart rate and rhythm disturbances, heart failure and hypotension.
- Pulmonary: respiratory distress/respiratory failure, pulmonary hypertension and pulmonary haemorrhage.
- Renal: renal failure, acute tubular/cortical necrosis and urinary retention.
- Gastrointestinal tract: ileus and necrotising enterocolitis.
- Central nervous system: increased intracranial pressure, cerebral oedema, encephalopathy, seizures, inappropriate antidiuretic hormone (ADH) secretion, hypotonia and apnoea.
- Metabolic: hypoglycaemia, hyperglycaemia, hypocalcaemia, hypomagnesaemia and metabolic acidosis.
- Body temperature: abnormal.
- Other: disseminated intravascular coagulation.

DIAGNOSTIC CRITERIA

To make the diagnosis of HIE, all of the following are required:

- Gestation ≥ 36 weeks (i.e. late premature or term).
- Evidence of intrapartum asphyxia or hypoxia.
- Evidence of encephalopathy.

Other criteria to consider:

- History of foetal distress and/or meconium stained amniotic fluid.
- Apgar scores:
  - one-minute Apgar score ≤ 3,
  - five-minute Apgar score of ≤ 6,
- Arterial blood lactate > 5 mmol/L.
- Severe mixed acidosis:
  - pH < 7.2,
  - base excess > –10,
  - $PaCO_2$ > 55 mmHg.
- Haematuria.
- Troponin T increased.
- Prolonged resuscitation (>10 min).

Stages of hypoxic-ischaemic encephalopathy (HIE) – *Sarnet and Sarnet*

Stage	Stage 1 mild	Stage 2 moderate	Stage 3 severe
Prognosis	Good	Guarded ± 50% may have varying degree of neurological sequelae	Poor ≥ 90% mortality with major neurological sequelae in survivors
Level of consciousness	» Hyperalert » Irritable	» Lethargic » Obtunded	» Stuporous » Comatose
Neuromuscular control	» uninhibited » over-reactive	» diminished » spontaneous movement	» diminished/absent » spontaneous movement
Muscle tone	» normal	» mild hypotonia	» flaccid
Posture	» mild distal flexion	» strong distal flexion	» intermittent decerebration
Tendon reflexes	» overactive	» overactive	» decreased/absent
Complex reflexes			
Suck	» weak	» weak/absent	» absent
Moro	» strong	» weak	» absent
Autonomic function	» general sympathetic	» general parasympathetic	» both systems depressed
Pupils	» mydriasis	» miosis	» mid-position, often unequal » poor light reflex
Respirations	» spontaneous	» spontaneous » occasional apnoea episodes	» periodic apnoea episodes
Heart rate	» tachycardia	» bradycardia	» variable, usually bradycardia
Bronchial and salivary secretions	» sparse	» profuse	» variable
Gastrointestinal motility	» normal or decreased	» increased	» variable » ileus
Seizures	» none	» common	» uncommon, but prolonged if present decerebrate

GENERAL AND SUPPORTIVE MEASURES

» Resuscitate.
» Avoid hyperthermia.
» Admit to neonatal high care or intensive care facility, if available.

» Mild HIE: ambient temperature at lower range of neutral thermal environment.
» Infants ≥ 36 weeks gestation with moderate HIE (stage 2): whole body or head cooling.
  > Initiate within 6 hours of birth to maintain rectal (core) temperature at 33–34ºC (whole body cryotherapy) or 34-35ºC (head cooling) for 72 hours.
  > Slowly rewarm at a rate of 0.5ºC/hour until core temperature 36.5-37.0ºC, then maintain axillary or skin temperature is at 36.5–36.8ºC.

Neonates not eligible for cooling:
1. Birth weight less than 2000 g.
2. Gestational age less than 36 weeks.
3. Inability to initiate cooling by 6 hours of age.
4. Suspected coagulopathy.
5. Life-threatening abnormalities of the cardiovascular or respiratory systems such as complex congenital heart disease and persistent pulmonary hypertension of the newborn (PPHN).
6. Major congenital malformations, imperforate anus, suspected neuromuscular disorders, or presence of known lethal chromosomal anomaly.
7. Death appears imminent.

» Ventilatory support if PaO_2 < 60 mmHg and/or $PaCO_2$ > 55 mmHg in newborns with moderate HIE (stage 2).
» Maintain:
  > Blood glucose at 2.6–6 mmol/L.
  > Haematocrit at ≥ 40%.
  > Blood pressure at 70/35 mmHg in a term infant and 50/35 mmHg in a preterm infant. Mean blood pressure at least 5–10 mmHg more than the gestational age.
» IV fluids
  > Frequent assessment of fluid balance, i.e. intake and output.
  > Restrict fluids to 50–60 mL/kg in the first 24–48 hours.
  > Use dextrose water 10% or a neonatal maintenance solution potassium-free until the possibility of renal failure has been excluded.
» Maintain serum electrolytes, calcium, magnesium and acid-base status within normal physiological range.
» Nutrition:
  > No enteral feeds for at least the first 12–24 hours.
  > Enteral milk feeds (preferably breastmilk) only after ileus has been excluded.
  > Consider IV alimentation if enteral feeds are not possible after 24 hours.
» Monitor:
  > neurological status,
  > vital signs,
  > acid-base status,
  > blood gases,
  > SaO_2,
  > blood pressure,
  > brain function (aEEG), where available.
  > fluid balance,
  > temperature,
  > blood glucose,
  > electrolytes,
  > calcium, magnesium,
  > renal function, and

» Brain imaging – at least one cranial US during admission if available.
» Follow up for assessment of neurodevelopment, hearing and vision.

MEDICINE TREATMENT

To keep PaO_2 between 60 and 80 mmHg and saturation 90-94% (normal range):

- Oxygen.

Haematocrit <40%:

- Packed red cells, IV, 10 – 20 mL/kg (consider pack size).

If infection is suspected or confirmed:
Treat as follows (if no renal dysfunction is present):

- Ampicillin, IV, 50 mg/kg/dose.
  - If age < 7 days: 50 mg/kg 12 hourly.
  - If 7 days – 3 weeks of age: 50 mg/kg 8 hourly.
  - If > 3 weeks of age: 50 mg/kg 6 hourly.

PLUS

- Gentamicin, IV, 5 mg/kg once daily.

Where available, gentamicin doses should be adjusted on the basis of therapeutic drug levels.

- Trough levels (taken immediately prior to next dose), target plasma level < 1 mg/L.
- Peak levels (measured 1 hour after commencement of IV infusion or IM/IV bolus dose), target plasma level > 8 mg/L.

Hypotension

- Sodium chloride 0.9%, IV, 20 mL/kg over 1 hour.

AND

- Dopamine, IV, 5–15 mcg/kg/minute.

AND/OR

- Dobutamine, IV, 5–15 mcg/kg/minute if cardiac dysfunction or failure is present.
  - Continue with blood pressure support until blood pressure is stabilised.

Seizure Control

Administer anticonvulsants with monitoring of cardiorespiratory function.

- Phenobarbitone, IV:
  - Loading dose: 20 mg/kg over 10 minutes.
  - Refractory seizures: Additional 10 mg/kg up to 40 mg/kg.

Maintenance:

- Phenobarbitone, IV or oral:
  - 4 mg/kg/day beginning 12–24 hours after the loading dose.

Admit neonates with seizures refractory to phenobarbitone to a high or intensive care unit.

Cardiorespiratory support is usually required in this category of infants.

For term normothermic neonates:

- Lignocaine (lidocaine), IV.
  - Loading dose: 2 mg/kg over 10 minutes.
  - Follow with a continuous infusion of:
    6 mg/kg/hour for 6 hours, then
    4 mg/kg/hour for 12 hours, followed by
    2 mg/kg/hour for 12 hours.
  - If seizures are well controlled, taper slowly over 12 hours.

For preterm neonates:

A safe dose of lidocaine in preterm neonates has not been established but the following dosing schedule has been used.

- Lignocaine (lidocaine), IV.
  - Loading dose: 2 mg/kg over 10 minutes.
  - Follow with a continuous infusion of 3 mg/kg/hour for 3 days.
  - Taper dose gradually over next 2 days.

Do not use lignocaine (lidocaine) if phenytoin was given.
Do not use lidocaine for seizures in newborns with congenital heart disease, dysrhythmias, acute heart failure and shock.

» A safe lignocaine (lidocaine) dosing regimen for term infants undergoing hypothermia treatment for HIE has not been established; recommended to use half infusion dosages.
» Clearance of lignocaine (lidocaine) is slower in hypothermic preterm infants and neonates and there is a risk of accumulation.
» Start tapering earlier than 3 days if seizures are well controlled.
» Continuous monitoring of ECG, heart rate and blood pressure is mandatory if lignocaine (lidocaine) is used.
» Main adverse effects of lignocaine (lidocaine): dysrhythmias and bradycardia.
» Life threatening dysrhythmias may indicate lignocaine (lidocaine) toxicity. Treat with:
  - Lipid emulsion 20%, IV, 1.5 mg/kg over 1 minute.
    - Follow with a continuous infusion of 0.25 mL/kg/minute for 30 minutes. Refer urgently.

Cardiac failure

Restrict fluid.

- Furosemide, IV/oral/nasogastric tube, 1 mg/kg/24 hours as a single daily dose.
- Dobutamine IV, 5–15 mcg/kg/minute.

Hypocalcaemia

Serum total calcium < 1.8 mmol/L or ionised calcium < 0.7 mmol/L.

- Calcium gluconate 10%, slow IV, 1–2 mL/kg over 15 minutes under ECG monitoring.

Hypomagnesaemia
Serum magnesium < 0.6 mmol/L:
- Magnesium sulphate 50%, IV, 0.2 mL/kg as a single dose.

Hypoglycaemia
Blood glucose < 2.6 mmol/L:
- Dextrose 10%, bolus IV, 2.5–5 mL/kg (250–500 mg/kg).
  Dextrose 10% = 10 g dextrose in 100 mL.
  Do not repeat dextrose bolus; titrate the glucose concentration of the IV fluid to increase glucose delivery.

Inappropriate ADH:
Moderate fluid restriction of 50–60 mL/kg/24hours for the first 24–48 hours.
Raise head of cot by 10–15 cm.

Cerebral oedema/raised intracranial pressure
Moderate hyperventilation to lower $PaCO_2$ to 35 mmHg, if ventilation facilities are available.

REFERRAL
» Neurological assessment of survivors at 3 months.
» Moderate HIE (gestational age ≥ 36 weeks) to reach referral hospital before 6 hours post birth.
» Lidocaine toxicity.

19.9 JAUNDICE, NEONATAL
P58

DESCRIPTION
Yellow discolouration of the skin and mucous membranes due to hyperbilirubinaemia.
Bilirubin is formed mainly from haem catabolism. Jaundice develops when there is an overproduction of bilirubin, defective bilirubin metabolism and/or defective excretion of bilirubin from the body.

DIAGNOSTIC CRITERIA
Jaundice may be physiological or pathological.

Physiological jaundice
» Seldom appears before 24–36 hours after birth.
» Rarely lasts more than 10 days in the full term infant and 14 days in the pre-term infant.
» Only the unconjugated bilirubin fraction is increased.
» Total peak serum bilirubin concentration is usually below 275 micromol/L in the term infant.

» Total bilirubin concentration does not rise by more than 85 micromol/L/24 hours or 17 micromol/L/hour.
» The baby thrives and shows no signs of illness or anaemia.
» Treatment is unnecessary.

Pathological jaundice

» May appear within the first 24 hours of birth, but can occur at any time after birth.
» Persists for longer than 10 days in the full term infant or 14 days in the pre-term infant.
» The unconjugated and/or conjugated fractions of bilirubin are increased.
» The conjugated bilirubin level exceeds 20% of the total bilirubin value, or the conjugated bilirubin fraction is 30 micromol/L or more.
» Total bilirubin concentration rises by more than 85 micromol/L/24 hours or 17 micromol/L/hour and the total serum bilirubin level is above physiological level.
» There are signs and symptoms of illness in the baby.
» Stools are pale in obstructive jaundice.

BREASTFEEDING ASSOCIATED JAUNDICE

Increased unconjugated bilirubin levels during the first week of life in breastfed babies is due to calorie and fluid deprivation and delayed passage of stools. Improves with increased frequency of breastfeeding.

19.9.1 HYPERBILIRUBINAEMIA, UNCONJUGATED

Excessive haemolysis	Defective conjugation
» ABO incompatability	» prematurity
» rhesus disease	» infection
» enclosed haemorrhages	» hypoxia
» polycythaemia	» hypoglycaemia
» infections*	» hypothyroidism*
» spherocytosis	» breast milk jaundice*
» G6PD deficiency	

* may cause prolonged neonatal jaundice.

GENERAL AND SUPPORTIVE MEASURES

» Treat the underlying cause.
» Monitor the infant's body temperature and maintain within thermoneutral range.
» Maintain adequate nutrition and hydration.
» Correct factors known to increase the risk of brain damage in babies with jaundice e.g.:
  > hypoxia,
  > hypoglycaemia,
  > acidosis,
  > haemolysis.
  > prematurity,
  > hypothermia,
  > hypoalbuminaemia, and

PHOTOTHERAPY

Guideline for initiating phototherapy:

» Commence phototherapy based on total serum bilirubin measurements, correlated with phototherapy graph attached. The need for phototherapy is determined by the level according to hours of life and gestation or weight.
» The skin colour of a baby receiving phototherapy does not reflect the degree of jaundice (bilirubin blood level) or the efficacy of the phototherapy.
» Undress the baby and cover the eyes with gauze pad or commercially available eye covers.
» Position the phototherapy unit (fluorescent light bulbs of 400–500 nm wavelength) not higher than 45 cm above the baby.
» Check spectral irradiance of the fluorescent lights using a radiometer after every 200–300 hours of use to ensure that they are effective.
» The spectral irradiance should be above 10 microwatt/cm^2/nm of wavelength. If spectral irradiance cannot be checked regularly, replace fluorescent light bulbs after 1 000 hours of continuous use.
» A quartz halogen light source (400–500 nm wavelength) can also be used for phototherapy.
» Phototherapy units with diodes emitting light in the blue spectrum or fibro-optic phototherapy units can be used instead of the fluorescent/quartz halogen units.
» Terminate phototherapy when the total serum bilirubin level is more than 50 micromol/L below the recommended phototherapy initiating level, and the cause of the jaundice has been determined and adequately addressed.
» A rebound increase in bilirubin may follow termination of phototherapy.
» Monitor bilirubin levels approximately 6 hourly after phototherapy has been stopped.

Guideline for exchange transfusion (see also the graphs below):

» Exchange transfusion is indicated when the risk of bilirubin encephalopathy and kernicterus is significant. Referral for exchange transfusion may be needed.

MEDICINE TREATMENT

Rh incompatibility (i.e. mother Rh negative, baby Rh positive).
ABO incompatibility (i.e. mother = O, baby = A, B or AB).
Once the diagnosis of Rh- or ABO-related haemolysis is confirmed, together with a positive direct Coombs test; and the serum bilirubin is rising rapidly (>17 µmol/hour with intensive phototherapy) or is approaching exchange transfusion level then administer:

- Gammaglobulin, IV, 500 mg/kg over 1 hour (in consultation with a specialist).
  - Can be repeated once after 6–8 hours.

Mothers of babies with Rh incompatibility should receive:

- Anti D immunoglobulin, IM, 100 mcg as soon as possible after birth but within 72 hours of birth.

PHOTOTHERAPY

South African Neonatal Academic Hospital Guidelines: 2006

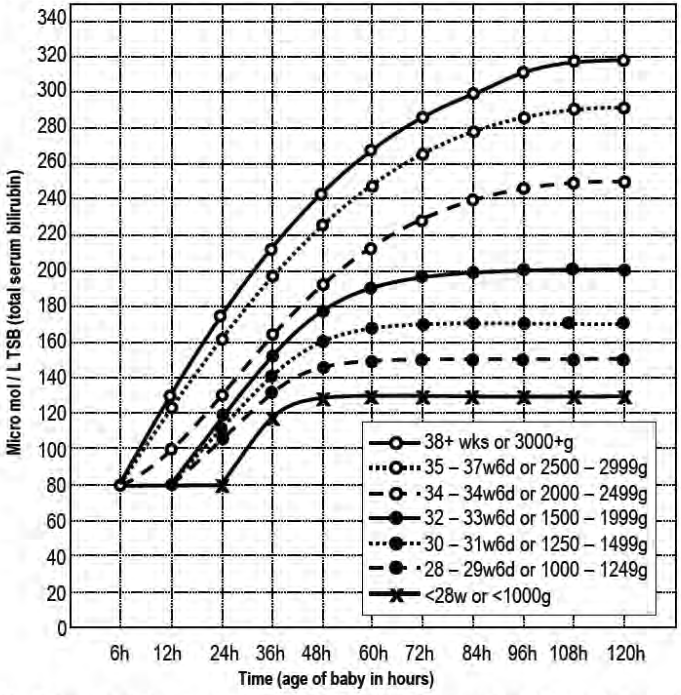
In presence of risk factors use one line lower (the gestation below) until <1000g.

If gestational age is accurate, rather use gestational age (weeks) instead of body weight

Infants > 12 hours old with TSB level below threshold, repeat TSB level as follows:
1- 20µmol/L below line:repeat TSB in 6hrs or start phototherapy and rept TSB in 12- 24hrs,
21 - 50 µmol/L below line: repeat TSB in 12 – 24hrs,
>50 µmol/L below line: rept TSB until it is falling and/or until jaundice is clinically resolving

Infants under phototherapy :
Check the TSB 12 – 24 hly but if TSB >30 µmol/L above the line , check TSB 4 – 6hly.

STOP phototherapy :
If TSB > 50 µmol/L below the line. Recheck TSB in 12 – 24hr.



Start intensive phototherapy when the TSB is ≥ the line according to gestation or weight.
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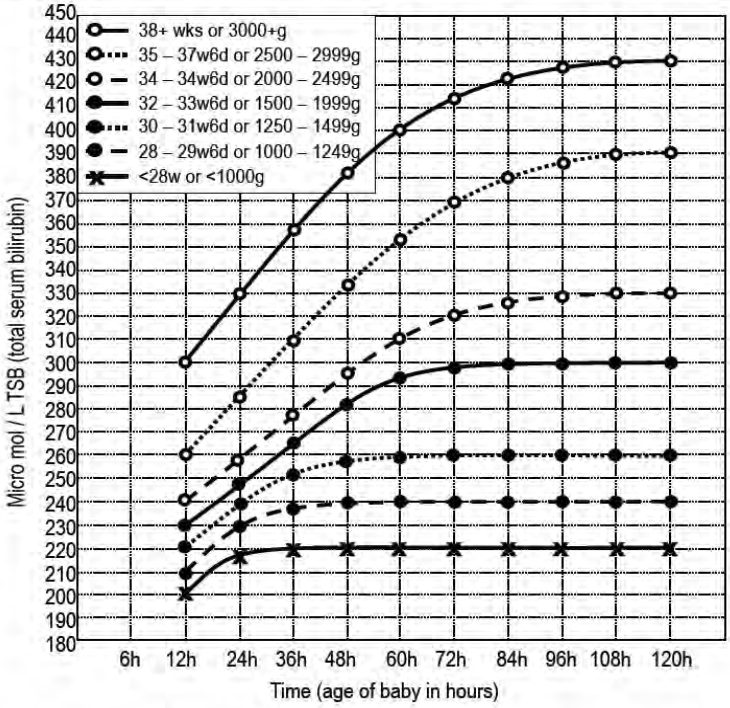
(SAMJ 2006;96:819-824)

EXCHANGE TRANSFUSION

South African Neonatal Academic Hospital Guidelines: 2006

In presence of sepsis, haemolysis, acidosis, or asphyxia,
use one line lower (gestation below) until <1000g
If gestational age is accurate, rather use gestational age (weeks) than body weight

Note: 1. Infants who present with TSB above threshold should have Exchange done if the TSB is not expected to be below the threshold after 6 hrs of intensive phototherapy.
2. Immediate Exchange is recommended if signs of bilirubin encephalopathy and usually also if TSB is >85 µmol/L above threshold at presentation
3. Exchange if TSB continues to rise >17 µmol/L/hour with intensive phototherapy



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19.9.2 HYPERBILIRUBINAEMIA, CONJUGATED

Hepatocellular disease	Bile duct obstruction
» hepatitis* » total parenteral nutrition* » syphilis » other congenital infections » galactosaemia*	» bile duct hypoplasia/atresia* » choledochal cyst » cystic fibrosis

* May cause prolonged neonatal jaundice.

Conjugated hyperbilirubinaemia is due to intra/extrahepatic obstruction of bile ducts (cholestasis) and usually presents in the second week of life or later.
The baby has a green-yellow skin discolouration, dark bile stained urine and pale acholic stools. Hepatomegaly is commonly present and the infant often fails to thrive.

Neonatal hepatitis, prolonged TPN and biliary atresia or hypoplasia accounts for the majority of cases of conjugated hyperbilirubinaemia.

GENERAL AND SUPPORTIVE MEASURES

» Treat the underlying cause.
» Dietary modifications to counteract the malabsorption of fat and fat soluble vitamins (A, D, E and K) that may occur in patients with a prolonged conjugated hyperbilirubinaemia.
» When galactosaemia is suspected avoid lactose containing feeds, i.e. breast milk and lactose containing formula.

MEDICINE TREATMENT

All premature babies, day 15 to 1 year:

- Multivitamin, oral, 0.6 mL daily.

SURGICAL TREATMENT

Conditions amenable to surgery e.g. biliary artresia.
Hepatoporto-enterostomy for biliary atresia should be done before 60 days of age for optimal outcome.

REFERRAL

» All cases of jaundice persisting more than 2 weeks with conjugated bilirubin level > 20% of total bilirubin, for diagnosis and initiation of treatment.

19.10 JAUNDICE, NEONATAL, PROLONGED

DESCRIPTION

Jaundice (static or a rising bilirubin) present for more than 10 days in a term infant and 14 days in a preterm infant. The usual causes are:

» breast milk jaundice,
» hypothyroidism,
» hepatitis,
» galactosaemia, and
» infections, e.g. UTIs.

Breast milk jaundice may be confirmed by substituting breastfeeding with formula feeds for 24–48 hours. The bilirubin level will always drop to a lower level and increase again when breastfeeding is resumed. However, the level will not rise to the original high level. Breast milk jaundice is an unconjugated hyperbilirubinaemia and the infant is always well and thriving.

Abnormal thyroid function, increased TSH and decreased T_3 and T_4, indicates hypothyroidism. Unconjugated bilirubin fraction is raised and the infant may have clinical signs of hypothyroidism e.g.:

» lethargy,
» feeding difficulties,
» poor cry,
» nasal obstruction,
» bradycardia.
» constipation,
» hypotonia,
» umbilical hernia,
» hypothermia, and

Infants with galactosaemia usually present with:

» a conjugated hyperbilirubinaemia,
» refusal to feed,
» failure to thrive,
» encephalopathy, and
» vomiting,
» hepatomegaly,
» hypoglycaemia,
» cataracts (later).

