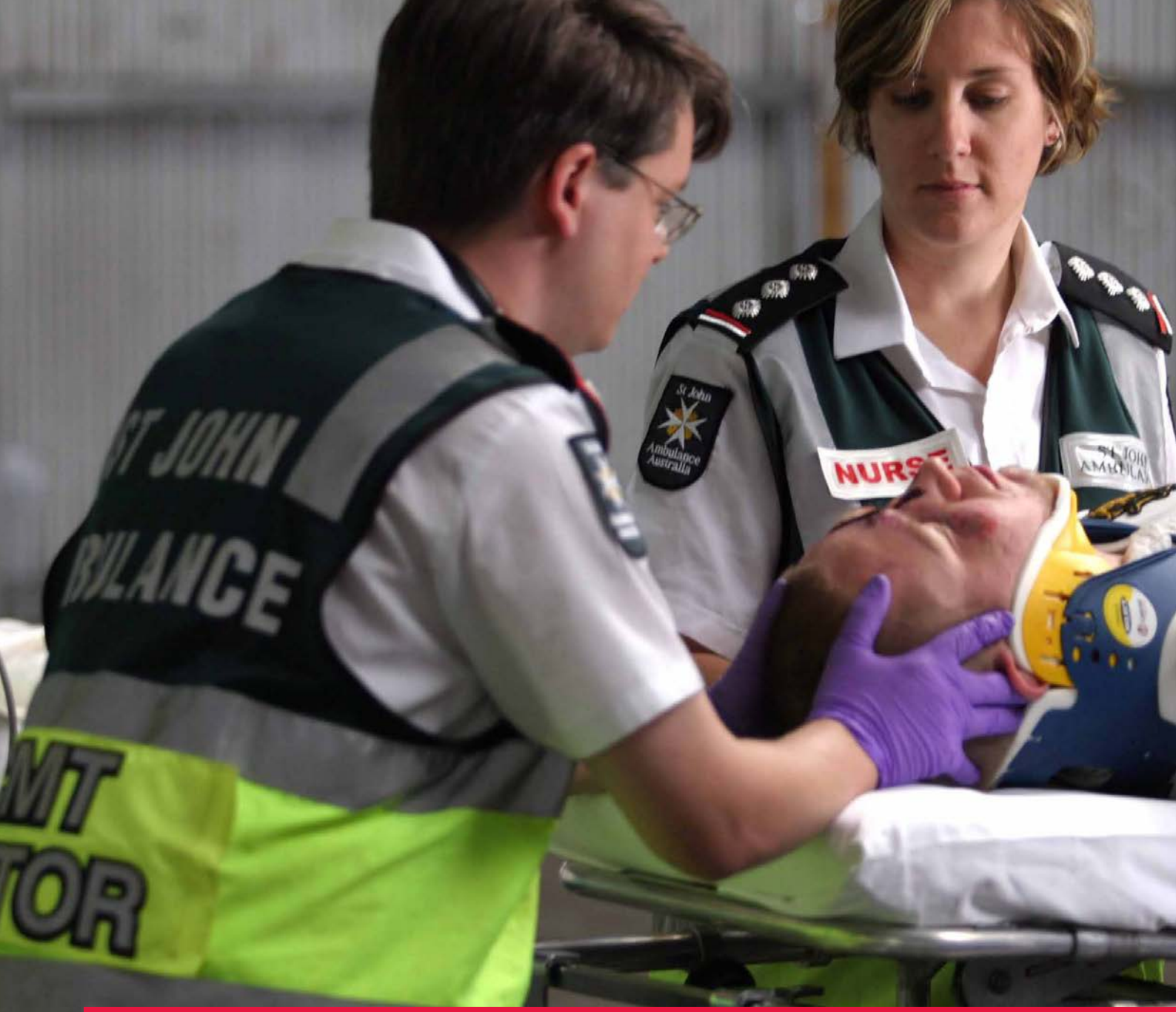

Clinical practice guidelines for health professionals

Edition 2022

St John Ambulance Australia Ltd

St John

This 2022 version of the Clinical Practice Guidelines for Health Professionals represents 'desktop reviews' undertaken by Professor Alan Eade in 2021.

It is the intention of the Clinical Governance Committee, that sections of the CPGs are reviewed annually, to ensure currency. Details of the revisions in this 2022 edition are held separately as evidence of change. They are available on request (gabrielle.lhuede@stjohn.org.au)

These CPGs have been produced as a national guideline for St John Ambulance Australia's First Aid and Event Health Services. It is acknowledged that individual State and Territory entities may have jurisdictional legislation and regulation that does not support the use of some of these protocols.

Version	Revision detail	Next revision due
Sept. 2022	Includes 'desk top' revisions. For evidence of change-available, request at gabrielle.lhuede@stjohn.org.au	March 2023
v3.1 2019	3rd edition; approved by National Board 10 August 2019	March 2020
2nd edn 2010	Revised July 2011	—
1st edn 2006	Revised 2008, 2010	—

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The production of the 2019 edition of the St John CPGs was the result of a working group led by Associate Professor Alan Eade ASM CStJ (volunteer intensive care paramedic with St John Ambulance Australia) The working group initiated and championed this project in the interests of all St John jurisdictions. The Medical Advisory Panel and National Board of St John Ambulance Australia express their thanks to Alan for chairing this project.

Thanks are also given to the Working Group members (established under the direction of Professor Peter Leggat, Chair of the Medical Advisory Panel): Mr Rob Elliot (SA Ambulance Service and Chief Paramedic, St John Ambulance Australia); Professor Glynn Kelly (Chief Medical Officer, St John Ambulance Australia); Mr Gary Lai (Registered Nurse and EHS Manager, St John Ambulance NSW); and Lt Col (Rtd) Geoff Newman-Martin (member of the Medical Advisory Panel, and St John Ambulance ACT Board member).

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Finally, grateful thanks are expressed to Mr Peter Bradley, CEO of St John Ambulance New Zealand, for giving permission to use their CPGs as the foundation for this document.

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Introduction

The **Clinical practice guidelines for health professionals** (CPGs) provide broad guidance to the health professional (HP) when providing clinical health services to patients on the behalf of St John Ambulance Australia (St John).

A health professional should only provide an intervention when they have the confidence, competence and capacity to safely do so.

All health professionals must be individually credentialed for their own scope of practice against the assessments, procedures and medications that make up the insured practice of these CPGs.

These CPGs:

- identify a limited number of specific conditions and clinical concerns that may be encountered
- provide a broad indication of acceptable management regimes
- acknowledge existing qualifications, professional accreditation and scope of practice (a prerequisite for St John practice).

These CPGs provide:

- a written outline of assessments, procedures, and medications that may be used in the St John context.
- some defined standards of patient care (e.g. capnography for intubation).

The CPGs do not dictate or restrict the practice of patient care, as they cannot remove the element of judgment necessary in each differing circumstance. They offer a range of treatment options (where appropriate) and actions within each person's scope of practice, and with the flexibility to withhold certain interventions in the interests of patient safety. However, HPs must be prepared to justify actions outside the approved CPGs and may be reliant on their own personnel indemnity insurance if they do so.

It is virtually impossible to create CPGs that take into account every unique patient presentation in the out-of-hospital situation. The CPGs form an acceptable basis for management of patients, but there may be sound clinical reasons for different therapeutic approaches. The complexity of clinical practice requires that in all cases HPs understand the individual clinical situation, and exercise independent professional judgment when basing therapy on these CPGs. These CPGs are not a substitute for seeking appropriate advice and support.

Medications

These CPGs do not include comprehensive medicine information, some of which may be important. Responsible use requires that the HP administering a medicine is familiar with the medicine HPs must check the current medication product information to verify recommended dose, method and duration of administration and contraindications. The material presented has been taken, wherever possible, from the Australian Medicines Handbook and the Therapeutic Guidelines (eTG).

It is noted that not all St John State and Territory entities will have the resources to implement all of the CPGs. States and Territories are encouraged to subscribe to those guidelines that they are able to implement within the confines of their jurisdictional state legislation, risk appetite of the event health services, training, resources and competency evidence.

The St John Medical Advisory Panel adopted the St John New Zealand **Clinical Procedures and Guidelines Comprehensive Edition 2017** as the principle resource and framework to form these CPGs. They represent the best available evidence, professional consensus and contemporary practice within the event health services context of care used around Australia by HP members of St John Ambulance Australia.

Disclaimer

The St John CPGs are contextual to the clinical practice of health professionals within St John. While all care has been taken to ensure that the information is correct at the time of publication, HPs should verify information if they are in doubt.

The CPGs remain the intellectual property of St John and may be recalled or updated at any time. Neither St John nor the Medical Advisory Panel and consulting clinicians acknowledged in this work, are responsible for any loss, damage or injury to persons (or property) as a result of, or arising out of, the information contained in these CPGs.

As research and clinical experience is constantly advancing, knowledge of new treatments and changes to medications in clinical practice are necessary. St John HPs are encouraged to continue their professional development, follow safety precautions, and deliver care within their accredited scope of practice. It is the responsibility of the HP, relying on experience and knowledge to determine the best treatment for the patient.

Communication

St John personnel should, in the first instance, contact their appropriate manager with any comments or enquiries concerning the information in these CPGs.

Otherwise, formal comments and enquiries concerning any element within these CPGs can be made to the: Secretariat, Medical Advisory Panel, St John Ambulance Australia Ltd, PO Box 292, Deakin West ACT 2600, email: publications@stjohn.org.au.

External resources

National Health and Medical Research Council - Australian guidelines for the prevention and control of infection in healthcare (2019)

Australian Medicines Handbook

The Royal Children's Hospital Melbourne - Clinical Practice Guidelines

Therapeutic Guidelines

St John Western Australia - Clinical resources

1 General information

1.1 Skill set matrix

A skill set matrix template (Excel spreadsheet) has been made available online.

This template can be used by state and territory St John event health service programs to map specific procedures, assessments, and medicines (given in these CPGs) against HPs' scopes of practice. St John Victoria, for example, use the traffic light system.

- **Med. 1** **Consultant**
- **Med. 2** **Medical practitioner** Does not include interns or consultants
- **Med. 3** **Intern** A limited scope
- **Para. 1** **Intensive Care / Critical Care Paramedic**
- **Para. 2** **Paramedic** Has completed the graduate year, or has equivalent experience
- **Para. 3** **Paramedic** Has not completed the graduate year, or does has not have equivalent experience; a limited scope
- **Nurse 1** **Nurse Practitioner**
- **Nurse 2** **Registered / Enrolled Nurse**

1.2 Infection control

The National Health and Medical Research Council's **Australian guidelines for the prevention and control of infection in healthcare (2019)** are endorsed as St John's national resource for infection prevention and control.

All HPs should apply these principles to the application of the CPGs within the St John context. While designed for use in structured health care settings, they can and should be adapted to the St John environment where health care is being delivered. Decisions around the plan of care (e.g. wound closure or wound cleaning) may be altered by the environment and the ability to achieve a safe environment for the patient.

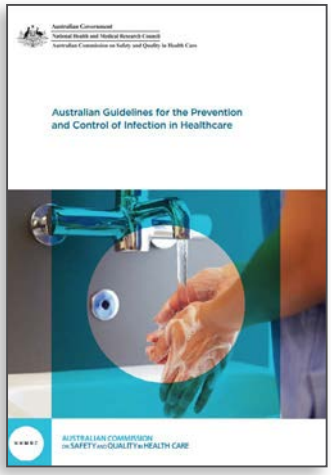
Key areas for all health professionals include:

- routine hand hygiene
- choice of product for routine hand hygiene practices
- choice of hand hygiene product when hands are visibly soiled
- wearing of aprons and gowns
- use of face and protective eye wear for procedures
- wearing of gloves
- sterile gloves
- safe handling of sharps
- disposal of single-use sharps
- routine cleaning of surfaces
- cleaning of shared clinical equipment
- surface barriers
- site decontamination after spills of blood or other potentially infectious materials
- implementation of contact precautions
- implementation of droplet precautions
- implementation of airborne precautions.

Accessing and using the guidelines

Australian guidelines for the prevention and control of infection in healthcare (2019)

The guidelines are available on an interactive 'living guidelines' platform, MAGICapp. This allows for 'point of care' use and for the guidelines to be accessed in both online and offline formats across a range of devices through an application or web browser.



1.3 Handover

Handover is a very important part of the patient's care. Standardisation of handover content and processes improves patient safety by ensuring consistency in the exchange of critical information.

All clinical handover processes need to be structured and documented. This ensures that all participants know the purpose of the handover, the required information and documentation they need to share.

Prior to handover, the HP should review the details so that they can be delivered in a proficient and succinct manner. It is important to determine what information to include because irrelevant information risks the possibility of important information not being noted.

- Aim to deliver the handover in 30–60 seconds.
- Pause at the end of the handover and ask if there are any questions.

Handover should occur:

- at change of shift to allocated staff
- from one St John team to another St John team
- at patient transfer to or from another care provider
- on patient discharge
- when a patient's condition warrants it.

1.3.1 ISBAR handover tool

I	**Identify**	• 'I am ... (name and role)' • 'I am calling from ... ' • 'I am calling because ... '
S	**Situation**	• 'I have a patient (age and gender) who is stable but I have concerns... • 'I have a patient (age and gender) who is unstable with rapid/slow deterioration' • The presenting symptoms are ... '
B	**Background**	'This is the background of ... ' Give pertinent information which may include: • date of admission • presenting symptoms • medications • recent vital signs • test results • status changes
A	**Assessment**	On the basis of the above: • 'The patient's condition is ... ' • 'They are at risk of ... ' • 'And in need of ... '
R	**Recommendation**	Be clear about what you are requesting: • 'This patient needs transfer to/review ... ' • 'Under the care of ... ' • 'In the following time frame ... '

iSoBAR and IMIST-AMBO are similar handover tools that can be used as an alternative for those HPs familiar with those processes.

1.4 Debriefing

Although debriefing is most important following an emergency, debriefing is always useful and will usually identify an area that could have been improved upon. Personnel are encouraged to debrief at least one incident each day to help embed the culture of regular self-review and continual improvement into business as usual.

A short debrief following an event should occur.

- Involve all team members.
- Discuss what aspects went well and what aspects could have been improved upon.
- If an area for improvement is identified, focus on constructive discussion on the principles and not on critique of an individual.

Post-event care and staff well being

- Everyone will respond uniquely to critical events that they experience through their work with St John. All health professionals should be mindful of the well being of those who have been involved in or witnessed the provision of care during critical illness or injury.
- Employee Assistance Programs (EAP) and similar support programs specific to jurisdictions, are available to all members of St John. They are discrete services and employees should be encouraged to make contact as needed.

