Standard Treatment Guidelines and Essential Medicines List for South Africa

PAEDIATRIC HOSPITAL LEVEL
2023 EDITION

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Electronic copies can be downloaded from the National Health Insurance web page:

- https://www.health.gov.za/nhi-edp-stgs-eml/

Additionally, the updated Paediatric Standard Treatment Guidelines and Essential Medicines List can be access from the "EMGuidance mobile application. This mobile application can be downloaded on android, IOS and windows operating systems, from the relevant app stores.

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.

Produced by: The National Department of Health, Pretoria, South Africa

FOREWORD

"Investing in children is one of the most important things a society can do to build a better future" – World Health Organization

The children of South Africa are our future, they will be driving the success of the country as they become adults. Good healthcare in childhood is the foundation on which a healthy life is developed, fundamental for the mental, social, emotional and physical development of children as they grow into functional adults. Children form a distinctive population, with unique treatment and patient care requirements. This vulnerable population group should be considered differently to adults in order to appropriately meet needs.

The National Department of Health has brought together the country's leading experts in paediatric healthcare to develop treatment guidelines reflective of the ever-changing needs of our children. The Paediatric Hospital Level Standard Treatment Guidelines (STGs) and Essential Medicines List (EML) aim to provide equitable access to good quality healthcare for all children, a vital element of universal healthcare that South Africa is striving for through the implementation of National Health Insurance.

I am proud to present the 5th version of the Paediatric Hospital Level STGs. This latest edition of the Paediatric Hospital Level STGs and EML is a culmination of many efforts from a broad range of experts, and we are thankful to all those who participated in the review process. The review of the STGs and EML is a dynamic process. We thus encourage the continued engagement, feedback, and collaboration from all healthcare stakeholders to ensure continued quality care for our children.

It is our hope that healthcare workers will continue to make use of the STGs and EML in their endeavors in providing quality care to the children of South Africa.

DR MJ PHAAHLA, MP

MINISTER OF HEALTH

DATE: 20 July 2023

INTRODUCTION

The COVID-19 pandemic had a profound impact on health systems across the world. Access and availability of health services were limited and care to children, one of the most vulnerable populations, was negatively impacted. The latest emerging evidence on the treatment and care of children with COVID-19 was evaluated and a section dedicated to management of COVID-19 was added to the Infectious Diseases Chapter of the Paediatric Standard Treatment Guidelines.

The National Department of Health would like to thank the wide range of experts that provided inputs into these guidelines as part of the Paediatric Hospital Level Expert Review Committee. The dedication of these individuals through the COVID-19 pandemic, when virtual meetings between increased clinical responsibilities became the norm, is highly appreciated. In addition, we would like to thank the members of the National Essential Medicines List Committee and all external stakeholders who provided feedback.

The fifth version of the Paediatric Hospital Level Standard Treatment Guidelines and Essential Medicines List has been enhanced through the improvement in methodology and rigor of decision-making. Expansion of chapters such as those addressing Palliative Care and Intensive Care was enabled through consultation with key experts in these areas.

It is my pleasure to present to you the fifth edition of the Paediatric Hospital Level Standard Treatment Guidelines and Essential Medicines List.

DR SSS BUTHELEZI

DIRECTOR-GENERAL: HEALTH

DATE: 12 July 2023

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 World Health Organization (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 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 Essential Drugs Programme (EDP) forms an integral part of this strategy. 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 different and changing situations.

HOW TO USE THIS BOOK

Principles

The National Drug Policy makes provision for an Essential Drugs Programme (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, topical retinoid e.g. tretinoin. 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 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 STGs 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 South African Health Products Regulatory Authority's (SAHPRA) guidance on reporting adverse drug reactions in South Africa, all healthcare professionals, including doctors, dentists, pharmacists, nurses and other healthcare professionals, patients, caregivers and representatives of the patient (e.g., lawyer) are encouraged to report all suspected adverse reactions to medicines. (see page xl: Guidelines for adverse drug reaction reporting.

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 Hospital Level 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:
  - medicine name and strength,
  - route,
  - dose or dosage,
  - dose frequency,
  - 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.	» Create a treatment plan with information on how and when to take the medications.
» A busy schedule makes it difficult to remember to take the medication.	» Use reminders such as cues that form part of the daily routine.
Attitudes and beliefs	
» The condition is misunderstood or denied.	» Remind patients that they have a long-term illness that requires their involvement.
» Treatment may not seem to be necessary.	» Use change techniques such as motivational interviewing.
» May have low expectations about treatment.	» Identify goals to demonstrate improvement/stabilisation.
Social and economic	
» May lack support at home or in the community	» Encourage participation in treatment support programs.
» May not have the economic resources to attend appointments.	» 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.	» Encourage patient to ask questions.
» Information may be provided in a way that is not understood.	» Use patient literacy materials in the patient's language of choice.
» Relationship with the patient may not promote understanding and self-management.	» Engage active listening.
Treatment related	
» Complex medication regimens (multiple medications and doses) can be hard to follow.	» If possible, reduce treatment complexity.
» May be discouraged if they do not feel better right away.	» Help the patient understand the condition and the role of their medication.
» May be concerned about adverse effects.	» 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.

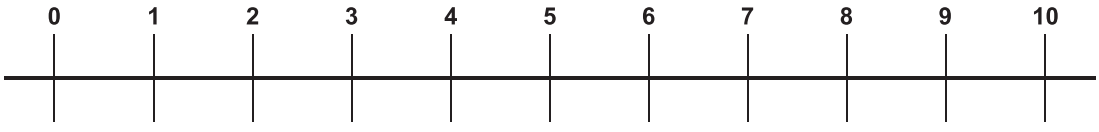
Patient Adherence Record

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 to 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 (place ahead of the normal queue):

These children need prompt assessment and treatment:

» young infant (< 3 months),
» temperature very high (> 38 ºC) or very low (< 36.4 ºC),
» 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.

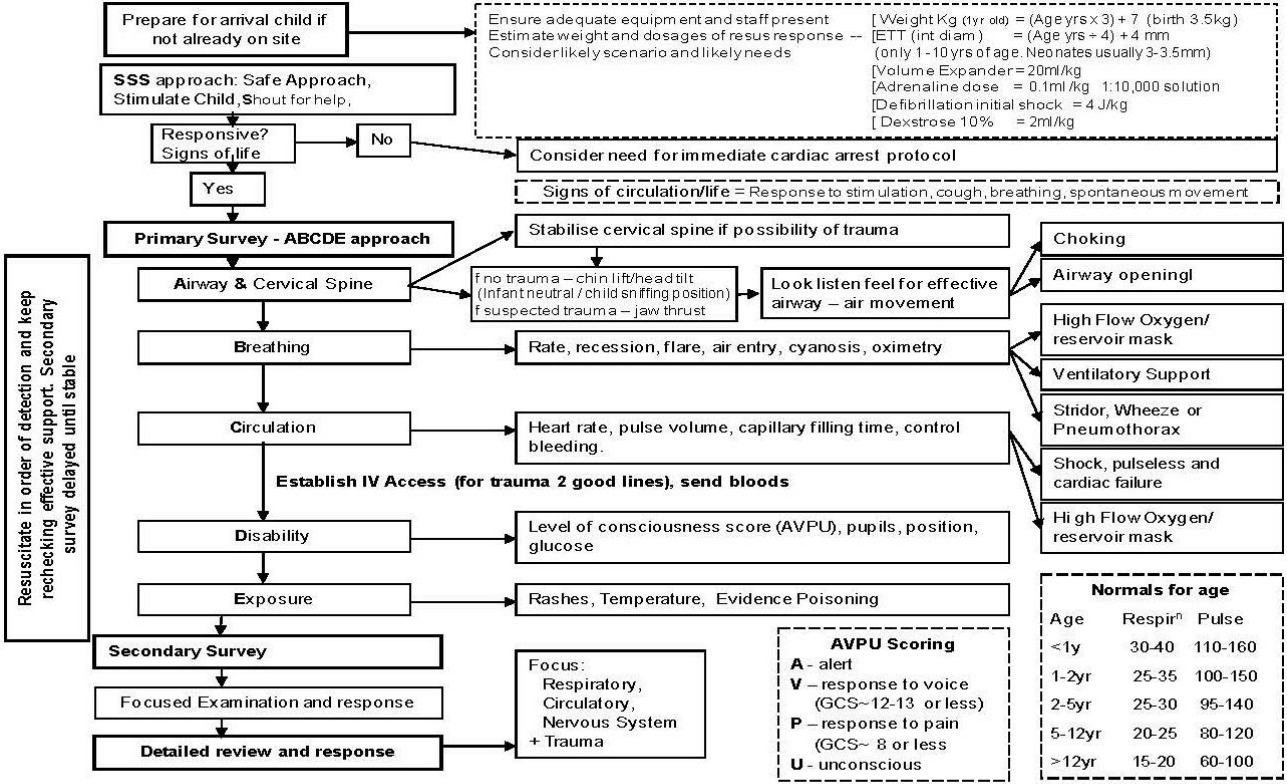
The ETAT triage presented above should be a minimum standard of triage in community health centres, district or regional hospitals in South Africa.

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 the diagram below).

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



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.
  - 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 the horizontal position. Do not place in a sitting position.
» Assess and secure airway. If necessary, bag via mask or intubate.

MEDICINE TREATMENT

- Adrenaline (epinephrine) 1:1000 (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.

If no response, use IV:

- Adrenaline (epinephrine) 1:1000 (undiluted), IV infusion at 0.02 mcg/kg/minute (mix 0.06 mg/kg adrenaline in 50 mL 5% dextrose, 1 mL/hour = 0.02 mcg/kg/minute).