DIAGNOSTIC CRITERIA

» Hepatitis may be confirmed by abnormal liver function tests, i.e. raised values of:
  > AST,
  > ALT,
  > GGT.
  > ALP,
  > bilirubin, mainly the conjugated fraction,
» Hepatomegaly or hepatosplenomegaly.
» If conjugated hyperbilirubiniaemia – see above.

Investigations

» Syphilis. See section 19.18: Syphilis, early congenital.
» Thyroid function (see Chapter 7: Endocrine System, section7.12 Hypothyroidism, congenital), and
» Urine for MCS (see Chapter 6: Nephrological/Urological Disorders, section 6.2 Urinary tract infections).

» Suspect galactosaemia if urine is positive for reducing substances but negative for glucose in a baby receiving lactose-containing feeds. A galactose-1-phosphate uridyl transferase assay will confirm the diagnosis.

GENERAL AND SUPPORTIVE MEASURES

» Monitor bilirubin levels.
» Treat the underlying cause.
» Dietary adjustment for prolonged conjugated hyperbilirubinaemia to counteract the malabsorption of fat and fat soluble vitamins (A, D, E and K).
» Avoid lactose containing feeds, i.e. breast milk and lactose containing formulae, when galactosaemia is suspected.
» Regular follow up until the underlying condition has been resolved.

MEDICINE TREATMENT

All premature babies, day 15 to 1 year:

- Multivitamin, drops, oral, 0.6 mL daily.

REFERRAL

» Pathological jaundice, unconjugated and/or conjugated, where the underlying cause cannot be identified.
» Serum unconjugated bilirubin at exchange transfusion level.
» Jaundice, unconjugated and/or conjugated, not improving on adequate treatment.
» Conjugated hyperbilirubinaemia due to conditions requiring surgical intervention e.g. biliary atresia.
» Prolonged neonatal jaundice, excluding breast milk jaundice.

19.11 MENINGITIS BACTERIAL, NEONATAL

G01

DESCRIPTION

A bacterial infection of the meninges in the first month of life.

Consider meningitis in any neonate being evaluated for sepsis or infection, as most organisms implicated in neonatal sepsis also cause neonatal meningitis. The most common causative organisms are *Group B ß-haemolytic streptococcus type III* and Gram-negative organisms such as *E. coli* with K_1 antigen. Consider *S. epidermidis* and *S. aureus* as causative organisms with central nervous system anomalies such as open defects or with indwelling devices such as VP shunts.

Consider HIV infection in neonates with meningitis.

DIAGNOSTIC CRITERIA

Clinical

» Clinical presentation is usually with one or more non-specific signs such as:
  - temperature disturbances,
  - lethargy,
  - irritability,
  - vomiting,
  - feeding problems,
  - vasomotor changes,
  - altered level of consciousness,
  - blood glucose disturbances,
  - bulging/full fontanel,
  - convulsions,
  - apnoea, and
» Complications include:
  - cerebral oedema,
  - raised intracranial pressure,
  - vasculitis, with haemorrhage,
  - ventriculitis,
  - ischaemia and infarctions of the brain,
  - inappropriate antidiuretic hormone (ADH) secretion.
  - convulsions,
  - hydrocephalus,
  - subdural effusion,
  - brain abscess,
» Late complications include:
  - neurological sequelae,
  - deafness, and
  - blindness,
  - intellectual disabilities.

SPECIAL INVESTIGATIONS

» Lumbar puncture:
  - CSF appears turbid to purulent.
  - Protein concentration is increased (> 1.0 g/L).
  - Leucocyte count is increased with a predominance of polymorphonuclear leucocytes (> 6 cells/mm^3).
  - Glucose concentration is low, < $^2/_3$ of blood glucose.
» Gram stain, microscopy, culture and sensitivity of CSF.
» Blood cultures for microscopy, culture and sensitivity.

GENERAL AND SUPPORTIVE MEASURES

» Admit to high or intensive care unit, if available.
» Maintain a neutral thermal environment.
» Monitor, where indicated:
  - neurological status,
  - vital signs,
  - electrolytes,
  - haematocrit,
  - fluid balance (hydration),
  - calcium and magnesium,
  - acid-base status,
  - blood glucose,
  - serum and urine osmolality,
  - blood gases.
» Ensure adequate nutrition:
  - Enteral feeding where possible, use nasogastric tube, if necessary.
  - If enteral feeding is not possible, IV fluids, e.g. neonatal maintenance solution and parenteral nutrition under supervision by paediatrician.
» Limit total daily fluid intake, IV and oral:
  - Do not exceed the daily requirements for age.
  - Prevent fluid overload.

MEDICINE TREATMENT

Antibiotics, empirical

- Cefotaxime, IV, 50 mg/kg over 30 minutes, for 21 days.
  - If < 7 days of age: 50 mg/kg 12 hourly.
  - If 7 days – 3 weeks of age: 50 mg/kg 8 hourly.
  - If > 3 weeks of age: 50 mg/kg 6 hourly.

PLUS

- Ampicillin, IV, for 14 days.
  - If < 7 days of age: 50mg/kg 12 hourly.
  - If > 7 days – 3 weeks of age: 50 mg/kg 8 hourly.
  - If > 3 weeks of age: 50 mg/kg 6 hourly.

During the course of treatment, a cranial ultrasound should be done.
Repeat CSF examination after 48–72 hours to ensure there is a response to therapy.
Reconsider choice of antibiotic when the results of blood and CSF cultures become available or the child does not improve within 72–96 hours.

No response or intolerant to cephalosporins or ampicillin

For patients not responding to adequate antibiotic therapy where no organisms were identified or cultured, consider viruses, fungi and bacteria not usually causing meningitis.

Convulsions

See section 19.16: Seizure, neonate.

Raised intracranial pressure or cerebral oedema

Avoid fluid overload.
Limit total daily intake, IV and oral.
Do not exceed the total fluid maintenance requirements for age.

REFERRAL

» Meningitis not responding to adequate treatment.
» Meningitis with complications.
» Follow up is essential for assessing neurodevelopment, hearing and vision.

19.12 PATENT DUCTUS ARTERIOSUS (PDA) IN THE NEWBORN

Q25.0

DESCRIPTION

Patent ductus arteriosus (PDA) is the extra-uterine persistence of the normal fetal vessel that joins the pulmonary artery to the aorta.

DIAGNOSTIC CRITERIA

Clinical

Depending on size of PDA:
» systolic or continuous murmur at left heart base,
» hyperactive precordium with easily palpable bounding peripheral pulses.

Investigations
» Echocardiography should be done to confirm the diagnosis in all symptomatic children with a heart murmur.
» Observe and follow up all asymptomiatic patients.

Risk factors include:
» prematurity,
» hypoxia,
» fluid overload,
» anaemia, and
» pulmonary hypertension,
» sepsis,
» lung disease,
» congenital cardiac abnorm alities.

Complications include cardiac failure, systemic hypotension, pulmonary haemorrhage and steal phenomena, such as a decrease in mesenteric blood flow.

GENERAL AND SUPPORTIVE MEASURES

Preterm Infants
» Identify and treat underlying risk factors.
» Restrict fluid intake to 80–120 ml/kg/24 hours. Individualise volume to avoid over restriction of fluid and poor weight gain.
» Maintain haematocrit at ≥ 40% and Hb ≥ 13 g/dL.
» Monitor cardiac function, renal function and urinary output.
» Provide adequate nutrition.
» Nurse in neutral thermal environment.

MEDICINE TREATMENT

In confirmed cases (in consultation with specialist)

Cardiac failure

Diuretics
- Furosemide, IV/oral, 1 mg/kg/24 hours.

Closure of PDA in preterm infants less than 14 days of age
- Ibuprofen, oral.
  First dose: 10 mg/kg. After 24 hours follow with 2 doses of 5 mg/kg 24 hours apart.
  Contraindications to ibuprofen therapy:
  - Thrombocytopaenia (< 50 000/mm^3).
  - Bleeding disorders.
  - Impaired renal function.
  - Jaundice approaching exchange transfusion levels.

SURGICAL TREATMENT

Consider if medicine treatment is contraindicated or fails.

REFERRAL

» Patients with complications, e.g. cardiac failure, pulmonary haemorrhage, ventilator dependence.
» PDA which remained patent despite adequate treatment.
» Term babies with symptomatic or persistent PDA.
» PDA in baby unable to take oral ibuprofen.

19.13 PREMATURITY/PRETERM NEONATE

P07.3

DESCRIPTION

Neonate born before 37 completed weeks of pregnancy.

GENERAL AND SUPPORTIVE MEASURES

» Admit unwell/unstable infants to neonatal high/intensive care facility.
» Temperature control:
  > Kangaroo mother care: Initiate if baby is well and vital signs are stable.
  > Provide a neutral thermal environment (incubator or infant crib with overhead heater) and keep ambient temperature at 26–28°C.
  > Keep infants temperature, axilla or skin of anterior abdominal wall, at 36.2–36.8°C.

Table for neutral thermal environment for age and body mass

Neutral Thermal Environment				
	Temperature for body mass range			
	< 1 200 g ± 0.5°C	≥ 1 200–1 500 g ± 0.5°C	≥ 1 500–2 500 g ±1°C	≥ 2 500 g ±1.5°C
0–12 hours	35	34.0	33.3	32.8
12–24 hours	34.5	33.8	32.8	32.4
2–4 days	34.5	33.5	32.3	32.0
4–14 days	33.5	32.1	32.0	
2–3 weeks	33.1	31.7	30.0	
3–4 weeks	32.6	31.4		
4–5 weeks	32.0	30.9		
5–6 weeks	31.4	30.4		

» Monitor to prevent or detect early the diseases/complications of prematurity:
  > respiratory rate,
  > blood pressure,
  > blood gas,
  > acid-base status,
  > calcium, magnesium,
  > growth parameters.
  > haematocrit,
  > bilirubin,
  > blood glucose,
  > electrolytes,
  > hydration statu s, and
» Nutritional support:
  > Give naso/orogastric tube feedings to infants with audible bowel sounds and no complications/diseases of prematurity.
  > Preferably use own mother's expressed breast milk, pasteurised donor breast milk or pre-term formula. Give small frequent bolus feeds, 1, 2 or 3 hourly or continuous naso/orogastric tube feeds (alternatives: cup, dropper, spoon, syringe).
  > Monitor gastric emptying by aspirating the stomach before each feed.
  > Consider stopping enteral feeding if:
    - aspiration of 3 mL or more of gastric contents before the next feed,
    - vomiting,
    - abdominal distension,

  - diarrhoea, or
  - ileus.
  - > IV alimentation if enteral feeds are contraindicated or not tolerated.
- » IV fluids to ensure adequate hydration, electrolyte and mineral intake, and normoglycaemia (blood glucose ≥ 2.6 mmol/L) until enteral (tube or oral) intake is satisfactory.
  - > Discontinue IV fluids gradually to avoid reactive hypoglycaemia.
  - > Discontinue the infusion when several oral feedings have been retained.
  - > If renal function is compromised, use potassium-free solution.

Fluid requirements for a healthy preterm infant	
Day of life	mL/kg/24 hours
1	70
2	90
3	110
4	130
5 and onwards	150

Some infants may require fluid volumes up to 200 mL/kg/24 hours after day 6.

- » Hospital discharge if:
  - > clinically well,
  - > able to breastfeed or formula feed,
  - > able to maintain body temperature, and
  - > usually > 1.8 kg.
- » Follow-up visits to assess growth parameters, neurodevelopment, hearing and vision.

MEDICINE TREATMENT

To maintain haematocrit at 40% or Hb ±13 g/dL for the first 2 weeks of life:

- Packed red cells, IV, 10 mL/kg.

To maintain oxygen tension in the blood at 60–80 mm Hg:

- Oxygen, humidified via head box, or nasal cannulae.
  - o Oxygen therapy should be utilised to maintain oxygen saturation of haemoglobin at of 90-94%; use pulse oximeter.

At birth

- Vitamin K, IM, 0.5–1 mg.
- Immunise according to EPI schedule according to chronological age.
- Iron and multivitamin supplementation from the third week of life.

Prophylaxis

- Iron (elemental), oral, 2–4 mg/kg/24/hours.
  - o Ferrous lactate 1 mL = 25 mg elemental iron.
  - o Multivitamin, oral, providing at least vitamin D, 400–800 IU and vitamin A, 1 250–5 000 IU per 24 hours.

Continue with iron and vitamin supplementation until the infant is on a balanced diet.

REFERRAL

Presence of one or more of the following complications that cannot be managed at the facility:

- Respiratory distress and/or apnoea attacks requiring ventilatory support.
- PDA with cardiac failure not responding to medical management.
- Necrotising enterocolitis requiring surgical intervention.
- Jaundice with serum unconjugated bilirubin level in the exchange transfusion zone.
- Septicaemic infants or infants with infections not responding to therapy.
- Pulmonary and/or intraventricular haemorrhage.
- Feeding difficulties where the underlying cause is unclear.
- Infants requiring hyperalimentation if parenteral nutrition is not available at the hospital.
- Convulsions not responding to treatment.
- Congenital abnormalities requiring surgical intervention.
- Hypoglycaemia not responding to treatment.
- For eye examination/hearing screening:
  - infants less than 1.5 kg,
  - infants < 32 weeks gestation,
  - infants who received prolonged respiratory support/oxygen,
  - infants with recurrent apnoea, and
  - infants with an unstable clinical course.

19.14 RESPIRATORY DISTRESS IN THE NEWBORN

P22.9

DESCRIPTION

Newborn experiencing difficulty with breathing.

Causes of respiratory distress include:

Pulmonary causes	Extrapulmonary causes
» hyaline membrane disease (surfactant deficiency), » meconium aspiration, » pneumonia, » pneumothorax, » wet lung syndrome, » pulmonary haemorrhage, » pulmonary hypertension, » hypoplastic lungs, and » diaphragmatic hernia.	» sepsis, » cardiac failure irrespective of cause, » hypothermia/hyperthermia, » hypoglycaemia, » anaemia, » polycythaemia, » hypovolaemic shock, and » perinatal hypoxia.

Hyaline membrane disease (HMD), meconium aspiration syndrome (MAS) congenital pneumonia and transient tachypnoea of the newborn (TTN) are the most common causes of respiratory distress in newborns.

DIAGNOSTIC CRITERIA

Clinical

» Pulmonary and/or extra pulmonary disorders presenting with two or more of the following signs in a newborn baby:
  > tachypnoea (≥ 60 breaths/minute),
  > expiratory grunting,
  > intercostal and sternal retractions (recession), and
  > central cyanosis while breathing room air.

Investigations

» Chest X-ray to determine underlying pathology.
» Echocardiography, if available, to exclude cardiac causes of respiratory distress.
» Haematocrit, blood glucose and temperature.
» Shake test to assess risk for hyaline membrane disease:
  > Within 15 minutes after birth place 0.5 mL gastric aspirate in a clean dry test tube.
  > Add 0.5 mL of sodium chloride 0.9% and replace the cap.
  > Shake well for 15 seconds.
  > Add 1 mL 95% alcohol to the 1 mL mixture of gastric aspirate and sodium chloride 0.9%.
  > Replace cap and shake well for 15 seconds.
  > Read at 15 minutes.

  Interpretation of test:

Observation	Result	Risk
No bubbles on surface	Negative	High
Incomplete ring of bubbles on surface	Intermediate	Possible
Complete ring of bubbles or bubbles covering the entire surface	Positive	Very low

  > In positive test (very low risk of hyaline membrane dsease): surfactant use may not be indicated.

GENERAL AND SUPPORTIVE MEASURES

» Identify and treat underlying cause, e.g.:
  > Chest tube and underwater drainage of pneumothorax.
  > Isovolaemic dilutional exchange transfusion for symptomatic polycythaemia.
» Admit to neonatal high care/intensive care facility, if available.
» Handle neonate as little as possible.
» Nurse non-intubated infant in the prone position.
» Keep in a neutral thermal environment (incubator or infant crib with overhead heater). Keep room temperature, at 26–28°C, and anterior abdominal wall skin temperature at 36.2–36.8°C.
» Monitor:
  > blood pressure,
  > peripheral perfusion,
  > haematocrit,
  > blood glucose,
  > respiratory rate,
  > heart/pulse rate,
  > acid-base status,
  > body temperature,

- blood gases,
- SaO_2,
- minerals and electrolytes,
- fluid balance.

» Nutrition:
- Provide adequate IV dextrose to maintain blood glucose ≥ 2.6 mmol/L.
- Commence nasogastric feeding after 12–24 hours if bowel sounds are audible and meconium has been passed.
- If enteral feeding is not possible 24 hours after birth, start IV hyperalimentation.

» Ventilation (non-invasive or invasive) is needed if:
- An oxygen saturation of at least 90% or PaO_2 of at least 60mmHg cannot be maintained with an inspiratory oxygen concentration of ≥ 80% with or without nasal CPAP;
- The PaCO2 rises to > 55 mmHg with uncompensated respiratory acidosis (pH ≤ 7.20), irrespective of oxygen saturation or PaO_2.
(1kPa = 7.5 mmHg; 1 mmHg x 0.133 = 1 kPa)

MEDICINE TREATMENT

To eliminate central cyanosis and to maintain oxygen saturation of haemoglobin at 90–94%:

- Oxygen, warmed and humidified via head box, or nasal cannula.
  - If a pulse oximeter or facility for blood gas analysis is available oxygen, humidified via head box, or nasal cannulae to maintain oxygen tension in the blood at 60–80 mmHg.
  - If a pulse oximeter or facility for blood gas analysis is not available, regulate the inspired oxygen concentration in such a way that the least amount of oxygen that will prevent central cyanosis is used.
  - Keep PaO_2 at 60–80 mmHg and $PaCO_2$ at 35–45 mmHg (arterial blood gas analysis).

Nasal CPAP is needed if the neonate has a good respiratory drive with a PCO_2 of ≤ 55 mmHg but unable to maintain a SaO_2 of 90–94% on an inspiratory oxygen concentration of ≥ 60% (F_IO_2) and pneumothorax has been excluded.
Administer nasal CPAP at 4–6 cm H_2O and monitor SaO_2, blood gas and acid-base status.

OR

- Oxygen/air mixture, hi-flow, warmed and humidified via nasal prongs. (Under specialist supervision)
  - Do not exceed 6 L/minute. The flow/minute (L/min) approximates the pressure generated in cm water.

Stabilise circulation and blood pressure

- Neonatal maintenance solution, IV infusion, 60–80 mL/kg/24 hours (day 1 of life) and adapt to daily maintenance requirements.

AND/OR

- Sodium chloride 0.9%, 10–20 mL/kg over 1–2 hours.
  - For preterm infants restrict to 10 mL/kg.

AND/OR

- Fresh Frozen Plasma, 10–20 mL/kg over 1–2 hours.

OR

- Lyphilised Plasma, 10-20 mL/kg over 1-2 hours.

Inotropic support

- Dopamine, IV, 5–15 mcg/kg/minute, continued until blood pressure has stabilised.
  - Response to inotropic support will be unsatisfactory if the circulating blood volume is not corrected.

Anaemia

If anaemia is present, Hct < 40 % and Hb <13 g/dL:

- Packed red cells, IV, 10 mL/kg over 1–2 hours.

Metabolic acidosis

If pH ≤ 7.0 and the metabolic acidosis does not respond to normalisation of PaO_2, $PaCO_2$, blood pressure, volume expansion (hydration) and correction of anaemia:

- Sodium bicarbonate, 4.2 %, IV, administered slowly.
  - 1 mmol = 2 mL
  - HCO_3 needed (mmol) = base excess x 0.3 x body mass (kg)
  - (½ correct base deficit initially)

CAUTION
Do not administer Ca++ containing infusions with sodium bicarbonate solution

Polycythaemia

Treat with isovolaemic dilutional exchange transfusion using sodium chloride 0.9% if the venous haematocrit is Hct > 65%: Hb >22 g/dL and the baby is symptomatic. Perform under paediatrician's supervision.

$$\text{Volume to be exchanged (mL) if desired Hct = 50:} = \frac{[\text{Baby's Hct} - \text{desired Hct (i.e. 50)} \times \text{body mass (kg)}] \times 90}{\text{Baby's Hct}}$$

Hyaline membrane disease (Surfactant deficiency)

In consultation with a paediatrician.

Shake test to assess risk for hyaline membrane disease and/or x-ray chest – see above.

If surfactant deficiency is suspected or present, provide respiratory support.

» Mild surfactant deficiency: nasal CPAP 4–6 cm H_2O.

» Moderate surfactant deficiency: "in-out" surfactant followed by nasal CPAP 4–6 cm H_2O. Intubate infant and administer surfactant via naso-or orotracheal tube. Ventilate for a few minutes with a T-Piece Resuscitation device or resuscitation bag with a CPAP generating device. Extubate baby and put on nasal CPAP 4–6 cm H_2O. Babies may be put on nasal CPAP directly after "in-out" surfactant administration, omitting the ventilation step following "in-out" surfactant.

» Severe surfactant deficiency: intubate baby and ventilate with a ventilator. Administer surfactant via the naso- or orotracheal tube. If a ventilator is not available the in-out surfactant followed by nasal CPAP can be used.

Short term intubation (In-out endotracheal surfactant administration)

» Nasal CPAP as required.
» If inadequate oxygenation on nasal CPAP, pre-oxygenate with bag-mask or T-piece ventilation to maintain preductal saturation between 90-94%.
» Intubate orally, give surfactant and follow with gentle manual ventilation or CPAP, as required, for 5 minutes:
  - Surfactant, 100mg/kg
» Extubate and recommence nasal CPAP.

Infection

» If infection, e.g. bronchopneumonia, is present or suspected, give antibiotics after blood cultures have been taken.
» Consider the antibiotic sensitivity profile of micro-organisms in a particular hospital when prescribing antibiotics.

▪ Aminoglycoside, e.g.:
- Gentamicin, IV, for 5-7 days in the first week of life.
  - If < 32 weeks gestation of age: 5 mg/kg/36 hours.
  - ≥ 32 weeks gestation of age: 5 mg/kg/24 hours.
  - After first week, 5 mg/kg/24 hours for all gestations.

PLUS

- Ampicillin, IV, for 5-7days.
  - If < 7 days of age: 50 mg/kg 12 hourly.
  - If 7 days – 3 weeks of age: 50 mg/kg 8 hourly.
  - If > 3 weeks of age: 50 mg/kg 6 hourly.

Review after 72 hours. If infection is confirmed or very strongly suspected continue for 10 days.
Where available, gentamicin doses should be adjusted on the basis of therapeutic drug levels.

- Trough levels (taken immediately prior to next dose), target plasma level < 1 mg/L.
- Peak levels (measured 1 hour after commencement of IV infusion or IM/IV bolus dose), target plasma level > 8 mg/L.

REFERRAL

» No improvement or deterioration despite adequate treatment.
» Development of respiratory failure and need for ventilatory support.

19.15 RESUSCITATION OF THE NEWBORN

Be prepared!
Be at the delivery!
Check the equipment and emergency medicines!

Ask 3 questions to evaluate the infant:

1. Is the newborn breathing adequately and not just gasping?
2. Is the newborn's heart rate (HR) above 100 beats per minute?
3. Is the newborn centrally pink, i.e. no central cyanosis?