Reportable events and critical incident reporting

Return of used equipment to operational service should immediately follow any interventions for the well being of members. Maintaining an operational capacity is essential to protection of the community. While critical incidents are confronting and rare in the St John context, if the event is continuing then the risk of further critical incidents remains. Ensuring that preparations are in place to service any further incidents will provide comfort to members and also to the community.

Each St John State and Territory organisation has operational procedures related to reporting of critical incidents and notifiable events. These should be followed. Where clarification is required, the relevant person on call should be contacted for advice.

1.5 Competency

The term 'competency' is used to describe the ability of a patient to be able to make informed decisions regarding their healthcare.

A competent patient has the right to make informed decisions, to refuse treatments, including life-saving treatments. They have the right to make decisions even when those decisions seem foolish, irrational or not in the patient's best interests.

A patient is presumed to be competent to make informed decisions unless there are reasonable grounds for believing a patient is not competent.

Reasonable grounds exist for determining that a patient is not competent, if the patient:

- appears unable to understand information
- appears unable to understand the consequences of their decisions
- appears unable to remember information

If personnel believe the patient is not competent to make informed decisions, treatment may be provided against the patient's will if:

- personnel believe treatment is in the patient's best interests and
- personnel believe the risks associated with providing treatment are less than the risks of not providing treatment and
- the treatment is not contradicting a valid advance directive.

A competent patient has the right to decline recommendations given to them. In this setting personnel must:

- explain the implications of the patient's decisions to them
- involve the patient's family, friends or GP, provided the patient consents to this and it is appropriate to do so
- provide the patient with appropriate advice on what to do if they do not improve
- ask the patient to sign the patient record confirming the advice
- fully document the assessment, interventions, recommendations and interactions.

When an adult patient appears to be not competent to make decisions, personnel should insist on treatment and/or transport if they believe this is in the best interest of a patient. The risks of treatment and/or transport against the patient's will must be balanced against the risks of their illness or injury. In this setting personnel must:

- encourage the patient to accept recommendations
- involve the patient's family, friends or care providers when appropriate
- take into account the patient's views and wishes if these are known
- fully document the assessment, interventions, recommendations and interactions.

1.6 Consent

Consent with children

If a patient is over the age of 18 years, they can consent to medical treatment without their parents or guardians.

A patient under the age of 18 years is competent to make decisions about medical treatment where the treatment is within their understanding and level of maturity.

The HP should consider the following factors when deciding this.

- The patient's age and maturity.
- How serious the treatment is.
- Whether the patient has the comprehension and intelligence to understand the treatment, risks and side effects and complications.
- Whether the patient has the ability to appreciate the wider consequences of the treatment (e.g. effects on family, schooling, emotional impact).

Consent in an emergency situation

No consent is required in emergency situations if it is impractical to do so.

A HP may perform emergency treatment:

- where it is not possible to communicate with the patient
- the treatment provided is reasonable in all the circumstances.

Informed consent

Informed consent is an interactive process involving communication between personnel and a patient, during which the patient gains an understanding of their condition and makes an informed choice regarding their treatment.

One of the rights is to make an informed choice and to give informed consent, noting that a competent patient has the right to refuse or withdraw consent at any time.

When a patient is not competent to make an informed choice, it may be appropriate to provide treatment without informed consent. For further information, see Competency and Referral.

1.6 Consent

Obtaining informed consent

Personnel must obtain informed consent whenever it is possible to do so.

When obtaining informed consent, personnel must fully inform the patient by providing an explanation (using non-clinical language) of:

- the nature of their condition
- the recommendations being made
- the reasons for the recommendations
- the benefits and risks of the proposed treatments, including the benefits and risks of any alternative courses of action

Personnel must also:

- introduce themselves and any others who will be providing treatment. The patient must be explicitly informed if a student is present who may perform any interventions. The patient must be given the opportunity to decline the student's involvement.
- fully assess the patient's competency to make informed decisions
- allow the patient to ask questions
- fully answer the patient's questions.

Documentation

Personnel are not required to routinely document that informed consent was obtained. However, personnel must document when a patient declines to accept information or to give consent.

1.7 Discharge

Safe and effective discharge from St John care requires planning and allocation of time. Discharge planning should commence early during patient contact and be a feature of the patient's initial reception.

For all patients, collect their contact details and the details of their support people, if present. Especially in the event environment, those available support people are very useful.

Prior to leaving St John care, the following items should be discussed with the patient, wherever possible.

- Clear summary of what brought the patient into St John care.
- What was provided in terms of care for them (e.g. procedures, medications, restraint).
- Discuss any ongoing concerns with regards to the likely diagnosis or if the diagnosis remains unclear.
- Explain the risks (if any) that remain for the patient.
- Any recommendations or advice for ongoing self-care, including time frames for this to remain in place.
- What warning signs should prompt clinical review, and how to obtain this.
- Test the patient's comprehension of the advice given and ability to undertake the recommendations.
- Confirm that the patient has the ability to implement any transportation or referral plan and assist with this where possible.
- Confirm that any referral letters, prescriptions, or discharge medication is understood, and in the patient's possession.
- Return any personal items that may have been secured.
- Offer and provide patient information. (Usually the State or Territory health department has standard advice sheets available for download from the internet, or the link can be located on the patient's device prior to discharge.)

Discharge discussions should be recorded in the clinical records.

1.8 Referral

Referral to other care providers is a common feature in the St John context. The information that patients are provided for their referrals should be of a high standard and follow existing health care standards.

Regardless of the clinical acuity of the referral, all patients who are formally referred to other providers should have some documentation associated with the referral. For example:

- a copy of the incomplete clinical records provided to the transporting paramedics
- a formal referral letter to a cardiologist provided to the patient with copies of their 12-lead ECG if they had presented for a narrow complex tachyarrhythmia that had been successfully reverted.

Referral of patients to health services may also involve the provision of telephone contact. In this circumstance, structured handover models should be used.

Copies of any referral letters should be retained in the patient's record.

1.9 Member education

St John Ambulance Australia provides online learning for all their volunteers. Go to https://memberslearning.stjohn.org.au/, and click on volunteer courses. Contact your jurisdiction's EHS Training Manager for further assistance.

All St John personnel are required to undertake the National Child and Vulnerable Persons' Safety Accredited training course.

2 General assessments

2.1 Credentialed assessments

Assessments	Subgroup
APGAR score	• appearance, pulse, grimace, activity, respiration (APGAR) score
blood pressure	• manual • non-invasive blood pressure (NIBP) • invasive (arterial line)
breath testing	• alcohol • smoke, carbon monoxide (CO)
burn surface area	• Rule of 9s • Lund and Browder • Palmer method (1%)
Canadian syncope risk score	• syncope
capillary blood testing	• glucose • ketones • lactate • coagulation (International Normalised Ratio [INR])
capnometry	• capnometry (colourmetric) • capnometry (numeric) • capnography
COAgulopathy of Severe Trauma	• COAST score
conscious state	• alert, verbal, pain, unresponsive (AVPU) • Glasgow Coma Scale (GCS)
cuff pressure (ETT [endotrachael tube])	• minimum occlusive volume • pressure manometer
delirium	• 4AT
electrocardiogram (ECG)	• limb lead/continuous monitoring • 12 lead collection • 12 lead interpretation/sign off

Assessments	Subgroup
eye examination	• acuity: Snellen's chart • ophthalmoscope
falls assessment	• falls risk assessment • timed up-and-go test
ongoing care of the critically ill patient	• FAST HUGS IN BED please
mental status exam	
myotatic stretch (deep tendon)	• reflexes
neurological	• 5-HEADS • SCAT5 • inducible clonis • memory test • finger-to-nose test • Romberg's test
neuromuscular monitoring	
neurovascular	• capillary refill • colour, warmth, movement, sensation (CWMS) pulses • Doplar
Ottowa rules	• ankle • knee
oximetry	• Carbon monoxide (SpCO) monitoring • Methaemoglobin (SpMET) monitoring • total haemoglobin measure (SpHb)
pain score/rating	• face, legs, activity, cry, consolability (FLACC) • Faces pain scale • visual analogue • numeric rating
point-of-care (POC) testing	• haematocrit • iSTAT • troponin

2.1 Credentialed assessments

Assessments	Subgroup
respiratory	• Peak expiratory flow rates - Male • Peak expiratory flow rates - female
sedation	• sedation assessment tool (SAT) • Richmond agitation score (RAS)
stroke	• Melbourne Ambulance Stroke Screen (MASS) • **f**acial drooping, **a**rm weakness, **s**peech difficulties, **t**ime to call emergency services (FAST) • large vessel occlusion tool (e.g. ACT-FAST, ABCD2 score)
Temperature	• oral • axilla • tympanic • oesophageal / rectal
thrombolysis	• checklist
ultrasound	
urine testing	• urinalysis • bHCG (Beta human chorionic gonadotropin—blood test used to diagnose pregnancy)
Verification of death	

2.2 Primary assessment

The primary assessment (a rapid survey) of the patient is the first priority, on presentation. Look for immediate threats to life and provide immediate treatment as required.

The primary assessment should take 30–60 seconds.

Any significant deterioration in the patient's condition should prompt a reassessment of the primary survey looking for a cause.

There are three intended outcomes of the primary survey.

1. Rapid recognition of cardiac arrest with immediate implementation of cardiopulmonary resuscitation (CPR), defibrillation (if required) and Adult Life Support (ALS).
2. Rapid intervention and correction of failure or insufficiency in any part of the primary survey.
3. Ensuring it is safe to progress to more detailed examinations when no immediate life threat exists.

Performing a primary assessment

Airway

1. Look and listen for signs of airway obstruction.
2. Open the airway using head tilt, chin lift and/or jaw thrust if required.
3. Utilise airway adjuncts such as a supraglottic, oropharyngeal airway and/or nasopharyngeal airway if required.
4. Consider the possibility of cervical spine injury if the patient is suffering from trauma, but the airway takes priority.

Breathing

1. Look and feel for adequate chest rise and fall.
2. Look for obvious signs of respiratory distress.
3. Assist breathing using a manual ventilation bag and mask if required.

Circulation

1. Control significant external bleeding.
2. Feel the pulse rate and strength.
3. Assess. Look and feel for abnormal peripheral perfusion/capillary refill time.

Disability

1. Check the level of consciousness using GCS (Glasgow Coma Scale) or AVPU (awake, responding to voice, responding to pain or unresponsive).
2. Then check for potential causes of unconsciousness.

Exposure, examination and environmental control

- This is the transition point between the primary and secondary survey.

2.3 Secondary assessment

The secondary survey is a 'top-to-toe' examination of the patient.

Although primarily designed for patients suffering from trauma, a secondary survey is important for all patients and should be appropriately modified if the patient is not suffering from trauma.

Do not conduct a detailed secondary survey if there are significant abnormalities in the primary survey.

Top-to-toe assessment

Central nervous system

1. Record the GCS. Individually examine and record each component.
2. Examine the pupils for asymmetry and reaction to light if the patient has an altered level of consciousness.
3. Examine movement by checking the patient can move their face and move all four limbs normally. Look for focal signs such as unilateral weakness.
4. Examine sensation by checking the patient can feel soft touch on all four limbs.
5. Watch the patient walk, if appropriate.
6. Assess short term memory, balance and coordination if appropriate.

Head, neck and face

1. Look and feel for abnormality such as deformity, tenderness, bleeding or infection.
2. Look at the jugular veins for distension once appropriately positioned.
3. Look for a medical information adjunct such as a necklace.
4. Examine the cervical spine if appropriate.

Chest

1. Look and feel for symmetry of air entry, tenderness and crepitus.
2. Look for abnormal chest wall movement.
3. Look for subtle signs of respiratory distress.
4. Auscultate. Listen anteriorly and posteriorly for symmetry of air entry and added sounds.

Abdomen and pelvis

1. Look and feel for abnormal masses, distension or tenderness.
2. Look at the pelvis and feel for tenderness, but do not examine the pelvis for signs of instability.

2.3 Secondary assessment

Extremities

1. Look and feel for wounds and fractures.
2. Look and feel for abnormality such as signs of infection or oedema.
3. Look at colour and feel warmth.
4. Re-examine peripheral capillary refill time.
5. Look for a medical information adjunct such as a bracelet.

Back and spine

1. Look and feel for tenderness or deformity.
2. Look and feel for sacral oedema.

Skin

1. Check for rashes, colour, erythema, abrasions, trauma, bruising.

2.4 Recognising and responding to clinical deterioration

The St John context is still a health care context—all usual considerations for patient safety apply. This includes the need to recognise and respond to clinical deterioration.

The following tabular guide forms the basis for recognising and responding to clinical deterioration.

Adult 16+ yrs	High risk	At risk	Low risk	At risk	High risk
RR	<5	5–9	10–24	25–29	30+
HR	<40	40–49	50–119	120–139	140+
SBP	<90	90–99	100–160	160–199	200+
Cap refill	—	3+ sec.	<3 sec.	—	—
SpO2	<90	90–94	95+	—	—
AVPU	P or U	V	A	—	—
Temp	<34·5	34·5–35·4	35·5–37·4	37·5–39·9	40·0+
BGL	<2	2·0–3·9	4·0+	—	—
PAIN	—	—	Nil	4–10	—

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Practically, this is not just an individual responsibility. All providers of care have an opportunity to raise concerns to a senior clinician, and all voices should be heard through this process.

Establishing a safe clinical environment requires attention to:

- the measurement of vital signs early in the patient contact at reception
- maintaining frequent vital signs measurement
- ensuring that the members providing care are comfortable to raise concerns at any stage
- where formalised track and trigger documentation is not available, that the table above is used to guide escalation based on vital signs
- events must have a defined escalation process. This must be communicated to all members at the commencement of the event. The 'response team' or 'resuscitation team' should have predetermined roles.

Where a patient is remaining in care for an extended period:

- the member providing the patient's primary care should undertake formal reassessment at least every 2 hours
- consider having a different member undertake the formal reassessment to ensure an unbiased and fresh approach
- senior clinician review should occur for patients after each formal review and should be recorded in the patient notes.

When vital signs must be recorded

Vital signs must be recorded when a patient is being treated under the CPGs.

- A set of vital signs includes: respiratory rate, heart rate, blood pressure, capillary refill time GCS and, where possible, SPO2 and temperature must be recorded.
- Personnel should have a lowered threshold for recording additional sets of vital signs if any of the previous set were at the outer limits of normal, or the patient receives treatment.

Vital signs must be recorded when they are a prerequisite to providing treatment (e.g. blood pressure must be recorded before administering glyceryl trinitrate).