To maintain arterial oxygen saturation ≥ 95%:

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

In severe anaphylaxis, nasal oxygen is unlikely to be adequate:

- Oxygen, 15 L/minute by face mask with a reservoir bag.

Crystalloid solutions, e.g.:

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

LoE I[1]

- 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.

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

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.

If associated stridor:

- Adrenaline (epinephrine), 1:1000, nebulise with oxygen, every 15–30 minutes until expiratory obstruction is abolished.
  - 1 mL adrenaline (epinephrine) 1:1000 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 adrenaline (epinephrine) pre-filled auto injecting device. Specialist initiated for patients who have anaphylactic reactions.
» Educate patient and parent/caregiver on allergy and anaphylaxis.

REFERRAL

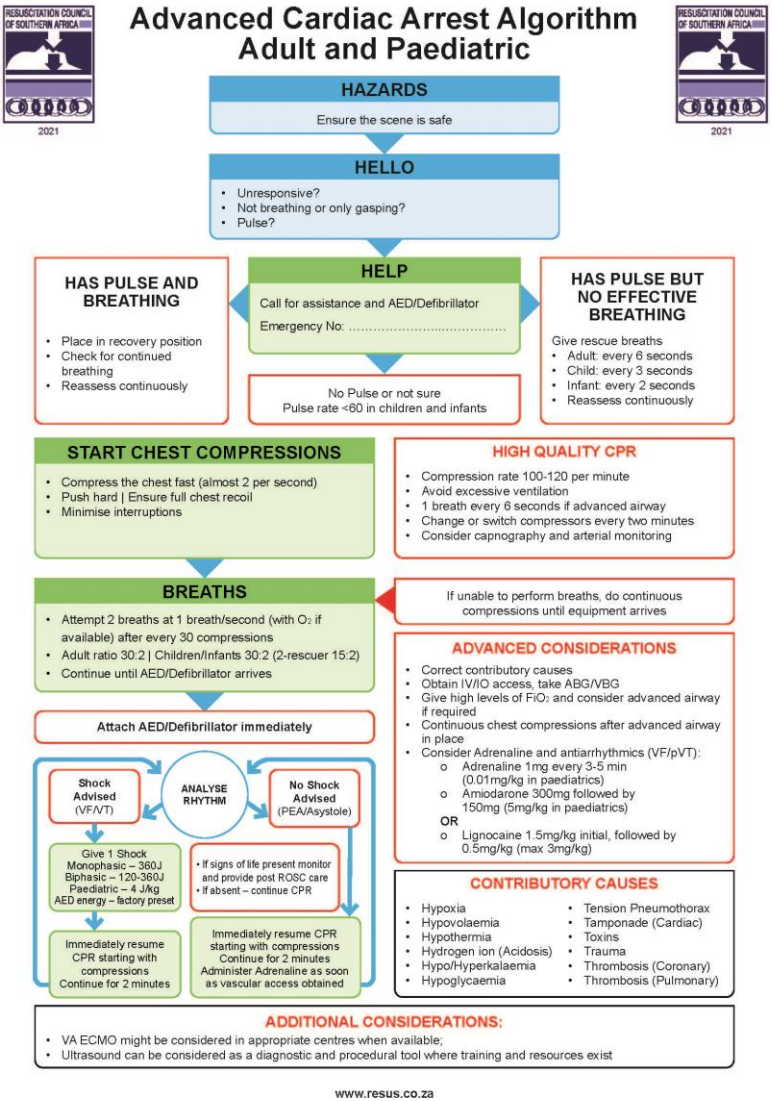
Caution

- **Do not refer the patient during the acute phase.**
- **Transfer can only be done once the patient is stable.**
- **Patients supplied with self-administered adrenaline (epinephrine) must be informed of the shelf life of adrenaline (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 (position head in a neutral position for toddlers or sniffing position for older children with head-tilt, chin-lift manoeuvre or jaw-thrust in trauma cases).

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). Squeeze the bag with enough air to cause the chest to rise, do not overinflate the child's lungs with too much tidal volume.

If there is inadequate chest movement with bag-valve-mask ventilation, re-assess airway patency and adjust, re-positioning the airway with a naso or oropharyngeal tube/airway. If necessary, place an appropriately sized endotracheal tube. In the event of an unexpected arrest or an arrest where there are no witnesses, consider foreign body obstruction. See section 1.1.7: Inhalation, foreign body.

Checklist:

1. Reassess head position to keep airway open.
2. Reassess for an adequate seal when performing bag-mask ventilation.
3. Ensure an adequate size bag is used according to the size of the patient.
4. Ensure no leaks in bag.
5. Exclude a pneumothorax.

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 30 compressions to 2 breaths (30:2) if alone and 15 compressions to 2 breaths (15:2) if two rescuers are present.
Attach a cardiac monitor to the child and secure vascular access. If unable to insert an IV line, obtain intra-osseous access. See section 1.1.10: Intra-osseous infusion in emergencies.

MEDICINE TREATMENT

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

- Adrenaline (epinephrine) 1:10 000 (diluted), 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 adrenaline (epinephrine) 1:1000 in 9 mL of sodium chloride 0.9% or sterile water to make a 1:10 000 solution.

ETT adrenaline is no longer recommended as absorption is unpredictable. It is faster to get an IO line than intubating the child – rather go for IO adrenaline.

Repeat the dose of adrenaline (epinephrine) 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% OR Ringers Lactate, IV, 20 mL/kg as a bolus.

LoE I[1]

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 adrenaline (epinephrine) (100 mcg/kg/dose).

Ventricular fibrillation or pulseless ventricular tachycardia
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.

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 every 4 minutes.

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

- Adrenaline (epinephrine) 1:10 000 (diluted), 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 adrenaline (epinephrine) 1:1000 in 9 mL of sodium chloride 0.9% or sterile water to make a 1:10 000 solution.

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

REFERRAL

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

1.1.5 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 a ward with appropriate monitoring facilities, e.g. a 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.

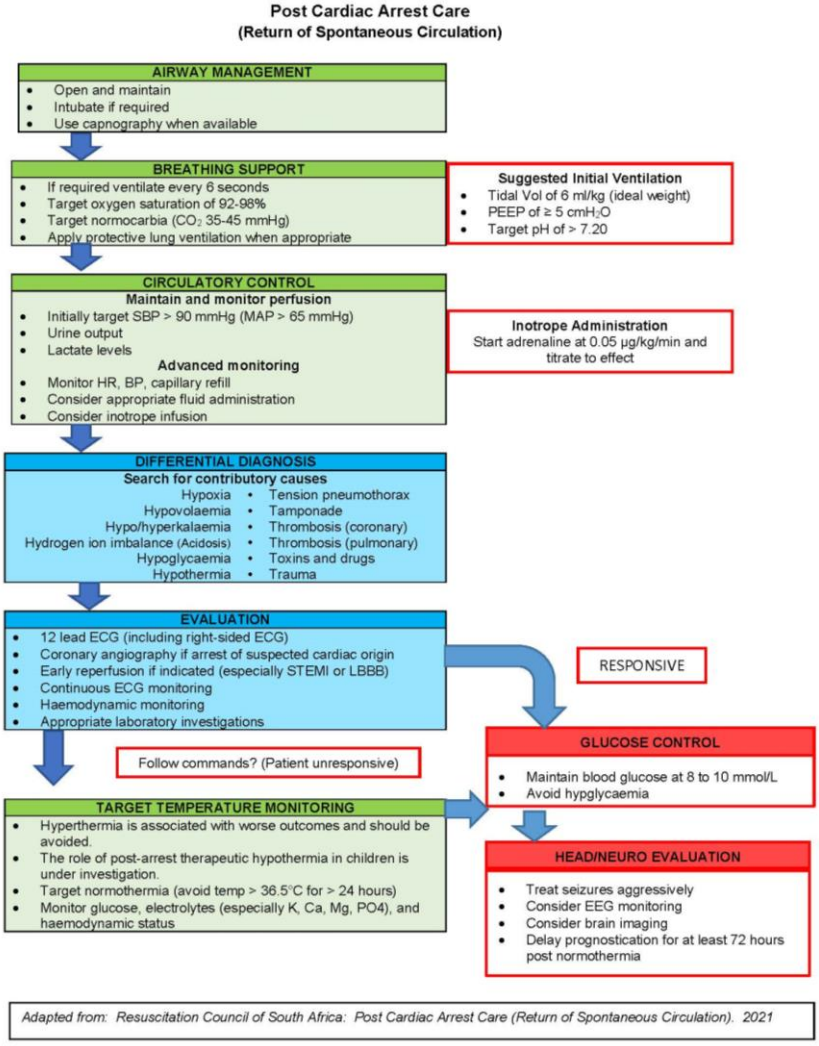
5. Maintain systolic BP ≥ 5th percentile for age (refer to Chapter 4: Cardiovascular System, section 4.11: Hypertension); this may require intravascular fluids and/or inotropes.
6. Avoid hyperthermia and treat fever aggressively.
7. Provide adequate nutrition.
8. Monitor and correct glucose and electrolyte abnormalities.
9. Provide appropriate analgesia.
10. Consider rehabilitation requirements.

1.1.5.1 TERMINATION OF RESUSCITATION

» The decision to stop CPR attempts depends on the specifics of the individual patient and should be based on clinical judgement.
» Consider stopping resuscitation attempts and pronouncing death if there is incurable underlying disease, or if asystole > 20 minutes.

Consider carrying on for longer especially with:
» hypothermia and drowning,
» poisoning or medicine overdose,
» neurotoxic envenomation (e.g. black and green mamba or Cape cobra snakebite) – see section 18.2.3: Snakebite.