If the answer to all three questions is "yes", the newborn does not need resuscitation.
If the answer to any of the three questions is "no" the newborn needs resuscitation.

Assess the infant using the above 3 questions every 30 seconds during resuscitation. If the newborn is improving, then the intervention e.g. bagging can be stopped. Only if the baby is not responding or getting worse, is further intervention needed e.g. chest compressions (see algorithm).

Check that each step has been effectively applied before proceeding to the next step. The algorithm follows the assumption that the previous step was unsuccessful and the newborn is deteriorating.

Use the lowest inspiratory oxygen concentration to alleviate central cyanosis and restore a heart rate above 100 beats per minute. There is some evidence that resuscitation with 100% oxygen may be harmful to the baby.

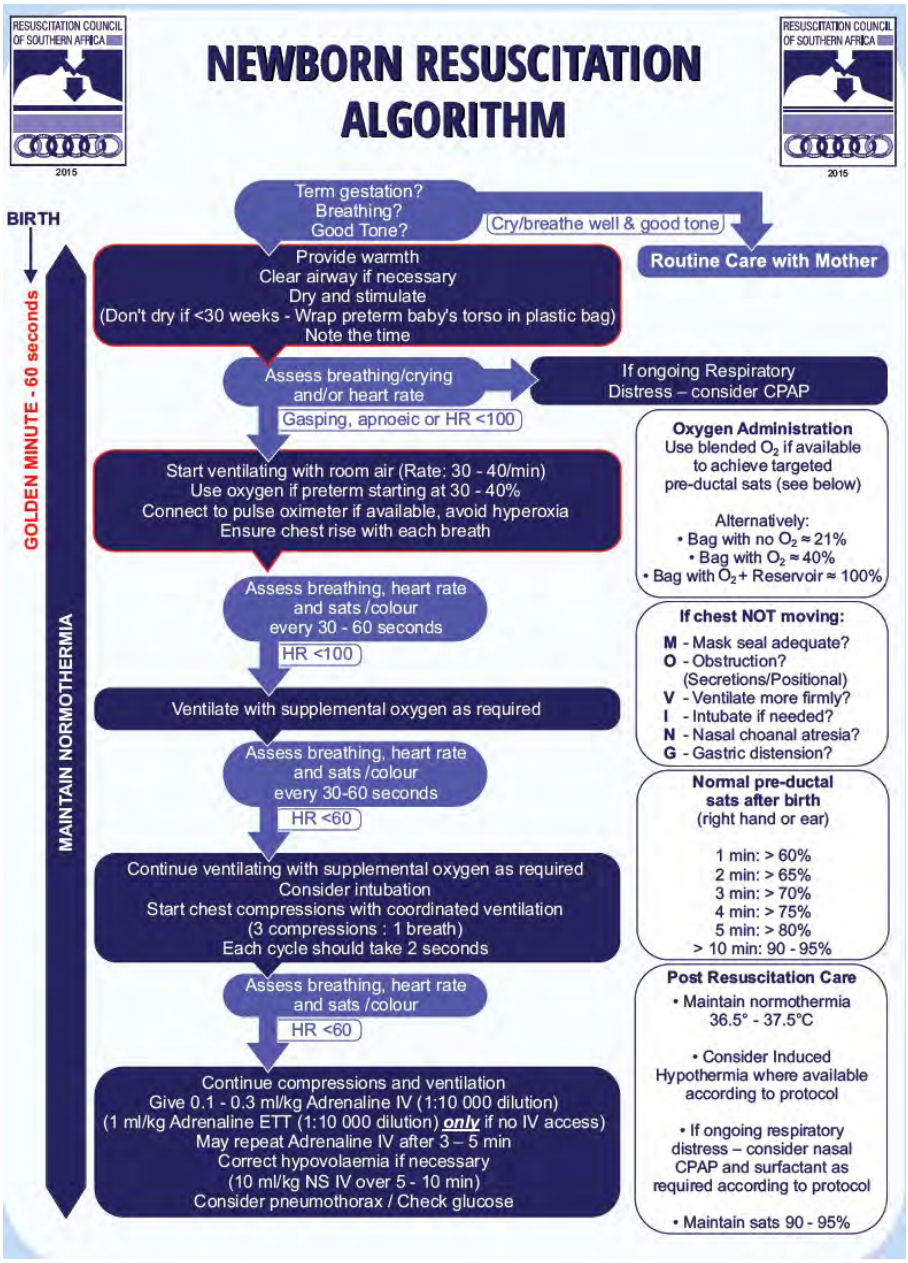
- Oxygen resucitation of newborns
  - ≥ 35 weeks gestation: begin with 21%
  - < 35 weeks gestation: begin with 21-30%

If baby is breathing but oxygen saturation is not within target range: free-flow oxygen administration may begin at 30%.
An unsatisfactory response to resuscitation includes:

» A sustained slow heart rate, usually less than, or equal to, 60/minute or a progressive decrease in heart rate until cardiac arrest occurs.
» Episodes of cardiac arrest, with a progressively weaker response to chest compressions, positive pressure ventilation and medicines.
» A decreasing blood pressure, increasing acidosis, severe hypotonia with central cyanosis or intense pallor.
» Apnoea or weak, irregular and inefficient respiratory efforts.
» Consider discontinuation of resuscitation if the unsatisfactory response to resuscitation persists for > 20 minutes and underlying conditions e.g. pneumothorax, diaphragmatic hernia has been excluded or > 10 minutes of unresponsive cardiac arrest (asystole) and/or > 20 minutes of unsustainable respiration.
» Admit newborns with a favourable response to resuscitation to a neonatal high or intensive care unit, if available, for post resuscitation care – See section 19.8: Hypoxia/Ischaemia of the Newborn.

MEDICINES USED DURING NEONATAL RESUSCITATION

Medicine	Indications	Dosage	Effect
Adrenaline (epinephrine)	» asystole » heart rate < 60/min	0.1 mL/kg of a 1:10 000 dilution, which may be repeated up to three times ET, 1mL/kg of 1: 10 000 solution	↑Heart rate ↑Myocardial contractility ↑Arterial pressure
sodium bicarbonate (4.2%) (1ml 4,2% = 0.5 mmol Soda Bic)	» life threatening metabolic acidosis »pH < 7.2 »BE > –10 mmol/L »$PaCO_2$ < 55 mmHg	slow IV, 2–4 mL/kg	Corrects metabolic acidosis. Improves cardiac output and peripheral perfusion.
naloxone	»maternal administration of opiates + apnoeic infant	ET/IV/SC/IM, 0.1 mg/kg	Corrects apnoea and/or hypoventilation.
Fluids: sodium chloride 0.9%	»hypovolaemia	slow IV, (5–10 min) 10–20 mL/kg	↑Blood pressure and improves tissue perfusion.
dextrose	»hypoglycaemia	IV, 250mg–500 mg/kg (2.5–5 mL/kg of 10% dextrose water)	Corrects hypoglycaemia.



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19.16 SEIZURES, NEONATAL

P90

DESCRIPTION

Neonatal seizures are usually secondary to a serum biochemical disorder or an underlying brain disturbance/injury/malformation. Seizures may be subtle due to the relatively underdeveloped cortex. Seizures persist when limbs are flexed (as opposed to jitteriness).

The most likely causes are:

- perinatal asphyxia,
- birth trauma,
- intracranial haemorrhage,
- meningitis,
- hypocalcaemia,
- hypomagnesaemi a,
- hyponatraemia,
- hypoglycaemia,
- narcotic or alcohol withdrawal syndrome,
- inborn errors of metabolism,
- pyridoxine deficiency,
- CNS developmental abnormalities.

DIAGNOSTIC CRITERIA

Categories of convulsions

- Subtle seizures:
  - tonic deviation of the eyes,
  - 'swimming' movements of the arms,
  - fluttering of the eyelids,
  - 'cycling' movements of the legs,
  - sucking and chewing movements,
  - apnoea,
  - vasomotor changes.
- Tonic clonic movements.
- Focal clonic movements.
- Myoclonic movements.
- Tonic movements/posturing.

GENERAL AND SUPPORTIVE MEASURES

- Identify and treat the underlying cause, e.g. meningitis and hypoxic-ischaemic encephalopathy.
- Ensure an open airway and administer oxygen, if necessary.
- Nurse in neutral thermal environment.
- Ensure adequate nutrition and hydration.
- Monitor and maintain within accepted physiological range:
  - respiration,
  - heart rate,
  - blood pressure,
  - blood gases,
  - SaO_2,
  - body temperature.
  - acid-base status,
  - electrolytes,
  - minerals,
  - blood glucose,
  - haematocrit,

MEDICINE TREATMENT

Seizure Control

Administer anticonvulsants with monitoring of cardiorespiratory function.

Phenobarbitone

- Phenobarbitone, IV.
  - Loading dose: 20 mg/kg administered over 10 minutes.
  - Refractory seizures: Additional 10 mg/kg/dose up to 40 mg/kg.

Maintenance:

- Phenobarbitone, IV or oral
  - 4 mg/kg/day beginning 12–24 hours after the loading dose.

Seizures refractory to phenobarbitone, should be admitted to a high or intensive care unit.

Cardiorespiratory support is usually required in this category of infants.

For seizures refractory to phenobarbitone use:

Lignocaine (lidocaine)

For term normothermic neonates:

- Lignocaine (lidocaine), IV.
  - Loading dose: 2 mg/kg administered over 10 minutes.
  - Follow with a continuous infusion of:
    6 mg/kg/hour for 6 hours, then,
    4 mg/ kg/hour for 12 hours, then,
    2 mg/kg for 12 hours.
  - If seizures are well controlled, slow taper lignocaine (lidocaine) over 12 hours.

For preterm neonates:

A safe dose of lignocaine (lidocaine) in preterm neonates has not been established but the following dosing schedule has been used.

- Lignocaine (lidocaine), IV.
  - Loading dose: 2 mg/kg administered over 10 minutes.
  - Follow with a continuous infusion of 3 mg/kg/hour for 3 days.
  - Gradually taper lidocaine over next 2 days.

Do not use lidocaine if phenytoin was given. Do not use lidocaine for seizures in newborns with congenital heart disease, dysrhythmias, acute heart failure and shock.

- A safe lignocaine (lidocaine) dosing regimen for term infants undergoing hypothermia treatment for hypoxic ischaemic encephalopathy has not been established.
- Clearance of lignocaine (lidocaine) is slower in hypothermic neonates and preterm infants. There is a risk of accumulation.
- Start tapering earlier than 3 days if seizures are well controlled.
- Continuous monitoring of ECG, heart rate and blood pressure is mandatory if lignocaine (lidocaine) is used.

- Dysrhythmias and bradycardia are the main side effects of lignocaine (lidocaine). Life threatening dysrhythmias may indicate lignocaine (lidocaine) toxicity.

Lignocaine (lidocaine) toxicity:

- Lipid emulsion 20%, IV, 1.5 mg/kg administered over 1 minute.
  - Follow with a continuous infusion of 0.25 mL/kg/minute for 30 minutes. (See Referral section.)

Pyridoxine deficiency:

- Pyridoxine, IV/IM, 20 mg/kg.

Maintenance anticonvulsant therapy

Maintenance anticonvulsant therapy is usually considered for neonates with underlying brain damage due to hypoxic ischaemic encephalopathy, meningitis, intracranial haemorrhage or birth trauma.

Continue until neonate is seizure-free for 2 weeks, then slowly taper to stop.

If seizures recur during tapering of anticonvulsant therapy, continue with maintenance therapy.

Follow-up by medical practitioner or at clinic/hospital after discharge

Note:

Patients with head or whole body cooling should have an adjustment of the anticonvulsant doses.

Hypocalcaemia

Serum total calcium ≤ 1.8 mmol/L, or ionized calcium < 0.7 mmol/L.

- Calcium gluconate 10%, IV, 100–200 mg/kg/dose administered over 10 minutes.
  - Dilute 1:4 with dextrose 5% water.
  - Administer under ECG monitoring over 5 minutes (preferred) or until seizure ceases. Repeat if necessary.
    (1 mL of 10% calcium gluconate = 100 mg calcium gluconate)

Hypoglycaemia

Serum glucose < 2.6 mmol/L.

- Dextrose, IV as bolus, 250–500 mg/kg.
  - Follow with 6–12 mg/kg/minute or more until blood glucose is within the physiological range. (10% Dextrose = 10g dextrose/100mL).

Hypomagnesaemia

Serum magnesium < 0.6 mmol/L.

- Magnesium sulphate 50%, IV, 0.25 mL/kg administered slowly over 3 minutes as a single dose.

REFERRAL

» Seizures not responding to adequate therapy.
» Seizures where the underlying cause is unclear.
» Refractory cases for further treatment and aEEG monitoring.
» Lidocaine toxicity.

19.17 SEPTICAEMIA OF THE NEWBORN

P36.9

DESCRIPTION

Bacterial or fungal invasion of blood before or after birth, which may spread to involve other organs/systems, e.g. meninges (meningitis), lungs, (pneumonia), bone (osteomyelitis), and kidneys (pyelonephritis).

DIAGNOSTIC CRITERIA

Clinical

The baby usually presents with one or more non-specific clinical sign e.g.:

- vasomotor changes,
- feeding problems,
- lethargy,
- jaundice,
- diarrhoea,
- tachypnoea,
- temperature disturbances,
- apnoea attacks,
- sclerema,
- acidosis,
- abdominal distension,
- tachycardia,
- organomegaly,
- petechiae,
- convulsions,
- blood glucose disturbances,
- hypotonia,
- shock,
- anaemia,
- cyanosis.
- Complications include:
  - septic shock,
  - hypoglycaemia,
  - apnoea,
  - convulsions,
  - anaemia,
  - meningitis,
  - bronchopneumonia,
  - cardiac failure,
  - dehydration,
  - bleeding tendency,
  - DIC and/or thrombocytopenia,
  - metabolic acidosis,
  - osteomyelitis,
  - respiratory failure,
  - necrotising enterocolitis,
  - ileus,
  - renal failure,
  - multi-organ failure.

Investigations

- Blood and cerebrospinal fluid cultures.
- Blood count and differential count.
- C-reactive protein and procalcitonin, if available.

GENERAL AND SUPPORTIVE MEASURES

- Admit to neonatal high or intensive care facility, if available.
- Ensure a neutral thermal environment.
- Start infusion with appropriate IV fluid, e.g. neonatal maintenance solution.
- Ensure adequate nutrition:
  - enteral feeding where possible, via oro/nasogastric tube after ileus, obstruction, or other contraindications to enteral feeding have been excluded.
  - if enteral feeding is not possible, IV fluids, e.g. neonatal maintenance solution and parenteral nutrition under supervision by paediatrician.

» Insert naso/orogastric tube.
» Oxygen to maintain PaO_2 at 60–80 mmHg or oxygen saturation of haemoglobin at 90-94%.
» Ventilatory support if $PaCO_2$ exceeds 55 mmHg.
» Monitor:
  > Body temperature 36.2–36.8° C (axillary or anterior abdominal wall).
  > Maintain blood glucose level of 2.6–6.8 mmol/L.
  > Acid-base status and maintain blood pH of 7.35–7.45.
  > Maintain a haematocrit of 40%.
  > Vital signs and respiration, and maintain blood electrolytes and minerals within their normal physiological ranges.
  > Clinical progress and for the emergence of complications.

MEDICINE TREATMENT

Antibiotic therapy

Be aware of the antibiotic sensitivity/resistance profile of bacterial pathogens in your hospital/community.
Reconsider choice of antibiotic when the results of blood and CSF cultures become available or the child does not improve within 72–96 hours.

Empiric treatment (first line):

- Aminoglycoside, e.g.:
- Gentamicin, IV, for 10 days.
  - If < 32 weeks gestation: 5 mg/kg/36 hours in the first week of life.
  - If ≥ 32 weeks gestation: 5 mg/kg/24 hours in the first week of life.
  - Monitor blood levels.

PLUS

- Ampicillin, IV, 50 mg/kg/dose for 10 days.
  - If age < 7 days: 50 mg/kg 12 hourly.
  - If 7 days – 3 weeks of age: 50 mg/kg 8 hourly.
  - If > 3 weeks of age: 50 mg/kg 6 hourly.

If child is deteriorating on above regimen and there are no culture positive results:

Empiric treatment (second line):

- Piperacillin/tazobactam, IV for 7 days.
  - If < 7 days of age: 50 - 100mg/kg 12 hourly (1st week of life).
  - If > 7 days of age: 50-100mg/kg 6-8 hourly.

PLUS

- Amikacin, IV for 7 days.
  - 15 mg/kg/dose 24 hourly.
    (Therapeutic drug monitoring to be done where available).

Note: Shorter durations of therapy should be used where there is there is no culture confirmed infection, and child shows clinical improvement.

Fungal infections
Where fungal septicaemia is demonstrated or suspected:
- Amphotericin B deoxycolate, IV, 1–1.5 mg/kg/day infusion in 5% dextrose water over 4 hours for 14 days.
  - Monitor renal function and serum potassium.

Anaerobic infections
Where anaerobic infection is likely, e.g. after gastro-intestinal surgery for sepsis, or where intra-abdominal sepsis is suspected:
- Metronidazole, oral/IV, for 10 days.
  - Loading dose, IV: 15 mg/kg administered over 60 minutes.
  - If ≤ 4 weeks of age: 7.5 mg/kg 12 hourly.
  - If ≥ 4 weeks of age: 7.5 mg/kg 8 hourly.

Note: In patients on piperacillin/tazobactam and amikacin, no additional anaerobic cover needed.

Inotropic support
Mean blood pressure should not be less than the gestational age (weeks) of the infant plus 5–10 mmHg.

If blood pressure is < $^{60}/_{40}$ mmHg in term infant or < $^{50}/_{35}$ mmHg in pre-term infant:
- Dopamine, IV, 5–15 mcg/kg/minute as a continuous infusion.
  - Continue with dopamine as long as it is necessary to maintain the blood pressure.

REFERRAL
» Septicaemia with complications.
» Septicaemia not responding to treatment.

19.18 SYPHILIS, EARLY CONGENITAL
A50.9
*Notifiable condition.

DESCRIPTION
Multi-organ infection caused by *T. pallidum* and acquired by vertical transmission via the transplacental route during pregnancy.

DIAGNOSTIC CRITERIA
Clinical
» Suspect if mother has syphilis or positive serology for syphilis and the baby a positive non-treponemal serological test at birth with a titre at least 4-fold higher than that of the mother.
» Large, pale, greasy placenta.

» The following signs may be present at birth or will develop within the first 3 months of life:
  - hydrops fetalis,
  - anaemia,
  - hepatosplenomegaly,
  - oedema,
  - condylomata,
  - hepatitis,
  - nephrosis/nephritis,
  - thrombocytopaenia,
  - lymphadenopathy,
  - jaundice,
  - hypoalbuminaemia,
  - pneumonia alba,
  - meningitis,
  - interstitial keratitis, and
  - transient bullous lesions, commonly on the hands and feet with later desquamation and an erythematous appearance of palms and soles.

» A generalised, reddish, maculopapular rash that may desquamate.
» Rhinitis with mucopurulent bloodstained discharge excoriating the upper lip.
» Other mucocutaneous lesions of the mouth, anus and genitalia, healing with scars, especially the corners of the mouth and on the chin.
» Involvement of long bones with/without pseudoparalysis of one or more limbs and radiological findings.

Investigations:
If mother is positive for syphilis:
» X-ray of long bones:
  - translucent metaphyseal bands,
  - osteochondritis,
  - osteitits, and
  - metaphysitis and periostitis.
» Confirm syphilis with:
  - Non-treponemal serological tests, i.e. RPR, VDRL, in mother and baby.

Do not use umbilical cord blood at delivery for laboratory investigations.

GENERAL AND SUPPORTIVE MEASURES

» Nurse infant in a neutral thermal environment.
» Maintain adequate nutrition and hydration.
» Monitor hepatic and renal function.
» Ensure maternal and paternal treatment if positive.

Pneumonia
To maintain oxygen saturation at 90-94% or PaO_2 at 60-80 mmHg:
- Oxygen via a head box or nasal cannulae.

1 kPa = 7.5 mmHg
1 mmHg x 0.133 = 1 kPa

Anaemia
If Haematocrit < 40% (Hb < 13 g/dL):
- Packed red cells, 10 mL/kg administered over 3 hours.

MEDICINE TREATMENT

Asymptomatic, well baby

Mother seropositive or result unknown, and mother has not been treated or was only partially treated:

- Benzathine benzylpenicillin (depot formulation), IM, 50 000 units/kg as a single dose into the antero-lateral thigh.

Symptomatic baby

- Procaine penicillin, IM, 50 000 units/kg daily for 10 days (not for IV use).

OR

- Benzylpenicillin (Penicillin G), IV, 50 000 units/kg 12 hourly for 10 days.

CAUTION Procaine penicillin and benzathine benzylpenicillin must not be given intravenously.

Follow up children at 3 months post treatment with repeat non-treponemal serological tests, until test becomes non-reactive. Re-treat if drop in titre less than 4-fold.

Prevention

Screen pregnant women for syphilis at first visit and repeat during the second and/or third trimester.
Investigate and treat both parents, if necessary.

REFERRAL

» Symptomatic infant with complications, e.g. respiratory failure, hepatic failure, nephrotic syndrome and meningitis.

19.19 TETANUS, NEONATAL

A33
*Notifiable condition

DESCRIPTION

Tetanus is an acute spastic paralytic illness caused by tetanospasmin, the neurotoxin produced by *C. tetani*. Neonatal tetanus is the most common form of the disease, usually caused by umbilical stump infections or contamination.

The disease only occurs in infants of non-immunised mothers or mothers with insufficient levels of protecting antibody to tetanus toxin.

DIAGNOSTIC CRITERIA

Clinical signs

» Presents with difficulty in sucking and swallowing due to masseter spasm, i.e. trismus, usually on day three with associated hunger and crying.
» Temperature of 40–41 °C.

» Tenseness and rigidity of all muscles, including paraspinal and abdominal muscles.
» Fists clenched and the toes fanned.
» Opisthotonic spasms and clonic jerks following sudden stimulation by touch and noise:
  > spasms are painful,
  > not true seizures,
  > there is no loss of consciousness, and
  > laryngeal spasms may result in respiratory distress.
» Umbilicus may appear normal but there may be discharge from, or dirt/dung on umbilicus.

REFERRAL
» Seek urgent telephonic guidance prior to referral.
» All infants with suspected neonatal tetanus.

19.20 PREVENTION OF MOTHER TO CHILD TRANSMISSION (PMTCT)
Z20.60

See Chapter 9 HIV Infection, section 9.1.1 The HIV Exposed Infant.

19.21 RETINOPATHY OF PREMATURITY
H35.1

See Chapter 16 Eye Conditions, Section 16.8 Retinopathy of Prematurity (ROP).

19.22 NEONATAL ABSTINENCE SYNDROME (NAS)
P96.1

DESCRIPTION
Postnatal opioid (or non-oipioid illicit drug) withdrawal syndrome occurring in 55-94% of newborns whose mothers were addicted to or treated with opioids or other non-opioid illicit drugs, during pregnancy.