Vital signs must be recorded following treatment that has been initiated in response to abnormal vital signs (e.g. if a crystalloid has been administered for hypotension, vital signs must be recorded after administration).

When vital signs should not be recorded

Vital signs should not be recorded if the patient has a time critical problem, and undertaking the full set of observations would delay critical lifesaving tasks. The results will not change the treatment that is provided. For example, not all vital signs need to be recorded prior to adrenaline administration if a patient has anaphylaxis that is clearly immediately life-threatening.

Clinical judgment is required if the patient is receiving end-of-life care. In this setting vital signs are not a prerequisite for providing treatment, and it is appropriate not to take recordings or perform examinations that will cause additional unnecessary discomfort.

When vital signs are not recorded (or are unable to be recorded), the reason for this must be documented on the patient record.

The frequency of vital sign recordings

Clinical judgment is required when determining how frequently to record vital signs.

- Vital signs should usually be recorded every 10–15 minutes for a patient that is unconscious or presents with serious/critical illness.
- Vital signs should usually be recorded every 20–30 minutes for patients that are of a lower acuity.

Some vital signs are monitored continually (e.g. heart rate via ECG leads) but are recorded at intervals. It is appropriate to record these if a significant change occurs, or other vital signs (e.g. blood pressure) are being recorded.

Specific vital signs

Respiratory rate Tachypnoea is a subtle but important sign related to the patient's condition. The respiratory rate must be counted and not estimated. The trend of the respiratory rate is more important than a single recording.

Heart rate Unexplained tachycardia is a subtle but an important sign that a patient is unwell or injured. The trend of the heart rate is more important than a single recording.

Blood pressure Blood pressure alone is a poor indicator of the adequacy of cardiac output. Take note of the pulse pressure and the trend, noting that a narrowed pulse pressure is a sign of vasoconstriction, usually in response to reduced cardiac output. A standing and lying/sitting blood pressure should be measured if postural hypotension may have contributed to the patient's clinical condition.

Capillary refill time In the absence of hypothermia or significant peripheral vascular disease, a prolonged capillary refill time is a sign of vasoconstriction, usually in response to reduced cardiac output. The trend of the capillary refill time is more important than a single recording.

Glasgow coma score Carefully determine each component noting that the motor score is the most important component of the GCS.

SpO2 The SPO2 should be considered in the context of the patient's respiratory efforts and work of breathing. How well a patient is breathing is also determined by clinical examination. Failure of the pulse oximeter probe to record an SpO2 is often an indication that the patient is vasoconstricted and poorly perfused.

Blood glucose It should be recorded to rule out hypoglycaemia or hyperglycaemia, taking into account the overall clinical picture.

Temperature There is no specific temperature that correlates well with severity of illness. A temperature greater than 39.9°C or below 34.5°C should usually result in a patient being referred for senior clinician review.

End tidal CO2 End tidal CO2 (ETCO2) must be measured continually via capnography and regularly recorded if the patient has been intubated with an ETT.

- ETCO2 may be measured via an LMA, noting that the trend is more important than individual recordings, as these are affected by any leak around the cuff.
- ETCO2 may be measured in a spontaneously breathing patient using nasal prongs if these are available, noting that clinical examination must be used in conjunction with the waveform and the ETCO2.

Other clinical signs

There are other clinical signs that are elicited by examining the patient. They are often just as important as the vital signs that are recorded. They include:

- features of general concern (e.g. pallor or sweating)
- airway noise (e.g. stridor or grunting)
- lung sounds (e.g. wheeze or crackles)
- signs of increased work of breathing (e.g. indrawing and nasal flaring)
- interaction and activity, particularly in small children
- the ability to mobilise normally without assistance.

2.5 APGAR score

Assign the newborn a score (0–2) for each of the five criteria at 1 minute and again at 5 minutes following delivery. Add all individual scores to calculate the total APGAR score (0–10).

APGAR	Action	0	1	2
Appearance	look at skin colour	blue/pale	pink (extremities blue)	all pink
Pulse	count heart rate	absent	less than 100	greater than 100
Grimace	monitor response—reflex irritability	no response	grimace	vigorous cough
Activity	look at muscle tone	limp	some flexion / extension	active motion
Respiration	count and assess breathes	absent	slow/irregular	good cry

- Continue to record the APGAR every 5 minutes until the total score is greater than 7.

2.6 COAgulopathy of Severe Trauma (COAST) score

A COAST score of 3 or more indicates high probability of acute traumatic coagulopathy (ATC) and suggests that the use of TXA (tranexamic acid) is indicated.

Variable	Value	Score
Entrapment (e.g. in a vehicle)	☐ Yes	☐ 1
Systolic blood pressure (mmHg)	☐ 90–100 ☐ less than 90	☐ 1 ☐ 2
Temperature (°C)	☐ 32–35 ☐ less than 32	☐ 1 ☐ 2
Major chest injury likely to require intervention (e.g. decompression, chest tube)	☐ Yes	☐ 1
Likely intra-abdominal or pelvic injury	☐ Yes	☐ 1
Total score		

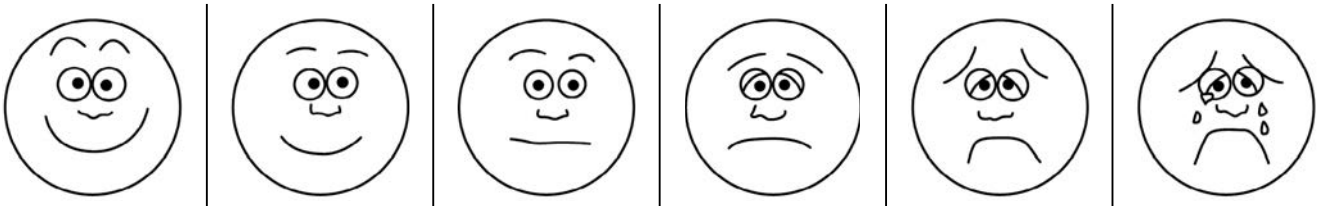
2.7 Faces pain scale

This scale is intended to measure how children feel inside, not how their face looks.

- '0' = 'no pain' and '10' = 'very much pain.'
- Do not use words like 'happy' and 'sad'.

In the following instructions, say 'hurt' or 'pain'—whichever seems right for a particular child.

- 'These faces show how much something can hurt. This face [POINT TO LEFT-MOST FACE] shows no pain'.
- The faces show more and more pain [POINT TO EACH FROM LEFT TO RIGHT] up to this one [POINT TO RIGHT-MOST FACE]—which shows a lot of pain'.
- 'Point to the face that shows how much you hurt right now'.
- Score the chosen face 0, 2, 4, 6, 8, or 10. Count left to right.



0	2	4	6	8	10
No hurt	**Hurts little bit**	**Hurts little more**	**Hurts even more**	**Hurts whole lot**	**Hurts worst**

2.8 Respiratory

2.8.1 Peak expiratory flow rates — male

Mean predicted normal values of Peak Expiratory Flow Rate (litres per second) in Caucasian men

Age (years)	Height (cm)										
	145	**150**	**155**	**160**	**165**	**170**	**175**	**180**	**185**	**190**	**195**
10	4.9	5.3	5.7	6.1	6.5	6.9	7.3	7.6	8.0	8.4	8.8
12	5.2	5.6	6.0	6.4	6.8	7.2	7.6	8.0	8.4	8.8	9.1
14	5.6	6.0	6.4	6.7	7.1	7.5	7.9	8.3	8.7	9.1	9.5
16	5.9	6.3	6.7	7.1	7.5	7.9	8.2	8.6	9.0	9.4	9.8
18	6.2	6.6	7.0	7.4	7.8	8.2	8.6	9.0	9.4	9.7	10.1
20	6.6	7.0	7.4	7.7	8.1	8.5	8.9	9.3	9.7	10.1	10.5
25	6.8	7.2	7.7	8.2	8.6	9.1	9.6	10.1	10.5	11.0	11.5
30	6.6	7.1	7.5	8.0	8.5	8.9	9.4	9.9	10.3	10.8	11.3
40	6.2	6.7	7.2	7.6	8.1	8.6	9.1	9.5	10.0	10.5	10.9
50	5.9	6.4	6.8	7.3	7.8	8.2	8.7	9.2	9.6	10.1	10.6
60	5.5	6.0	6.5	6.9	7.4	7.9	8.4	8.8	9.3	9.8	10.2
70	5.2	5.7	6.1	6.6	7.1	7.5	8.0	8.5	8.9	9.4	9.9
80	4.8	5.3	5.8	6.2	6.7	7.2	7.7	8.1	8.6	9.1	9.5

2.8.2 Peak expiratory flow rates — female

Mean predicted normal values of Peak Expiratory Flow Rate (litres per second) in Caucasian women

Age (years)	Height (cm)										
	145	150	155	160	165	170	175	180	185	190	195
10	4.8	5.0	5.2	5.5	5.7	6.0	6.2	6.5	6.7	7.0	7.2
12	5.1	5.3	5.6	5.8	6.1	6.3	6.5	6.8	7.0	7.3	7.5
14	5.4	5.6	5.9	6.1	6.4	6.6	6.9	7.1	7.3	7.6	7.8
16	5.7	5.9	6.2	6.4	6.7	6.9	7.2	7.4	7.7	7.9	8.2
18	6.0	6.3	6.5	6.8	7.0	7.2	7.5	7.7	8.0	8.2	8.5
20	5.9	6.1	6.4	6.6	6.9	7.1	7.3	7.6	7.8	8.1	8.3
25	5.7	6.0	6.2	6.5	6.7	7.0	7.2	7.5	7.7	8.0	8.2
30	5.6	5.9	6.1	6.4	6.6	6.8	7.1	7.3	7.6	7.8	8.1
40	5.4	5.6	5.9	6.1	6.4	6.6	6.8	7.1	7.3	7.6	7.8
50	5.1	5.4	5.6	5.9	6.1	6.3	6.6	6.8	7.1	7.3	7.6
60	4.9	5.1	5.4	5.6	5.9	6.1	6.3	6.6	6.8	7.1	7.3
70	4.6	4.9	5.1	5.4	5.6	5.8	6.1	6.3	6.6	6.8	7.1
80	4.4	4.6	4.9	5.1	5.4	5.6	5.8	6.1	6.3	6.6	6.8

2.9 Oximetry

2.9.1 Carbon monoxide (SpCO) monitoring

CO binds reversibly to haemoglobin (Hb) with a high affinity resulting in a temporary, relative anaemia (hypoxia). It can be measured by a carboxyhaemoglobin (COHb) level. The correlation of COHb levels and clinical features is variable. The table below is a guide for levels taken soon after exposure.

The accuracy of the COHb measurement is particularly poor after any oxygen therapy or a delay between exposure and testing (hours).

COHb results also need to be interpreted within the context of a patient's smoking and occupational exposure history.

The half-life of COHb is 4–6 hours in normal air (FiO2 21%) and ambient air that has a CO steady-state level of 35 parts per million (ppm) will result (under normal circumstances) in a COHb concentration of 5%.

Summary of acute health effects of carbon dioxide

COHb conc. %	Principal signs and symptoms
less than 2	• no significant health effects
2.5–5	• decreased exercise duration due to increased chest pain (angina) in patients with cardiovascular disease • no significant health effects expected in rest of population
5–10	• subtle neurobehavioral symptoms
10–20	• headache ('frontal tightness') • possible shortness of breath in healthy population • may be lethal for someone with severe heart disease
20–30	• throbbing headache • nausea • flushing
30–40	• severe headache • dizziness • nausea • rapid breathing
greater than 40	• collapse • coma • convulsion • death

Factors that may affect an individual's COHb level

Smoking Current smokers have a higher level of COHb than non-smokers. The blood COHb background level in these individuals is reported to be less than 10% but in clinical practice can be seen to be as high as 15–20% in heavy smokers.

Location Where they have been in the past 2 hours (e.g. in a confined space).

Other possible CO exposures for example: occupational, motor vehicle emissions or gas cooking in a confined space.

Children are more susceptible to COHb poisoning due to a higher resting respiratory rate leading to a faster accumulation of COHb. The normal reference range remains unchanged.

Maximising accuracy

- High intensity extreme lights (e.g. pulsating strobe lights) directed on the sensor may not allow the pulse CO-oximeter to obtain vital sign readings.
- High ambient light sources such as surgical lights (especially those with a xenon light source), bilirubin lamps, fluorescent lights, infrared heating lamps, and direct sunlight can interfere with the performance of the sensor.
- To prevent interference from ambient light, ensure that the sensor is properly applied: cover the sensor site with opaque material if necessary. Failure to take this precaution in high ambient light conditions may result in inaccurate measurements.
- **For increased MetHb**, the SpO2 may be decreased by levels of MetHb of up to approximately 10–15%.
- **At higher levels of MetHb**, the SpO2 may tend to read in the low to mid-80s.
- **When elevated levels of MetHb are suspected**, laboratory analysis (CO-oximetry) of a blood sample should be performed.
  - Elevated levels of methemoglobin (MetHb) will lead to inaccurate SpO2 and SpCO measurements.
  - Elevated levels of carboxyhemoglobin (COHb) will lead to inaccurate SpO2 measurements.
  - Motion artifact may lead to inaccurate SpMet and SpCO measurements.
  - Very low arterial oxygen saturation (SpO2) levels may cause inaccurate SpCO and SpMet measurements.

2.9.2 Methaemoglobin (SpMET) monitoring

What is methaemoglobin?

Methaemoglobin (MetHb) is an oxidised form of haemoglobin that is unable to carry oxygen. MetHb normally exists in small concentrations in blood: 1–2% of the total available haemoglobin.

Methaemoglobinemia (elevated levels of methaemoglobin in the blood) can be difficult to diagnose and is lethal at high levels.

- With a methaemoglobin of 3–15%, the skin can turn to pale gray or blue (cyanosis).
- With levels of 25% additional symptoms can include headache, weakness, confusion and chest pain.
- Levels above 70% may result in death if not treated immediately.

What causes methaemoglobinemia?

- Methaemoglobinemia can be congenital (rare), caused by a defect in the body's systems to reduce methaemoglobin to haemoglobin, but it is more commonly acquired.
- Acquired methaemoglobinemia can be caused by local anaesthetics (e.g. benzocaine or lidocaine), ingestion of poisonous substances (e.g. acetone: nail polish remover) or nitrates/nitrites (from contaminated well water, meat preservatives or silver nitrate burn therapy).
- Other potential causes can include industrial solvents, gun-cleaning products, prescribed medications (e.g. pyridium, nitroglycerin or antimalarials), room deodorizer propellants, mothballs, fungicides and matches, explosives or pyrotechnics.
- Elevated levels of methemoglobin (MetHb) will lead to inaccurate SpO2 and SpCO measurements.
- Elevated SpMET levels can result in a FALSE HIGH SpCO reading. A patient in a small examination space surrounded by multiple asymptomatic care providers, who has cyanosis and respiratory distress, and did not have any respiratory complaints until a few minutes ago, probably has methaemoglobinemia rather than CO toxicity.
- Elevated SpMET levels can result in a FALSE LOW SpO2 reading. It is very common for the SpO2 to sit in the mid-80s range and not change with oxygen therapy. In all cases of high SpMET readings provide oxygen.