This decision should take into consideration the potential risk that CPR poses to the rescuer, e.g. infectious diseases.



1.1.6 CONVULSIONS, NOT FEBRILE CONVULSIONS

See section 13.1: Seizures.

1.1.7 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 manoeuvres (child) repeatedly.
» If the child is unresponsive, carry out standard cardiorespiratory resuscitation, i.e. cardiac compressions and ventilation (provide artificial breaths at a ratio of 30 compressions to 2 breaths (30:2) if alone and 15 compressions to 2 breaths (15:2) if two rescuers are present).

Caution

Blind finger sweeps are dangerous and 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.

1.1.8 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 may be relatively well maintained but the patient still requires urgent resuscitation. Hypotension is a late and ominous sign.

Shock can be further characterised:

» **Hypovolaemic shock:** 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. A patient may have more than one type of shock present, e.g. a trauma patient with spinal cord injury, pneumothorax and haemorrhagic shock.

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 ABCDE 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 1.1.10: 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.

If oxygen saturation < 92% or P_aO_2 < 80 mmHg, consider the 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 40 mL/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% OR Ringers Lactate, IV, 20 mL/kg rapidly.
  - Review after each bolus to see if shock has resolved.

LoE I[1]

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, urine output, skin perfusion and level of consciousness improved), do not repeat the 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/vasopressors.
» 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.
  > Increasing oxygen requirement.

After circulatory stabilisation, continue with appropriate maintenance fluid.

For blood loss:
- Packed red cells **or** whole blood, 10–20 mL/kg, repeat if required.
  - Stop once haemodynamic stability reached.

While awaiting blood products to arrive, proceed with volume resuscitation.
See section 1.1.9: Massive blood loss.

2. Cardiogenic shock

Ideally, children receiving treatment for cardiogenic shock should be in a 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.
  - Initiate slowly and with caution as dobutamine can potentially drop BP due to unopposed β-2 adrenergic vasodilation properties.

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:
- Adrenaline (epinephrine), IV infusion, 0.05–1 mcg/kg/minute.

If poor ventricular contractility and increased afterload are considered as the primary problem, do not give adrenaline (epinephrine) 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% **OR** Ringers Lactate, IV, 10 mL/kg rapidly.
  - Review after each bolus to see if shock has resolved.

LoE I[1]

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 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 an additional agent if poor response.

- Adrenaline (epinephrine), IV infusion, 0.05–1 mcg/kg/minute.

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

Septicaemic shock unresponsive to inotropes:
- Hydrocortisone, IV, 1–2 mg/kg/dose, 6 hourly until shock has resolved.

Antibiotic therapy
» Start empiric antibiotics early.
» Aim to get source control: all pus should be drained; all necrotic tissue should be removed/debrided.

Before initiating antibiotic therapy, take blood and urine specimens, if appropriate, for culture and sensitivity testing.

Consider whether community or hospital acquired and treat based on anticipated susceptibility. Ensure immediate administration.

Reconsider antibiotic and/or antifungal therapy when culture and sensitivity results become available.

Caution **Patients must be resuscitated and stabilised before referral.**

1.1.9 MASSIVE HAEMORRHAGE WITH MASSIVE TRANSFUSION OF BLOOD

DEFINITION

Massive blood loss in children is recognised when a child requires a blood transfusion to replace 50% of total blood volume in 3–4 hours (40 mL/kg) or > 100% of total blood volume in 24 hours or receives replacement of 10% of total blood volume/minute. The rapid recognition is important to maintain tissue oxygenation by restoration of blood volume and haemoglobin.

Common causes:
» Trauma (especially blunt injuries).
» Ruptured aortic aneurysm.
» Liver surgery.
» Gastrointestinal bleeding.
» Invasive tumour.

Presentation: Hypotension, prolonged capillary fill time, tachycardia, urinary output decreases, oxygen saturation reduced, hypothermia.

DIAGNOSTIC CRITERIA

Investigations
» ABG, Thromboelastogam (TEG), haemoglobin, PT/PTT, platelets, INR, clotting factors, DIC screening.
» Haemoglobin must be done initially and repeated every 60 minutes.

MEDICINE TREATMENT

Massive transfusion protocol (MTP) activation must be prompt as every minute from activation to product arrival increases odds of mortality by 5%.

Facilities without access to a blood bank:
- Lyophilised plasma, IV.
  - 1 unit for each unit of emergency blood transfused.

Arrange urgent transfer to a centre with blood bank and specialist services.
Facilities with access to a blood bank:
» Ensure that the blood bank receives an appropriate specimen as soon as the possible need for transfusion is identified.
» Notify the blood bank as soon as possible of the need for a massive transfusion and request a massive transfusion pack.

A massive transfusion pack will typically consist of:
- Red blood cells (RBCs).

AND
- Lyophilised plasma, IV.
  - 1 unit for each unit of emergency blood transfused.

OR

- FFP – thawed when requested.

AND

- Platelets
  - Aim to transfuse the above products in a 1:1:1 ratio, or as guided by laboratory parameters.
  - Send specimens for FBC and INR and continue to monitor.

Watch for complications:

» Electrolyte abnormalities:
  > Hyperkalaemia
  > Hypocalcaemia
» Transfusion:
  > Induced coagulopathy.
» Immunologic reactions:
  > ABO incompatibility.
  > Transfusion-related acute lung injury.
  > Transfusion-associated circulatory overload.
  > Alloimmunization

REFERRAL

» All
» MTP deactivation must be stopped timeously to decrease wastage and adverse effects.

1.1.10 INTRA-OSSEOUS INFUSION IN EMERGENCIES

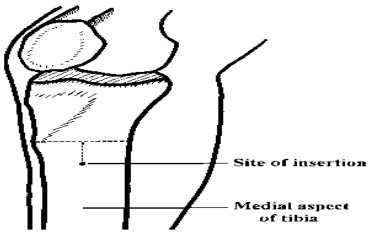
During resuscitation and when managing a critically ill child, if intravenous access is not established within 5 minutes, obtain intra-osseous (IO) access.

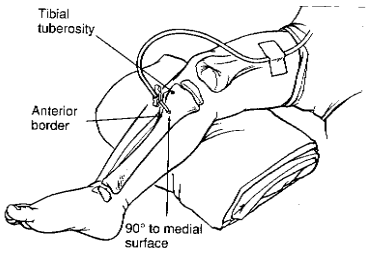
1. Use an intra-osseous needle or if not available, a FG18 x 1.5 cm (or less ideally FG20 x 1.5 cm) or lumbar puncture needle.
2. Grasp the thigh and knee above and lateral to the insertion site with the palm of the left hand (if right-handed). Wrap the fingers around the knee to stabilise the proximal 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.
13. Secure the IO needle to the skin by using forceps/spatula/cord-clamp, clamping the IO needle perpendicular to the leg and place two-plaster straps over the forceps/cord-clamp/spatula. Do not cover the leg with a circumferential dressing, as you need to watch the calf for signs of compartment syndrome.

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 (> 40 kg) the proximal humerus can be used as an access site.

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

1.1.11 EXPOSURE TO POISONOUS SUBSTANCES

See Chapter 18: Poisoning, section 18.1: Poisoning.

1.1.12 INSECT BITES AND STINGS

See Chapter 18: Poisoning, section 18.2: Envenomation.

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, and
» 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 20 minutes.
» In all burns, > 10% or where carbon monoxide poisoning is possible (enclosed fire, decreased level of consciousness, disorientation) administer high flow oxygen by face mask with reservoir bag (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.

Since burns are usually sterile, empiric antibiotics are not initially indicated.

Depth of burn wound	Surface/Colour	Pain sensation/Healing
Superficial or epidermal	Dry, minor blisters, erythema.	» Painful » Heals within 7 days.

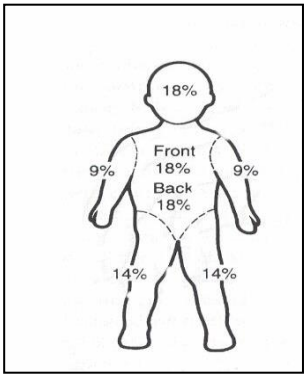
Depth of burn wound	Surface/Colour	Pain sensation/Healing
Superficial partial thickness or superficial dermal	Blisters, moist.	» Painful » Heals within 10–14 days.
Deep partial thickness or deep dermal	Moist white or yellow slough, red mottled.	» Less painful. » Heals within a month or more. » Generally needs surgical debridement and skin graft.
Full thickness (complete loss of dermis)	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 (superficial or deep) 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 total body surface area (TBSA) involved in burn injury:



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 percentage, 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 lower limb.
» **Less than 1 year**:
  > Head and neck are 18% of TBSA.
  > Each leg is 14% of TBSA.
» **After 1 year**:
  For each year of life:
  > Head and neck decrease by 1% of TBSA until 9% (adult value).
  > Leg gains 1/2% of TBSA until 18% (adult value).

Age (Years)	Head + neck Front + back	Torso Front	Torso Back	Lower limb Front + back	Upper limb 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 to < 9 years	10%	18%	18%	18%	9%
≥ 9 years *(plus 1% perineum)*	9%	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 (15 L/min by facemask with reservoir bag).

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).
Within the 1st 24 hours, commence nasogastric feeds in children with > 15% TBSA where ileus is not suspected.

Nutritional support
Consult a dietician as children with burns require a higher than usual intake of nutrients (due to a hypermetabolic state).
Start enteral feeds within 6 hours in all children unless there are contraindications.

Estimate daily energy and protein needs using the formulae:

Energy (kJ):	250 kJ/kg body mass + (150 kJ x % burned TBSA)
Protein (g):	3 g/kg body mass + (1 g x % burned TBSA)
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 with iron during sepsis or infection.
In addition, provide:
» psychological support,
» physiotherapy,
» occupational therapy,
» waterbeds and cradles,
» distraction therapy: music, video games, etc. for dressing changes.