Can result in:
» foetal malformation,
» intrauterine death,
» preterm delivery,
» growth restriction, and
» an increased risk of antepartum haemorrhage (APH).

After birth withdrawal symptoms are most commonly associated with opiate exposure, but can occur with a wide range of substances including SSRIs which have a separate guideline. Babies developing Neonatal Abstinence Syndrome (NAS) risk subsequent morbidity and SIDS mortality. A multi-disciplinary approach is needed to optimise care for often complex social, psychological and support issues.

DIAGNOSTIC CRITERIA

Mother

- Assessing the mother's drug use – especially during pregnancy
- The mother's urine may be screened for drugs as well.

Newborn include:

- Neonatal abstinence syndrome scoring system (Modified Finnegan can be used http://www.lkpz.nl/docs/lkpz_pdf_1310485469.pdf), which assigns points based on each symptom and its severity. The infant's score can help determine treatment.
- Toxicology (drug) screen of urine and of first bowel movements (meconium).

GENERAL AND SUPPORTIVE MEASURES

- At birth record maternal past and current drug use, dosage and route including time of last use. Partner's drug use – consider adding it to the Road to Health Chart
- Record relatives' awareness of maternal drug use.
- Check and document mother's viral status and offer Hepatitis B vaccine
- (Cross reference: Local Hepatitis B, C, HIV management guidelines)
- Record mother's choice of feeding method, noting prior discussions and decisions.
- Collect urine sample from baby within 48 hours to check drug exposure
- (maternal consent, check antenatal record of discussion)
- Commence withdrawal observations 4 hourly/1-hour post-feed times for at least 72 hours and record severity level. See Table 2 for guidance.

Table 2: Timing of symptoms onset

Typical timing of symptom onset	Substance
3 - 72 hours	Alcohol, Heroin, Morphine, Buprenorphine, Codeine, Diazepam, SSRIs
24hours - 21 days	Methadone, Benzodiazepines, Barbiturates

MEDICINE TREATMENT

Withdrawal symptoms are reduced when drugs from the same group are re-introduced. Heroin is the most commonly abused illicit opioid in South Africa and is referred to as "unga" or "Thai white". "Sugars" is a mixture of cheap heroin and cocaine that can be cut with a variety of other substances that may even include rat poison or other household detergents. "Nyaope" is a mixture of cheap heroin and

cannabis that is commonly used is Gauteng. This mixture is also referred to as "Pinch" in other some areas. There is debate about the exact content of the street drug, "Woonga". It is thought to consist of a number of different substances, that may include heroin, crystal methamphetamine as well as rat poison and antiretroviral medications, specifically efavirenz.

Medicine treatment of NAS

PROBLEM DRUG	TREATMENT OPTIONS
Opiate withdrawal	• Morphine Sulphate o 40mcg/kg/dose 4 hourly o Increase dose 20- 40mcg/kg/dose 8 hourly until symptoms controlled o Maximum dose: 100mcg/kg/dose [Addition of Phenobarbitone may reduce symptom severity]
Non-opiate withdrawal	• Phenobarbitone o 20mg/kg orally loading dose o maintenance dose 24 hours later o 4mg/kg daily in 2 divided doses
Seizure management	Any seizures should be fully investigated: • Refer to Section 19.16 Seizures, Neonatal. • Phenobarbitone o 20mg/kg orally loading dose o maintenance dose 24 hours later o 4mg/kg daily in 2 divided doses For opioid withdrawal: • Morphine sulphate (for opiate withdrawal) 100mcg/kg stat dose oral/IV according to clinical status If on maintenance morphine sulphate consider increasing dose

Weaning Process

» Decrease dose NOT dose interval time.
» Discuss weaning difficulties with a specialist.

Weaning regimen

DRUG	WEANING REGIMEN
Morphine sulphate	After 24-48 hours of symptom control reduce dose by 10-20% each 24-48 hours as tolerated until dose of 20 mcg/kg Reached. Then reduce frequency until 40 mcg/kg/day/stable to discontinue
Phenobarbitone	After 24-48 hours stability reduce dose by 2mg/kg/dose 48 hourly as tolerated

Notes

- Continue NAS assessments for 48 hours after discontinuing medication.
- Ensure hepatitis B immunisation is given when due.

REFERRAL

» All neonates with repeated seizures

CHAPTER 20

PAIN CONTROL

20.1 PAIN CONTROL

R52.9

DESCRIPTION

Pain is a subjective unpleasant experience comprising sensory and emotional components.

Pain needs to be recognised and assessed before it can be managed appropriately.

» Self-report of pain is the gold standard of pain assessment in children, but this is not possible in uncommunicative children.
» Parental report gives valuable information.
» Assessment of physiological and behavioural responses to pain is also important. Physiologic features of pain and anxiety include tachycardia, hypertension and sweating. These may be absent in chronic pain.
» Behavioural features in acute pain: crying, moaning, irritability, facial grimacing, thrashing, jerking, fisting, arching.

PAIN SCALES TO ASSESS AND REVIEW PAIN MANAGEMENT

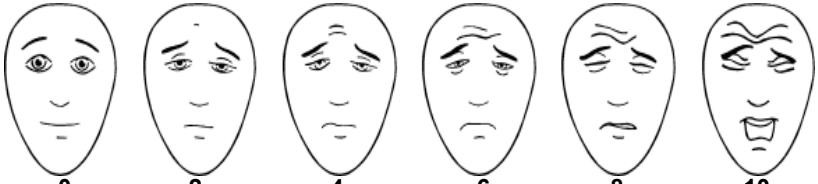
FLACC scale:

» For use in children under 3 years or older uncommunicative children.
» Evaluate each item and arrive at a total score out of 10.

Item	0	1	2
Face	No particular expression or smile	Occasional grimace or frown, withdrawn disinterested	Frequent to constant frown, clenched jaw, quivering chin
Legs	Normal position or relaxed	Uneasy, restless, tense	Kicking, or legs drawn up
Activity	Lying quietly, normal position, moves easily	Squirming, shifting back and forth, tense	Arched, rigid or jerking
Cry	No cry (awake or asleep)	Moans or whimpers, occasional complaint	Crying steadily, screams or sobs, frequent complaints
Consolability	Content, relaxed, no need to console	Reassured by occasional touching, hugging or “talking to”, distractible	Difficult to console or comfort

Revised Faces Pain Scale

» Use in children over 4 years.
» Ask them to point to the face that best depicts their level of pain.



PAIN MANAGEMENT

Basic principles of pain management

» Treat the underlying cause.
» Determine the pathophysiology of the pain to determine the most suitable treatment (e.g. nociceptive vs neuropathic).
» Use both medicine and non-medicine measures.
» Address associated psychosocial distress (e.g. separation anxiety).
» Continually re-evaluate pain and its response to treatment.

The primary aim is to alleviate pain

» Choose the appropriate pain relief according to the severity of pain.
» Re-assess degree of response and adjust accordingly.
» Do not hesitate to start with a strong analgesic in cases of severe pain.

GENERAL AND SUPPORTIVE MEASURES

» Discuss the management with the family, including the child, as appropriate for development.
» Address all factors that may contribute to pain and associated symptoms, e.g. family stress, anxiety and sleep deprivation. Address parental anxiety.
» Where possible, allow a parent to room-in or stay with the child as long as possible.
» Make sure that the child is comfortable, e.g. nappy is clean and dry, child is fed.
» Use non-medicine therapies and distraction, e.g. massage, breast-feeding, splints, music or play therapy and storybook reading, where appropriate.
» For babies up to three months of age: sucrose 24% on to infant's tongue given 2 minutes before the painful procedure may provide some comfort.

20.1.1 PROCEDURAL SEDATION AND ANALGESIA

Procedural pain relief is of utmost importance in children. Failure to provide proper preventative pain measures increases anxiety in both the child and caregiver making repeat procedures more difficult (due to anticipatory anxiety). In the case of neonates, failure to provide proper preventative pain control can reset the child's pain threshold for the rest of their life.

GOALS OF PROCEDURAL SEDATION AND ANALGESIA

» Provide a safe environment for the patient.
» Effectively control pain, anxiety and movement.
» Decreased awareness and amnesia are also advantageous.

GENERAL AND SUPPORTIVE MEASURES

Non-medication measures are as important as medication measures in the management of procedural pain. These include adequate preparation/explanation to the child and parent/caregiver, correct positioning, and the use of distraction.

Note: If the pathology or procedure would cause pain in an adult, it is likely to be painful for a child.

MEDICINE TREATMENT

» For some procedures both local anaesthetic and systemic treatment is necessary to relieve anxiety and pain.
» For some procedures, it is necessary to give sedation in combination with systemic pain treatment. Sedation should never be used on its own without analgesics for procedural pain.
» If pain is likely to be on-going post procedure, remember to prescribe continued analgesia.
» Selection of medication and routes of administration depends on the child's age, developmental level, procedural requirements and expected level of pain.

Procedural Pain and Sedation Table

Note:

- Before performing procedural pain and sedation strategies, it is important that clinicians are familiar with procedural pain and sedation guidelines as well as appropriate monitoring.
- Each case should be individualised. This table does not supersede clinical judgement.

	Procedure associated with mild pain		Procedure associated with moderate pain		Procedure associated with severe pain
Examples (Not exclusive)	Blood taking Heel prick IM injection Nasogastric tube insertion Catheterisation Supra-pubic aspiration of urine Peripheral cannulation		Arterial line Central venous line Simple laceration Intercostal drain insertion Intubation Dressing change for burns < 10% Lumbar puncture Intercostal drain removal		Bone marrow aspirate trephine (BMAT) Deep wound drain removal Complicated laceration Incision and drainage Dressing change for burns >10% Fracture reduction
ANALGESIA					
Local analgesia	• Topical Lignocaine (lidocaine)/prilocaine • (30 mins – 1hr before procedure) • Lignocaine (lidocaine) 2% gel		• Topical Lignocaine (lidocaine)/prilocaine • (30 mins – 1hr before procedure) • Lignocaine (lidocaine) infiltration (1%)		• Lignocaine (lidocaine) infiltration (1%) • Consider local blocks (anaesthetist)
	< 6 months (oral)	**>6 months (oral)**	**Oral**	**IV route available (and safe)**	**Consider general anaesthesia or IV route as per procedures associated with moderate pain**
	• Sucrose 24% solution (12% if NEC risk) • Breastfeed	• Paracetamol 20mg/kg stat 1-2 hrs before procedure **OR** • Ibuprofen 10mg/kg 2 hrs before procedure	• Tilidine SL 1 mg/kg 45 minutes before procedure **OR** • Morphine 0.1-0.3 mg/kg 30 – 60 min before procedure **OR** • Ketamine 4-6 mg/kg in a sweet drink 30 min before procedure	• Morphine 0.05 -0.1 mg/kg 10-20 min before procedure **OR** • Ketamine 0.25-1 mg/kg (titrate to effect)	Refer to Chapter 21: Intensive Care and anaesthetics for recommendations General anaesthesia for all ASA Class III-IV patients (severe systemic illness, life-threatening conditions, moribund), congenital syndromes, advanced respiratory disease, cardiac dysfunction, depressed level of consiousness, raised intracranial pressure, hypertension, difficult airway, obesity, full stomach + emergency
SEDATION					
			Oral	**IV route available (and safe)**	
Sedation	Not necessary unless: • Co-operation is poor • High level of anxiety • Procedure better if patient is still		• Midazolam 0.25–0.5 mg/kg 30 min before procedure **OR** • Ketamine 6-10 mg/kg 5-30 min before procedure	• Midazolam 0.025-0.1 mg/kg (max 1 mg) 3-5 mins before procedure (NB: Use half dose if combining with morphine) **OR** • Ketamine 0.25-1 mg/kg 3-5 mins before	GENERAL ANAESTHESIA
Post procedure	Not generally required		As per persistent pain guidelines below		

20.1.2 MANAGEMENT OF PAIN

DESCRIPTION

Acute Pain
R52.0

Acute pain is pain of short duration that usually resolves as injured tissues heal. Acute pain is often distinct from chronic pain being more sharp and severe.

Persistent/Chronic Pain
R52.2

Persisting pain is pain lasting longer than the expected time for healing, and does not always have an obvious physical cause. Behavioural manifestations in chronic pain are more subtle and are often overlooked: features include apathy, disinterest, depression and decreased activity level.

GENERAL PRINCIPLES

The broad principles of analgesic use in children:
» By the clock (regular rather than as required dosing).
» By the correct route for the type of pain (preferably oral, avoid IM injections).
» By the child (individualise treatment).
» By the WHO pain ladder.

Note:
» Always re-assess the degree of response and adjust management accordingly.
» Do not hesitate to start with a strong analgesic in cases of severe pain.

MEDICINE TREATMENT

The correct use of the correct analgesic will relieve most pain in children. Treatment should be individualised as pain experiences vary from child to child.

Non-opioid medicines

- Paracetamol, oral.
  - Loading dose 20 mg/kg/dose, then 15 mg/kg/dose 4–6 hourly.

OR

Where oral medication cannot be used:

- Paracetamol, suppositories, 6 hourly.

Weight	Dose
6 - 11 kg	125 mg
12 - 17 kg	250 mg
18 - 24 kg	375 mg
25 - 30 kg	500 mg
31 - 37 kg	625 mg
38 - 45 kg	750 mg
46 - 50 kg	875 mg

Note: Suppositories should not be cut into pieces, as the amount of paracetamol in each portion may not be consistent.

Non-steroidal anti-inflammatory drugs (NSAIDS)

Where anti-inflammatory effect is required.

- Ibuprofen, oral, 10 mg/kg/dose 8 hourly with meals.
  - Can be used in combination with paracetamol or opioids.

Intermediate efficacy opioid

- Tilidine, oral, 6 hourly.
  - 1 drop per 2.5 kg of body weight (i.e. 1 mg/kg/dose).

Strong opioid

- Morphine, oral [Immediate release morphine (liquid)].
  - Starting dose:
    - If 0 – 1 month of age: 0.05 mg/kg 6 hourly.
    - If > 1–12 months of age: 0.1 mg/kg/dose 4 hourly.
    - If > 12 months of age: 0.2–0.4 mg/kg/dose 4 hourly.
  - Dosing is 4 hourly except in patients with delayed clearance, i.e. newborns, hepatic and renal dysfunction where it is prescribed 6 hourly.

  Titrate morphine slowly to avoid side effects.

In palliative care the dose of morphine is titrated to the patient's pain control. Increase dose by 30–50% with each dose if pain control is sub-optimal. There is no maximum dose of morphine.

  - Breakthrough dose: 50–100% of the regular pain dose.
  - Give regular and breakthrough doses at least one hour apart.
  - If the child requires breakthrough doses less than an hour after the regular dose has been given, then it is likely that the regular dose needs to be increased.
  - At the end of a 24-hour period all the breakthrough doses should be added up and this value divided by 6 to determine the increase needed in the regular dose for the next day.
  - Increase breakthrough dose as regular doses are increased.

If patient is unable to swallow or is vomiting:

- Morphine, IV, 4 hourly bolus.
  - Starting dose:
    - If > 1–6 months of age: 0.05 – 0.1 mg/kg.
    - If > 6 months of age: 0.1mg/kg.

- Morphine, IV infusion, 10 - 20 mcg/kg/hour, titrate to effect.
  - i.e. Morphine 1 mg/kg mixed with 50 mL dextrose 5% or sodium chloride 0.9% at 0.5 - 1 mL/hour.

In all patients receiving morphine:

- Lactulose, oral, 2.5-10 mL 12 hourly.

Children receiving properly titrated doses of analgesics, including opioids, do not become addicted**.** There is a difference between tolerance, which is a need for escalating doses to achieve the same therapeutic effect, and addiction.

Withdrawal from opioids

This must be done for any child who has received morphine for more than 5–7 days. Wean by decreasing the daily dose by one third for three days.

Co-analgesics

Co-analgesics are drugs that have weak or non-existent analgesic action when administered alone but can enhance analgesic actions when co-administered with known analgesic agents.

Steroids

Steroids may be used as an adjuvant in consultation with a specialist for the following indications:

» infiltration of bone/meninges,
» compression of nerves and spinal cord,
» visceromegaly,
» tumour invasion of organs,
» stretching of periosteum or peritoneum.

Stretching of periosteum or peritoneum:

- Prednisone, oral, 1–2 mg/kg/day as single dose or in 2 divided doses.

Neuropathic pain:

- Carbamazepine, oral, 5 mg/kg/dose 12 hourly.

REFERRAL

» Adequate analgesia will control pain in almost all cases. Discuss resistant cases with a specialist.
» Those patients with for neuropathic pain who present with contraindications (including drug interactions) or who are intolerant to carbamazepine.

CHAPTER 21

PALLIATIVE CARE

21.1 PALLIATIVE CARE

Z51.5

DESCRIPTION

Palliative care is an approach that aims to improve the quality of life of patients and their families facing the problems associated with life-threatening illness, through the prevention and relief of suffering by means of early identification and impeccable assessment and treatment of pain and other problems, physical, psychosocial and spiritual. Palliative care is not restricted to only end of life care, but includes any relief of suffering associated with illness.

A key component to relieving suffering is the management of distressing symptoms that include both pain and non-pain symptoms (e.g. nausea, anxiety, etc.). There are certain key principles that should be applied when managing these symptoms, i.e.:

» Determine and treat underlying causes of the symptom, including non-physical causes.
» Relieve the symptom without creating new symptoms or unwanted side effects.
» Consider different types of interventions: drug and non-drug interventions.
» Consider whether the treatment is of benefit to the individual patient.

Common non-pain symptoms and other problems in paediatric palliative care are described below.

RESPIRATORY

Dyspnoea

» Reduce anxiety by addressing psychosocial factors, e.g. parental separation.
» Blowing cool air onto the face with fan or open window.
» Consider home oxygen concentrator.

- Morphine, oral [Immediate release morphine (liquid)].
  - Starting dose:
    - If 0–1 month of age: 0.05 mg/kg 6 hourly.
    - If > 1–12 months of age: 0.1 mg/kg/dose 4 hourly.
    - If > 12 months of age: 0.2–0.4 mg/kg/dose 4 hourly.

Chronic cough

» Simple linctus to soothe throat.
» Alternatively, a homemade solution of hot water with a squeeze of lemon and teaspoon of honey.

GASTRO-INTESTINAL

Nausea and vomiting

Appropriate treatment depends on the cause of nausea and vomiting.

- **Selective serotonin antagonists, e.g.:**
- Ondansetron, oral, 0.1-0.2 mg/kg 12 hourly.

OR

- Metoclopramide, oral, 0.1 mg/kg/dose, 6–12 hourly.
  - Neonates: 100 mcg/kg, 6 – 8 hourly
  - 1 month – 11 months (up to 10 kg): 100 mcg/kg 12 hourly (Maximum: 1mg/dose)
  - 1 year to 18 years: 100 – 150 mcg/kg 8 hourly (Maximum: 10 mg/dose)

Use with caution as extrapyramidal side effects may occur (especially at higher doses).

If oral route cannot be used:

- Ondansetron, IV, 0.1 mg/kg immediately.
  - Maximum dose: 4 mg/day.

Persistent Diarrhoea

Refer to Chapter 2: Alimentary Tract, Section 2.2.5 Persistent Diarrhoea.
Consider:

- Loperamide, oral, 0.08 - 0.24 mg/kg/day in 2-3 divided doses. *LoE III*[1]

Constipation

Laxatives should be used prophylactically in all patients receiving morphine.

- Lactulose, oral, 2.5–10 mL 12 hourly.

For further guidance, refer to Chapter 2: Alimentary Tract, Section 2.2.2 Constipation/Faecal Loading.

Spasmodic abdominal pain

- Hyoscine butylbromide, IV/oral, 0.5 mg/kg/dose 6–8 hourly.

NEUROPSYCHIATRIC

Anxiety

- Benzodiazepine, e.g.:
- Diazepam, oral, 8 hourly.
  - If > 2–12 years of age: 2–3 mg.
  - If > 12–18 years of age: 2–10 mg.

Depression

Refer to Chapter 14: Paediatric Psychiatry, Section 14.4.1 Depression in Childhood and Adolescence.

Chorea-athetosis

Refer to Chapter 13: The Nervous System, Section 13.9 Syndenham Chorea

Dystonia

- Biperidin, IV, slow injection.
  - If < 1 year of age 1mg
  - If 1–6 years of age: 2mg
  - If 6–10 years of age: 3mg

Muscle Spasms

» Where possible, refer for physiotherapy and/or occupational therapy.

▪ Benzodiazepine, e.g.:

- Diazepam, oral, 8 hourly.
  - If > 2–12 years of age: 2–3 mg.
  - If > 12–18 years of age: 2–10 mg.

PLUS

- Morphine, oral (Immediate release morphine (liquid))
  - Starting dose:
    - If 0–1 month of age: 0.05 mg/kg 6 hourly.
    - If > 1–12 months of age: 0.1 mg/kg/dose 4 hourly.
    - If > 12 months of age: 0.2–0.4 mg/kg/dose 4 hourly.

Intractable Seizures

Refer to Chapter 13: The Nervous System, Section 13.1 Seizures.

DERMATOLOGICAL

Pruritus

- Promethazine, IV/oral, 0.1 mg/kg/dose 6 hourly.

Malodorous fungating wounds/tumours

» Disguise smell of wound: using methods such as burning incense, or having vanilla essence in a bowl.

Oral care

- Zinc and castor oil cream, topical, applied to lips every 2 hours.

- Sodium chloride solution, gargle, to rinse mouth.
  - Dissolve 5 g sodium chloride in 1 L of water.

OR

- Chlorhexidine 0.2%, 10 mL as a mouthwash or gargle, 12 hourly.
  - Do not swallow.

Aphthous ulcers
See Chapter 2: Alimentary Tract, section: 2.1.5 Aphthous ulcers.

Mucositis
- Chorhexidine 2%/benzydamine, oral rinse, rinse or gargle 6–8 hourly.

Perineal mucositis/nappy rash
- Zinc and castor oil cream, topical, applied as needed.
  - o If pain is a feature: mix with lidocaine 2% gel.

In no improvement within 3 days, suspect candida and:
ADD
- Clotrimazole 2% cream followed by zinc and castor oil ointment applied after each nappy change.

Secretions
» Suctioning and re-positioning is often helpful.
» Attention to oral hygiene is essential.
- Hyoscine butylbromide, IV/oral, 0.5 mg/kg/dose 6–8 hourly.

HAEMOTALOGICAL
Epistaxis
» Refer to Chapter 17 Ear, Nose and Throat, section 17.4 Epistaxis.

Mucosal bleeding
» Refer to Chapter 3 Blood and blood forming organs.

21.2 END OF LIFE CARE

The management of a child who is imminently terminal (death expected to occur within a few days or weeks), should include:
- Relieving physical and emotional distress in the child.
- Treating easily manageable complications causing suffering, but not to prolong dying.
- Stopping all unnecessary medicines.
- Limiting hospital admissions or reducing the duration of hospital stays if possible.
- Ensuring that parents/caregivers are adequately counselled.
- Decision making as to preferred place of death (home, hospice, hospital) and referral to community based services where available (hospice palliative and home based care services).