SpMET % interpretation (methaemoglobin)

0–3%	• Normal in all patients
greater than 3%	• SpCO level may be suspect. Interpret cautiously
greater than 5%	• Do not base treatment decisions on SpCO readings
greater than 10%	• Clinically significant MET • Assess for signs and symptoms • Consult Poisons Information Centre (11 13 26) for direction
greater than 30%	• Assess for signs and symptoms • Provide oxygen • Transfer the patient to a facility where methylene blue is able to be administered

Maximising accuracy

- High intensity extreme lights (e.g. pulsating strobe lights) directed on the sensor may not allow the pulse CO-oximeter to obtain vital sign readings.
- High ambient light sources such as surgical lights (especially those with a xenon light source), bilirubin lamps, fluorescent lights, infrared heating lamps, and direct sunlight can interfere with the performance of the sensor.
- To prevent interference from ambient light, ensure that the sensor is properly applied: cover the sensor site with opaque material if necessary. Failure to take this precaution in high ambient light conditions may result in inaccurate measurements.
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- **When elevated levels of MetHb are suspected**, laboratory analysis (CO-oximetry) of a blood sample should be performed.
  - Elevated levels of methemoglobin (MetHb) will lead to inaccurate SpO2 and SpCO measurements.
  - Elevated levels of carboxyhemoglobin (COHb) will lead to inaccurate SpO2 measurements.
  - Motion artifact may lead to inaccurate SpMet and SpCO measurements.
  - Very low arterial oxygen saturation (SpO2) levels may cause inaccurate SpCO and SpMet measurements.

2.10 Ongoing care of the critically ill patient

Following the initial resuscitation and stabilisation of a critically unwell patient, they should be evaluated and have the following considered in their current and planned ongoing care.

Following any shift change, or long-term handover of care, the same process should be repeated by the oncoming HP accepting responsibility for the patient.

2.10.1 FAST HUGS IN BED please

F	Fluid therapy and feeding
A	Analgesia, antiemetics and ADT (AAA)
S	Sedation and Spontaneous breathing trial
T	Thromboprophylaxis
H	Head up position (30 degrees) if intubated
U	Ulcer prophylaxis
G	Glucose control
S	Skin/eye care and suctioning
I	Indwelling catheter
N	Nasogastric tube
B	Bowel care
E	Environment (e.g. temperature control, appropriate surroundings)
D	De-escalation (e.g. end of life issues, treatments no longer needed)
Please	Psychosocial support (for patient, family and staff)

2.11 Verification of death

Death may be verified when:

- there are clear and obvious signs of death such as decomposition, rigor mortis, incineration, hemicorporectomy, cranial destruction, decapitation or
- all of the clinical criteria below are met.

Clinical criteria

To verify death using clinical criteria:

- there must be no signs of breathing for 1 minute
- there must be no palpable central pulse
- there must be no audible heart sounds
- the pupils must be dilated and unreactive to light.

After 10 minutes, all of the above examinations must be repeated and at this time a limb lead ECG must show asystole.

A patient may be dead but may not be in asystole at the second examination after 10 minutes. For example:

- there may be slow broad complexes consistent with a dying heart. If this is the case wait until asystole is present before verifying death
- a patient with a pacemaker may have electrical activity generated by the pacemaker for many hours after death. In this setting it is appropriate to verify death despite electrical activity on the ECG, provided all of the other clinical criteria are met.

3 Procedures

3.1 Credentialed procedures

The credentialing of health professionals to perform procedures is undertaken on an individual basis. The following listed procedures are those that have been considered appropriate for the St John environment.

There is no explanation or instruction here on performance of these procedures. Education, competence, and confidence should be brought by the HP to the point of credentialing. HPs should not be dependent upon this document as a guide to the performance of the procedure.

Clinical procedure	Subgroup
administer medication	• buccal • IM (intramuscular) • intraosseous • IV (intravenous) • intranasal • nebulised • oral • rectal • SC (subcutaneous) • sublingual • topical
airway management	• endotracheal • nasopharyngeal • oropharyngeal • supraglottic (e.g. LMA [laryngeal, mask, airway]; iGEL)
airway obstruction	• Magills forceps • manual techniques
arterial line	• femoral • radial
bleeding control	• abdominal aortic compression • haemostatic dressing • junctional tourniquet • limb tourniquet • temporary closure

3.1 Credentialed procedures

Clinical procedure	Subgroup
bleeding control (obstetric)	• bi-manual compression • fundal massage
cooling techniques	• exposure, fan or air-conditioning • ice packs or cold water spray • cooled IV fluid
defibrillation	• Automated external defibrillator (AED) • manual (includes paediatric) • synchronised cardioversion
establish intraosseous access	
establish IV access (adult)	
establish IV access (paediatric)	
front of neck access (FONA)	• needle cricothyroidotomy • surgical airway
fracture	• back slab • formable splinting • reduction • traction splinting
gastric tube	• nasal • oral • percutaneous endoscopic gastrostomy (PEG) • via supraglottic airway (SGA) gastric port
infusion	• controlled delivery pump • controlled delivery syringe driver • IV gravity feed
instil eye drops	
joint relocation	• ankle • shoulder (anterior) • elbow • finger (not thumb) • hip • patella • shoulder (posterior)

3.1 Credentialed procedures

Clinical procedure	Subgroup
laryngoscopy	• direct • video
mechanical CPR	
medicine-facilitated airway	• rapid sequence induction (RIS) • sedation
patient restraint	• chemical restraint • mechanical restraint • physical restraint
regional anaesthesia	• digit • fascia illiaca
spinal clearance	• Canadian C-spine • NEXUS
thoracostomy	• finger • needle
transthoracic pacing	
urinary catheter	• suprapubic • urethral
vagal manoeuvres	• ice water • modified valsalva (REVERT) • valsalva manoeuvres
ventilation	• bilevel positive airway pressure (biPAP) • continuous positive air pressure (CPAP) • mechanical ventilation • positive end-expiratory pressure (PEEP)
warming techniques	• active self-warming blankets • heated air device (e.g. Bair hugger) • hot water bottles • warmed IV fluid
wound closure	• glue • staples • sutures • tape

3.2 Spinal clearance

Principles of trauma care

- Consider C-spine and manage as appropriate.
- Focus on maintaining airway, breathing and circulation.
- Identify and control external haemorrhage.
- Maintain adequate perfusion using minimal fluid replacement.
- Control pain using a combination of basic measures and intravenous analgesia.
- Where possible, reduce and immobilise fractures and dislocations.
- Perform comprehensive top-to-toe assessment.
- Gain IV access preferably at two sites.
- Maintain body temperature and prevent heat loss.
- In obstetric trauma, consider early fluid resuscitation to prevent placental hypoperfusion.

Primary aim of clinical management

Spinal injuries are associated with potentially significant morbidity and mortality. The primary aim of management is to prevent further damage to the spinal cord and to prevent unstable spinal column injuries (without cord damage) from damaging the spinal cord.

HPs must have a high index of suspicion of spinal injury in patients with significant injury above the clavicles (especially if unconscious) and in elderly patients (more than 65 years) following a fall (even if less than 1 month), and in those patients with pre-existing vertebral disease.

Clinical criteria for neck immobilisation / cervical collars

Patients deemed at risk of cervical spine injury should have their neck immobilised. Spinal immobilisation / precautions are indicated in blunt trauma patients with ANY of the following clinical criteria:

- altered LOC (LOC (AVPU Scale) V, P or U or / GCS<15)
- posterior midline spine tenderness (cervical, thoracic or lumbar)
- any motor or sensory deficit (i.e. weakness or paraesthesia in extremities)
- evidence of intoxication (with drugs or alcohol)
- any painful distracting injury.

Patients with pre-existing vertebral anatomical abnormalities (e.g. ankylosing spondylitis) should have their necks immobilised in a position of comfort. In such cases the use of collar is not compulsory and may be detrimental.

Cervical spine immobilisation should be maintained until full risk assessment including clinical assessment (and imaging if deemed necessary) indicates it is safe to remove the immobilisation device.

Clearance — blunt neck injury

Cervical spine imaging should be requested for the following patients that have been subjected to blunt trauma with a mechanism that may have injured the neck:

- Glasgow Coma Scale less than 15 on assessment
- paralysis, focal neurological deficit, or paraesthesia in the extremities
- severe neck pain
- patients with neck pain and any of the following high risk factors:

Apply validated cervical spine clinical decision rule.

Collar removal

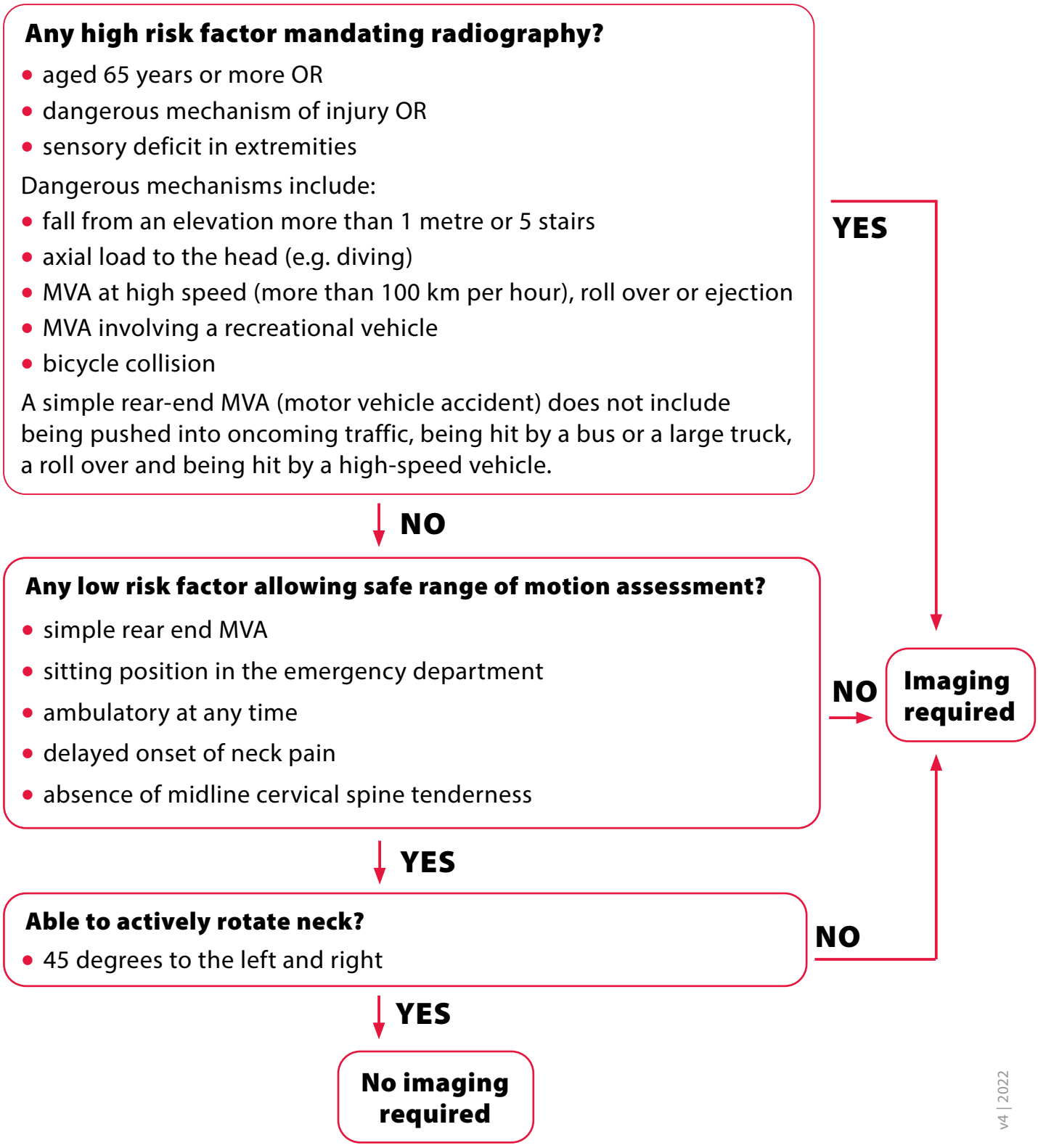
HPs should not remove cervical collars unless they have received specific training in the use of a validated cervical spine clinical decision rule.

Nurses and paramedics can safely apply clinical decision rules designed for cervical spine clearance following targeted training.

3.2 Spinal clearance

3.2.1 Canadian C-spine rule

For patients with trauma who are alert (as indicated by Glasgow Coma Scale score 15) and in a stable condition BUT where cervical spine injury is a concern, consider the use of cervical spine radiography.



3.2.2 NEXUS criteria

- Aims to identify trauma patients who are at very low risk of sustaining a spinal cord injury.
- Could be transported without spinal motion restriction.
- May be used for adults and paediatrics.
- Children may still present with spinal cord injury without radiological abnormality.

Radiography is NOT required for patients that meet ALL the following criteria.

No posterior mid-line cervical spine tenderness

Mid-line posterior body cervical spine tenderness is present if the patient:

- reports pain on palpation of the posterior midline neck from the nuchal ridge to the prominence of the first thoracic vertebra, OR
- evinces pain with direct palpation of any cervical spinous process

No evidence of intoxication

Patients should be considered intoxicated if they have:

- a recent history provided by the patient or an observer of intoxication or intoxicating ingestion
- evidence of intoxication on physical examination such as an odour of alcohol, slurred speech, ataxia, dysmetria, or other cerebellar findings or any behaviour consistent with intoxication.
- if tests of bodily secretions are positive for alcohol or drugs that affect the level of alertness

A normal level of alertness

An altered level of alterness can include any of the following:

- Glasgow Coma Scale score of 14 or less
- disorientation to person, place, time or events
- inability to remember three objects in five minutes
- a delayed or inappropriate response to external stimuli
- other findings

No focal neurologica deficit

A focal neurological deficit is any focal neurological finding on motor or sensory examination

No painful distracting injuries

Those injuries include any condition thought by the HP to be producing pain sufficient to distract the patient from a second (neck) injury. Such injuries may include:

- any long bone fracture
- a visceral injury requiring surgical consultation
- a large laceration
- degloving injury
- crush injury
- large burns
- any other injury causing acute functional impairment.