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 1.1.8: Shock.

As in all fluid administration in sick children, volumes are estimates, 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 OR Ringers lactate.
  - 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 from the time of the burn.
Administer remaining fluid volume in the next 16 hours.

LoE I[1]

Note:
If urine output not adequate (adequate urine output = 1–2 mL/kg/hour), 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 the 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 4 kg = 4 kg x 20 mL/kg/24 hours Total maintenance:	 = 1000 mL + = 500 mL + = 80 mL **= 1580 mL**
Thus	
1st 8 hours: = ½ resuscitation fluids + ⅓ maintenance fluids	480 mL sodium chloride 0.9% + 527 mL sodium chloride 0.9%/dextrose 5%
Next 16 hours: = ½ resuscitation fluids + ⅔ maintenance fluids	480 mL sodium chloride 0.9% + 1053 mL sodium chloride 0.9%/dextrose 5%

The above are guidelines. Regular review is needed 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.

If urine output > 1–2 mL/kg/hour or base excess (BE) better than minus 4, stop resuscitation fluids. Too much fluid is almost as harmful as too little fluid.

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

PLUS

Maintenance:
- Sodium chloride 0.9%/dextrose 5% (dextrose saline), 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. Aim for full enteral feeds as soon as possible.

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

Pain associated with burn injury is often severe and requires active and continuous management. Procedural pain management measures need to be taken during dressing changes.

See Chapter 20, section 20.1.1: Management of pain.

For pruritus
Antihistamines
- Chlorphenamine, oral, 0.1 mg/kg/dose as a single dose at night.
  - Maximum: 4 mg.

For children 2 years and older, second-generation antihistamines can be considered:
- Cetirizine, oral, as a single dose.
  - Children 2–6 years: 5 mg.
  - Children 6–12 years: 10 mg.

Topical
- Aqueous cream.

If not controlled:
- Ondansetron, oral, 0.1–0.2 mg/kg 12 hourly.

If oral route cannot be used:
- Ondansetron, IV, 0.1 mg/kg immediately.
  - Maximum: 4 mg/day.

Refractory pruritus: Refer for consideration of gabapentinoids.

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.

Proton pump inhibitor, e.g.
- 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:
- Proton pump inhibitor, e.g.
  - Pantoprazole, IV, 0.5 mg/kg/dose 12 hourly.

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

Local treatment of burns
Gently clean the wounds with running water, utilising appropriate pain and sedation, see Chapter 20, section 20.1.1: Management of pain.
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 and crepe bandages.

- 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 three 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/thrombocytopenia,
» looks ill/toxic/altered level of consciousness,
» local inflammatory changes,
» vomiting.

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.
» Start empiric antibiotics early.
» Aim to get source control: all pus should be drained; all necrotic tissue should be removed/debrided.

Before initiating antibiotic therapy, take blood and urine specimens, if appropriate, for culture and sensitivity testing.

Consider whether community or hospital acquired and treat based on anticipated susceptibility. Ensure immediate administration.

Reconsider antibiotic and/or antifungal therapy when culture and sensitivity results become available.

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.

1.2.2 TRAUMATIC BRAIN INJURY
S06.2

See Chapter 23: ICU, section 23.7: Traumatic Brain Injury (TBI) and neuro-protection in the ICU, for full management details.

DESCRIPTION
Types:
» Concussion (minor), e.g. shaken baby.
» Contusion
» Penetrative
» Anoxic – commonest, e.g. falls, vehicle collusion, violence, sport injuries.

DIAGNOSTIC CRITERIA
Symptoms:
» Headache
» Eating/nursing habits.
» Unusual or easy irritability.
» Persistent crying & inability to console.
» Change in sleeping habits.
» Seizure
» Mood
» Drowsiness
» Loss of interest in toys.

Signs of raised intracranial pressure (> 20 mmHg):
» Cushing response (hypertension and bradycardia).
» Crackpot sign.
» Features on fundoscopy.

Imaging:
» CTS – done within 0–6 hours.
» Transcranial doppler: Cerebral perfusion pressure > 40 mmHg.

GENERAL AND SUPPORTIVE MEASURES
» Rest/Trendelenburg position.
» Tight glucose and calcium control.

REFERRAL
» Refer all patients.

References

[1] Kartha GB, Rameshkumar R, Mahadevan S. Randomized Double-blind Trial or Ringers Lactate versus Normal Saline in Pediatric Acute Severe Diarrheal Dehydration. Journal of Pediatric Gastroenterology and Nutrition. 2017, (6):621-626.

CHAPTER 18

POISONING

For advice contact:

POISON INFORMATION CENTRES		
Poisons Information Helpline (National service)	24 hours/day, every day for poisons queries	0861 555 777
Red Cross War Memorial Children's Hospital Poisons Information Centre Email: poisonsinformation@uct.ac.za http://www.paediatrics.uct.ac.za/poisons-information-centre	Office Hours	(021) 658 5308
Tygerberg Poison Information Centre Email: toxicology@sun.ac.za www.sun.ac.za/poisoncentre	Office Hours	(021) 938 9596
University of the Free State Poison Control and Medicine Information Centre	24 hours/day	082 491 0160

The Afritox poisons information database is available free of charge to public hospitals in South Africa: see www.afritox.co.za for information on how to access it.

18.1 POISONING

DESCRIPTION

Frequently encountered poisonings in children include:

- analgesics,
- hydrocarbons,
- pesticides,
- plant material,
- household cleaning products.
- vitamins and minerals,
- anticonvulsants,
- antipsychotics,
- 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,
- 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,
- dilated pupils,
- coma,
- hallucinations and seizures.

Sedative-hypnotic, e.g. alcohol, benzodiazepines:

- Obtundation or coma.

Opiates, e.g. morphine:

- Pinpoint pupils,
- respiratory depression,
- bradycardia,
- hypotension.
- decreased bowel sounds,
- hypothermia,
- altered (decreased) mental status,

Dystonic reaction, e.g. haloperidol, antihistamines, anti-emetics:

- torticollis,
- opisthotonus,
- intermittent spasms and tongue thrusting.

Sympathomimetic, e.g. cocaine, amphetamines:

- hypertension,
- tachycardia,
- hyperthermia,
- agitation,
- sweating,
- dilated pupils.

Sympathomimetic toxidrome resembles anticholinergic toxidrome, i.e. fight, flight and fright response, however, the sympathomimetic toxic patient is sweaty as opposed to hot, dry skin seen with anticholinergic toxicity.

Toxic alcohols, e.g. ethylene glycol, methanol:

- » metabolic acidosis,
- » increased osmolar gap,
- » increased anion gap,
- » visual disturbances (methanol),
- » hypoglycaemia,
- » convulsions,
- » renal failure (ethylene glycol),
- » depressed level of consciousness.

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 the patient if necessary.
- » Decontaminate the patient if indicated (see below) and contra-indications are not present.
- » Give antidote if available. There are a limited number of antidotes for poisoning by certain substances, e.g. N-acetylcysteine for paracetamol, naloxone for opioids. Each antidote has specific criteria and indications for use.
- » Enhance elimination if possible.
- » Monitor hydration status carefully.

Decontamination:

1. Gastric lavage

Gastric lavage is seldom indicated and may cause more harm than benefit. If indicated, it should only be performed by experienced staff and within 60 minutes of ingestion.

Indicated only if patient:

- has ingested a potentially life-threatening poison,
- has a protected airway, i.e. fully awake and cooperative or intubated with a depressed level of consciousness.

Gastric lavage is contraindicated after ingestion of corrosive substances and volatile hydrocarbons such as paraffin.

Technique:

- Place patient in left lateral head down position.
- Insert orogastric tube if possible, with largest bore and rounded tip.
- Insert 200 mL warmed water or normal saline, and aspirate.

Continue until recovered solution is clear of particulate matter.

2. Activated charcoal

May reduce systemic absorption of a variety of poisonous substances. The greatest benefit is achieved if activated charcoal is given within one hour after ingestion; however, where gastric emptying is delayed by certain substances, there may be a longer period of time in which it is effective.

Activated charcoal must only be given in cases where the airway is protected, i.e. fully awake and cooperative patient or intubated with a depressed level of consciousness.

Repeated doses of activated charcoal every 4 hours are effective in enhancing elimination of substances that undergo enterohepatic circulation, e.g. carbamazepine, dapsone, phenobarbital, quinine or theophylline overdose.

- Activated charcoal, oral, given as a slurry:
  - If < 6 years of age: 1 g/kg in 50–100 mL water.
  - If > 6 years of age: 20–50 g in 100–300 mL water.

LoE III[1]

Note: In the intubated patient with a protected airway, the activated charcoal can be administered via a nasogastric tube (the slurry is thick and requires administration to be pushed through a syringe).

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 doses
» 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

Whole bowel irrigation can be done for potentially toxic ingestions of substances that are:
» not absorbed by activated charcoal (e.g. iron and lithium),
» sustained-release and enteric-coated products, or
» for removal of illicit drugs in body packers.
Patients must have a protected airway, i.e. fully awake and cooperative or intubated with a depressed level of consciousness.

- Polyethylene glycol (PEG) balanced electrolyte solution, NGT:
  - Child (9 months to 6 years): 500 ml per hour
  - Child (6 to 12 years): 1000 ml per hour
  - Continue until rectal effluent is clear.

LoE III[2]

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.

SECONDARY PREVENTION

All cases of accidental poisoning require an assessment of home circumstances. The opportunity must be taken to educate childcare providers on safe storage practices, particularly of medications and household products.