Indications for inpatient hospital or hospice in patient terminal care:
- Hypoxia and respiratory distress where oxygen therapy provides relief.
- IV/nasogastric fluid requirements or medication administration needed to relieve suffering.
- Carer/s unable to cope at home.

Feeds and fluids at the end of life:

- Anorexia and refusal of feeds/fluids in dying patients is a normal phenomenon and not an indication for nasogastric feeds or intravenous fluids as these may prolong dying.
- Encourage the family to 'feed for comfort only" and reassure them that the dying child is not hungry.

Investigations at the end of life:

- Investigations should be kept to a minimum and only done if it is believed that doing these will shorten the duration of hospital stay or in some way contribute to the child's comfort.

Antibiotics at the end of life:

- Oral antibiotic therapy may be started, where it is thought that a course of antibiotics could shorten the duration of discomfort or hospital stay.
- Non-treatment of a terminal pneumonia (a common end of life event) is an acceptable palliative care practice.

REFERRAL

Discuss with a specialist:

» Children with symptoms not described here.
» Children not responding to management.

References

[i] Loperamide dose: South African Medicines Formulary (SAMF), 12th Edition. Division of Pharmacology, Faculty of Health Sciences, University of Cape Town. 2016.

CHAPTER 22

INTENSIVE CARE AND ANAESTHETICS

Healthcare professionals engaged in intensive care and anaesthetics must undergo appropriate training.

22.1 SEDATION FOR INTENSIVE CARE PROCEDURES

22.1.1 ICU SEDATION, NEONATE

DESCRIPTION

Sedation is required for various procedures and situations in newborns in an intensive care setting to decrease discomfort and suffering, and to improve the management outcomes of the procedure/care that is being given.

GENERAL AND SUPPORTIVE MEASURES

In all situations, appropriate control of the environment, provision of normal physiological requirements, monitoring of vital signs and provision of comforting care should be incorporated into the care of neonates in order to minimise stress on the child.

MEDICINE TREATMENT

1. For controlled endotracheal intubation for ventilation

This skill should have been learnt in an appropriate learning situation. If not, endotracheal intubation should take place under supervision of a specialist.

Pre-oxygenate with bag-mask and reservoir, T-piece or equivalent ventilator. Maintain pre-ductal (right hand or ear lobe) oxygen saturation between 88–92% by adjusting the F_iO_2.

- Ketamine, IV, 1–2 mg/kg. (Acts within 60 seconds. Effect lasts 5-10 minutes.)

OR

- Propofol, IV, titrate up to 2.5 mg/kg. Titrate as necessary to achieve required sedation. (Acts within 30 seconds. Effect lasts 3-10 minutes.)

LoE III[i]

OR

- Midazolam, IV, 0.1–0.2 mg/kg. (Acts within 1-5 minutes. Effect lasts 20-30 minutes.) Avoid in preterm babies. In term babies, use in combination with fentanyl. Fentanyl, IV, 1-4 mcg/kg. (Acts immediately. Effect lasts 30-60 minutes.)

LoE III[ii]

THEN

- Suxamethonium, IV, 2 mg/kg. (Produces 5–10 minutes of neuromuscular blockade within 30-60 seconds.) **Causes paralysis and apnoea.**
  - Note: Avoid Suxamethonium in patients with or at risk of developing hyperkalaemia, neuromuscular disease and a family history of malignant hyperthermia.

LoE III[iii]

PLUS

Atropine should be readily available in the case of bradycardia or ketamine hypersecretion:

- Atropine, IV, 0.02 mg/kg.

If it is an emergency with no IV line, consider:

- Ketamine, IM, 5–10 mg/kg. (Effect lasts 12-25 minutes.)

2. During continuous mechanical ventilation

For pain and sedation when indicated but *not routinely*:

- Fentanyl, IV, 1–5 mcg/kg bolus.
  If necessary, follow with IV infusion, 5–10 mcg/kg/hour, i.e. 50 mcg/mL at 0.1–0.2 mL/kg/hour.

LoE III[v]

OR

- Morphine, IV, 10–30 mcg/kg/hour infusion.
  - i.e. Morphine 1 mg/kg mixed with 50 mL dextrose 5% or sodium chloride 0.9% at 0.5–1.5 mL/hour.
  - Do not use routinely in *preterm* infants.

OR

- Sucrose 24% solution, onto the infant's tongue, as needed for minor procedures.
  - Preterm infants: 0.5–1 mL.
  - Term infants: 2 mL.

LoE III[iv]

REFERRAL

» Inability to provide appropriate care.

22.1.2 ICU SEDATION, INFANT AND CHILD

DESCRIPTION

Sedation is required for various procedures and situations in infants and children in an intensive care setting to decrease discomfort and suffering, and to improve the management outcomes of the procedure/care that is being given.

GENERAL AND SUPPORTIVE MEASURES

In all situations, appropriate control of the environment, provision of normal physiological requirements, monitoring of vital signs and provision of comforting care should surround the care of infants and children in order to minimise the stress on the child.

MEDICINE TREATMENT

Endotracheal intubation should be learnt in an appropriate learning situation.
If not, endotracheal intubation should take place under supervision of an experienced health practitioner.

1. For endotracheal intubation

Pre-oxygenate with bag-mask and reservoir, T-piece or equivalent ventilator.
Maintain oxygen saturation > 90%.
Consider conditions that will determine appropriate medication options and prepare equipment.

- Ketamine, IV, 1–2 mg/kg. (Acts within 60 seconds. Effect lasts 5-10 minutes.)

OR

- Propofol, IV, titrate up to 2.5 mg/kg. Titrate as necessary to achieve required sedation. (Acts within 30 seconds. Effect lasts 3-10 minutes).

LoE III[1]

THEN

If muscle relaxant is necessary:

- Suxamethonium, IV, 1-2 mg/kg. (Produces 5–10 minutes of neuromuscular blockade within 30-60 seconds). Use the lower dose in older children and the higher dose in younger children. **Causes paralysis and apnoea.**
    - **Note**: Avoid Suxamethonium in patients with or at risk of developing hyperkalaemia, neuromuscular disease and a family history of malignant hyperthermia.

PLUS

If bradycardia occurs or if using ketamine:

- Atropine, IV, 0.02 mg/kg (not less than 0.1 mg/dose).
  - Maximum dose: 0.6 mg.

If it is an emergency with no IV line, consider:

- Ketamine, IM, 5–10 mg/kg. (Effect lasts 12-25 minutes.)

2. During continuous mechanical ventilation

- Midazolam, IV, 1–4 mcg/kg/minute.
  - i.e. Midazolam 3 mg/kg mixed with 50 mL dextrose 5% at 1–4 mL/hour.

PLUS

- Fentanyl, IV, 1–5 mcg/kg bolus.
  - If necessary, follow with IV infusion, 5–10 mcg/kg/hour, i.e. 50 mcg/mL at 0.1–0.2 mL/kg/hour.

LoE III[v]

OR

PLUS

- Morphine, IV, 20–80 mcg/kg/hour infusion.
  - i.e. Morphine 1 mg/kg mixed with 50 mL dextrose 5% or sodium chloride 0.9% at 1–4 mL/hour.

3. For procedures (not ventilated)

Take standard precautions for respiratory arrest.

For painful procedures:

- Ketamine, oral, 5 mg/kg (Acts within 30 minutes. Effect lasts 60 minutes.) **or** IV, 1–2 mg/kg. (Acts within 60 seconds. Effect lasts 5-10 minutes.)

For non painful procedures

- Midazolam, oral, 0.5 mg/kg (Acts within 20 minutes. Effect lasts 60-90 minutes.) **or** intranasal, 0.2 mg/kg **or** IV, 0.1–0.2 mg/kg. (Acts within 1-5 minutes. Effect lasts 20-30 minutes.) (Has no analgesic effect.)
  - Maximum dose: 15 mg.

LoE III[vi]

REFERRAL

» Inability to provide appropriate care.

22.2 PARENTERAL NUTRITION

» Parenteral nutrition (PN) is the intravenous administration of amino acids (proteins), lipids, carbohydrates, electrolytes, minerals, vitamins and trace elements necessary for metabolic requirements and growth.
» PN may be total, i.e. total parenteral nutrition (TPN) where all nutrients are administered, usually via a central venous line, until the infant is again ready to take enteral feeds.
» PN may also be partial, i.e. partial parenteral nutrition (PPN) where it is used to supplement enteral feeds in infants who cannot yet tolerate their full complement of enteral feeds.
» If possible, the enteral route should also be used, even if it is only able to supply a fraction of the required nutrients.
» PN should be used only when it is not possible to meet nutritional requirements enterally or when there is gastrointestinal dysfunction resulting in inability to tolerate enteral nutrition for a prolonged time: 1 to 3 days in infants, 4 to 5 days for children and adolescents.
» Administer PN preferably via a central venous line, especially when it is expected that the infant will require TPN for more than 7 days. For partial parenteral nutrition, a peripheral venous line may be used, especially where it is expected that the infant will require PPN for only a few days (< 7 days). Only PN solutions which contain lipids and have an osmolarity of < 1000 mOsm/L and non-lipid containing PN solutions with an osmolarity < 800 mOsm/L can be safely administered via a peripheral vein.
» Check peripheral vein infusion sites and patency of the line/catheter regularly for tissue infiltration.
» Transport and store PN solutions at 2–8ºC. Start administration of the PN solutions within one hour after removal from the refrigerator.
» Do not make additions to a PN bag or decant contents as the stability and/or the sterility may be compromised.
» Do not use the PN line to collect blood samples.
» Administer PN through a dedicated line and do not administer medications, blood, etc. through the PN line.
» Use a 1.2 micron in-line filter for lipid containing PN solutions and a 0.2 micron filter for lipid-free PN solutions.
» Adhere to a strict aseptic technique when administering PN solutions. Check solution and administration sets before starting the infusion.
» Use bags within 24 hours of starting the infusion.
» PN should be prescribed and administered under the supervision of a paediatrician and dietician.

COMPLICATIONS OF PN:

» IV line/catheter complications, e.g. extravasation, blockage or bacterial/fungal contamination;

» metabolic complications, e.g. hyperglycaemia, high ammonia, metabolic acidosis, electrolyte and mineral disturbances and hyperlipidaemia;
» infection/sepsis; and
» cholestatic hepatitis.

Monitor:
» vital signs and hydration;
» blood glucose 12 hourly, maintain blood glucose at 2.6–6.0 mmol/L;
» electrolytes, minerals and acid-base on a daily basis or more regularly if necessary;
» growth parameters and weight, once weekly;
» infection markers at least once weekly or more frequently if necessary; and
» liver enzymes, bilirubin, ammonia, lipids, urea and creatinine once weekly or more frequently, as indicated by the condition of the infant.

PARENTERAL NUTRITION FORMULATIONS

Use the standard TPN formulations that are commercially available for paediatric use and that have been manufactured at a GMP (Good Manufacturing Practice) compliant site and have been regulated by the Medicines Control Council.

22.2.1 PARENTERAL NUTRITION, NEONATAL

DESCRIPTION

Parenteral nutrition (PN) should be considered within 24 hours in neonates where enteral feeds are not indicated, not tolerated or are contra-indicated due to medical or surgical conditions, e.g. NEC, post intestinal surgery, ileus, bowel obstruction and malabsorption, severe hypoperfusion / significant vasopressor-ionotropic support.

DOSE AND DURATION OF PN INFUSION

The volume of PN to be administered to the neonate depends on the age, weight and underlying disease of the neonate. Use the daily fluid requirements as a guide to determine the volume of PN solution to be administered.

The maximum volume of TPN for a neonate should not exceed 150 mL/kg/24 hours. The PN solution should be administered over 24 hours depending on the condition of the infant and volume to be administered. The remainder of the daily fluid requirements should be made up by an IV neonatal maintenance solution.

Discuss choice of PN and methods of initiating PN with a relevant expert prior to initiating PN.

Taper PN as the infant becomes able to tolerate enteral feeds.

Caution
Extravasation of peripheral nutrition solutions causes severe tissue damage and necrosis.
Do not infuse peripheral nutrition solutions into poorly running IV lines.

AVERAGE DAILY REQUIREMENTS

	Preterm neonate		Term neonate
	< 1500 g	≥ 1500 g	
The figures below are for stable full requirements after the transition phase (i.e. > day 5) – The slow increase in requirements during the transition phase is usually addressed by the incremental introduction of TPN with the parallel withdrawal of crystalloid infusion during this phase.			
Fluid mL/kg	140–180	140–160	140–170
Energy kcal/kg	110–120		90–100
Protein g/kg	1.5–4		1.5–3
CHO g/kg	6–12		10–18
Lipid g/kg	3–4		3–4

Adapted from ESPGHAN 2005.

Some infants may be intolerant to the total daily requirements of the different nutrients and may require slow up-titration.

REFERRAL

» No progress with the introduction of enteral feeds.
» Recurrent/serious complications.
» Absolute contraindications to enteral feeds.

22.2.2 PARENTERAL NUTRITION, PAEDIATRICS

DOSE AND DURATION OF PN INFUSION

The maximum volume of TPN for a child depends on the age, weight and underlying disease and is based on the total daily fluid requirements.

AVERAGE DAILY REQUIREMENTS

	Birth – 3 months	> 3 months – 1 year	>1 – 3 years	> 3 – 6 years	> 6 – 12 years
Fluid mL/kg	120–150	120–150	80–100	80	60–80
Energy kcal/kg	90–100	90–100	75–90	75–90	60–75
Protein g/kg	1.5–3	1– 2.5	1–2.5	1– 2	1–2
CHO g/kg	18	18	14	14	12
Lipid g/kg	3–4	3–4	2–3	2–3	2–3

Adapted from ESPGHAN 2005.

AVERAGE DAILY REQUIREMENTS

The daily nutritional requirements are influenced by age, physical activity and underlying diseases/disorders, e.g. burns, liver failure, etc.

REFERRAL

» No progress with the introduction of enteral feeds.
» Recurrent/serious complications.
» Absolute contraindications to enteral feeds.

22.3 ANAESTHETIC AND POST ANAESTHETIC CARE OF CHILDREN

22.3.1 LOCAL AND REGIONAL ANAESTHESIA

DESCRIPTION

Local anaesthesia is accomplished by either local infiltration of soft tissue or the instillation of local anaesthetic into potential or existing body spaces such as the epidural space, sub-arachnoid spinal spaces or around major nerves or plexuses.
Appropriate care is always used to limit the volumes. Use appropriate agents, avoid adrenaline (epinephrine) where end-artery blood supply exists and ensure the agents are in the correct sites. This should be learnt under appropriate learning situations.

MEDICINE TREATMENT

Dental local anaesthesia

- Lignocaine (lidocaine) 2% with adrenaline (epinephrine) (1:80 000).
  - Maximum dose: 7 mg/kg Lignocaine (lidocaine) with adrenaline (epinephrine) (i.e. 0.35 mL/kg) per use.

Diffuse local soft tissue infiltration

Do not use adrenaline containing lignocaine in sites where vascular (end-artery) compromise may result from vasoconstrictor use, i.e. fingers, toes, penis and eyes.

For sites where vascular (end-artery) compromise is a risk:

- Lignocaine (lidocaine) 2% [**without** adrenaline (epinephrine)].
  - Maximum dose: 3 mg/kg of Lignocaine (lidocaine) (i.e. 0.15 mL/kg) per use.

For sites where vascular (end artery) compromise is not a risk:

- Lignocaine (lidocaine) 2% with adrenaline (epinephrine) (1:80 000).
  - Maximum dose: 7 mg/kg Lignocaine (lidocaine) with adrenaline (epinephrine) (i.e. 0.35 mL/kg) per use.

Intercostal nerve block/penile block/digital ring block/brachial (axillary approach) block, preferably with an ultrasound or nerve stimulation.

- Lignocaine (lidocaine) 2% [**without** epinephrine (adrenaline)].
  - Maximum dose: 3 mg/kg of Lignocaine (lidocaine) (i.e. 0.15 mL/kg of 2%).

OR

- Bupivacaine 5 mg/mL (0.5%) [**without** epinephrine (adrenaline) and **without** dextrose]. Can be diluted to 0.25% with normal saline where larger areas need anaesthetising.
  - Maximum dose: 2 mg/kg of bupivacaine (i.e. 0.4 mL/kg of 5mg/mL).

22.3.2 GENERAL ANAESTHESIA

22.3.2.1 PREPARATION

DESCRIPTION

Premedication of children for anaesthesia is largely a sedative/anxiolytic intervention.
Recognition of the child's condition should guide in the choice of agent.

Avoid sedative premedication in children less than 6 months, with evidence of airway compromise, obstructive sleep apnoea or hypotonia.

Other special medical interventions such as prevention of hyper-secretion are ordered according to specific-or anticipated need.

Premedication care should be learnt in an appropriate learning situation.

Pre-operative starvation period:
» clear fluid: 2 hours,
» breast milk: 4 hours,
» solids, breast milk substitutes, non-human milk: 6 hours.

MEDICINE TREATMENT

Premedication:

- Midazolam, oral, 0.5 mg/kg, 10–30 minutes pre-operative.

  LoE III[vii]

  - Maximum dose: 15 mg.

  LoE III[v]

OR

For children over 2 years of age:

- Promethazine, oral, 0.5 mg/kg, 30-60 minutes pre-operative.
  - Maximum dose: 25 mg (2-5 years) – 50 mg (over 5 years).
  - Decrease dose of any narcotics given.

LoE III[viii]

OR

- Ketamine, oral, 3-5 mg/kg. (Acts within 30 minutes. Effect lasts 60 minutes).

22.3.2.2 INDUCTION

Induction should be learnt in an appropriate learning situation.

DESCRIPTION

Induction of anaesthesia is the critical part of the transition from consciousness to general anaesthesia.

All patients undergoing anaesthesia should be monitored with a minimum of:

» clinical observation,
» ECG,
» blood pressure monitor,
» pulse oximeter, and
» temperature monitoring, especially in neonates and infants.

It is desirable to do capnography for ventilated patients.

This is a period which requires highly attentive and skilled care.

MEDICINE TREATMENT

Endotracheal intubation

Caution
This procedure should be learnt under supervision.

The condition of the patient and the surgical requirements dictate airway management by way of face mask, supraglottic device or endotracheal tube.

Inhalational agents:

- Nitrous oxide.
- Oxygen.
- Sevoflurane.
- Halothane.
- Medical air.

LoE III[ix]

Intravenous agents: (Use reduced doses if inhalational agents also used).

- Propofol, IV, titrate up to 2.5 mg/kg. Titrate as necessary to achieve required sedation. (Acts within 30 seconds. Effect lasts 3-10 minutes).

LoE III[i]

OR

- Ketamine, IV, 1–2 mg/kg. (Acts within 60 seconds. Effect lasts 5-10 minutes).

OR

- Thiopental sodium, IV, 2–5 mg/kg. Titrate as necessary to achieve required sedation. (Acts within 30-60 seconds. General effect lasts 5-30 minutes, sedation may last for up to 24 hours.) Use smaller doses in neonates and child, higher dose in infants.

Muscle relaxant during induction for intubation:

Note: A nerve stimulator should always be used when non-depolarising muscle relaxants are used.

Ventilate all patients receiving muscle relaxants.

- Suxamethonium, IV, 1-2 mg/kg. (Produces 5–10 minutes of neuromuscular blockade within 30-60 seconds). **Causes paralysis and apnoea.**
  - **Note**: Avoid Suxamethonium in patients with or at risk of hyperkalaemia, neuromuscular disease and a family history of malignant hyperthermia.

OR

- Rocuronium bromide, IV, 0.3-0.6 mg/kg. (Acts within 1-2 minutes. Effect lasts 20-30 minutes). **Causes paralysis and apnoea.**

LoE III[x]

Endotracheal tube sizes in anaesthesia (Children)				
Age	Weight (kg)	ETT*	Oral (at lips)	Nasal (at nostril)
Prem	1	2.5	7	8.5
Prem	2	2.5-3	8	9.5
Term	3	3–3.5	9.5	11.5
2 months	4.5	3.5	11	12.5
1 year	10	4	12	14
18 month	12	4.5	13	15
2 years	15	5	14	16
4 years	17	5.5	15	17
6 years	21	6	16	19
8 years	25	6.5	17	20
10 years	31	7	18	21

*If using a cuffed endotracheal tube, use a half size smaller.

22.3.2.3 MAINTENANCE

Caution
This procedure should be learnt under supervision.

DESCRIPTION

After induction, transition occurs to maintenance of adequate level of pain prevention, amnesia and immobility to allow pain-free and safe surgical care, i.e. adequate narcosis, analgesia and muscle relaxation.

Appropriate care is always required to monitor the patient, detect complications of, and depth of anaesthesia.

MEDICINE TREATMENT

Inhalation anaesthesia

- Oxygen.
- Nitrous oxide.
- Isoflurane.
- Halothane.
- Medical air.

Intravenous medicine used during anaesthesia in children (not neonates):

- Fentanyl, IV, 1–2 mcg/kg bolus as required (under anaesthetist supervision up to 2–5-mcg/kg).
  - Maximum dose: 50–100 mcg if unventilated.

OR

- Morphine, IV, 0.05-0.1 mg/kg bolus as required.

LoE III[xi]

Muscle relaxant during maintenance:

- Rocuronium bromide, IV.
  - Maintenance doses: IV, 0.15 mg/kg, as needed, and guided by use of nerve stimulator.

Reversal of muscle relaxant:

- Neostigmine, IV, 50 mcg/kg plus atropine 10 mcg/kg solution:
  - Neostigmine/atropine solution, IV: 0.5 mL of neostigmine 2.5 mg/mL **plus** 0.6 mL atropine 0.5 mg/mL **plus** 0.4 mL sodium chloride 0.9%.

OR

- Neostigmine plus glycopyrrolate, IV, 1 mL/5 kg of neostigmine/glycopyrrolate solution below:
  - Neostigmine/glycopyrrolate solution: 1 mL of neostigmine 2.5 mg/mL **plus** 2 mL glycopyrrolate 0.2 mg/mL **plus** 7 mL sodium chloride 0.9%.

LoE II[xii]

To reduce secretions, only if required (especially if ketamine is given):

- Atropine, IV, 0.02 mg/kg.

22.3.3 POST OPERATIVE CARE

DESCRIPTION

After surgery, adequate control of pain is required for comfort and also for the optimisation of outcome and minimisation of adverse effects of pain on recovery. Pain relief should be adapted to the specific needs of each patient – according to the severity of pain, site of pain and type of pain.

GENERAL AND SUPPORTIVE MEASURES

Appropriate control of the environment, provision of sedation (as above), normal physiological requirements, monitoring of vital signs and provision of comforting care should be incorporated into the care of infants and children during and after surgery.

MEDICINE TREATMENT

Less than 3 months of age: Refer to a tertiary centre.

For pain (post operation): older child (more than 3 months of age).