HPs may also classify any injury as distracting if it is thought to have the potential to impair the patient's ability to appreciate other injuries.

4 Management

4.1 ANZCOR flowcharts and guidelines

All the following flowcharts and guidelines can be downloaded from the Australian Resuscitation Council website.

Flowcharts: https://resus.org.au/flowcharts-3/

- Adult cardiorespiratory arrest - Jan. 2016
- Anaphylaxis (for adults and children) - Mar. 2019
- Basic life support flowchart - April 2021
- Choking (management of a foreign body airway obstruction) - Jan. 2016
- Neonatal - April 2021
- Paediatric cardiorespiratory arrest - Jan. 2016

Guidelines: https://resus.org.au/the-arc-guidelines/

- Guideline 8 Cardiopulmonary resuscitation - April 2021

Section 11 - Adult advanced life support

- Guideline 11.2 Protocols for Adult Advanced Life Support - Aug. 2018
- Guideline 11.5 Medications in Adult Cardiac Arrest - Aug. 2016
- Guideline 11.6 Equipment and Techniques in Adult Advanced Life Support - Jan. 2016
- Guideline 11.6.1 Targeted Oxygen Therapy in Adult Advanced Life Support - Jan. 2016
- Guideline 11.7 Post-Resuscitation Therapy in Adult Advanced Life Support - Jan. 2016
- Guideline 11.8 Targeted Temperature Management (TTM) after Cardiac Arrest - Jan. 2016
- Guideline 11.10 Resuscitation in Special Circumstances - Nov. 2011
- Guideline 11.10.1 Management of Cardiac Arrest due to Trauma - Apr. 2016

Section12 - Paediatric Advanced life support

- Guideline 12.1 Paediatric Basic Life Support (PBSL) for health professionals - Nov. 2021
- Guideline 12.2 Paediatric Advanced Life Support (PALS) - Nov. 2021
- Guideline 12.3 Management of other (non-arrest) arrhythmias in infants and children - Nov. 2021
- Guideline 12.4 Paediatric resuscitation in special circumstances - Nov. 2021
- Guideline 12.5 Management after return of spontaneous circulation (ROSC) - Nov. 2021

4.1 ANZCOR flowcharts and guidelines

Section 13 - Neonatal guidelines

- Guideline 13.1 Introduction to Resuscitation of the Newborn - April 2021
- Guideline 13.2 Planning for Neonatal Resuscitation and Identification of the Newborn at Risk - April 2021
- Guideline 13.3 Assessment of the Newborn - April 2021
- Guideline 13.4 Airway Management and Mask Ventilation of the Newborn - April 2021
- Guideline 13.5 Tracheal Intubation and Ventilation of the Newborn - April 2021
- Guideline 13.6 Chest Compressions during Resuscitation of the Newborn - April 2021
- Guideline 13.7 Medications or Fluids for the Resuscitation of the Newborn - April 2021
- Guideline 13.8 The Resuscitation of the Newborn in Special Circumstances - April 2021
- Guideline 13.9 After the Resuscitation of a Newborn - April 2021
- Guideline 13.10 Ethical Issues in Resuscitation of the Newborn - April 2021

4.2 Antibiotic stewardship

The implementation of appropriate antimicrobial formulary restrictions is considered a core strategy of antimicrobial stewardship in the Australian health care system.

Like other health care providers, St John uses a 'traffic light system' to guide treatments. While this is not an absolute requirement, such a system is generally considered to be a successful tool for educating prescribers about a local antimicrobial restriction policy.

St John has only GREEN (unrestricted) and ORANGE (restricted) agents in our formulary. St John does not carry RED (highly restricted) antimicrobials as the benefits are unlikely to outweigh the risks in our setting.

St John's focus is on ensuring that antimicrobials are available for indications which our HPs are likely to encounter, and for indications where a delay in administration is likely to result in harm (e.g. life-threatening infections).

St John HPs may also need to initiate antimicrobial therapy for non-urgent indications when there is likely to be a significant delay in patients accessing appropriate health care (e.g. remote locations, limited access to primary care).

We recommend treatments broadly consistent with the current version of the Therapeutic Guidelines (eTG) with adjustments to maximise benefit and minimie the total number of available agents. Consult the eTG (where possible) to confirm most contemporary practice, acknowledging the limited number of agents that will be available for use.

Limitations

The St John formulary has limited options for patients with true immediate or delayed severe hypersensitivity to penicillins.

4.2 Antibiotic stewardship

4.2.1 Antibiotic recommendations

	Severe		Mild (oral)
Indication	**First Line**	**Alternative**	
Meningitis	ceftriaxone sodium	benzylpenicillin	—
Sepsis—community acquired (source not apparent)	gentamicin + flucloxacillin	gentamicin + cefazolin[1]	—
Respiratory infections	benzylpenicillin + doxycycline	ceftriaxone sodium + doxycycline	ampicillin sodium OR doxycycline
Urinary infections	gentamicin + ampicillin sodium	ceftriaxone sodium	cefazolin OR amoxicillin OR amoxicillin with clavulanic acid OR ciprofloxacin
Skin infections	cefazolin	clindamycin[2]	di/flucloxacillin OR cefalexin OR clindamycin
Bone and joint infections	cefazolin	clindamycin	di/flucloxacillin OR cefalexin OR clindamycin
Intra-abdominal infections	ampicillin sodium + metronidazole	ceftriaxone sodium + metronidazole or gentamicin + clindamycin	—
Acute infectious diarrhoea	ceftriaxone sodium	ciprofloxacin	ciprofloxacin
Traumatic wounds	cefazolin (+/–) metronidazole[2,3]	clindamycin	di/flucloxacillin OR cefalexin OR clindamycin

4.2 Antibiotic stewardship - 4.2.1 Antibiotic recommendations

	Severe		Mild (oral)
Indication	**First Line**	**Alternative**	
Bite and clenched fist injuries	ciprofloxacin[2] + clindamycin[2]	—	amoxicillin with clavulanic acid OR metronidazole + doxycycline
Wounds exposed to water	cefazolin + ciprofloxacin	[ciprofloxacin[2] + clindamycin[2]][5]	doxycycline + cefalexin +/– metronidazole[4]
Dental infections	ampicillin sodium + metronidazole	—	amoxicillin +/– metronidazole OR clindamycin

Compiled by J Bendall. References: eTG and Australian Commission on safety and quality in health care: Antimicrobial stewardship clinical care standard

1. Lincomycin is an alternative agent; it is not recommended to carry both.
2. Has high bioavailability, therefore consider oral use.
3. Use for heavily contaminated severe injuries (e.g. such as agricultural injuries) OR wound infection associated with systemic features or deeper tissues.
4. Use for soil- or sewage-contaminated water (e.g. following a flood or natural disaster)

4.3 Pain control

Overall principles

Analgesia is usually best achieved by a combination of non-pharmacologic approaches (e.g. rest, ice, positioning, splinting) and medicines.

A combination of analgesic medicines usually provides better analgesia than one analgesic medicine.

The choice and combination of analgesic medicines administered should be escalated in proportion to the level of the patient's pain or discomfort.

For mild pain

- Administer paracetamol.
- Consider adding ibuprofen.

For moderate pain

- Consider starting with methoxyflurane if the patient is distressed.
- Administer paracetamol.
- Consider adding ibuprofen and/or tramadol and/or codeine.
- Administer an opioid and/or methoxyflurane if pain is not adequately controlled.

For severe pain

- Start with methoxyflurane if opioid administration is going to be delayed.
- Administer an opioid and titrate further doses to effect.
- Administer ketamine if pain is not adequately controlled and titrate further doses to effect.
- Consider the use of local/regional anaesthesia if appropriate.
- Do not routinely administer paracetamol and/or ibuprofen, but consider doing so once pain is sufficiently controlled for the patient to swallow medicines.
- Do not routinely administer tramadol, but consider doing so if no suitable health professional is available to administer an opioid.

Acute exacerbations of chronic pain

- Check if the patient has a management or care plan.
- Seek advice from a medical practitioner that knows the patient well, if possible.
- Avoid ketamine administration if possible, unless this is part of a management or care plan. Ketamine is not contraindicated, but it does not usually have a role in treating acute exacerbations of chronic pain and may make chronic pain worse.

4.4 Wounds

The St John HP should establish a low threshold for referral to an emergency department for patients who:

- have wounds
- a state of immunosuppression
- poor wound healing.

Treat these patients according to these CPGs, bearing in mind an increased possibility for the following complications:

- diabetic patients with vascular disease
- transplant/oncology patients
- patients with long-term steroid use
- chronic illness or multiple co-morbidities.

Infection control

Standard infection control precautions with body fluids apply at all times.

Referrals

The St John HP will initially assess, diagnose, treat and manage a patient's wound. The HP may refer the patient to another senior clinician e.g. a specialist registrar, consultant, to an emergency department, or another practitioner for wound review.

Wounds that require urgent referral include:

- damaged or divided tendons and/or nerves
- underlying fracture
- embedded or suspected foreign bodies
- post surgery dehiscence
- infected wounds or wounds with significant risk of infection.

4.4.1 Wound assessment

A physical examination should be undertaken in conjunction with, or immediately following, history. This assessment will assist in establishing a provisional diagnosis and determining treatment.

The examination will require assessment of:

- neurovascular status type, size, location and surface area of the wound
- stage of wound healing
- object of management.

4.4.1 Wound assessment

Assess for:

- pain
- bleeding
- swelling
- wound depth/length
- colour
- exudate
- odour of wound.

Imaging

Referral for radiology is indicated if:

- a foreign body is suspected, particularly glass
- there is a suspected fracture underlying the wound.

Point of care ultrasound may be useful if suitable equipment and credentialed personnel are available.

4.4.2 Wound cleansing

Effective wound cleansing is essential for good healing. The cleansing process, however, should not be tissue toxic or increase wound inflammation.

The use of antiseptics may be useful in the initial management of traumatic wounds as they help dislodge dirt, soil, and foreign bodies by suspending them in solution.

The use of sterile solutions (e.g. normal saline, see crystalloid) is always preferred, but potable/tap/drinking water can be used if a sterile solution is not available.

The continued use of antiseptics following initial management is not recommended.

Gentle cleansing

Gentle cleansing is recommended for low risk wounds i.e. not showing signs of clinical infection or contamination.

Gentle irrigation with warmed non-irritating solution (e.g. normal saline see crystalloid) or showering with water.

Vigorous cleansing

Vigorous cleansing is recommended when the patient has reduced host defences or gross contamination.

Vigorous cleansing is achieved with warmed non-irritating solutions (e.g. normal saline [see crystalloid] or water) via a syringe (e.g. 30 mL) and 18 g blunt needle which achieves a pressure enough to dislodge contaminants.

4.4.3 Wound treatment

The aim of wound treatment should be to normalise the natural healing process so that granulation and epithelialisation can occur at their optimum rates.

This treatment should:

- do no harm
- be of minimal discomfort
- provide the best cosmetic effect.

Antibiotics

Antibiotics are not indicated for simple lacerations. If the wound is heavily contaminated or at risk of infection or tetanus, commence (where available) and then refer for ongoing appropriate antibiotic cover.

Tetanus prophylaxis

Patients should be offered or referred for tetanus prophylaxis (see Guide to tetanus prophylaxis in wound management).

The recommended dose for tetanus (TIG) is 250 units, given by IM injection using a 21 gauge needle, as soon as practicable after the injury.

If more than 24 hours has elapsed, 500 units should be given.

Guide to tetanus prophylaxis in wound management

History of tetanus vaccination	Time since last dose	Type of wound	DTPa, DTPa combinations, dT, dTpa, as appropriate	Tetanus immuno-globulin
≥3 doses	less than 5 years	Clean, minor wounds	No	No
≥3 doses	less than 5 years	All other wounds	No	No (unless person has immuno-deficiency)[a]
≥3 doses	5–10 years	Clean, minor wounds	No	No
≥3 doses	5–10 years	All other wounds	Yes	No (unless person has immuno-deficiency)[a]
≥3 doses	greater than 10 years	Clean, minor wounds	Yes	No
≥3 doses	greater than 10 years	All other wounds	Yes	No (unless person has immuno-deficiency)[a]
less than 3 doses or uncertain[b]	Uncertain	Clean, minor wounds	Yes	No
less than 3 doses or uncertain[b]	Uncertain	All other wounds	Yes	Yes

a. Give tetanus immunoglobulin to people with a humoral immune deficiency and people with HIV (regardless of CD4+ count) if they have a tetanus-prone injury. This is regardless of the time since their last dose of tetanus-containing vaccine.

b. People who have no documented history of a complete primary vaccination course (3 doses) with a tetanus-containing vaccine should receive all missing doses and must receive tetanus immunoglobulin for tetanus-prone wounds. See Australian Immunisation Handbook: Catch up vaccination.

4.4.4 Wound closure

The type of wound will determine the type of closure.

- **For lacerations less than 3 cm** in length with relative superficial depth, use tissue glue.
- **For lacerations less than 5 cm** in length and not involving muscosal surfaces, give local anaesthetic (lidocaine with adrenaline (epinephrine) or lidocaine as local anaesthetic), and suture.
- Other

Site	suture diameter	days to suture removal
chest/abdomen	3/0 or 4/0	7
back	3/0 or 4/0	7–10
arm	3/0 or 4/0	7
leg	3/0 or 4/0	7

Tissue glue

Tissue glue is a topical adhesive that bonds to the outermost layer of skin to form a seal over the apposed edges of a laceration.

- Tissue glue can be used on wounds that:
  - have clean edges
  - do not require deep sutures
  - are not under tension.

It is best for wounds of less than 3 cm in length with edges easily held together.

If the forehead or in the vicinity of the eye are to be glued, an eye pad should be applied to avoid any glue dripping into the eye or onto the eyelashes.

- Wounds not to be glued, include:
  - infected or chronic wounds
  - wounds on flexor or extensor surfaces (under tension)
  - wounds that are on or near mucous membranes.

How to use tissue glue

1. Clean the wound.
2. Oppose the edges of the wound and apply a very small amount of glue to the surface, holding the edges together for 30 seconds.
3. Apply steristrips to keep wound edges in the correct position.
4. Advise the patient to keep the wound dry for 24 hours, and that the glue does not need to be removed, as it comes off in 1–2 weeks.

Caution

- Do not allow the glue to enter the wound itself (non-absorbable and acts as a foreign body).
- The tissue glue generates heat and may be uncomfortable if applied too thickly.

Suturing

Simple interrupted suturing using non-absorbable material is a common method of closing skin defects following injury.