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:
  > dilated pupils,
  > 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.

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 poisoning due to agricultural or stock remedy, e.g. rodenticide).

DESCRIPTION

Poisoning due to warfarin and 'super-warfarins' (long-acting warfarin) (products such as pellets, granules, wedges, blocks and powder marketed as rodent pesticides). These may be accidentally ingested by toddlers or young children.

Note: Where the history is of an unspecified rat poison or pesticide ingestion, consider other active ingredients such as amitraz and organophosphates.

DIAGNOSTIC CRITERIA

Clinical

» Signs and symptoms depend on the potency, and onset of coagulopathy may be delayed by 48–72 hours. 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 of significant ingestion at 36–72 hours post-ingestion.

GENERAL AND SUPPORTIVE MEASURES

» Observe an asymptomatic child: may be as outpatient depending on history (amount ingested) and ability to return if symptoms develop.

MEDICINE TREATMENT

ONLY if INR deranged (> 2.5 IU):
Vitamin K1, IV/oral, 1–5 mg/dose administered slowly.

Note: Intravenous solution can be used orally.

Oral vitamin K1 is usually preferred to intravenous vitamin K1 unless more rapid reversal is required (e.g. the patient is bleeding). Intravenous vitamin K1 may cause hypersensitivity reactions.

If significant bleeding present:
ADD

- Lyophilised plasma, IV, 20 mL/kg.

OR

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

Repeat vitamin K_1 dosing and length of therapy is dependent on INR response to treatment and clinical response—contact poison center for patient specific advice.

Ingestion of 'super-warfarins' 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 (TCAs) 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. Patients can deteriorate rapidly.

DIAGNOSTIC CRITERIA

» Can cause anticholinergic syndromes.
» Mainly affects the cardiovascular and nervous systems leading to:
> QRS widening,
> ventricular 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: see section 18.1: Poisoning.
  - TCAs delay gastric emptying, therefore, activated charcoal may be effective for a longer period than usual.

For hypotension:
- Sodium chloride 0.9% or Ringer's Lactate, IV bolus, 20 mL/kg.

Serum alkalinisation for all patients with:
» ventricular dysrhythmias,
» prolonged QRS > 100 ms,
» hypotension unresponsive to fluids, or
» seizures.

- Sodium bicarbonate, bolus doses (1–2 mEq/kg as an 8.4% solution), to achieve a pH of 7.45–7.55. (Specialist consultation with Poisons Information Centre if possible.)
- Monitor acid-base status, serum potassium and sodium.

LoE III[3]

In severe cases, inotropic support and anti-arrhythmic agents may be required in addition to serum alkalinisation. Hypotension is due to myocardial dysfunction and alpha-adrenergic vasodilation, therefore be careful to avoid fluid overload.

For seizures:
» See Chapter 13: The Nervous System, section 13.1: Seizures.
Note: Phenytoin should be avoided (due to potential cardiotoxicity).

LoE III[4,5]

For circulatory and respiratory support:
See Chapter 1: Emergencies and Trauma, section 1.1.4: Cardiorespiratory arrest.

REFERRAL

» Any cardiac arrhythmia.

18.1.4 INGESTION OF CAUSTIC OR CORROSIVE AGENTS

T54

DESCRIPTION

Alkalis, e.g. sodium hydroxide, potassium permanganate.
Acids, e.g. hydrochloric acid.
The severity of the injury is dependent on the concentration and duration of exposure to the acid or alkali.

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/activated charcoal are contraindicated in all cases.
» Keep patient nil per mouth.
» Insertion of a NGT is contraindicated.
» Airway injury may necessitate endotracheal intubation.
» Endoscopic evaluation.

MEDICINE TREATMENT

» Prophylactic antibiotics are not indicated.
» Empiric steroid therapy is not indicated, however, based on endoscopy findings, may be appropriate (sub-specialist initiated).

For pain control:
See Chapter 20: Pain Control, section 20.1.1: Management of pain.

REFERRAL

» All symptomatic cases for endoscopic evaluation as soon as possible.

18.1.5 VOLATILE SOLVENTS

T53

DESCRIPTION

Inhalants include: spray-paint, glue and paint thinners that may contain hydrocarbons such as toluene and/or n-Hexane. If these are ingested, hydrocarbon poisoning with possible chemical pneumonitis 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 with hypoglycaemia:

- Dextrose 10%, IV, 2 mL/kg followed by 10% dextrose maintenance infusion. Titrate until blood glucose is controlled.

If patient responds 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.
- » A 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	125 mg/mL	25 mg elemental iron per mL	25 mg 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 mcg/dL (60 µmol/L).	Any of these features present: » Lethargy/decreased level of consciousness. » Metabolic acidosis. » Shock/hypotension. » Evidence of haematemesis or melaena. » Serum iron > 500 mcg/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; if history is uncertain or to assess the efficacy of gut decontamination.
» Arterial blood gas.
» Serum electrolytes.
» Liver function tests.
» 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 is recommended if:
  > > 60 mg/kg elemental iron has been ingested.
  > Modified-release preparations are ingested.
  > Undissolved tablets are still visible on abdominal X-ray.

LoE III[2]

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 resolves 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 preferably 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,
» altered mental state,
» musculoskeletal effects (pipe-like rigidity).
» autonomic instability,
» diaphoresis,

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.

» Patients with hyperthermia, muscular rigidity or seizures are more at risk for rhabdomyolysis and subsequent renal failure; test urine for myoglobin (urine test strip for haemoglobin) and serum for creatine kinase and creatinine.

MEDICINE TREATMENT

- Activated charcoal, see section 18.1: Poisoning.

For acute dystonic reactions:

- Biperidin, IV, slow injection.
  - If < 1 year of age: 1 mg.
  - If 1–6 years of age: 2 mg.
  - 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.
» Patients 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.

Note: Where the history is of an unspecified rat poison or pesticide ingestion, consider other active ingredients such as amitraz and 'super-warfarin' anticoagulants.

DIAGNOSTIC CRITERIA

Clinical

» Acute cholinergic toxidrome has central and peripheral effects.

Peripheral effects:

> Muscarinic: diarrhea, vomiting, urinary incontinence, lacrimation, pinpoint pupils, bronchorrhoea, bronchoconstriction, hyper-salivation, sweating, bradycardia, hypotension.

> Nicotinic: tachycardia, hypertension, dilated pupils, muscle weakness and fasciculations.

Cardiac features of bradycardia and tachycardia depend on whether muscarinic or nicotinic effects predominate.

Central effects:
> Nicotinic: confusion, coma, convulsions.

» Intermediate syndrome can occur within 1–4 days after recovery from cholinergic crisis. Patients develop weakness or paralysis predominantly affecting the muscles of respiration (including the neck flexors and bulbar muscles) and proximal limb muscles, sparing the distal muscles. Cranial nerves may also be affected. Supportive care is the mainstay of therapy.

LoE III[6]

» 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. If using suxamethonium or mivacurium for intubation, consider that metabolism may be delayed and prolonged respiratory support may be required. Use alternative agents if possible.

LoE III[7]

» Also monitor heart rate, pupillary size and level of consciousness.

MEDICINE TREATMENT

For bradycardia, bronchorrhoea or bronchospasm:

- Atropine bolus, IV, 0.05 mg/kg.
  - Reassess after 3–5 minutes for evidence of atropinisation as indicated by reduced bronchial secretions, dry skin, increasing heart rate and blood pressure, and dilating pupils (note: pupil dilatation may be delayed).
- Give repeated atropine boluses, incrementally doubling the dose until adequate clinical response achieved, e.g.:
  - 10 kg child: 0.5 mg, 1 mg, 2 mg, 4 mg, 8 mg, (no maximum dose).
  - If no clinical response, give double the dose.
  - If some response, give the same or reduced dose.

» 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, dilated pupils, 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 dilated pupils are not contraindications for giving atropine in the acute resuscitation setting.

Glycopyrrolate is not a substitute for atropine. However, it does not penetrate the CNS and therefore, may be useful in patients who are suffering from central cholinergic toxicity as a result of atropine but still require control of peripheral muscarinic symptoms.

- Glycopyrrolate, 0.025 mg/kg, IV.

LoE III [6]

Patients with organophosphate poisoning may be extremely agitated or develop seizures due to central toxicity. Treat both with a benzodiazepine. 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 pinpoint pupils.
» 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 the early phase 1–2 hours after ingestion. Neonates of mothers using heroin may present with withdrawal, manifested as jitteriness.

GENERAL AND SUPPORTIVE MEASURES

» Airway protection is a priority.
» Supportive care, ventilate with bag-mask device.
» Monitor oxygen saturation constantly.
» Observe for urinary retention.

MEDICINE TREATMENT

- Activated charcoal.

If respiratory depression or depressed level of consciousness:

» Provide airway support.
» Ventilate until $PaCO_2$ 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 of naloxone are necessary, a continuous IV infusion of naloxone can be instituted (0.01 mg/kg/hour).