- Ventilated: Morphine, IV, 20–40 mcg/kg/hour infusion.
  - i.e. Morphine (15 mg/mL) 1 mg/kg mixed with 50 mL dextrose 5% or sodium chloride 0.9% at 1– 2 mL/hour.
- Unventilated: Morphine 5-20 mcg/kg/hour infusion.
  - i.e. Morphine (15 mg/mL) 1 mg/kg mixed with 50 mL dextrose 5% or sodium chloride 0.9% at 0.25 – 1 mL/hour.

LoE II[xiii]

OR

- Tilidine, oral, 1 mg/kg/dose (i.e. 1 drop per 2.5 kg) 6 hourly.

OR

- Morphine, IM/SC, 0.1 mg/kg/dose 4–6 hourly as necessary.

Note:
Use all the above medications for pain control with cardio-respiratory monitoring, especially in infants.

PLUS

- Paracetamol, oral, 20 mg/kg as a single dose immediately.
  - Follow with 15 mg/kg/dose 6 hourly oral.

If oral cannot be used:

- Paracetamol suppositories, rectal, 6 hourly.
  - If 3–12 months of age: 62.5-125 mg.
  - If 1–5 years of age: 125–250 mg.
  - If 6–12 years of age: 250–500 mg.

OR

- Ibuprofen, oral, 4–10 mg/kg/dose 6–8 hourly.

Regional anaesthesia

See section 22.3.1: Local and regional anaesthesia.

REFERRAL

» Inability to provide appropriate care.

22.3.4 MANAGEMENT OF ANAESTHETIC AND POSTANAESTHETIC COMPLICATIONS

DESCRIPTION

Various events may occur during and after anaesthesia, which require management.

MEDICINE TREATMENT

Laryngospasm

Bag-mask ventilation, maintaining continuous positive pressure and reintroduction of a volatile general anaesthetic agent (but not isoflurane) may overcome laryngospasm without the need for Suxamethonium.

- Suxamethonium, IV, 1-2 mg/kg. (Produces 5–10 minutes of neuromuscular blockade within 30-60 seconds). **Causes paralysis and apnoea.**
  - **Note**: Avoid Suxamethonium in patients with or at risk of hyperkalaemia, neuromuscular disease and a family history of malignant hyperthermia.

LoE III[iii]

Bronchospasm

Intraoperatively, the first step is to deepen anaesthesia with sevoflurane or halothane and check patient for precipitating factors, e.g. ET tube at carina, light anaesthesia, secretions, aspiration, allergic reactions.

- Salbutamol nebulisation – administered in line (i.e. in circuit) or by mask.

OR

- Salbutamol, IV 5–10 mcg/kg/minute for 1 hour.
  - Follow with 1–2 mcg//kg/minute.

See Chapter 15: Respiratory System, section 15.4.1: Asthma attack, acute.

Hypersecretion

- Atropine, IV, 0.02 mg/kg.
  - Maximum dose: 0.6 mg.

Respiratory depression/apnoea from opiates:

- Naloxone, IV, 0.01 mg/kg, repeated every 2 minutes, if required, up to 4 times.
  - Maximum dose: 0.4 mg.

Note: All patients need to be kept under direct observation until the effect of the opiates has completely worn off. Further doses of naloxone may be needed as naloxone has a shorter duration of action than most opiates.

Post operative nausea and vomiting

Children > 2 years of age:

- Ondansetron, slow IV, 0.1 mg/kg.
  - Maximum dose: 4 mg.

LoE III[xiv]

Malignant hyperthermia

- Dantrolene, IV, 1 mg/kg/minute until improvement.
  - Do not exceed a cumulative dose of 10 mg/kg.
  - Follow with 1–2 mg/kg IV 6 hourly for 1–3 days.

Shock

See Chapter 1: Emergencies and Trauma, section 1.1.7: Shock.

Dysrhythmias

See Chapter 4: Cardiovascular System, section 4.1: Cardiac dysrhythmias.

Prevention of hypocalcaemia during rapid large blood transfusion in children with acid citrate anticoagulated blood:

- Calcium gluconate 10%, IV infusion.
  - 5–10 mL of calcium gluconate 10% added to 200 mL bag of compatible IV infusion fluid.
  - Infuse at maintenance IV fluid rate if blood transfusion volumes approach circulating volume of child (~80 mL/kg).

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CHAPTER 23

ADOLESCENCE

Adolescence is a period of significant physical, emotional, and cognitive change. The development of independence from family and the pressure to conform to peers can impose challenges in the management of chronic disease. However, adolescents with chronic illnesses require more support from family and caregivers.

Adolescence spans the period of pubertal development, which manifests with physical changes which reflect maturation of the gonads and hypothalamic pituitary gonadal axis. The generally accepted age for adolescence includes 10 to 19 years, but the adolescent/youth period may extend to 24 years. Irresponsible behaviour and tendency towards risk taking are features in adolescence that are related to the hormonal changes in puberty.

Distinct psychosocial features characterise early, mid- and late adolescence; these stages impact on adherence. In early adolescence, the individual is unable to think abstractly or plan ahead; in middle adolescence, concrete thinking in times of stress develops; in late adolescence abstract thinking and the ability to anticipate the future and plan develops.

CHILD RIGHTS (CHILDREN'S ACT 38 of 2005)

http://www.justice.gov.za/legislation/acts/2005-038%20childrensact.pdf

Access to information and confidentiality

Every child has a right to access to information and confidentiality regarding his/her health status and treatment, except when this confidentiality is not in the best interests of the child. Consent to disclose that a child is HIV positive may be given by the child if (s)he is 12 years or older or of sufficient maturity to understand the implications of such disclosure. In younger children, the consent may be given by the parent/caregiver, or person in charge of a hospital (if the child is hospitalised).

Consent to medical and surgical treatment

A child may consent to his/her own medical treatment and surgical operation if (s)he is over 12 years and has the mental capacity to the implications of the treatment/procedure. For surgical operation the child must be duly assisted by his/her parent or guardian. The person in charge of a hospital may consent to the medical treatment or surgical operation if this is necessary to save the life of the child or save the child from serious injury or disability or if the need for the operation is urgent.

Contraceptives

Condoms may not be withheld from children older than 12 years if they so request them. Contraceptives other than condoms may be given to children older than 12 years without the consent of the parent/caregiver provided that proper medical counselling has been given to the child and that the child has been examined to exclude contraindications to giving specific contraceptives.

Termination of pregnancy (Choice on Termination of Pregnancy Act 92 of 1996)

If a pregnant minor requests termination of pregnancy she should be advised to discuss it with her parents/guardians but their consent is not required.

Sexual assault [Criminal law (sexual offenses and related matters) Act 32 of 2007]

While a person younger than 18 years is considered a child in South Africa, the act does allow consensual sex for people who are between 16 and 18 years. It is illegal for any person younger than 16 years to consent to or to be involved in any sexual act. It should be noted that consensual sex where both parties are 12 to 15 years is no longer a sexual offence. Consensual sex between an adolescent younger than 16 years and a partner who is not more than 2 years older is legal.

A healthcare worker may prescribe contraception to children under the age of 16 without obtaining parental/caregiver consent.

Health workers are reminded of their obligation to report sexual assault
Refer to Sexual Offenses and Related Matters Act 32 of 2007 and the Constitutional Court ruling Case CCT [2013] ZACC 35 for further guidance.

23.1 ADOLESCENT CHRONIC DISEASE: TRANSITION OF CARE

Z00.3

DESCRIPTION

Transition of care in adolescence is described as the purposeful, planned movement of a person with chronic medical conditions from a child-centred to an adult-orientated health care service.

Specialised programmes for transition improve adherence and outcomes. Careful assessment of growth and development may determine an individualised approach to transition. Chronic disease during this period impacts on growth and development.

GENERAL AND SUPPORTIVE MEASURES

» Promote adherence to medicine and follow up.
» Counselling and support.

» Manage and co-ordinate treatment through a multidisciplinary team including physicians and paediatricians.

MEDICINE TREATMENT

The Tanner Staging is used to assess pubertal development.

TANNER STAGING OF PUBERTAL DEVELOPMENT

Tanner stage	Pubic hair	Breast development	Testicular and scrotal development	Penis
1.	No hair	Pre-adolescent	Pre-adolescent	Pre-adolescent
2.	Sparse, downy hair at base of symphysis pubis	Breast bud	Enlargement of scrotum and testis Skin of scrotum reddens, changes in texture	Little or no penis enlargement
3.	Sparse, coarse hair across symphysis pubis	Continued growth of breast	Further growth of testes and scrotum	Enlargement of penis mainly in length
4.	Adult hair quality, fills in pubic triangle, no spread to thighs	Areolar and papillae form secondary mound	Testes and scrotum larger; scrotal skin darkened	Increased size with growth in breadth and development of glans
5.	Adult quality and distribution of hair including spread to medial thighs	Mature female breast	Adult size and shape	Adult size and shape

Note: deviation from normal pubertal development may be primarily a disorder of the endocrine system, and may reflect the impact of another disease process on the endocrine system.

In 50% of children, breast stage 2 develops at 10 years, pubic hair stage 3 at 11.5 years and menarche at 12.5 years.

Titrate doses according to Tanner staging rather than strictly on basis of age.

» Tanner 1 or 2 (early puberty): use paediatric schedules.
» Tanner stage 5 (late puberty): use adult schedules.
» Puberty may be delayed in children with chronic disease, adding to discrepancies between Tanner stage-based dosing and age-based dosing (consult relevant package inserts for guidance of dosage).
» Optimise therapy of certain medicines by monitoring drug levels, adjusting doses during puberty and with weight gain.
» Consider medicine interactions, e.g. induction of oral contraceptive metabolism by rifampicin and changes of drug disposition during

puberty and use convenient medicine formulations and devices that contribute to better treatment adherence.
» Minimise the adverse impact of medicines on cognition and brain development.

REFERRAL

» Refer patients with cognitive impairment and mental health problems to a psychiatrist.
» Adolescents with chronic disease for assessment by psychologist and mental health specialist for recognition of anxiety, depression, attention-deficit disorder and posttraumatic stress disorder.

23.2 CONTRACEPTION, TEENAGE PREGNANCY AND TERATOGENICITY RISKS

Z30.9

DESCRIPTION

Adolescents are at risk for both sexually transmitted disease and unintended pregnancy. Health care workers need to be supportive of adolescents regardless of whether they are abstinent or sexually active.

The foetus may be at risk for teratogenic effects of chronic medications taken by a pregnant adolescent. Examples of potential teratogenic medicines include some members of the following classes, e.g. anticonvulsants, antiretrovirals, anticoagulants, antithyroids, chemotherapy and radiation.

GENERAL AND SUPPORTIVE MEASURES

» Offer sex education (risk of pregnancy and sexually transmitted infections) early and at every opportunity in adolescence.
» Counsel pregnant adolescent females about the risks of teratogenicity.

MEDICINE TREATMENT

For contraception, refer to the Standard Treatment Guidelines and Essential Medicines List for Primary Healthcare. Where necessary adolescents should have access to the full range of contraception options.

Seek expert advice for pregnant teenagers on potential teratogenic medicine.

REFERRAL

» All pregnant teenagers with significant disease requiring chronic medicine.
» Refer a pregnant adolescent at risk for teratogenicity for early foetal ultrasonography.

CHAPTER 24
DRUG ALLERGIES

24.1 DRUG ALLERGIES

T88.7

DESCRIPTION

Drug allergy is an immune-mediated reaction to the drug. Reactions are idiosyncratic and, unlike side-effects, can not be predicted by physiological action of the pharmaceutical agent. Common drugs involved include penicillin, sulphonamides, and non-steroidal anti-inflammatory drugs.

CLASSIFICATION

Drug hypersensitivity reactions are simply classified as:

» immediate (≤ 1 hour after exposure): anaphylaxis, urticaria, angioedema; or
» delayed (≥ 6 hours): often involving rash with or without systemic symptoms.

DIAGNOSIS

Drug allergies are diagnosed clinically, based on symptoms and signs, and their timing relative to drug exposure; as well as exclusion of other potential causes.

In the acute setting, laboratory tests help to confirm the diagnosis and to determine the extent of systemic involvement (e.g. eosinophil counts, liver or renal function tests).

Tryptase measurement

An elevated serum tryptase concentration can help to confirm the diagnosis of anaphylaxis in cases where this is in doubt, but normal measurements do not necessarily exclude it. Serial tryptase measurements are the most helpful, with sampling at 1-2 hours, 4-6 hours, and 24 hours after the start of the reaction.

No serum biomarkers are currently available to identify delayed hypersensitivity reactions.

Specific diagnostic testing to identify causative drug

Do tests to confirm the causative drug only if the benefit to the patient outweighs the risk, and only in consultation with a specialist.

» Skin tests: Includes subcutaneous skin prick tests, intradermal tests, and patch tests:
    > Should be performed in specialised units. Safety equipment required as significant reactions can occur.
    > Variable sensitivity and specificity depending on the drug.

» Serum specific IgE against suspected drug:
  > Available for a few drugs only.
  > Majority have low sensitivity but high specificity.

» Cellular antigen stimulation tests for selected drug:
  > Useful for non-IgE mediated reactions.
  > Either measures basophil activation markers (via flow cytometry) or sulpholeukotrienes (via ELISA).

Drug provocation testing
> Is gold standard to identify causative drug and is often required for a number of drugs due to the limited diagnostic accuracy of *in vitro* and *in vivo* testing.
> Perform only in specialised units. Safety equipment must be available as they can provoke significant reactions.

24.2 IMMEDIATE HYPERSENSITIVITY REACTIONS

24.2.1 DRUG RELATED ANAPHYLAXIS
T88.6

See Chapter 1: Emergencies and Trauma, section 1.1.3: Anaphylaxis/anaphylactic reactions.

24.2.2 DRUG RELATED URTICARIA
L50.9

See Chapter 5: Dermatology, section 5.3.7: Urticaria.

24.2.3 DRUG RELATED ANGIOEDEMA
T78.3

DESCRIPTION
Local swelling of skin and/or mucosal tissue. May occur in isolation or together with urticaria or anaphylaxis. It must be distinguished from recurrent non-pruritic angioedema which has a hereditary component and does not respond to the treatment below. Complement C4 and C1 esterase inhibitor levels are used to help to distinguish the two entities.

GENERAL AND SUPPORTIVE MEASURES
» Stop potentially causative drug(s).
» Monitor airway closely and intubate early if necessary.

MEDICINE TREATMENT

If symptoms and signs of anaphylaxis: treat as for anaphylaxis, see Chapter 1: Emergencies and Trauma, section 1.1.3: Anaphylaxis/anaphylactic reactions.

If angioedema in isolation:

- Chlorphenamine, oral, 0.1 mg/kg/dose 6 hourly.

AND

- Prednisone, oral, 1–2 mg/kg daily for 1 week.

OR

If unable to take oral and ≥ 2 years:

- Promethazine, IM, 0.5 mg/kg immediately, followed by above oral therapy.

LoE III[1]

REFERRAL

» All cases after stabilisation for confirmation of diagnosis and long-term management.
» Recurrent non-pruritic angioedema.

24.3 DELAYED HYPERSENSITIVITY REACTIONS

See Chapter 5: Dermatology, sections 5.3.1: Drug reactions, 5.2.1 Erythema multiforme and 5.2.2 Stevens-Johnson syndrome.

DESCRIPTION

Broad spectrum of clinical manifestations involving different organs, including liver, kidneys and skin. Cutaneous reactions are most prevalent and range from maculopapular or morbilliform rashes (most common presentation), to life-threatening cutaneous reactions such as Stevens-Johnson Syndrome/toxic epidermal necrolysis (SJS/TEN). Common drugs associated are antiretrovirals (efavirenz or nevirapine), anticonvulsants, anti-tuberculous therapy, penicillins and co-trimoxazole.

GENERAL AND SUPPORTIVE MEASURES

Stop the suspected causative medicine(s) immediately. Use an alternative class of agent if required.
If there are compelling reasons to continue with the suspected medicine, seek expert advice.

Severe cutaneous reactions will usually require admission and intensive supportive therapies. See Chapter 5: Dermatology, sections: 5.2.1 Erythema Multiforme and 5.2.2 Stevens-Johnson Syndrome.

MEDICINE TREATMENT

Mild reactions without systemic or mucosal involvement may be treated symptomatically:

- Chlorphenamine, oral, 0.1 mg/kg/dose 6 hourly.

REFERRAL

» SJS/TEN for management in a specialist centre with experience or a unit familiar with managing burns.

24.4 SPECIFIC ALLERGIES

24.4.1 ALLERGIES TO PENICILLINS

Z88.0

DESCRIPTION

Patients may present with immediate (e.g. anaphylaxis, bronchospasm, angioedema) or delayed reactions (most commonly maculopapular rash without systemic involvement; rarely SJS/TEN or other systemic reactions).

GENERAL AND SUPPORTIVE MEASURES

Stop penicillin.

MEDICINE TREATMENT

If an antibiotic is still required, treat with a suitable alternative antibiotic class according to the condition.

Milder infections e.g. upper respiratory tract infections, impetigo, mild cellulitis:

- Macrolide, e.g. Azithromycin, oral, 10 mg/kg/day for 3 days.

Severe infections e.g. osteomyelitis, pneumonia:

- Third generation cephalosporin, provided there is no history of immediate hypersensitivity (see below, cross-reactivity of other β-lactams).

Alternative antibiotics for Gram positive infections:

- Clindamycin, oral, 6 mg/kg/dose 6 hourly.

OR

- Vancomycin, IV, 15 mg/kg 8 hourly.

Urinary Tract Infection

- Neonates: Ciprofloxacin, oral, 6 mg/kg/dose 12 hourly.
- Infants: Ciprofloxacin, oral, 6 mg/kg/dose 8 hourly.
- > 1 year of age: Ciprofloxacin, oral, 10 mg/kg/dose 12 hourly.

Prophylaxis in rheumatic heart disease or post splenectomy, consider**:**

- Macrolide e.g.
  - < 11 years: Azithromycin, oral, 10 mg/kg/day, 3 times weekly.
  - ≥ 11 years: Azithromycin, oral 250 mg daily.

LoEIII[ii]

Cross-reactivity of other β-lactams in patients with penicillin allergy

The risk of cross-reactivity to cephalosporins in penicillin allergic patients is low. Consequently, only avoid oral cephalosporins in patients with a history of anaphylaxis to penicillin.

In hospitalised patients, and in those with mild reactions such as rash to aminopenicillin, cephalopsporins should not be avoided if indicated for infection. If concerned, discuss with expert and/or consider test dose.

Risk of cross-reactivity is very low with carbapenems, and these agents can be used without allergy assessment in penicillin allergic patients.

If no alternative antibiotic is available, consider desensitisation after consultation with a specialist. Desensitisation to be done by a specialist, in a tertiary facility.

REFERRAL

» In cases where desensitisation is considered.

Consult a specialist:

» For alternative antibiotics in all patients with severe immediate reactions.

24.4.2 ALLERGIES TO SULPHONAMIDES

Z88.2

DESCRIPTION

The commonest sulphonamide allergies are related to co-trimoxazole, especially when used in HIV-infected patients for *P. jirovecii* treatment and/or prophylaxis.

Patients may present with:

» a morbilliform or maculopapular rash only, usually within a few days of starting treatment (most common presentation),
» a rash with fever, which may progress to
» a drug-induced rash with eosinophilia and systemic symptoms (DRESS) usually with hepatitis (usually within 1–2 weeks of treatment commencement)
» SJS/TEN, or
» an immediate hypersensitivity reaction (rare).

GENERAL AND SUPPORTIVE MEASURES

Stop the sulphonamide-containing drug. Severe cutaneous drug reactions with or without organ involvement require admission and specialist review to optimise supportive management. See Chapter 5: Dermatology, section 5.2.2 SJS/TEN.

MEDICINE TREATMENT

Options for HIV-infected patients requiring treatment for *P. jirovecii* pneumonia with history of mild reaction, e.g. rash to prior co-trimoxazole exposure:

- Dapsone, oral, 2 mg/kg daily.
  - Maximum dose: 100 mg (1 tablet) daily.
  - Note: Dapsone is a sulphone, not a sulphonamide, but there are cases of cross-reactivity with sulphonamide allergy but reactions are usually mild. Avoid dapsone if there is a history of anaphylaxis, SJS/TEN, or rash with systemic involvement.

If no alternative antibiotic is available, consider desensitisation after consultation with a specialist. Desensitisation to be done by a specialist in a tertiary facility.

REFERRAL

» In cases where desensitisation is considered. Consult a specialist.
» For alternative antibiotics in all patients with severe immediate reactions.

References

[i] Promethazine: South African Medicines Formulary. 11th Edition. Division of Clinical Pharmacology. University of Cape Town. 2014
[ii] Azithromycin: Gerber MA, Baltimore RS, Eaton, CB, Gewitz M, Rowley AH, Shulman ST, Taubert KA. Prevention of Rheumatic Fever and Diagnosis and Treatment of Acute Streptococcal Pharyngitis. Circulation. 2009; 119:1541-1551.

GUIDELINES FOR THE MOTIVATION OF A NEW MEDICINE ON THE NATIONAL ESSENTIAL MEDICINE LIST

Section 1: Medication details

» Generic name
A fundamental principle of the Essential Drug Programme is that of generic prescribing. Most clinical trials are conducted using the generic name.

» Proposed indication
There will usually be many registered indications for the medication. However, this section should be limited to the main indication, which is supported by the evidence provided in section 2.

» Prevalence of the condition in South Africa
This information is not always readily available. However, it is an important consideration in the review of a proposed essential medicine.

» Prescriber level
Here the proposed prescriber level should be included. If more than one level is proposed each relevant box should be ticked.

Section 2: Evidence and motivation

» Estimated benefit:

- Effect measure: this is the clinical outcome that was reported in the clinical trial such as BP, FEV, CD_4, VL etc.
- Risk benefit: this should be reported in the clinical trial and, in most cases, includes the 95% confidence level (95% CI). Absolute risk reduction, also termed risk difference, is the difference between the absolute risk of an event in the intervention group and the absolute risk in the control group.
- Number Need to Treat (NNT): gives the number of patients who need to be treated for a certain period of time to prevent one event. It is the reciprocal of the absolute risk or can be calculated using the formula below.

Calculations

	Bad outcome	Good outcome	Total patients
Intervention group	a	c	a + c
Control group	b	d	b + d

Measure	**Equation**
Absolute risk:	$[b/(b+d)] - [a/(a+c)]$
Number needed to treat	$\frac{1}{[b/(b+d)] - [a/(a+c)]}$
Relative risk	$[a/(a+c)] \div [b/(b+d)]$
Odds ratio	$\frac{[a/(a+c)] \div [c/(a+c)]}{[b/(b+d)] \div [d/(b+d)]} = (a/c) \div (b/d)$

Reference - Aust Prescr 2008;31:12–16)

» Motivating information, (**Level of evidence based on the SORT system**)

The National Essential Drug List Committee has endorsed the adoption of the SORT system for categorising levels of evidence. This system[1] contains only three levels:

Level I	Good quality evidence	Systematic review of RCTs with consistent findings High quality individual RCT
Level II	Limited quality patient orientated evidence	Systematic review of lower quality studies or studies with inconsistent findings Low quality clinical trial Cohort studies Case-control studies
Level III	Other	Consensus guidelines, extrapolations from bench research, usual practice, opinion, disease-oriented evidence (intermediate or physiologic outcomes only), or case series

A: Newer product: for most newer products, level I evidence such as high quality systematic reviews or peer-reviewed high quality randomised controlled trials should be identified and referenced in the space provided.