- Prepare a suitable volume of lidocaine as local anaesthetic.
- Select an appropriate suture diameter for the location and type of wound.

Suturing is suitable for the following indications:

- adult patient ≥ 16 years-of-age
- ≤ 4 hours from injury
- the wound is an uncontaminated simple laceration
- the wound has easily apposed wound edges with non-ragged edges to minimise scar formation and healing time

If a wound has any of the following contraindications, refer the patient to their primary health provider or a health care facility:

- unable to be easily approximated
- animal or human bites, or marine injury (e.g. coral cuts)
- evidence of infection
- wounds over joints, the face (including the chin), scalp, hands, ears, armpit, genitals or feet
- obvious tissue defect of cavity (dead space) under the wound
- history of keloid scarring
- potential damaged to underlying structures (i.e. tendons or bone on view)
- skin flaps or tear.

4.4.5 Wound discharge advice

Before discharging the patient:

- instruct them about care of the wound and/or suture removal
- provide a discharge letter for follow-up with their chosen health care provider.
- Instruct the patient to seek further medical review if any of the following occurs:
  - foul odour/smell from the wound
  - inflammation/redness to the wound
  - wound feels hot
  - there is continued pain from the wound
  - pus is draining from the wound
  - a fever develops
  - there is unexpected bleeding from the wound.

Wound care

Suture wounds

- Instruct the patient to keep the wound dry for 48 hours.

Tissue glue

- Instruct the patient to keep the wound dry for 24 hours. The patient may shower after this time, although prolonged contact with water (e.g. bathing or swimming) should be avoided.
- The glue will slough off after 7–10 days.
- If concerned about the wound, seek medical review.

4.5 Respiratory

- Choking flowchart (Management of Foreign Body Airway Obstruction) - Jan. 2016
- ANZCOR Guideline 4 - Airway - April 2021

4.5.1 Asthma

Follow the individual patient's asthma action plan. Alternatively, refer below.

Mild asthma

1. Administer salbutamol 400 micrograms (4 puffs) via MDI and spacer. Repeat to a maximum total dose of 1200 micrograms.
2. If MDI and spacer not available, administer salbutamol 5 mg nebulised.
3. Repeat treatment every 20 minutes if required.

Moderate asthma

1. Administer salbutamol 400 micrograms (4 puffs) via MDI and spacer. Repeat to a maximum total dose of 1200 micrograms; AND Ipratropium bromide 20 micrograms (1 puff). Repeat to a total maximum dose of 160 micrograms.
2. If MDI and spacer not available, administer salbutamol 5 mg nebulised, and Ipratropium bromide 0.5 mg.
3. Repeat treatment every 20 minutes if required.

Severe asthma

1. Commence oxygen.
2. Administer salbutamol 5 mg nebulised in combination with ipatropium 2 0.5 mg nebulised and administer continuous salbutamol until improvement occurs. MDI and spacer may also be used.
3. Consider adrenaline (epinephrine) 0.5 mg IM if the patient is not rapidly improving, is deteriorating or becoming fatigued.
4. Gain IV access. Adrenaline (epinephrine) IM may be repeated every 10 minutes if IV access cannot be obtained.
5. Consider magnesium sulphate 10 mmol (2.47 g), IV, over 20 minutes. A second dose may be administered after 30 minutes if the patient is not improving.
6. Prednisolone 50 mg, oral, if the patient is able to swallow. Otherwise, IV steroid administration is appropriate.

Life-threatening asthma

1. Commence treatment for severe asthma.
2. Administer adrenaline (epinephrine) 0.5 mg IM. If the patient is in respiratory arrest OR severely hypoxic OR unresponsive, consider intermittent positive-pressure ventilation (IPPV) with high flow oxygen at a slow rate (4–6 ventilations per minute).
3. Consider adrenaline (epinephrine), IV, in addition to the treatments for severe asthma.
4. Consider non-invasive ventilation (NIV).

Referral

- Episodes of mild or moderate asthma which have been completely resolved may be referred for self-care and follow-up from the patient's normal health care provider.
- Asthma that does not improve, or worsens despite treatment, is a medical emergency and care should be escalated.

4.5.2 Chronic obstructive pulmonary disease (COPD)

Administration of oxygen and nebulised bronchodilators

- Only administer oxygen if the patient has an SpO2 less than 88%. Titrate the oxygen flow to maintain an SpO2 of 88–92%.

Mild and moderate COPD

- Administer salbutamol 400 micrograms (4 puffs) via MDI and spacer. Repeat to a maximum total dose of 1200 micrograms, AND
- Ipatropium 2 20 micrograms (1 puff). Repeat to a total maximum dose of 160 micrograms.
- If MDI and spacer are not available or ineffective, administer salbutamol 5 mg nebulised, and Ipratropium bromide 0.5 mg.
- Repeat treatment every 20 minutes if required.
- For moderate COPD, consider prednisolone 50 mg, oral.

Severe COPD

- Administer salbutamol 5 mg nebulised in combination with ipatropium 2 0.5 mg nebulised, and administer continuous salbutamol until improvement occurs.
- Gain IV access.
- Administer oral or IV steroid administration is appropriate.
- Consider non-invasive ventilation support. Commence at low pressures and titrate to effect.
- IPPV may be of benefit in severe respiratory failure.

Referral

- Episodes of mild or moderate COPD which have been completely resolved may be referred for self-care and follow-up from the patient's normal health care provider.
- COPD that does not improve or worsens despite treatment, is a medical emergency and care should be escalated.

4.5.3 Upper airway swelling

For any form of upper airway obstruction secondary to infection or swelling:

- consider adrenaline (epinephrine) 5 mg nebulised if swelling is causing moderate or severe respiratory distress.
- Repeat adrenaline (epinephrine) as required every 10 minutes.

4.6 Cardiac

ANZCOR flowcharts

- Adult cardiorespiratory arrest - Jan. 2016
- Neonatal - April 2021
- Paediatric cardiorespiratory arrest - Jan. 2016

ANZCOR guidelines - Section 11 Adult Advanced Life Support

- 11.2 Protocols for Adult Advanced Life Support - Aug. 2018
- 11.5 Medications in Adult Cardiac Arrest - Aug. 2016
- 11.6 Equipment and Techniques in Adult Advanced Life Support - Jan. 2016
- 11.6.1 Targeted Oxygen Therapy in Adult Advanced Life Support - Jan. 2016
- 11.10 Resuscitation in Special Circumstances - Nov. 2011
- 11.10.1 Management of Cardiac Arrest due to Trauma - Apr. 2016

4.6.1 Ischaemic chest pain

1. Attach ECG monitor if available. Obtain 12 lead ECG if available. If patient has STEMI on 12 lead ECG, arrange for URGENT transfer to hospital.
2. Establish IV access.
3. Glyceryl trinitrate 0.4 mg, spray sublingual, OR glyceryl trinitrate 0.6 mg, tablet sublingual. Repeat every 5 minutes if pain persists.
4. Aspirin 300 mg orally as a single dose.
5. Consider additional analgesia if glyceryl trinitrate does not reduce pain adequately.
6. If required, titrate oxygen.
7. Consider glyceryl trinitrate infusion.

4.6.2 Cardiogenic pulmonary oedema

1. Attach ECG monitor if available. Obtain 12 lead ECG if available. If patient has STEMI on 12 lead ECG, arrange for URGENT transfer to hospital.
2. Establish IV access.
3. Glyceryl trinitrate 0.4 mg, spray sublingual, OR glyceryl trinitrate 0.6 mg, tablet sublingual. Repeat every 5 minutes.
4. Consider aspirin 300 mg orally as a single dose
5. Consider additional analgesia if glyceryl trinitrate does not reduce pain adequately.
6. If required, titrate oxygen.
7. Consider glyceryl trinitrate infusion.
8. Consider continuous positive air pressure (CPAP)

4.6.3 Ventricular tachycardia

1. Attach ECG monitor if available. Obtain 12 lead ECG if available.
2. Attach defibrillation pads.
3. Establish IV access.
4. Do not administer glyceryl trinitrate even if the patient has cardiac chest pain.
5. If the patient IS haemodynamically stable consider amiodarone 300 mg, IV, over 20 minutes.
6. If the patient IS NOT haemodynamically stable consider procedural sedation and synchronised cardioversion. Repeat as necessary.

4.6.4 Supraventricular tachycardia (SVT)

1. Attach ECG monitor if available. Obtain 12 lead ECG if available.

- If the patient is symptomatic but normotensive:
  - valsalva manoeuvres
  - administer adenosine if the rhythm fails to revert and the patient has a history of recurrent SVT that is known to be responsive to adenosine.
- If the patient is hypotensive or symptoms become distressing to the patient:
  - reconsider the diagnosis as it is rare for SVT to cause severe compromise
  - consider procedural sedation
  - synchronised cardioversion. Repeat as necessary.

4.6.5 Atrial fibrillation

1. Consider anti-platelet therapy aspirin 300 mg, oral, and evaluate for further anti-coagulation therapy (e.g. clopidogrel, enoxaparin, heparin).

- If haemodynamically unstable (and atrial fibrillation is less than 24 hours duration), consider rate control with synchronised cardioversion.

4.6.6 Cardiogenic shock

1. Attach ECG monitor if available. Obtain 12 lead ECG if available. If patient has STEMI on 12 lead ECG, arrange for URGENT transfer to hospital.
2. Establish IV access.
3. Consider a crystalloid to a maximum 1000 mL, IV. If the patient becomes more short of breath, consider stopping fluid administration.
4. Consider inotropic support.
5. Consider vasopressor support.
6. Arrange for URGENT transfer to hospital.

4.6.7 Post-resuscitation care

See ANZCOR guidelines:

- 11.7 Post-Resuscitation Therapy in Adult Advanced Life Support - Jan. 2016
- 11.8 Targeted Temperature Management (TTM) after Cardiac Arrest - Jan. 2016

4.7 Anaphylaxis and allergy

- Adults and child 12 years and greater: ANZCOR Anaphylaxis flowchart - Mar. 2019
- Child less than 1–12 years: Anaphylaxis guidelines, Royal Children's Hospital Melbourne

4.7.1 For mild or moderate allergy

Consider oral non-sedating antihistamines:

- loratadine OR
- fexofenadine OR
- cetirizine.

If oral non-sedating antihistamines are not available, consider promethazine.

4.7.2 For severe allergy or anaphylaxis

In all patients with severe allergy which is likely to be anaphylaxis (e g hypotension, severe bronchospasm, or respiratory distress due to angioedema):

1. adrenaline (epinephrine) 10 micrograms / kg to maximum of 500 micrograms IM, or use auto-injector appropriate to the patient's weight.
2. Supine position until stable.
3. Supplemental oxygen or IPPV with slow ventilation rates if required for ineffective breathing
4. crystalloid up to 10 ml / kg, IV. Repeat if required.
5. Reassess every 5 minutes If additional adrenaline (epinephrine) is required after each 5 minutes, select either:
   - adrenaline (epinephrine) 10 micrograms / kg to maximum of 500 micrograms, IM, OR use the auto-injector appropriate to the patient's weight, OR
   - IV access and adrenaline (epinephrine) infusion.
6. The role of steroids remains unproven in anaphylaxis. Consider either oral or parenteral steroid.

4.8 Bites and stings

- Contact Poisons Information Centre 13 11 26 (24 hours).
- Clinical personnel are strongly advised to consult A Clinician's Guide to Australian Venomous Bites and Stings.

4.8.1 Snake bite

- ANZOR guideline 9.4.1 Australian Snake Bite - April 2021

In almost all cases in Australia, the spread of snake venom depends on its absorption through the lymphatic system.

General management

If the patient remains at rest, and a very firm pressure bandage is applied and the limb is splinted rapidly (e.g. within 1–2 minutes), very little venom reaches the circulation, even after several hours.

However, bandages may loosen during transport, thus reducing the effectiveness of this technique. So, the bandages should be regularly checked and if necessary a tighter bandage applied over the top of the existing bandage. Do not remove the pressure bandage in order to apply another bandage.

- All known or suspected snake bites must be treated as potentially life-threatening.
- Anyone with a suspected snake bite must be transferred to hospital for observation for at least 24 hours (and for removal of compression bandages).
- Antivenoms must only be administered where there are resuscitation and other appropriate monitoring facilities.

Signs and symptoms of envenomation

- Snake bites are not necessarily painful, whereas spider bites usually are.
- Depending on the species, the usual cause of death is respiratory failure.
- Point-of-care pathology testing is not accurate for coagulopathy associated with snake bite.

Local

- puncture marks, oedema at the site (puncture marks are not always visible)
- site may not be painful
- petechiae (small pink spots that do not blanche)
- bruising
- no signs at all

Less than 1 hour after bite

- vomiting
- headache and sweating
- transient hypotension, confusion or unconsciousness
- convulsion sometimes within 1–10 minutes after bite

1–3 hours after bite – depending on species involved

- cranial nerve paralysis: ptosis, double vision, voice changes, difficulty in swallowing
- abdominal pain
- cardiovascular effects: hypotension, tachycardia, hypertension
- increasing confusion
- dark urine (due to haemoglobinuria)
- haemorrhage
- tachycardia

Over 3 hours after bite– depending on species involved

- muscular paralysis: limb paralysis, respiratory muscle weakness or paralysis, hypoxia, cyanosis
- shock, hypoxia

Management

- ANZOR guideline 9.4.8 Pressure Immobilisation Technique - Aug. 2011

1. Do not wash, cut out, or apply a tourniquet to bite area.
2. Manage patient in a high acuity area.
3. Keep patient CALM and as STILL as possible.
4. Delay venom movement by applying effective pressure bandaging with immobilisation.
5. Apply pressure bandaging with immobilisation. DO NOT release bandaging and splinting until patient reaches the appropriate medical facility or antivenom has commenced.
6. Mark puncture site on the outside of any bandages.
7. Observe for signs of compromised circulation from the lymphatic pressure bandage.
8. Splint limb.
9. If analgesia is required use paracetamol.

10. Take careful history
11. Observe for signs of envenomation
12. Test urine: LOOK FOR BLOOD.
13. Check tetanus immunisation status.

4.8.2 Funnel-web spider bite

- ANZCOR guideline 9.4.2 Australian Spider Bite - April 2021
- ANZOR guideline 9.4.8 Pressure Immobilisation Technique - Aug. 2011
- Antivenom exists for Funnel-web Spider

Signs and symptoms

If severe systematic envenoming occurs, it develops rapidly, usually within 30 minutes and almost always within 2 hours.