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

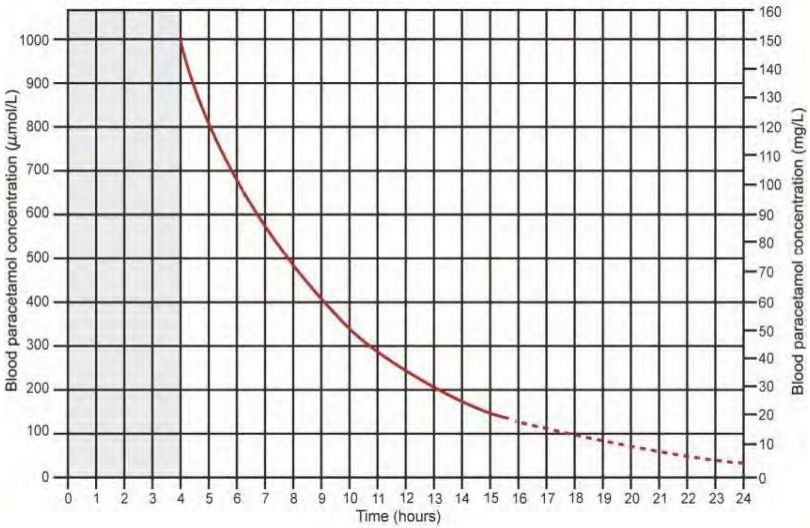
Poisoning due to paracetamol by adolescents is generally due to intentional ingestion. The accidental ingestion of paracetamol elixir preparations by toddlers very rarely causes toxicity. Toxicity can be due to acute ingestions or repeated supratherapeutic ingestion (RSTI). Toxicity due to IV paracetamol may also occur.

Patients with predisposing risk factors for hepatotoxicity, so-called ‘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 200 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, or delayed presentation (> 24 hours post-ingestion).

Repeated supratherapeutic ingestions (RSTI)

Can occur with repeated high doses of the same product or the concurrent use of multiple paracetamol-containing products.

RSTI is 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) per 24-hour period for

more than 48 hours AND patients with symptoms suggestive of liver injury.

This nomogram is not designed for use in RSTI. Management of RSTI is complex; contact the Poisons Information Helpline for advice.

LoE III[8]

Investigations

If toxic dose ingested or patient symptomatic, do:

» Serum paracetamol level.
» Baseline electrolytes.
» ALT.
» INR, if abnormal ALT or showing signs of hepatotoxicity.

MEDICINE TREATMENT

Acute ingestion:

» Gastric lavage is unlikely to be required.
» Activated charcoal can be considered for large intentional overdoses.
» 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.
» If a patient has taken a potentially toxic dose [≥ 10 g (20 tablets) or ≥ 200 mg/kg, whichever is smaller] AND the serum paracetamol level results will not be available before 8 hours post-ingestion OR the patient presents > 8 hours post-ingestion, do not delay initiation of NAC. It can always be stopped if the serum level plotted on the nomogram does not indicate its continued use.
» If the time of ingestion is unknown, start treatment for any detectable level of paracetamol or any elevation of AST or ALT.

RSTI:

Management of RSTI is complex; contact the Poisons Information Helpline for advice.

- N-Acetylcysteine, IV:
  20-hour regimen:
  - 200 mg/kg in 7 mL/kg of 5% dextrose over 4 hours.
  - Followed by 100 mg/kg in 14 mL/kg 5% dextrose over 16 hours.

  Repeat infusions according to second dose.

REFERRAL

Patients with severe hepatotoxicity as indicated by any of the following:

» INR > 2 IU at 24 hours or > 3 IU at any time after overdose,
» pH < 7.3, bicarbonate < 18 mmol/L or lactate > 3 mmol/L,
» hypotension despite adequate fluid resuscitation,
» 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.
» Remove contaminated clothes and wash skin to prevent chemical burns.

MEDICINE TREATMENT

If infection develops 48 hours after ingestion:

» See Chapter 15: Respiratory, section 15.1.1: Pneumonia.

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 almost 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 and electrolytes, urine output and urine pH.
» Monitor salicylate levels if possible (do not always correlate with clinical severity):
  > Asymptomatic: peak plasma salicylate level of < 20 mg/dL (< 30 mg/dL in adolescents).
  > Mild toxicity: Peak plasma salicylate level 20 to <45 mg/dL in child (30 to <60 mg/dL in adolescents).
  > Moderate toxicity: Peak plasma salicylate 45 to 70 mg/dL in child (60 to 80 mg/dL in adolescents).
  > Severe toxicity: Peak plasma salicylate level > 70 mg/dL in child (> 80 mg/dL in adolescents).
» Serial monitoring until declining levels are documented.
» Monitor and treat hypoglycaemia; patients with normoglycaemia may still be neuroglycopaenic.

GENERAL AND SUPPORTIVE MEASURES

» Consider gastric lavage, see section 18.1: Poisoning.
» Correct hydration.

MEDICINE TREATMENT

After gastric lavage:

- Activated charcoal.
  - May be used for up to 12 hours due to delayed gastric emptying or if sustained-release/enteric-coated preparations were ingested.

Urinary alkalinisation

If metabolic acidosis (pH < 7.3) is present and/or salicylate levels are high, give:

- Sodium bicarbonate 8.4%, IV, 1 mL/kg bolus dose to increase pH to 7.4, administered over 1 hour (with maintenance fluid).
  - Repeat bolus doses, if necessary, to maintain urine pH above 7.5.
  - Monitor urine pH hourly and potassium levels 3 hourly.

For hydration:

- 5% dextrose saline, 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.
» Only supportive treatment is necessary in most patients.

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	T½ = 10 hours
» Gliclazide	T½ = 10–12 hours
» Glimepiride	T½ = 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; see section 18.1: Poisoning.

If symptoms of hypoglycaemia are present or blood glucose is 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,
» dilated pupils,
» diaphoresis,
» hyperthermia: effects of sympathomimetics that predispose to hyperthermia include:

- peripheral vasoconstriction and impaired cutaneous heat loss,
- agitation,
- seizures,
- increased muscle activity,
- impaired behavioural response.

» With cocaine toxicity, cardiovascular manifestations predominate, including:
- supraventricular and ventricular dysrhythmias,
- myocardial ischaemia.

» Neonates of mothers using 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.

For agitation and tachycardia:

- Diazepam, IV/oral, 0.1–0.2 mg/kg.
  - Maximum dose of 10 mg.

For severe hypertension:

See Chapter 4: Cardiovascular System, section 4.11.1: Hypertension, acute severe.

For seizures:

See Chapter 13: The Nervous System, 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.

GENERAL AND SUPPORTIVE MEASURES

» Respiratory and circulatory support.

MEDICINE TREATMENT

- Activated charcoal, see section 18.1: Poisoning.

For seizures:

- 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 oral 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.

Note: Benzodiazepines and phenobarbitone may be used to control seizures (whilst pyridoxine is being prepared/given). Phenytoin should be avoided (due to potential cardiotoxicity).

LoE III[4]

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 111 µmol/L (> 20 mg/L) is considered toxic.
» Hyperglycaemia.
» Hypokalaemia.
» Respiratory alkalosis and/or metabolic acidosis.

GENERAL AND SUPPORTIVE MEASURES
» Observe all patients who have ingested 10 mg/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
- Ondansetron for vomiting. See Chapter 21: Palliative care.
- Activated charcoal. Repeated doses may be required to enhance elimination of theophylline. See section 18.1: Poisoning.
- **Note**: Phenytoin should be avoided (due to potential cardiotoxicity).

LoE III[4]

REFERRAL
Refer for consideration of haemodialysis, severe poisonings as evidenced by:
» serum theophylline > 555 µmol/L (> 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 a 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.

Note: Where the history is of an unspecified rat poison or pesticide ingestion, consider other active ingredients such as 'super-warfarin' anticoagulants and organophosphates.

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. Pinpoint pupils or dilated pupils may be present.
» Cardiovascular: bradycardia, hypotension (or hypertension).
» Respiratory depression, or tachypnoea, aspiration and chemical pneumonitis.
» Hypothermia and hyperglycaemia are common.

Amitraz poisoning can be confused with organophosphate poisoning, but it does not cause excessive sweating and salivation, urinary and faecal incontinence or muscle fasciculation which are seen with organophosphate poisoning. Furthermore, organophosphate toxicity results in reduced serum pseudocholinesterase levels.

Investigations

» Acidosis (respiratory or metabolic).
» Liver enzymes.
» Chest X-ray, if respiratory symptoms.

GENERAL AND SUPPORTIVE MEASURES

» Decontaminate skin and clothes if applicable.
» 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

- Activated charcoal, see section 18.1: Poisoning.

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.

18.1.20 ANTIRETROVIRAL AGENTS POISONING

T37.5

DESCRIPTION

» Limited data is available regarding overdose of these medicines.
» Toxicological effects are generally extensions of adverse effects.

GENERAL MEASURES

» Monitor FBC, serum electrolytes, renal and liver function.
» Monitor serum lipase in patients with abdominal pain.
» Lactic acid and serum pH should be monitored in acidotic patients.

TREATMENT

» There are no specific antidotes.
» Treatment is symptomatic and supportive.

18.1.21 CARBON MONOXIDE POISONING

Y17

DESCRIPTION

Poisoning caused by accidental or intentional exposure to fires in poorly ventilated areas, combustion engines, faulty stoves and faulty heating systems.

Patients present with:

» dizziness,
» headache,
» seizures and other CNS symptoms,
» nausea and vomiting,
» chest pain,
» tachycardia,
» high arterial carboxyhaemoglobin levels,
» impaired level of consciousness,
» retinal haemorrhages,
» respiratory alkalosis (mild),
» metabolic acidosis (severe).

Note: There may be a normal arterial PaO_2, but low oxygen saturation on pulse oximetry. Neither are useful in assessing severity of carbon monoxide poisoning. Ideally, a blood gas sample should be sent for co-oximetry to specifically detect carboxyhaemoglobin levels.

GENERAL MEASURES

» Remove patient from toxic environment.
» Ventilation may be needed in deeply comatosed patients.
» Monitor ECG and neurological status.

MEDICINE TREATMENT

» Give 100% oxygen via positive pressure facemask.
» Evidence for the benefit of hyperbaric oxygen therapy is unclear, therefore, it cannot be routinely advised.