B: Older products: many of these products were developed prior to the wide use of randomised controlled trials. However, there may be level I evidence where the product was used as the control arm for a newer product. If no level 1 evidence can be identified, then level II data from poorer quality controlled trials or high quality observational studies should be referenced in the space provided.

» Cost considerations

Where a published reference supporting the review of cost is available comments should be made regarding its applicability to the South African public sector environment.

Possible unpublished information that can be included:

- Cost per daily dose or course of therapy – for long term or chronic therapy such as hypertension the usual daily dose should be calculated (Dose x number of times a day) and converted into the number of dosing units e.g. tablets. This is then used to calculate the cost per day. For medications used in a course of therapy such as antibiotics this is then multiplied by the number of days in the course of therapy.
- Cost minimisation is used where there is evidence to support equivalence and aims to identify the least costly treatment by identifying all the relevant costs associated with the treatment.
- Cost-effectiveness analysis is used to compare treatment alternatives that differ in the degree of success in terms of the therapeutic or clinical outcome. By calculating a summary measurement of efficiency (a cost-effectiveness ratio), alternatives with different costs, efficacy rates, and safety rates can be fairly compared along a level playing field.

Where any of these have been performed tick the relevant block and send as an attachment with all the calculations. If possible, the spread sheet should be supplied electronically.

Section 3: Motivator's Details

The receipt of all submission will be acknowledged. In addition, all decisions with supporting arguments will be communicated where appropriate. This section therefore forms a vital link between the motivator and the decision making process.

[1] Ebell MH, Siwek J, Weiss BD, et al. Strength of recommendation taxonomy (SORT): a patient-centered approach to grading evidence in the medical literature. Am Fam Physician. 2004;69:550-6.

Motivation form for the inclusion of a new medication on the National Essential Medicines List

Section 1: Medication details			
Generic name (or International Non-proprietary Name):			
Proposed indication:			
Prevalence of condition (based on epidemiological data, if any):			
Prescriber level			
Primary Health Care 1	Medical Officer 2	Specialist 3	Designated Specialist 4

Section 2: Evidence and motivation			
2.1 Estimated benefit			
Effect measure			
Risk difference (95% CI)			
NNT			
2.2: Motivating information (Level of evidence based on the SORT system)			
A. Newer product: High quality systematic reviews or peer-reviewed high quality randomised controlled trials (Level I)			
Author	Title	Journal ref	
B. Older product with weaker evidence base: Poorer quality controlled trials or high quality observational studies (Level II)			
Author	Title	Journal ref	
2.3: Cost-considerations			
Have you worked up the cost?	YES		NO
	Daily cost	Cost minimisation	Cost-effectiveness analysis
Other relevant cost information if available:			
Author	Title	Journal ref	
2.4: Additional motivating comments.			

Section 3: Motivator's Details	
PTC Title:	**Date submitted:**

GUIDELINES FOR ADVERSE DRUG REACTION REPORTING

National Pharmacovigilance Programme

The Medicines Control Council (MCC) has a responsibility to ensure the safety, efficacy and quality of all medicines used by the South African public. The National Pharmacovigilance Programme is coordinated by the MCC and has a dedicated Unit, The National Adverse Drug Event Monitoring Centre (NADEMC), in Cape Town, which monitors the safety of all registered medicines in South Africa.

What is Pharmacovigilance?

Pharmacovigilance is defined as the science and activities concerned with the detection, assessment, understanding and prevention of adverse reactions to medicines (i.e. adverse drug reactions or ADRs). The ultimate goal of this activity is to improve the safe and rational use of medicines, thereby improving patient care and public health.

What is an Adverse Drug Reaction (ADR)?

The Medicines Control Council (MCC) defines an Adverse Drug Reaction (ADR) as a response to a medicine which is noxious and unintended, including lack of efficacy, and which occurs at any dosage and can also result from overdose, misuse or abuse of a medicine.

Who should report Adverse Drug Reactions?

All health care workers, including doctors, dentists, pharmacists, nurses and other health professionals are encouraged to report all suspected adverse reactions to medicines (including vaccines, X-ray contrast media, traditional and herbal remedies), especially when the reaction is not in the package insert, potentially serious or clinically significant.

What happens to a report?

All ADR reports are entered into a national ADR database. Each report is evaluated to assess the causal relationship between the event and the medicine. A well-completed adverse drug reaction/product quality form submitted could result in any of the following:

» additional investigations into the use of the medicine in South Africa;
» educational initiatives to improve the safe use of the medicine;
» appropriate package insert changes to include the potential for the reaction, and
» changes in the scheduling or manufacture of the medicine to make it safer.

The purpose of ADR reporting is to reduce the risks associated with the use of medicines and to ultimately improve patient care.

Will reporting have any negative consequences on the health worker or the patient?

An adverse drug reaction report does not constitute an admission of liability or that the health professional contributed to the event in any way. The outcome of a report, together with any important or relevant information relating to the reaction, will be sent back to the reporter as appropriate. The details of a report are stored in a confidential database. The names of the reporter or any other health professionals named on a report and that of the patient will be removed before any details about a specific adverse drug reaction are used or communicated to others. The information is only meant to improve the understanding of the medicines used in the country.

Is the event possibly an ADR?

The following factors should be considered when an adverse drug reaction is suspected:

1. What exactly is the nature of the reaction? (*Describe the reaction as clearly as possible and where possible provide an accurate diagnosis.*)

2. Did the reaction occur within a reasonable time relationship to starting treatment with the suspected medicine? *(Some reactions occur immediately after administration of a medicine while others take time to develop.)*
3. Is the reaction known to occur with the particular medicine as stated in the package insert or other reference? *(If the reaction is not documented in the package insert, it does not mean that the reaction cannot occur with that particular medicine.)*
4. Did the patient recover when the suspected medicine was stopped? *(Some reactions can cause permanent damage, but most reactions are reversible if the medication is stopped.)*
5. Did the patient take the medicine again after the reaction abated (i.e. rechallenge). If so, did the same reaction occur again? *(In most situations it is not possible or ethical to rechallenge the patient with the same medicine. If such information is available or if such a rechallenge is necessary, recurrence of the event is a strong indicator that the medicine may be responsible.)*
6. Can this reaction be explained by other causes (e.g. underlying disease/s; other medicine/s; toxins or foods)? *(It is essential that the patient is thoroughly investigated to decide what the actual cause of any new medical problem is. A medicine-related cause should be considered, when other causes do not explain the patient's condition.)*

What types of reactions should be reported?

The following adverse drug reactions should be reported:

- All ADRs to newly marketed drugs or new drugs added to the EDL
- All serious reactions and interactions
- ADRs that are not clearly stated in the package insert.
- All adverse reactions or poisonings to traditional or herbal remedies

Report even if you are not certain that the medicine caused the event.

What Product Quality Problems should be reported?

The following product quality problems should be reported:

- suspected contamination;
- questionable stability;
- defective components;
- poor packaging or labeling;
- therapeutic failures.

How can ADRs be prevented from occurring?

Some ADRs are unavoidable and cannot be prevented. However, most ADRs can be prevented by following the basic principles of rational use of medicines.

How are adverse drug reactions reported?

An Adverse Drug Reaction/Product Quality Report Form is enclosed in this book and should be completed in as much detail as possible before returning it by fax or post to any of the addresses provided below. Additional forms can be obtained by contacting the MCC at these addresses. Report forms may also be accessed via the following website: *http://www.mccza.com*

1. The Registrar of Medicines

Medicines Control Council, Department of Health, Private Bag X828
Pretoria, 0001
Tel: (021) 395 8003/8176; Fax: (012) 395 8468

2. The National Adverse Drug Event Monitoring Centre (NADEMC)

C/o Division of Pharmacology, University of Cape Town,
Observatory, 7925
(021) 447 1618; Fax: (021) 448 6181

health
Department:
Health
REPUBLIC OF SOUTH AFRICA

ADVERSE DRUG REACTION (ADR)/ PRODUCT QUALITY PROBLEM REPORT FORM (PUBLIC AND PRIVATE SECTOR)

(Including Herbal Products)

mcc
MEDICINES CONTROL COUNCIL

Reports will be shared with the Pharmacovigilance Centre for Public Health Programmes (PCPHP) - 0123959506

Reporting Health Care Facility/Practice					
Tel: 012 395 8197 (MCC) 021 447 1618 (NADEMC) **Fax:** 086 620 7253 **E-mail:** adr@health.gov.za	Facility/Practice				
	District		Tel		
	Province		Fax		

Patient Details									
Patient Initials		File/Reference Number		Date of Birth/Age					
Sex	☐ M ☐ F ☐ Unk	Race		Weight (kg)		Height (cm)		Pregnant?	☐ N ☐ Y
Allergies		Estimated Gestational Age at time of reaction							

Suspect Medicine(s) [Medicines suspected to have caused the ADR]

Trade Name [Generic Name if Trade Name is unknown]	Route	Dose (mg) and Interval	Date Started/Given	Date Stopped	Reason for use	Batch Number	Expiry Date

All other Medicines Patient was taking at time of reaction [Including over-the-counter and herbal products]

Trade Name [Generic Name if Trade Name is unknown]	Route	Dose (mg) and Interval	Date Started/Given	Date Stopped	Reason for use	Batch Number	Expiry Date

Adverse Drug Reaction/Product Quality Problem			
Date and time of onset of reaction		Date reaction resolved/duration	

Please describe Adverse Reaction/Product Quality Problem: (kindly add as much clinical information as possible)

Intervention(tick all that apply)	**Patient Outcomes (tick all that apply)**
☐ No intervention	☐ ADR recovered/resolved ☐ recovering/resolving
☐ Intervention unknown	☐ not recovered/not resolved
☐ Patient Counselled/non-medical treatment	☐ Patient Died: Date of death:_____
☐ Discontinued Suspect Drug; **Replaced with**:_____	☐ Impairment/Disability ☐ Congenital Anomaly
☐ Decreased Suspect Drug Dosage; **New Dose**:_____	☐ Patient Hospitalised or Hospitalisation prolonged
☐ Treated ADR - with:_____	☐ Life Threatening ☐ Other:_____
☐ Referred to Hospital: **Hospital Name**_____	☐ ADR reappeared after restarting suspect drug/similar drug (rechallenge)?: ☐ N ☐ Y ☐ Not done ☐ Unknown
☐ Other Intervention (e.g. dialysis): _____	

Laboratory Results			**Additional Laboratory Results**		
Lab Test	**Test Result**	**Test Date**	**Lab Test**	**Test Result**	**Test Date**

Co-morbidities/Other Medical Condition(s)

Reported by			
Name		E-mail	
Designation	☐ Nurse ☐ Pharmacist ☐ Doctor ☐ Other:	Telephone	
Date reported:		Signature	

THIS ADR REPORT IS NOT A CONFIRMATION THAT THE REPORTER OR THE SUSPECT MEDICINE(S) CAUSED THE ADR **v4.0 07/16**

ADVICE ABOUT VOLUNTARY REPORTING

Report adverse experiences with:
- medications (drugs, vaccines and biologicals)
- medical devices (including *in-vitro* diagnostics)
- complementary / alternative medicines (including traditional, herbal remedies, etc)

Please report especially:
- adverse drug reactions to newly marketed products
- serious reactions and interactions with all products
- adverse drug reactions which are not clearly reflected in the package insert.

Report Product Quality Problems such as:
- suspected contamination
- questionable stability
- defective components
- poor packaging or labelling
- therapeutic failures

Report even if:
- you're not certain the product caused the event
- you don't have all the details

Important numbers:

Investigational Products and Product Quality Problems:
- fax: (012) 395-9201
- phone: (012) 395-8010
- email: Wondo.Mlungisi@health.gov.za

Adverse Events Following Immunisation:
- fax: (012) 395 8486
- phone: (012) 395 8914/8273
- email: Makgomo.Mphaka@health.gov.za

Confidentiality: Identities of the reporter and patient will remain strictly confidential.

Your support of the Medicine Control Council's adverse drug reaction monitoring programme is much appreciated. Information supplied by you will contribute to the improvement of medicine safety and therapy in South Africa.

PLEASE USE ADDRESS PROVIDED BELOW - JUST FOLD IN THIRDS, TAPE and MAIL

Postage will be paid by the Addressee
Posgeld sal deur die geadresseerde betaal word

No Postage stamp necessary if posted in the Republic of South Africa
Geen posseël nodig nie indien in die Republiek van Suid-Afrika gepos

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DEPARTEMENT VAN GESONDHEID

REGISTRAR OF MEDICINES
REGISTRATEUR VAN MEDISYNE

PRIVATE BAG / *PRIVAATSAK* X828
PRETORIA
0001

NOTIFIABLE MEDICAL CONDITIONS

The disease reporting system in South Africa is based on government law (the Health Act, Act No. 61 of 2003), together with regulations on the reporting of specific diseases to the Local, Provincial and/or National Health Department.

Who should notify

The first health care professional to come into contact with a patient presenting with one of the prescribed Notifiable Medical Conditions (NMC) is required by law to notify. This may include clinic personnel, infection control nurses, other hospital staff or private medical practitioners. In the event of deaths (or cases) in the community, a member of the community is obliged to notify the event.

Which diseases to notify

Currently 33 broad medical conditions are currently notifiable in South Africa (see List of Notifiable MedicalCondition). Some conditions (e.g.tuberculosis and viral hepatitis) have been divided into various components, resulting in more than 40 notifiable medical conditions.

Notifiable medical conditions have been sub-divided into two categories according to type of disease:

Category 1 NMC are conditions that require immediate reporting by the most rapid means available upon clinical or laboratory diagnosis followed by a written or electronic notification to the Department of Health within 24 hours of diagnosis by health care providers.

Any health care professional identifying even a single case of a disease (presumptive of laboratory confirmed) contained in Category 1 should make and immediate notification directly to the designated local health officer through fax or telephonically as rapidly as possible. The local health officer must report to the Provincial health officer and/or National Department of Health. Where it is applicable, laboratory confirmation should be obtained at the earliest opportunity and reported to the designated health officer. After reporting, telephonically/fax, it is still required of the health care provider to send a complete GW17/5 form to the designated local health authority within five days after telephonic reporting.

Category 2 NMC are conditions that must be notified through a written or electronic notification to the Department of Health within 7 days of diagnosis by health care providers.

The notification system is based on clinical notifications and, therefore, all suspected cases of a notifiable condition must be notified immediately.

Reporting a Notifiable Disease during an outbreak
During an outbreak of a notifiable disease, report all cases by phone, email or fax. Daily reporting by health facilities should be maintained through an Outbreak Case Line Listing Form as well through the notification form (GW17/5) to the local health authority that must report to the provincial health officials and the National Department of Health.

Priority Reporting of MDR & XDR-TB
Tuberculosis (TB) is one of 33 medical conditions, which is notifiable in terms of the National Health Act (Act 61 of 2003). The Directorate: Epidemiology and Surveillance have instituted a priority reporting for MDR and XDR TB. This means that all health care facilities, public and private, including clinics, hospitals, laboratories, general practitioners and private specialist doctors, are required to report all cases of MDR and XDR TB to the Department of Health within 24 hours.

How to notify
The initial notification of a medical condition is done on a case-based form (*GW 17/5*) with the relevant details by the health personnel e.g., clinic personnel, infection control nurses, other hospital staff, public or private medical practitioners. Initial notification makes tracing as easy as possible, since a disease notification demands action (follow-up) at the peripheral level. The GW17/5 form makes provision for the notification of cases as well as deaths. Any person contracting a notifiable disease and then dies from the disease should be notified twice: first as a **"CASE"** and then later as a **"DEATH".** This will ensure that when estimating the **"Case Fatality Rate"** (CFR%), all deaths in the numerator are also included in the denominator. Depending on the structural organization of the province, the completed **GW 17/5** forms is sent to the relevant local health authority, district health office or the provincial office.

National Department of Health
Cluster: Health Information, Evaluation & Research (HIER)
Directorate: Epidemiology & Surveillance
Private Bag X828
PRETORIA
0001

Tel: 012 395 8150/1

List of Notifiable Medical Conditions

Category 1

Acute flaccid paralysis
Acute rheumatic fever
Anthrax
Botulism
Cholera
Food borne illness outbreak
Malaria
Measles
Meningococcal disease
Plague
Poliomyelitis
Rabies (human)
Respiratory disease caused by a novel respiratory pathogen**
Rift valley fever (human)
Smallpox
Viral haemorrhagic fever diseases*
Waterborne illness outbreak
Yellow fever

Category 2

Agricultural or stock remedy poisoning
Bilharzia (schistosomiasis)
Brucellosis
Congenital rubella syndrome
Congenital syphilis
Diphtheria
Enteric fever (typhoid or paratyphoid fever)
Haemophilus Influenza type B
Hepatitis A
Hepatitis B
Hepatitis C
Hepatitis E
Lead poisoning
Legionellosis
Leprosy
Maternal death (pregnancy, childbirth and puerperium)
Mercury poisoning
Pertussis
Soil-transmitted helminth infections
Tetanus
Tuberculosis: pulmonary
Tuberculosis: extra-pulmonary
Tuberculosis: multidrug-resistant (MDR-TB)
Tuberculosis: extensively drug -resistant (XDR-TB)

USING THE ROAD TO HEALTH BOOKLET

Check and update the Road to Health booklet at each consultation and on each admission and discharge.

The South African Road to Health Booklet is an extremely important document for the child and family.

It is designed to support and integrate the various child health strategies such as IMCI, EPI, TB and HIV care and the Integrated Nutrition Programme. It reminds health care workers to look for, respond to, and record important events and care given to the child.

OWNERSHIP OF THE BOOKLET

The Road to Health Booklet is the exclusive property of the parent (primary caregiver) and the child. This is important as the booklet contains information on the child's health including HIV status, and if the booklet is used for other purposes, mothers may hide the booklet or refuse to allow important information to be recorded in it. This can result in the child receiving less than optimal care.

USE OF THE ROAD TO HEALTH BOOKLET

Issuing the Road to Health Booklet

At birth, all children should be issued with a Road to Health Booklet – in which all vital information is recorded including:

- » Name and date of birth — Page 1 (front cover)
- » Details of child and family — Page 4
- » Neonatal information — Page 5
- » Immunisations at birth — Page 6
- » PMTCT/HIV information — Page 7

Use at health service contacts

On the cover the booklet states:

"IMPORTANT: always bring this booklet when you visit any health Clinic, doctor or hospital"

To use the booklet effectively the attending nurse or doctor should ask, at each attendance, to see the Road to Health booklet both due to its intrinsic value as part of a child health consultation and to emphasise the importance of the booklet and its use to the mother.

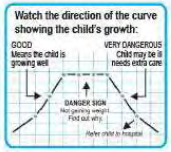
On each visit, complete/record appropriately

» Well child visit routine care (incl. growth, TB status, PMTCT HIV status, feeding etc.): Pages 2 and 3.
» Immunisations given: Page 6.
» Information on the HIV status of the mother and child (if HIV-exposed): Page 8.
» Vitamin A and deworming: Page 9.
» Weight for age, length/height for age and weight for length/height charting: Pages 14-19.
» Any clinical notes (ideally using IMCI classification, treatment and follow up should be made in the clinical notes): Pages 21-27.
» Any hospital admissions should be recorded: Page 19.

During the health visit certain care given will depend on whether this is a scheduled well child visit, a follow-up visit, or a first attendance for a new illness.

<table>
<tr><th>Well child visit</th><th>Sick child consultation</th><th>Follow up consultation</th></tr>
<tr><td colspan="3">Greet mother and child</td></tr>
<tr><td>Ask why she has come and whether she has any concerns.</td><td>Ask why she has come and what her concerns are.</td><td>Ask how the child is and whether any further concerns have arisen.</td></tr>
<tr><td colspan="3">Ask for Road to Health Booklet and use it.</td></tr>
<tr><td>If the child has an illness, proceed to sick child consultation (IMCI) in addition to the well child consultation.</td><td>Proceed to sick child consultation (IMCI). Ensure that promotive aspects of IMCI (nutrition, immunisalions, HIV and TB status)are covered.</td><td>Carry out the follow-up process from IMCI, but also check the well child consultation.</td></tr>
<tr><td colspan="3">Check and record all due visit items- see above.</td></tr>
<tr><td>Carry out and record the well child visit. Note and respond to any other problems Identified.</td><td colspan="2">Manage the child according to IMCI classification. Follow up as required. Carry out and record the well child visit. Note and respond to any other problems Identified.</td></tr>
<tr><td colspan="3">Tell mother what has been done, what was found and what this means. Ensure the mother knows when to follow up for the next well child visit, and when to come if the child is ill or for other scheduled follow up.</td></tr>
</table>

Boy's Weight-for-Age Chart



Interpretation of lines:

This Weight-for-Age Chart shows body-weight relative to age in comparison to the Median (0-line).

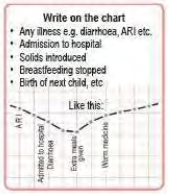
A boy whose weight-for-age is below the -2 line, is underweight.

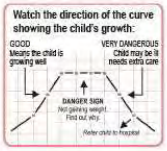
A boy whose weight-for-age is below the -3 line, is severely underweight. Clinical signs of Marasmus or Kwashiokor may be observed.

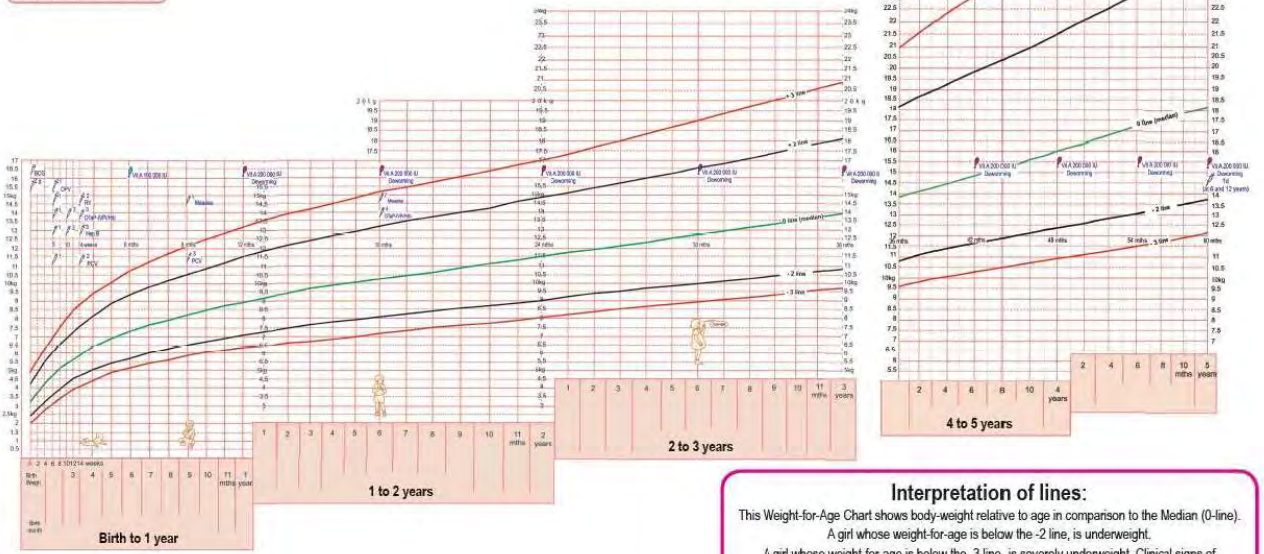
If his line crosses a z-score line and the shift is away from the median, this may indicate a problem or risk of a problem.