- history of (usually) witnessed, painful bite by big black spider with large fangs
- severe pain at bite site, but little local reaction: no swelling or redness
- tongue and other muscle twitching, tingling of the lips
- lacrimation, piloerection (erection of the hair), sweating, hypersalivation
- abdominal pain, nausea, vomiting, headache
- hypertension, bradycardia or tachycardia
- breathlessness
- anxiety

Management

1. Apply pressure bandaging with immobilisation.
2. Check vital signs every 15 minutes.
3. Oral or IV analgesia if required.
4. Observe for signs of increasing envenomation or allergic reaction.
5. Confirm identity of spider, if possible.
6. If CPR required, prolonged resuscitation may be appropriate. URGENT transfer to hospital.

4.8.3 Red-back spider bite

- ANZCOR guideline 9.4.2 Australian Spider Bite - April 2021

Signs and symptoms

- immediate pain
- tachycardia
- sweating: localised and general
- nausea, vomiting
- abdominal pain
- headache
- untreated, symptoms may increase in severity over several hours

Management

- Do not apply pressure bandaging with immobilisation, as restricting venom movement increases pain.
- May be life-threatening to a child. URGENT transfer to hospital.

1. Wash, rest, elevate and cool the bite site.
2. Check vital signs every 15 minutes.
3. Apply ice packs wrapped to bite site for 20 minutes.
4. Oral or IV analgesia if required.
5. Observe for signs of increasing envenomation or allergic reaction.
6. Confirm identity of spider if possible.
7. Discharge advice around wound care and signs of infection.
8. Refer to hospital if pain is persistent and severe.

4.8.4 Tick bites, bee, wasp and ant stings

- ANZCOR guideline 9.4.3 Envenomation from Tick Bites and Bee, Wasp and Ant Stings - Nov. 2021

Signs and symptoms

- may cause considerable immediate pain
- allergic reaction or anaphylaxis is possible

Management

1. Ice pack to bite or sting site.
2. Remove the sting if present.
3. Ensure tetanus prophylaxis.
4. Discharge advice around wound care and signs of infection.
5. Treat for anaphylaxis if present.

4.8.5 Centipede bite

Signs and symptoms

- burning pain
- local swelling, erythema
- infection may occur, which is sometimes severe (e.g. lymphangitis, lymphadenopathy)
- systemic effects do not occur

Management

1. Wash, rest, elevate and cool.
2. May infiltrate around bite with local anaesthetic.
3. Ensure tetanus prophylaxis.
4. Discharge advice around wound care and signs of infection.
5. For severe reactions, antihistamines and steroids may be required. Refer to health provider.

4.8.6 Scorpion sting

Signs and symptoms

- may cause intense local pain, local erythema, tenderness
- may also cause numbness or paraesthesia
- mild systemic effects may occur but are rare

Management

1. Ice pack to sting site.
2. Ensure tetanus prophylaxis.
3. Discharge advice around wound care and signs of infection.

4.8.7 Box jellyfish — tropical

- ANZCOR Guideline 9.4.5 Jellyfish stings - July 2010

Signs and symptoms

- wide (up to 1 cm) whip-like sting marks, with frosted ladder pattern
- immediate severe localised pain
- tentacles stuck to the skin
- venom acts quickly and can move rapidly to cause:
  - loss of consciousness
  - cardiac or respiratory failure or both
  - irregular heart beat
- death may be very rapid

Management

1. BLS if required - ANZCOR Basic Life Support Flowchart - April 2021
   - Do not rub site with sand or a towel.
   - Do not wash the sting with fresh water.
2. Irrigate with vinegar (acetic acid). If vinegar is not available, pick off remnants of tentacles and rinse well with sea water (not fresh water).
3. Vital signs (serial).
4. Remove adherent tentacles (not known to be harmful to receiver).

5. Apply ice packs wrapped to site for pain relief. Do not allow fresh water to contact with the injury site.
6. Insert IV cannula
7. Titrate oxygen
8. Consider IV analgesia
9. If CPR required, prolonged resuscitation may be appropriate.
10. URGENT transfer to hospital.
    - Antivenoms should be administered by medical personnel in a hospital environment where there are resuscitation and other appropriate facilities to handle any complications.
    - Prompt referral is required in tropical environments.

4.8.8 Irukandji stings (Irukandji syndrome)

- ANZCOR Guideline 9.4.5 Jellyfish stings - July 2010
- No antivenom available. (Antivenoms must only be administered where there are resuscitation and other appropriate monitoring facilities.)
- Prompt referral is required in tropical environments
- Signs and symptoms can develop 30 minutes after being stung by this jellyfish.

Signs and symptoms

- Very small or unnoticeable sting site.
- Initial symptoms:
  - patch of goose bumps on red base
  - localised sweating
  - minor brief initial pain
- Little or no immediate pain but within 5–40 minutes, dramatic signs and symptoms, including:
  - severe muscle, back, limbs or abdominal pain
  - nausea and vomiting
  - profuse sweating
  - anxiety, agitation, restlessness
  - a distressing feeling of 'impending doom'
  - coughing, restlessness

- hypertension (often severe)
- cardiac dysfunction: arrhythmia, pulmonary oedema (may be life-threatening)
- may mimic decompression illness, heart attack, acute abdomen or food poisoning

Management

1. BLS if required - ANZCOR Basic Life Support Flowchart - April 2021
2. Irrigate with vinegar (acetic acid). If vinegar is not available, pick off remnants of tentacles and rinse well with sea water (not fresh water).
3. Monitor vital signs (ECG monitoring if available. Perform 12 lead ECG).
4. Apply ice packs wrapped to site for pain relief. Do not allow fresh water to contact with the injury site.
5. Insert IV cannula.
6. Consider IV analgesia.
7. If hypertension remains after adequate analgesia, consider acute management of hypertension with glyceryl trinitrate.
8. If CPR required, prolonged resuscitation may be appropriate.

4.8.9 Jellyfish sting—non-tropical, minor

- ANZCOR Guideline 9.4.5 Jellyfish stings - July 2010

Signs and symptoms

- wheals of varying size and shape on a red base
- localised pain
- occasional symptomatic or allergic reaction

Management

1. Pick off any adherent tentacles with fingers (not known to be harmful to receiver).
2. Rinse stung area well with sea water to remove invisible stinging cells. Do not wash with fresh water.
3. Apply ice pack for pain relief.
4. Oral analgesia.
5. Administration of antihistamine for allergic reaction (skin).

4.8.10 Blue-ringed octopus and cone shell

- ANZCOR Guideline 9.4.6 Blue-Ringed Octopus and Cone Shell - July 2014
- ANZOR Guideline 9.4.8 Pressure Immobilisation Technique - Aug. 2011
- There is no antivenom available for Blue-ringed octopus or Cone shell envenomation, therefore management is supportive.

Signs and symtoms

- frequently, a painless wound
- onset often within a few minutes
- initial numbness of lips and tongue may occur
- can rapidly progress to muscle weakness, disturbance of speech and vision
- progresses to motor paralysis (e.g. swallowing and breathing difficulties, respiratory arrest)

Management

1. Apply pressure bandaging with immobilisation.
2. Keep patient still
3. If CPR required, prolonged resuscitation may be appropriate.
4. Ensure tetanus prophylaxis.
5. Do not remove pressure bandage with immobilisation until symptoms resolved.
6. URGENT transfer to hospital.

4.8.11 Fish stings (stonefish, stingray)

- ANZCOR Guideline 9.4.7 Envenomation - Fish Stings - July 2014
- There is an antivenom for stonefish stings but its efficacy for other stinging fish is uncertain.

Signs and symptoms

- immediate intense pain
- stingray barb may cause a penetrating and bleeding wound (which may necrose)
- barbs or integumentary fragments may remain in the wound
- swelling and blue or grey discolouration of sting site
- stonefish sting may cause muscle weakness, paralysis, respiratory difficulty, and hypotension and shock

Management

- Do not apply pressure bandage with immobilisation.

1. Treat bleeding first.
2. Immerse in hot water, preferably greater than 43°C (or as hot as YOU can comfortably tolerate, or immerse both of the patient's limbs, so if it is too hot the good limb will feel it), for 20 minutes.
3. IV analgesia may be required.
4. Irrigate and dress stingray wound. May require infiltration with local anaesthetic to assist with pain relief.
5. In stonefish sting, monitor vital signs. Patient may require stonefish antivenom if systemic signs of envenomation (e.g. respiratory compromise, severe pain, multiple puncture sites).
6. Ensure tetanus prophylaxis.
7. Discharge advice around wound care and signs of infection.
8. Always refer to hospital in case surgery for debridement of retained foreign body matters is required.

4.9 Burns

1. Administer oxygen if required.
2. Cool thermal burns for 20 minutes. Irrigate chemical burns for at least 30 minutes.
3. Estimate burn depth and size.
4. Cover burns with cling film or other suitable dressing after cooling.
5. Gain IV access, and consider a crystalloid, IV, to maintain adequate perfusion.
6. Administer nebulised bronchodilators if bronchospasm is prominent.

Patients requiring transfer to a hospital with a Burns Unit

- burns greater than 10% total body surface area
- circumferential partial thickness or full thickness burns
- chemical burns
- electrical burns
- special area burns i.e. face, neck, hands, feet, perineum, joint or inhalation burns

4.10 Diabetes

4.10.1 Hyperglycaemia

1. Administer a crystalloid, IV, to maintain adequate perfusion. Do not administer rapid boluses of a crystalloid, IV, unless the patient is severely shocked.
2. If transport to hospital will be delayed, consider implementing an insulin protocol.

4.10.2 Hypoglycaemia

1. Check blood sugar level.
2. When patient is fully conscious follow the patient's action plan or give oral carbohydrates followed by oral complex carbohydrates (e.g. sandwich).
3. If the patient is unable to receive oral carbohydrates:
   - Establish IV access.
   - If blood sugar level is less than 4 mmol OR the patient is unconscious, give glucose 10% 2.5–5 mL / kg (max 250 mL) OR glucose 50% 25–50 mL, IV.
   - If IV access is not available, give glucagon 1 mg, IM.
   - Recovery time may be prolonged in some patients.

4.11 Poisoning

1. Contact **Poisons Information Centre 13 11 26** (24 hours).
2. Do not induce vomiting.
3. The treatment of poisoning and overdose is rarely poison/medicine-specific and is focused on supporting airway, breathing and circulation.
4. Symptomatic management is the focus of care.

- For suspected opioid poisoning, administer naloxone if the patient has a significantly impaired level of consciousness or breathing.
- For suspected tricyclic antidepressant poisoning, consider sodium bicarbonate OR a crystalloid OR sodium chloride 3% if the patient has tachycardia, QRS prolongation, signs of poor perfusion or an altered level of consciousness. These patients will require urgent transfer to hospital for ongoing care.

4.11.1 Alcohol

- crystalloid, IV, do not speed recovery from alcohol intoxication. It is not indicated for the treatment of alcohol intoxication unless there are signs of hypovolaemia or dehydration.
- The patient may be discharged once they are obeying commands and able to mobilise safely.

4.11.2 Paracetamol poisoning

- A patient with significant paracetamol poisoning is commonly asymptomatic in the first 6–12 hours after poisoning and then usually develops nausea, vomiting and non-specific abdominal pain.
- A patient with suspected paracetamol poisoning requires transport to a hospital, even if asymptomatic.
- A patient with suspected paracetamol poisoning may require N-acetylcysteine (NAC).

4.11.3 Serotonin syndrome

- Serotonin syndrome is a time-sensitive critical illness that requires immediate intervention.
- Concurrent management of the temperature and muscle tone is required.

1. Treat agitation and increased motor tone with midazolam (midazolam may be commenced via the IM route where IV access is delayed)
2. Where a crystalloid, IV, is administered, it should be cold, if possible.
3. Apply all available external cooling strategies. s
4. Progress to intubation early, if limited or no response to sedation and cooling approaches.
5. Consider anti-serotonin medications, chlorpromazine and cyproheptadine.

4.11.4 Organophosphate poisoning

- Organophosphate poisoning may occur with deliberate ingestion of, or accidental exposure (skin or inhalation) to, pesticides containing an organophosphate.
- Adequate protection for staff is achieved by wearing nitrile gloves and overalls or a gown, unless the patient is in a confined space with an aerosolised organophosphate.

1. Administer atropine 1.2 mg IV, doubled every 5 minutes until symptoms are controlled.

4.11.5 Paraquat poisoning

- Oxygen administration following paraquat (a common herbicide) poisoning worsens outcomes in animal experimental models. For this reason it is sometimes recommended that oxygen is only administered for very severe hypoxia. There is however, little evidence to support this in humans.

1. Oxygen should be administered if required, with the minimum flow needed to achieve an SpO2 of 88%.

4.11.6 Mushroom poisoning

1. Collect vomitus to go with the patient to hospital.

4.12 Seizures and convulsions in adults

- For patients who have a known seizure disorder with a defined management plan, assist the patient or carers to follow the management plan, if available.
- For all other generalised seizures which cause (or may cause) hypoxia or physical injury:
  1. Titrate oxygen.
  2. Midazolam, IM, IV, intraosseous or IN. Repeat if required after 5 minutes if the seizure persists.
  3. If the seizure persists after 2 doses of midazolam, consider a third dose of midazolam OR commence a second line anticonvulsant if available.
  4. Prolonged refractory seizures with hypoxia that do not respond to treatment, require URGENT transfer to hospital.

4.13 Hyperthermia

1. Establish IV access.
2. Reduce temperature urgently to 38.5°C.
3. Titrate oxygen.
4. Ensure adequate blood pressure and perfusion.
5. Consider the use of cooled (refrigerated) intravenous fluid.
6. If convulsing or muscle rigidity manage as per seizures and convulsions.

4.14 Hypothermia

- Medication absorption is reduced by hypothermia. Consider avoiding or increasing the interval between any medication administration.
- Defibrillation (if required) is less effective in severe hypothermia. Consider stopping after 3 shocks. ANZCOR Guideline 7 - Automated External Defibrillation in Basic Life Support - April 2021
- Titrate oxygen.
- Consider warmed IV fluid if used.
- It may be appropriate to provide prolonged resuscitation for patients who have sudden and profound hypothermia (e.g. ice water immersion).

4.15 Sepsis

- Gain IV access, preferably at two sites.
- Administer a crystalloid, IV, to maintain adequate perfusion.
- Administer antibiotics, IV. Meningococcal septicaemia should receive benzylpenicillin and/or ceftriaxone sodium.
- Consider vasopressor support if IV fluid has not restored adequate perfusion.