For seizures:

- Benzodiazepines. See Chapter 13: The Nervous System, section 13.3: Status epilepticus (convulsive).
- **Note**: Phenytoin should be avoided (due to potential cardiotoxicity).

LoE:III[4]

Metabolic acidosis:
Metabolic acidosis shifts the oxygen-dissociation curve to the right and, therefore, aids in maintaining tissue oxygenation despite reduced haemoglobin carrying capacity. Metabolic acidosis should only be treated if profound and persistent, following standard treatment protocols.

Patients should be followed up after discharge for the persistence of neurocognitive symptoms.

In patients not responding to 100% oxygen, consider exposure to cyanide during the fire and refer patient urgently.

18.2 ENVENOMATION

» The management of severe envenomation, particularly by snakes and scorpions, is complex.
» Please contact the Poisons Information Helpline for advice.
  - **0861 555 777.**

18.2.1 INSECT BITES AND STINGS

T63.4 + (X29.99/X23.99) + External Cause Code (V,W,X,Y)

DESCRIPTION

Toxicity due to insect bites and stings usually results in local effects only; systemic effects are rare. Occasionally, hypersensitivity reactions are

encountered, which may vary from minor local inflammation to acute anaphylaxis.

Multiple bee stings can result in toxicity and may require ICU care.

GENERAL MEASURES

» Allergic reactions may be acutely life-threatening.
» Patients with multiple stings may develop delayed systemic toxicity. Beware of premature discharge from the healthcare facility.

MEDICINE TREATMENT

For anaphylaxis:
See Chapter 1: Emergencies and Trauma, section 1.1.3: Anaphylaxis/Anaphylactic reactions.

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

18.2.2 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 stings from other causes of pain.
» 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.
» Nausea, vomiting, tachycardia and severe agitation can also occur.
» Other serious effects include cardiac dysfunction, pulmonary oedema, and pancreatitis.

GENERAL AND SUPPORTIVE MEASURES

» If unidentified scorpion or confirmed thick-tailed scorpion, observe for a minimum of 12 hours in hospital.
» Monitor airway, breathing and circulation.
» Ventilatory support may be required.

MEDICINE TREATMENT

For pain:

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

Very painful scorpion stings

- Lidocaine (lignocaine) 2%, 2 mL injected around the sting as a local anaesthetic.

Caution
Opiates increase the risk of respiratory depression and if required, should only be used with caution in severe uncontrolled pain.

For muscle cramps:

- Calcium gluconate 10%, IV, 0.5 mL/kg by slow intravenous injection.
  - Give 0.5–1 mL/minute.
  - Monitor ECG.
  - Monitor response and repeat as needed.

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.

Obtainable from South African Vaccine Producers (SAVP):

SAVP For procurement of snake/spider/scorpion antivenom: Email: Benita.mouton@nhls.ac.za	Office hours: (011)386 6062/6063/6078 After hours: 071 680 9897

- Scorpion antivenom, slow IV, 10 mL administered over 3–5 minutes. If consistency is too thick, can be diluted in sodium chloride or 5% dextrose.

CAUTION
Never administer antivenom without being prepared to manage acute anaphylaxis.

REFERRAL

» Severe cases requiring intensive care.

18.2.3 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.
» Rinkhals has both cytotoxic and neurotoxic features.
» Venom causes severe local damage to tissues and vascular endothelium.
» Severe swelling and local necrosis occurs.

Neurotoxic venom

» Mamba, non-spitting cobra, e.g. Cape cobra, berg adder.
» Rinkhals has both cytotoxic and neurotoxic features.
» 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.

The bite site can be rather unremarkable, except for the berg adder, which also has some swelling.

Haemotoxic venom

» Boomslang, vine snake.
» Venom may cause: spontaneous bleeding, headache, dizziness, fainting.

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

Analgesia:

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

Avoid NSAIDS and aspirin due to concerns of coagulopathy.
Opioids can be used for severe pain, but should be used cautiously in neurotoxic snakebite.

All patients not immunized within the past 5 years:

- Tetanus toxoid, IM, 0.5 mL.

In children with a 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.

Antibiotics are seldom needed, except for secondary infection.

Antivenom therapy

Two types of snake antivenom are available:

- Polyvalent antivenom: active against puff adder, gaboon adder, rinkhals, green mamba, black mamba, Jameson's mamba, Cape cobra, forest cobra, snouted cobra, Mozambique spitting cobra.
- Monovalent antivenom: for boomslang bites only.

Obtainable from South African Vaccine Producers (SAVP):

SAVP For procurement of snake/spider/scorpion antivenom: Email: Benita.mouton@nhls.ac.za	Office hours: (011)386 6062/6063/6078 After hours: 071 680 9897

Indications:

» Consider antivenom in children who are persistently and severely affected even after the first day.

» Polyvalent antivenom:
  > Positively identified snake included in polyvalent antivenom AND evidence of severe cytotoxic envenomation.
  > Unidentified snake and evidence of progressive severe cytotoxic envenomation:
    - Painful swelling of whole hand/foot within 1 hour.
    - Swelling to the elbow/knee in less than 6 hours.
    - Swelling of the whole limb in less than 12 hours.
    - Swelling progression > 2.5 cm per hour.
    - A threatened airway due to swelling.
    - Evidence of complication, e.g. compartment syndrome.
    - Systemic evidence of severe cytotoxicity.
      - Shock.
      - Haematological abnormalities: INR > 1.5 IU, Hb < 8 g/dL, thrombocytopaenia (< 100 x 10^9/L) or leukocytosis (> 10 x 10^9/L).
      - Arrhythmias (rare).
  > Any signs of neurotoxicity, i.e. weakness or paralysis.

» Monovalent antivenom:
  > Positively identified boomslang AND clinical or laboratory features of coagulopathy.
  > Unidentified snakebite with evidence of coagulopathy AND no swelling at the bite site.

Administration and antivenom dose:

CAUTION
Never administer antivenom without being prepared to manage acute anaphylaxis.

» In most cases patients do not need and should not be given antivenom.
» Adverse reactions to antivenom are common and may be severe.
» Pre-medication with adrenaline (epinephrine) may reduce the risk of severe adverse reactions to polyvalent snake antivenom.

- Adrenaline (epinephrine) 1:1000, SC, 0.01 mL/kg, to a maximum of 0.25 mL.

» The dose of antivenom is the same for adults and children.
» Monitor for any deterioration in respiratory function as patients may need ventilation whether or not polyvalent antivenom has been given.
» Antivenom should be given as soon as possible, however, administration may be considered even as late as 48–72 hours after the bite, if there is continued clinical deterioration indicating ongoing venom activity.

- Polyvalent snake antivenom, IV.
  - 1 ampoule contains 10 mL antivenom.
    - Cytotoxic snakebite: give 50 mL.
    - Neurotoxic snakebite: give 80–100 mL (and up to 200 mL in black mamba bites).
  - Dilute in sodium chloride 0.9%, 50–100mL.
  - Administer IV, over 30 minutes.

LoE III[9]

- Boomslang monovalent antivenom:
  - Slow IV, 10 mL administered over 3–5 minutes.

  OR
  - IV infusion, 10–20 mL diluted in sodium chloride 0.9% or dextrose 5%, 50–100 mL administered over 5–10 minutes.

Spontaneous systemic bleeding should stop within 15–30 minutes and blood coagulability be restored within 6 hours.

» After administration of antivenom, observe patient for 24 hours.
» Contact the Poisons Information Helpline for further advice.
» Correct anaemia and bleeding tendency.

REFERRAL

» Snakebite with neurotoxic or haemotoxic manifestations may need intensive care.

18.2.4 SNAKE VENOM IN THE EYE

S05.9 + (X20.99)

DESCRIPTION

Direct or indirect snake venom exposure to the eye, particularly from various species of spitting cobras and rinkhals, can cause chemical injury with varying clinical presentations ranging from periocular swelling and mild conjunctival and corneal inflammation to frank corneal ulceration and perforation with eventual blindness.

GENERAL MEASURES

» Instill local anaesthetic and promptly perform copious irrigation for 15–20 minutes to dilute or remove the toxin with sodium chloride 0.9%.

» Apply chloramphenicol ointment and cover the affected eye with an eye patch.
» **Note**: Do not instill polyvalent antivenom in the eye or give systemically.

LoE:III[9]

REFERRAL
» Refer all patients to an ophthalmologist.

18.2.5 SPIDER BITES
T63.3

The vast majority of spiders are not harmful to humans.

18.2.5.1 SPIDER BITES, NEUROTOXIC (BUTTON/WIDOW SPIDERS)

DESCRIPTION
The term latrodectism is used to describe the systemic symptoms and signs following envenomation by the bite of the *Latrodectus* species (button or widow spiders). Most cases are caused by the bite of a black button spider; brown button spider bites are usually milder and characterized by local symptoms and signs.

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.
» Priapism may occur, especially in children.

GENERAL AND SUPPORTIVE MEASURES
» Supportive care of airway, breathing and circulation.

MEDICINE TREATMENT
Analgesia:
- Paracetamol, oral, 15 mg/kg/dose, 6 hourly as required.

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):

- *Latrodectus* spider antivenom, IV infusion, 5–10 mL diluted in sodium chloride 0.9% or dextrose 5%, 50–100 mL administered over 5–10 minutes.
- Obtainable from South African Vaccine Producers (SAVP):

SAVP For procurement of snake/spider/scorpion antivenom: Email: Benita.mouton@nhls.ac.za	Office hours: (011)386 6062/6063/6078 After hours: 071 680 9897

CAUTION
Never administer antivenom without being prepared to manage acute anaphylaxis.