If his line stays close to the median, occasionally crossing above or below it, this is fine.

Girl's Weight-for-Age Chart







Interpretation of lines:

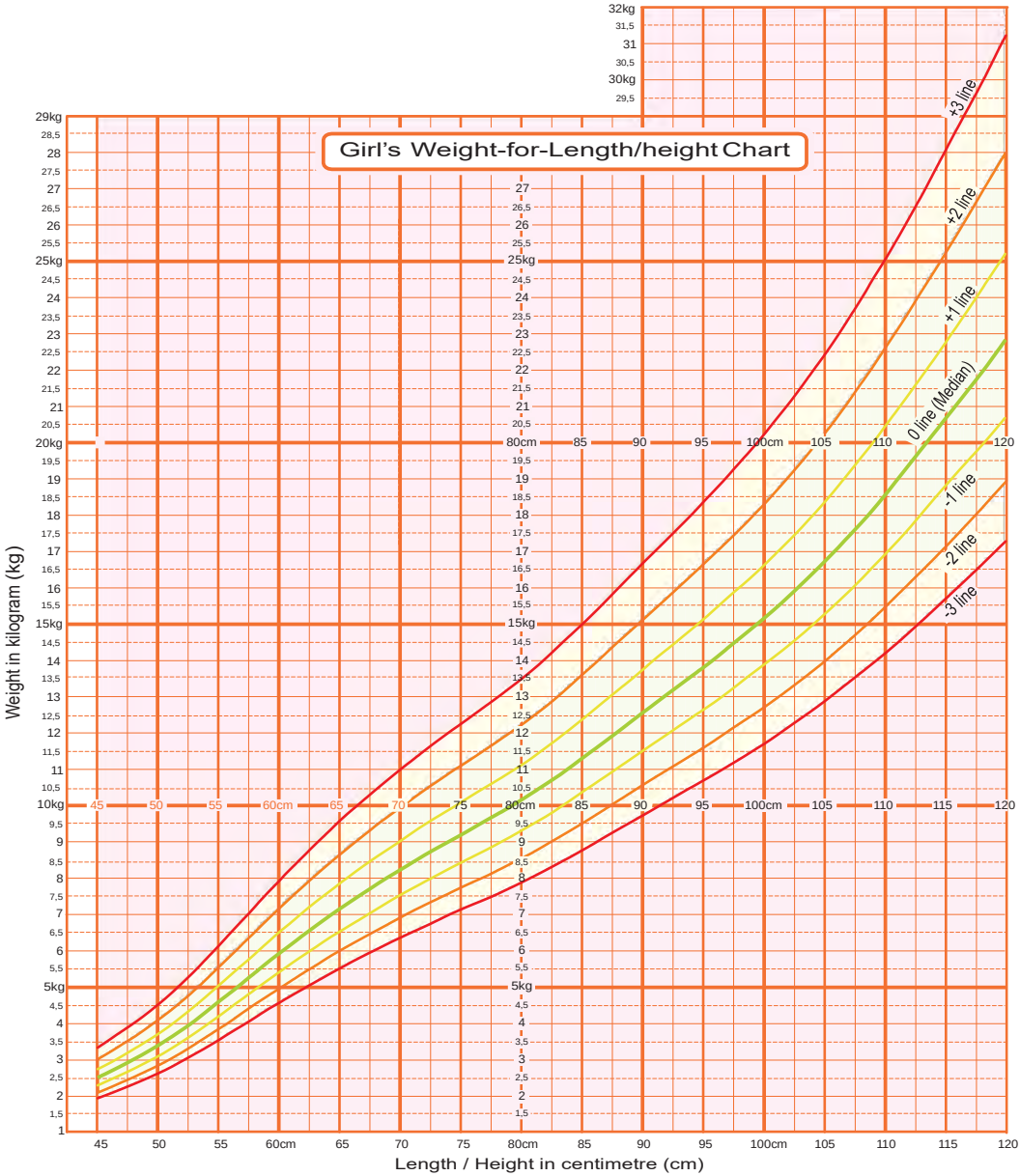
This Weight-for-Age Chart shows body-weight relative to age in comparison to the Median (0-line).

A girl whose weight-for-age is below the -2 line, is underweight.

A girl whose weight-for-age is below the -3 line, is severely underweight. Clinical signs of Marasmus or Kwashiokor may be observed.

If her ine crosses a z-score line and the shift is away from the median, this may indicate a problem or risk of a problem.

If her line stays close to the median, occasionally crossing above or below it, this is fine.



This Weight-for-Length/height Chart shows body-weight relative to length/height in comparison to the Median (the 0 z-score line).

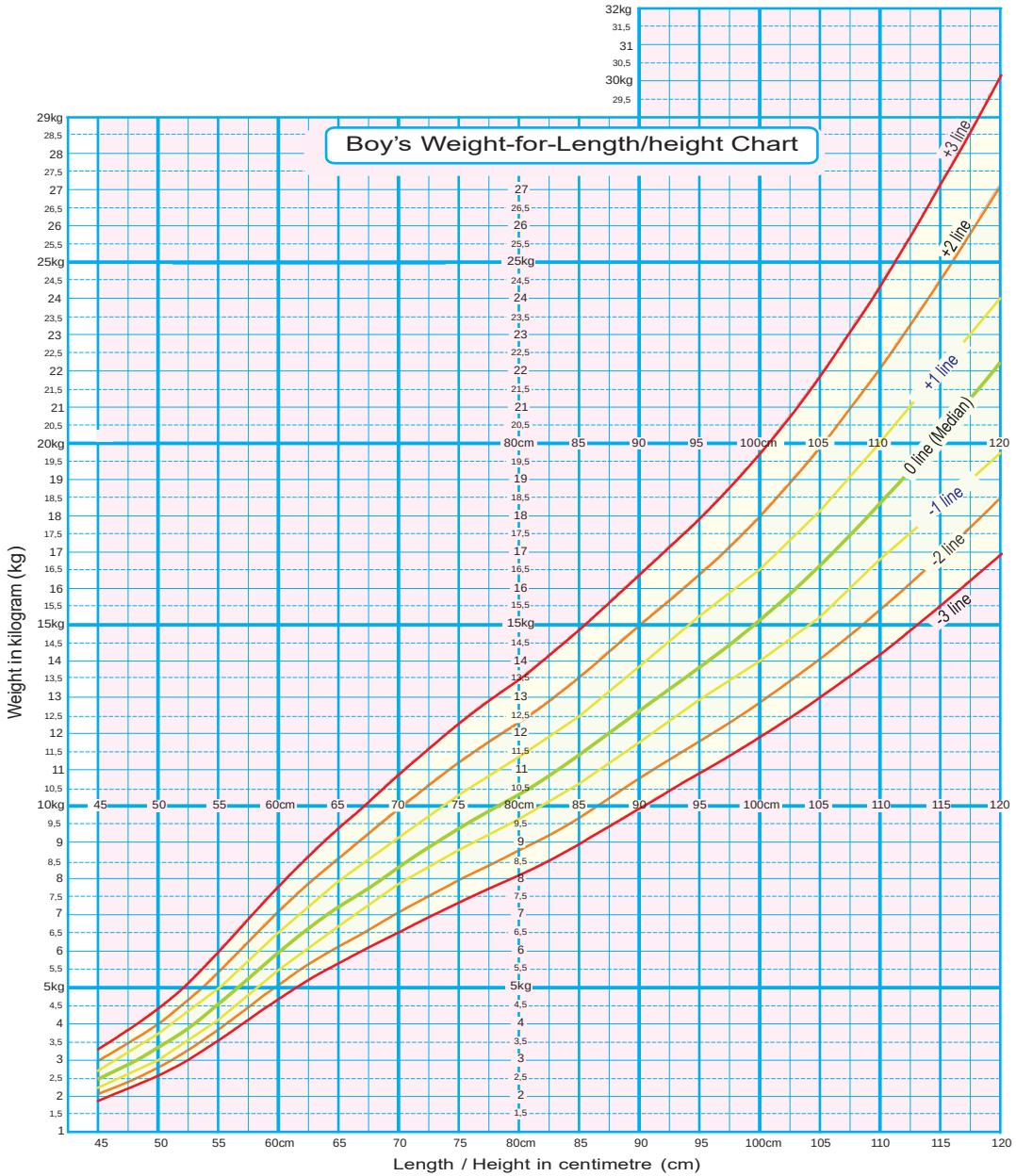
A girl whose weight-for-length/height is above the +3 line, is obese.

A girl whose weight-for-length/height is above the +2 line, is overweight.

A girl whose weight-for-length/height is above the +1 line, shows possible risk of overweight.

A girl whose weight-for-length/height is below the -2 line, is wasted.

A girl whose weight-for-length/height is below the -3 line, is severely wasted. Refer for urgent specialised care.



This Weight-for-Length/height Chart shows body-weight relative to length/height in comparison to the Median (the 0 z-score line).

A boy whose weight-for-length/height is above the +3 line, is obese.

A boy whose weight-for-length/height is above the +2 line, is overweight.

A boy whose weight-for-length/height is below the -2 line, is wasted.

A boy whose weight-for-length/height is below the -3 line, is severely wasted. Refer for urgent specialised care.

BALLARD SCORING
Maturational Assessment of Gestational Age

NEUROMUSCULAR MATURITY

NEUROMUSCULAR MATURITY SIGN	SCORE							RECORD SCORE HERE
	-1	0	1	2	3	4	5	
POSTURE								
SQUARE WINDOW (Wrist)	 >90°	 90°	 60°	 45°	 30°	 0°		
ARM RECOIL		 180°	 140 –180°	 110 –140°	 90 –110°	 <90°		
POPLITEAL ANGLE	 180°	 160°	 140°	 120°	 100°	 90°	 <90°	
SCARF SIGN								
HEEL TO EAR								
							TOTAL NEUROMUSCULAR MATURITY SCORE	

PHYSICAL MATURITY

PHYSICAL MATURITY SIGN	SCORE							RECORD SCORE HERE
	-1	0	1	2	3	4	5	
SKIN	sticky friable transparent	gelatinous red translucent	smooth pink visible veins	superficial peeling & / or rash, few veins	cracking pale areas rare veins	parchment deep cracking no vessels	leathery cracked wrinkled	
LANUGO	none	sparse	abundant	thinning	bald areas	mostly bald		
PLANTAR SURFACE	heel-toe 40–50 mm: -1 < 40 mm: -2	>50 mm no crease	faint red marks	anterior transverse crease only	creases ant. 2/3	creases over entire sole		
BREAST	imperceptible	barely perceptible	flat areola no bud	stippled areola 1–2 mm bud	raised areola 3–4 mm bud	full areola 5–10 mm bud		
EYE / EAR	lids fused loosely: -1 tightly: -2	lids open pinna flat stays folded	sl. curved pinna; soft; slow recoil	well-curved pinna; soft but ready recoil	formed & firm instant recoil	thick cartilage ear stiff		
GENITALS (Male)	scrotum flat, smooth	scrotum empty faint rugae	testes in upper canal rare rugae	testes descending few rugae	testes down good rugae	testes pendulous deep rugae		
GENITALS (Female)	clitoris prominent & labia flat	prominent clitoris & small labia minora	prominent clitoris & enlarging minora	majora & minora equally prominent	majora large minora small	majora cover clitoris & minora		
							TOTAL PHYSICAL MATURITY SCORE	

Reference
Ballard JL, Khoury JC, Wedig K, et al: New Ballard Score, expanded to include extremely premature infants. J Pediatr 1991; 119:417–423.

SCORE

Neuromuscular _____
Physical _____
Total _____

MATURITY RATING

SCORE	WEEKS
-10	20
-5	22
0	24
5	26
10	28
15	30
20	32
25	34
30	36
35	38
40	40
45	42
50	44

GESTATIONAL AGE (weeks)

By dates
By ultrasound
By exam _____

INDEX OF CONDITIONS

INDEX OF MEDICINES

ABBREVIATIONS

3TC	lamivudine
ABC	abacavir
ACTH	adrenocorticoid hormone
ADA	adenosine deaminase
ADEM	acute disseminated encephalomyelitis
ADH	antidiuretic hormone
ADHD	attention deficit hyperactivity disorder
ADR	adverse drug reaction
AED	antiepileptic drug
AFP	acute flaccid paralysis
AI	aortic incompetence
AIDP	acute inflammatory demyelinating polyradiculoneuropathy
AIDS	acquired immune deficiency syndrome
ALP	alkaline phosphatase
ALT	alanine aminotransferase
AMAN	acute motor axonal neuropathy
AMSAN	acute motor-sensory axonal neuropathy
ANA	anti-nuclear antibody
AP	anteroposterior
APH	antepartum haemorrahge
APSGN	acute poststreptococcal glomerulonephritis
ARDS	acute respiratory distress syndrome
ART	antiretroviral therapy
ARV	antiretroviral
ASA	American Society of Anaesthesiology
ASD	atrial septal defect
ASO	antistreptolysin O
ASOT	antistreptolysin O titre
AST	aspartate aminotransferase
AVSD	atrioventricular septal defect
AZT	zidovudine

BCG	Bacille Calmette-Guérin
BD	twice daily
BHCG	beta-human chorionic gonadotropin
BIPP	bismuth iodoform paraffin paste
BMI	body mass index
BP	blood pressure
BSA	body surface area
CA-MRSA	community aquired methicillin-resistant Staphylococcus aureus
cART	combination antiretroviral therapy
CBT	cognitive behavioural therapy
CD4	cluster of differentiation 4
CDC	Centers for Disease Control and Prevention
CHD	congenital heart disease
CIDP	chronic inflammatory demyelinating polyradiculoneuropathy
CKD	chronic kidney disease
CMP	comprehensive metabolic panel
CMV	cytomegalovirus
CNS	central nervous system
COCs	combined oral contraceptives
CPAP	continuous positive airway pressure
CPP	cerebral perfusion pressure
CPR	cardiopulmonary resuscitation
CRF	chronic renal failure
CRP	C-Reactive Protein
CRT	capillary refilling time
CSF	cerebrospinal fluid
CT	computerized tomography
CVP	central venous pressure
CVT	cerebral venous thrombosis
d4T	stavudine
DAT	diphtheria antitoxin treatment
DC	direct current

DEET	diethyltoluamide
DIC	disseminated intravascular coagulation
DKA	diabetic ketoacidosis
dL	decilitre
DMARDs	disease modifying antirheumatic drugs
DMDD	disruptive mood dysregulation disorder
DNA	deoxyribonucleic acid
DOT	directly observed therapy
DPT	diphtheria, pertussis, tetanus
DR	drug resistance
DRESS	drug-induced rash with eosinophilia and systemic symptoms
DSD	disorders of sexual development
DSM	diagnostic and statistical manual
DST	drug susceptibility testing
E	ethambutol
ECG	electrocardiogram
eCrCl	estimated creatinine clearance
EEG	electroencephalogram
EFV	efavirenz
ELISA	enzyme linked immunosorbent assay
EMB	ethambutol
ENT	ear, nose and throat
EPI	expanded programme on immunisation
ESPE	extrapyramidal side effects
ESPGHAN	European Society for Paediatric Gastroenterology Hepatology and Nutrition
ESR	erythrocyte sedimentation rate
ESRF	end stage renal failure
ETAT	emergency triage assessment and treatment
ETT	endotracheal tube
FBC	full blood count
FDA	Food and Drug Administration
FDC	fixed dose combination

FDP	freeze dried plasma
FEV	forced expiratory volume
FEV1	forced expiratory volume in 1 second
FFP	fresh frozen plasma
FiO2	fraction of inspired oxygen
FLACC	face, legs, activity, cry, consolability
FSGS	focal segmental glomerulosclerosis
g	gram
g	gram
G6PD	glucose-6-phosphate dehydrogenase
GABA	gamma aminobutyric acid
GAD	generalised anxiety disorder
GBS	Guillain-Barre' syndrome
GCS	glasgow coma scale
GEFS+	genetic epilepsy with febrile seizures plus
GFR	glomerular filtration rate
GGT	gamma-glutamyl transferase
GIT	gastrointestinal tract
GMP	Good Manufacturing Practice
GORD	gastro-oesophageal reflux disease
GTCS	generalised tonic-clonic seizures
H	isoniazid
Hb	haemoglobin
HbA1C	glycosylated haemoglobin, type A1C
HBV	hepatitis B virus
HCV	hepatitis C virus
HCV	head circumference
Hib	haemophilus influenza type B
HIE	hypoxic-ischaemic encephalopathy
HIV	human immunodeficiency virus
HLA	human leukocyte antigen
HMD	hyaline membrane disease

HSP	Henoch-Schönlein purpura
HSV	herpes simplex virus
HT	hypertension
IAS	intra-articular steroids
ICHD	International Classification of Headache Disorders
ICP	intracranial pressure
ICU	intensive care unit
IE	infective endocarditis
IgE	Immunoglobulin E
IgG	immunoglobulin G
IgM	immunoglobulin M
ILAE	International League against Epilepsy
IM	intramuscular
IMCI	Integrated Management of Childhood Illness
IMI	intramuscular injection
INH	isoniazid
INR	international normalised ratio
IO	intraosseous
IO	intraosseous
IPT	isoniazid prevention therapy
IRDS	infant respiratory distress syndrome
IRIS	immune reconstitution inflammatory syndrome
IRIS	immune reconstitution inflammatory syndrome
ITP	immune thrombocytopaenic purpura
IU	international unit
IUCDs	intra-uterine contraceptive device
IV	intravenous
J	joule
JIA	juvenile idiopathic arthritis
JVP	jugular venous pressure
KDQOI	Kidney Disease Outcomes Quality Initiative
kg	kilogram

kJ	kilojoule
L	litre
LABA	long-acting beta agonist
LDH	lactate dehydrogenase
LDL	low-density lipoprotein
LDL-C	low-density-lipoprotein cholesterol
LFTs	liver function tests
LGE	lineal gingival erythema
LGS	Lennox-Gastaut syndrome
LIP	lymphoid interstitial pneumonitis
LMWH	low molecular weight heparin
LOC	loss of consciousness
LoE	level of evidence
LP	lumbar puncture
LPV/r	lopinavir/ritonavir
LTB	laryngotracheobronchitis
MAC	mycobacterium avium complex
MAS	meconium aspiration syndrome
MCNS	minimal change nephrotic syndrome
MCS	microscopy, culture, sensitivity
MCUG	micturating cystourethrogram
MCV	meningococcal conjugate vaccine
MDD	major depressive disorder
MDI	metered-dose inhaler
MDR	multi-drug resistant
mg	milligram
MI	mitral incompetence
mL	millilitre
mmol	millimole
MRI	magnetic resonance imaging
MRSA	methicillin-resistant Staphylococcus aureus
MTB	mycobacterium tuberculosis

NAC	N-acetyl cysteine
NAS	neonatal abstinence syndrome
NEC	necrotising enterocolitis
NGAs	nasogastric aspirates
NGT	nasogastric tube
NHLS	National Health Laboratory Service
NICD	National Institute for Communicable Diseases
NIMART	nurse-initiated and managed antiretroviral therapy
NMS	neuroleptic malignant syndrome
NNRTIs	non-nucleoside reverse transcriptase inhibitors
NRTIs	nucleoside reverse transcriptase inhibitors
NS	nephrotic syndrome
NSAIDs	nonsteroidal antiinflammatory drugs
NTS	non-typhoid salmonella
NVP	nevirapine
OCD	obsessive compulsive disorder
ODD	oppositional defiant disorder
OME	otitis media with effusion
ORS	oral rehydration solution
PA	posteroanterior
PA	pulmonary atresia
PaCO2	partial pressures of carbon dioxide
PAIR	percutaneous puncture aspiration injection
PANDAS	paediatric autoimmune neuropsychiatric disorders associated with streptococcal infections
PCR	polymerase chain reaction
PCV	pneumococcus conjugate vaccine
PDA	patent duct arteriosus
PEA	pulseless electrical activity
PEF	peak expiratory flow
PEFR	peak expiratory flow rate
PGL	persistent generalised lymphadenopathy
PHC	primary healthcare

PI	protease inhibitor
PJP	pneumocystis jiroveci pneumonia
PML	progressive multifocal leukoencephalopathy
PMTCT	prevention of mother to child transmission
PN	parenteral nutrition
PPHN	persistent pulmonary hypertension of the newborn
PPN	partial parenteral nutrition
PPV	pneumococcus polysaccaride vaccine
PT	prothrombin time
PTB	pulmonary tuberculosis
PTSD	post traumatic stress disorder
PTT	partial thromboplastin time
PZA	pyrazinamide
R	rifampicin
RBC	red blood cell
RF	rheumatoid factor
rHuEPO	recombinant human erythropoietin
RIG	rabies immunoglobulin
RNA	ribonucleic acid
ROP	retinopathy of prematurity
RPR	rapid plasma reagin
RSTI	repeated supratherapeutic ingestion
SAM	severe acute malnutrition
SANCA	South African National Council on Alcoholism and Drug Dependence
SaO2	Oxygen saturation
SC	subcutaneous
SD	standard deviation
SE	status epilepticus
SIADH	syndrome ofinappropriate antidiuretic hormone secretion
SIDS	sudden infant death syndrome
SJS	Stevens-Johnson Syndrome
SLE	systemic lupus erythematosus

SMEI	severe myoclonic epilepsy of infancy
SSRI	selective serotonin re-uptake inhibitors
SSS	sugar and salt solution
STI	sexually transmitted infection
SUD	substance use disorders
TA	tricuspid atresia
TB	tuberculosis
TBM	tuberculous meningitis
TC	total cholesterol
TCA	tricyclic antidepressants
Td	tenus, diphtheria
TDF	tenofovir
TEN	toxic epidermal necrosis
TG	triglycerides
TGA	transposition of great arteries (TGA)
TIG	tetanus immunoglobulin
TOF	tetralogy of fallot
TPN	total parenteral nutrition
TSH	thyroid-stimulating hormone
TST	tuberculin skin test
TT	tetanus toxoid
TTN	transient tachypnoea of the newborn
U&E	urea and electrolytes
UCT	University of Cape Town
UFH	unfractioned heparin
URTI	upper respiratory tract infection
UTI	urinary tract infection
VL	viral load
VLDL	very low-density lipoprotein
VP	ventriculoperitoneal
VSD	ventricular septal defect
WHO	World Health Organisation

Wt	weight
XDR	extensively drug-resistant
Z	pyrazinamide