18.2.5.2 SPIDER BITES, NECROTIC ARACHNIDISM

T63.3

DESCRIPTION

Violin/recluse (*Loxosceles)* spiders and sac (*Cheiracanthium*) 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 reactions, i.e. blistering, bluish discolouration progressing to frank necrosis.
» Systemic effects occasionally include nausea, vomiting, fever, chills, arthralgia, haemolysis, thrombocytopaenia, haemoglobinuria and renal failure.

GENERAL AND SUPPORTIVE MEASURES

» Supportive care.
» Surgical debridement may be required once clear margins around the necrotic lesions are established.

MEDICINE TREATMENT

For pain:

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

Antibiotic therapy for septic lesions.
Surgical debridement may be considered for large necrotic lesions.

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ABBREVIATIONS

3RH	rifampicin/isoniazid daily for 3 months
3TC	lamivudine
6H	isoniazid daily for 6 months
ABC	abacavir
ABCDE	airways, breathing, circulation, disability, exposure
ABRS	acute bacterial rhinosinusitis
ACS	abdominal compartment syndrome
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
AKI	acute kidney injury
ALP	alkaline phosphatase
ALT	alanine aminotransferase
AMAN	acute motor axonal neuropathy
AMSAN	acute motor-sensory axonal neuropathy
ANA	anti-nuclear antibody
AOM	acute otitis media
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
ATV	atazanavir
ATV/r	atazanavir/ritonavir
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 acquired methicillin-resistant Staphylococcus aureus
cART	combination antiretroviral therapy
CBT	cognitive behavioural therapy
CCF	congestive cardiac failure
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
COVID-19	coronavirus disease 2019

CP	cerebral palsy
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
CVC	central venous catheter
CVP	central venous pressure
CVT	cerebral venous thrombosis
DAT	diphtheria antitoxin treatment
DC	direct current
DEET	diethyltoluamide
DIC	disseminated intravascular coagulation
DKA	diabetic ketoacidosis
dL	decilitre
DMARDs	disease modifying antirheumatic drugs
DMD	duchenne muscular dystrophy
DMDD	disruptive mood dysregulation disorder
DNA	deoxyribonucleic acid
DOT	directly observed therapy
DPT	diphtheria, pertussis, tetanus
DR	drug resistance
DR-TB	drug resistant TB
DRESS	drug-induced rash with eosinophilia and systemic symptoms
DS	drug sensitive
DSD	disorders of sexual development
DSM	diagnostic and statistical manual
DST	drug susceptibility testing
DT	dispersible tablet

DTG	dolutegravir
E	ethambutol
ECG	electrocardiogram
eCrCl	estimated creatinine clearance
EEG	electroencephalogram
EFV	efavirenz
eGFR	estimated glomerular filtration rate
ELISA	enzyme linked immunosorbent assay
EMB	ethambutol
ENT	ear, nose and throat
EOS	early onset schizophrenia
EPI	expanded programme on immunisation
ESBL	extended spectrum beta lactamase
ESPE	extrapyramidal side effects
ESPGHAN	European Society for Paediatric Gastroenterology Hepatology and Nutrition
ESR	erythrocyte sedimentation rate
ESRF	end stage renal failure
ET	endotracheal
ETAT	emergency triage assessment and treatment
Eto	ethionamide
ETT	endotracheal tube
FBC	full blood count
FC	film coated
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

FTC	emtricitabine
FVC	forced vital capacity
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
GMFCS	gross motor function classification system
GMP	Good Manufacturing Practice
GORD	gastro-oesophageal reflux disease
GTCS	generalised tonic-clonic seizures
H	isoniazid
Hb	haemoglobin
HbA1C	glycosylated haemoglobin, type A1C
HBeAg	hepatitis B e antigen
HBsAg	hepatitis B surface antigen
HBV	hepatitis B virus
HCV	hepatitis C virus
HCV	head circumference
HGT	haemo glucose test
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
IDM	infant of a diabetic mother
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
InSTI	integrase strand transfer inhibitors
IO	intraosseous
IPPV	intermittent positive-pressure ventilation
IPT	isoniazid prevention therapy
IRDS	infant respiratory distress syndrome
IRIS	immune reconstitution inflammatory syndrome
ITP	immune thrombocytopaenic purpura
IU	international unit
IUCDs	intra-uterine contraceptive device
IV	intravenous
IVIG	intravenous immunoglobulin
J	joule
JIA	juvenile idiopathic arthritis
JVP	jugular venous pressure
KCl	potassium chloride

KDQOI	Kidney Disease Outcomes Quality Initiative
kg	kilogram
kJ	kilojoule
L	litre
LABA	long-acting beta agonist
LAST	local anaesthetic systemic toxicity
LDH	lactate dehydrogenase
LDL	low-density lipoprotein
LDL-C	low-density-lipoprotein cholesterol
LFTs	liver function tests
LGA	large for gestational age
LGE	lineal gingival erythema
LGS	Lennox-Gastaut syndrome
LIP	lymphoid interstitial pneumonitis
LMWH	low molecular weight heparin
LOC	loss of consciousness
LOD	late-onset disease
LoE	level of evidence
LP	lumbar puncture
LPV/r	lopinavir/ritonavir
LTB	laryngotracheobronchitis
MAC	mycobacterium avium complex
MAP	mean arterial pressure
MAS	meconium aspiration syndrome
MC	myasthenic crisis
mcg	microgram
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
MIS-C	multisystem inflammatory syndrome in children
mL	millilitre
mmol	millimole
MRI	magnetic resonance imaging
MRSA	methicillin-resistant Staphylococcus aureus
MTB	mycobacterium tuberculosis
MTP	massive transfusion protocol
MUAC	mid upper arm circumference
Na	sodium
NAC	N-acetyl cysteine
NAS	neonatal abstinence syndrome
NDI	nephrogenic diabetes insipidus
NDoH	National Department of Health
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
NIPS	neonatal infant pain scale
NMS	neuroleptic malignant syndrome
NNRTIs	non-nucleoside reverse transcriptase inhibitors
NRS	numeric rating scale
NRTIs	nucleoside reverse transcriptase inhibitors
NS	nephrotic syndrome
NSAIDs	nonsteroidal anti-inflammatory drugs
NTS	non-typhoid salmonella
NVP	nevirapine
OCD	obsessive compulsive disorder

ODD	oppositional defiant disorder
OME	otitis media with effusion
ORS	oral rehydration solution
OT	occupational therapy
OTC	over-the-counter
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
PICU	paediatric intensive care unit
PJP	pneumocystis jiroveci pneumonia
PML	progressive multifocal leukoencephalopathy
PMTCT	prevention of mother to child transmission
PN	parenteral nutrition
PONV	post-operative nausea and vomiting
POVOC	post-operative vomiting in children score
PPE	personal protective equipment
PPHN	persistent pulmonary hypertension of the newborn
PPN	partial parenteral nutrition
PPV	pneumococcus polysaccharide vaccine
PR	per rectum
PRN	pro re nata (as necessary)

PT	prothrombin time
PTB	pulmonary tuberculosis
PTSD	post traumatic stress disorder
PTT	partial thromboplastin time
PUV	posterior urethral valve
PZA	pyrazinamide
R	rifampicin
RBC	red blood cell
RDS	respiratory distress syndrome
RF	rheumatoid factor
R-FLACC	revised FLACC (face, legs, activity, cry, consolability)
RH	rifampicin/isoniazid
rHuEPO	recombinant human erythropoietin
RHZE	rifampicin/isoniazid/pyrazinamide/ethambutol
RIG	rabies immunoglobulin
RNA	ribonucleic acid
ROP	retinopathy of prematurity
RPR	rapid plasma reagin
RSI	rapid sequence intubation
RSTI	repeated supratherapeutic ingestion
RUTF	ready to use therapeutic food
RTV	ritonavir
SAM	severe acute malnutrition
SANCA	South African National Council on Alcoholism and Drug Dependence
SaO2	Oxygen saturation
SARS-CoV-2	Severe acute respiratory syndrome coronavirus 2
SC	subcutaneous
SD	standard deviation
SE	status epilepticus
SIADH	syndrome of inappropriate 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
SVT	supraventricular tachycardia
TA	tricuspid atresia
TAPVD	total anomalous pulmonary venous drainage
TB	tuberculosis
TBI	traumatic brain injury
TBM	tuberculous meningitis
TBW	total body water
TC	total cholesterol
TCA	tricyclic antidepressants
Td	tenus, diphtheria
TDD	total daily dose
TDF	tenofovir
TEG	thromboelastogam
TEN	toxic epidermal necrosis
TG	triglycerides
TGA	transposition of great arteries (TGA)
TIG	tetanus immunoglobulin
TLART	third-line antiretroviral therapy
TLD	tenofovir, lamivudine, dolutegravir
TOF	tetralogy of fallot
TPN	total parenteral nutrition
TPT	TB preventive therapy
TSB	total serum bilirubin
TSH	thyroid-stimulating hormone
TST	tuberculin skin test

TT	tetanus toxoid
TTN	transient tachypnoea of the newborn
TTP	thrombotic thrombocytopenia purpura
U&E	urea and electrolytes
UCT	University of Cape Town
UFH	unfractioned heparin
UGA	underweight for gestational age
URTI	upper respiratory tract infection
UTI	urinary tract infection
VBG	venuos blood gas
VEOS	very early onset schizophrenia
VF	ventricular fibrillation
VL	viral load
VLDL	very low-density lipoprotein
VP	ventriculoperitoneal
VSD	ventricular septal defect
VT	ventricular tachycardia
VTE	venous thrombo-embolism
VTP	vertical transmission prevention
WHO	World Health Organization
Wt	weight
XDR	extensively drug-resistant
Z	pyrazinamide