4.16 Autonomic dysreflexia

- For patients with chronic spinal cord impairment and history of autonomic dysreflexia, look for cause of noxious stimuli. Minimising the stimuli is the preferred management. Stimuli may include:
  - distended bladder due to blocked/kinked catheter
  - urinary tract infection
  - bowel irritation (e.g. constipation/faecal impaction)
  - skins irritations (e.g. pressure sores, ingrown toenails, burns, sunburn)
  - burns, fractures, contracting uterus or any other event that would normally be deemed painful.
- Sit the patient up with their legs dependent.
- If the patient remains symptomatic with a systolic blood pressure greater than 180 mmHg, and no neurological abnormalities are present, consider:
  - glyceryl trinitrate 400 micrograms, SL, and repeat every 5 minutes if BP remains above 180 mmHg, OR
  - glyceryl trinitrate 300 micrograms or 600 microgram tablets and repeat every 5 minutes if BP remains above 180 mmHg
  - If ongoing and uncontrolled pain is the probable cause, consider morphine or fentanyl. Be cautious of hypotension with glyceryl trinitrate and opioids combined.

4.17 Epistaxis

- For severe bleeding that remains uncontrolled, consider topical vasoconstrictors (e.g. adrenaline (epinephrine), cophenylcaine spray).
- If bleeding is severe and continues despite topical vasoconstrictors, insert a nasal tamponade device if available.

4.18 Nausea and vomiting

- Nausea and vomiting may indicate significant underlying causative illness. Nausea and vomiting related to ingestion of alcohol or an antigen causing allergy, may benefit from gastric emptying rather than antiemetic therapy.
- Ensure that patients with nausea have adequate oxygenation and hydration.
- Administer a clinically-relevant antiemetic (e.g. ondansetron, granisatron, tropisetron, metoclopramide, prochlorperazine, promethazine).

4.19 Stroke

- Excludes stroke mimics.
- Use a validated stroke screening tool (e.g. FAST)
- Gain IV access preferably at two sites.
- Arrange transfer to a hospital with a stroke unit.

4.20 SCUBA diving emergencies

1. Position the patient flat.
2. Administer oxygen via a reservoir mask in all cases.
3. Gain IV access.
4. Administer a crystalloid, IV.
5. Provide the patient's dive computer to the ambulance service if this is available
6. Transfer to a hospital with a hyperbaric unit.

- For a list of hyperbaric medicine units in Australia and New Zealand, see SPUMS (South Pacific Underwater Medicine Society): https://spums.au/index.php/resources/hyperbaric-medicine-units-australia-new-zealand
- See also the DAN World Diving Emergency Service: http://danap.org/emergency/des_hotline.php

4.21 Shock

1. Establish adequate airway and breathing.
2. Control obvious bleeding.
3. Titrate oxygen.
4. Gain IV access preferably at two sites.
5. Place patient in a recumbent position.
6. Administer IV crystalloid. The goal is to maintain adequate perfusion using minimal fluid volumes.

4.22 Trauma

4.22.1 Severe traumatic head injury

1. Maintain systolic blood pressure of 120 mmHg.
2. Ensure 30ºC head raise with cervical spine precautions.
3. Titrate oxygen.
4. If ventilating the patient and end tidal capnography is available, maintain the EtCO2 within a normal range (35–45 mmHg).
5. Consider intubation.
6. Consider analgesia and/or sedation for agitated patients.

4.22.2 Limb injury

Beware of compartment syndrome:

- tense compartment over/around fracture (rigid to touch)
- reduced sensation distal to the fracture
- pain is out of proportion to injury
- pain on passively stretching muscle within the compartment.

The patient needs URGENT surgical decompression (within hours).

4.22.3 Compound fractures

- Do not suture any wounds.

1. Irrigate soiled and exposed bone before reduction by irrigating with copious normal saline (see crystalloids).
2. Cover wound with normal saline-soaked dressing.

4.23 Obstetrics

4.23.1 Post-partum haemorrhage (PPH)

1. Administer oxytocin 10 units, IM, into the mother's lateral thigh. If multiple babies are present, administration must be delayed until after the birth of the last baby.
2. If the placenta has not delivered, seek urgent advice regarding controlled cord traction to help deliver the placenta.
3. Gain IV access preferably at two sites.
4. Administer IV crystalloid. The goal is to maintain adequate perfusion using minimal fluid volumes.
5. Feel for the uterus at approximately umbilical level and massage it firmly using a circular motion.
6. If oxytocin is not available, encourage the baby to begin suckling or ask the patient or their partner to stimulate both nipples by gently rolling them back and forth between their fingers and thumbs for approximately 15 minutes.
7. Perform bimanual compression of the uterus if bleeding is severe and the patient is deteriorating.
8. Refer the patient to a hospital with obstetric facilities whenever feasible.

4.24 Intubation and ventilation

4.24.1 Measurement of exhaled CO2

- Intubation with an endotracheal tube (ETT) must not be attempted unless measurement of exhaled CO2 via capnography is immediately available.
- Confirmation of correct placement of the ETT via capnography must occur as the first step following placement of an ETT.
- Continuous measurement of the end tidal CO2 (ETCO2) via capnography is compulsory for all patients intubated with an ETT, including those in cardiac arrest.
- If no EtCO2 waveform is detected, or the waveform is ambiguous, then the ETT must be considered to be misplaced. Immediate action should be taken to resolve the patients' effective ventilation. Such action will likely include the removal of the ETT and the use of a different ventilation approach (e.g. BVM).

4.24.2 Rapid sequence intubation (RSI)

- Use of a RSI checklist is encouraged to maximise patient safety.
- See also: sodium thiopental, propofol, rocuronium, suxamethonium chloride, vecuronium, pancuronium bromide

4.24.3 Mechanical ventilation

- Wherever clinically appropriate, a lung-protective strategy should be used for all patients undergoing prolonged periods of mechanical ventilation.

5 Medicines

Medicines

This is the list of insured medications and the insured indications for their use.

Not all medicines listed here may be available across all St John jurisdictions. Each jurisdiction will have different legislative and regulatory permissions. Jurisdictions may choose to carry some, none, or all of them as they see appropriate to their operations. HPs should be aware of their jurisdictional requirements; States and Territories are encouraged to subscribe to those guidelines that they are able to implement within the confines of their jurisdictional state legislation.

The information contained in the following medicine profiles is only a summary. For example, only precautions and adverse effects relevant to medicine administration in the scope of the CPGs are listed.

Responsible use requires that the HP administering is familiar with these matters. HPs must check the most current medication product information to verify recommended dose, method and duration of administration and contraindications.

The material presented has been taken, wherever possible, from the Australian Medicines Handbook and the Therapeutic Guidelines, and is correct at the time of publication.

Drawing up and administering medicines

- Whenever a medicine is described for intravenous (IV) administration, the medicine may be administered using the same dose via the intraosseous route.
- Any oral liquid preparations must be prepared using a graduated syringe to ensure accurate dose delivery.

Reporting medicine errors

- Medicine errors must be appropriately reported.

For patients less than 12 years (children)

The following medications contain information across all age spectrums of use.

For specific condition guidance for patients less than 12 years, please refer to the Royal Children's Hospital (Victoria)'s Clinical Practice Guidelines.

Paediatric calculations

Age	Estimated weight (kg)
Newborn	3.5
6 months old	7
1–10 years	(Age in years x 2) + 8
11–14 years	Age in years x 3.3
Cuffed endotracheal tube (ETT) size (mm)	
Newborn to 1 year	3–4
1 year and over	(Age in years ÷ 4) + 4
Endotracheal tube length at lips (cm)	
Newborn	6 + weight in kg
Under 1 year	ETT size x 3
1 year and over	(Age in years ÷ 2) + 12

5.1 Adenosine

Mechanism of action

- Adenosine is an antidysrhythmic used for the treatment of paroxysmal supraventricular tachycardia (SVT) (page 64) .
- Adenosine is a nucleoside that depresses conduction through the AV node. This interrupts re-entry circuits within the heart and may restore sinus rhythm in patients with SVT.

Indications

- SVT causing moderate cardiovascular compromise
- recurrent SVT known to be responsive to adenosine

Contraindications

- known severe allergy
- known sick sinus syndrome without an internal pacemaker in place
- may cause severe bradycardia if the patient has sick sinus syndrome
- previous 2nd or 3rd degree heart block without an internal pacemaker in place
- may cause heart block if the patient has had previous heart block
- previous heart transplantation without an internal pacemaker in place. Following a heart transplant the heart is denervated and adenosine may cause severe bradycardia

Cautions

- **Asthma.** Adenosine may precipitate bronchospasm and should be withheld if the patient has had recurrent life-threatening attacks of bronchospasm, or is currently suffering an exacerbation of asthma.
- **COPD (chronic obstructive pulmonary disease)**. Adenosine may precipitate bronchospasm and should be withheld if the patient has had recurrent life-threatening attacks of bronchospasm or is currently suffering an exacerbation of COPD.
- **Wolff-Parkinson-White (WPW) syndrome** if the rhythm is possibly fast atrial fibrillation. Adenosine is not contraindicated in a patient with known WPW syndrome provided the rhythm is clearly SVT. If the rhythm is possibly fast atrial fibrillation, adenosine should be withheld because of the risk of precipitating VF.

Common adverse effects

- bradycardia and/or sinus pause which may be up to 30 seconds, ventricular ectopy, shortness of breath and/or an urge to breathe deeply, light-headedness, nausea and flushing, feeling of chest pressure and/or severe apprehension, bradycardia / asystole, adverse effects resolve quickly on ceasing administration

5.1 Adenosine

Use in pregnancy or breastfeeding

- Safety has not been demonstrated. However, the balance of risk is in favour of administration if indicated.

Pharmacology

- Depresses sinus node activity and slows conduction through the atrioventricular node; also produces peripheral and coronary vasodilation.
- Adenosine is rapidly taken up and metabolised within seconds by red blood cells and vascular endothelial cells.

Usual preparation

- Ampoule: 6 mg in 2 mL

Administration

- Administer undiluted as a rapid IV bolus, followed by a rapid flush of 20 mL of a crystalloid preferably via an antecubital fossa vein.

Usual onset of effect

- 5–10 seconds

Usual duration of effect

- 10–20 seconds

Dosage regimen

- 6 mg. Two further doses of 12 mg may be administered if the rhythm does not revert.

Common interactions

- Dipyridamole inhibits the cellular uptake of adenosine and may cause the duration of effect to be prolonged. Dipyridamole is a medicine that inhibits thrombus formation and is only rarely prescribed.

Special notes

- Adenosine usually causes a brief period of very low cardiac output and this often causes the patient to feel severe apprehension or an impending sense of doom. Warn the patient they may feel awful but reassure them this will pass very quickly.

Linked management

4.6.4 Supraventricular tachycardia (SVT)

5.2 Adrenaline (epinephrine)

Mechanism of action

- Adrenaline stimulates alpha and beta receptors, with the predominant effects occurring at alpha 1, beta 1 and beta 2 receptors.
- Alpha 1 stimulation causes smooth muscle contraction, vasoconstriction of blood vessels and stimulation of glycogenolysis and gluconeogenesis.
- Beta 1 stimulation causes an increase in inotropy (cardiac contractility), an increase in chronotropy (heart rate) and an increase in dromotropy (speed of electrical conduction within the heart).
- Beta 2 stimulation causes smooth muscle relaxation, skeletal muscle vasodilation, bronchodilation and stabilisation of mast cell membranes, reducing histamine release from mast cells.

Indications

- cardiac arrest
- anaphylaxis
- severe asthma or bronchospasm
- imminent respiratory arrest from COPD
- severe bradycardia
- septic shock, cardiogenic shock and neurogenic shock unresponsive to a crystalloid solution, IV
- severe stridor or croup
- intranasal for clinically significant bleeding from the nose
- topical for clinically significant bleeding from a wound

Contraindications

- none

Cautions

- myocardial ischaemia: will increase myocardial oxygen consumption
- tachydysrhythmias: will usually make tachydysrhythmias worse
- coronary insufficiency and cardiac dilatation
- non-selective beta-blockers: may result in severe hypotension
- hypovolaemia

Use in pregnancy or breastfeeding

- Safe to use in pregnancy and while breastfeeding.

5.2 Adrenaline (epinephrine)

Dosage regimen

- The dose of adrenaline (epinephrine) is dependent on the indication and the route. See the individual sections.

Pharmacology

- Direct acting sympathomimetic agent exerting its effect on alpha and beta adrenoreceptors.
- Adrenaline (epinephrine) is metabolised by the liver and taken up by sympathetic nerve endings.
- There are no significant effects from liver impairment on acute administration.

Presentation

- 1 mL ampoule 1:1000 (1 mg / mL)
- 10 mL ampoule 1:10,000 (pre-diluted) (0.1 mg / mL)
- autoinjector device with either 0.15 mg or 0.3 mg preloaded

Administration

- **Topical** Dilute each mg of adrenaline (epinephrine) to a total of 10 mL using a crystalloid. This solution contains 0.1 mg / mL. Apply topically in addition to direct pressure.
- Intranasal Dilute each mg of adrenaline (epinephrine) to a total of 10 mL using a crystalloid. This solution contains 0.1 mg / mL . Administer 2 mL of this solution into each bleeding nostril using a mucosal atomising device, in addition to direct pressure.
- **Nebulised** Administer undiluted.
- **IM** Administer undiluted. The preferred IM site is the lateral thigh. If this site is not suitable use the lateral upper arm.
- **Cardiac arrest**
  - Adults and children whose weight has been rounded to 50 kg or more: administer undiluted as an IV bolus.
  - Child under 45 kg: dilute adrenaline (epinephrine) 1 mg to a total of 10 mL using crystalloid. This solution contains 0.1 mg / mL . Draw up the dose from this solution and administer as an IV bolus.
  - IV infusion Place 1 mg of adrenaline (epinephrine) into a 1 litre bag of a crystalloid. Shake well and label. This solution contains 0.001 mg / mL .
  - Adult: administer as an IV infusion starting at 2 drops per second. Adjust the rate to the patient's condition.
  - Child aged 5–14 years: administer as an IV infusion starting at 1 drop per second. Adjust the rate to the patient's condition.

- **For all other IV administration** Place adrenaline (epinephrine) 1 mg into a 1 litre bag of a crystalloid. Shake well and label. This solution contains 0.001 mg / mL . Draw up the dose from this solution and administer as an IV bolus.
- **Adrenaline (epinephrine) infusion via controlled delivery device** is the preferred use of adrenaline (epinephrine) infusion. The resultant solution will be 60 micrograms / mL, and may be presented as 3 mg in 50 mL OR 6 mg in 100 mL depending on the device being used.

Common adverse effects

- tachycardia, tachydysrhythmia, myocardial ischaemia, ventricular ectopy, hypertension, nausea and vomiting, tremor, anxiety and sweating, hyperglycaemia

Usual onset of effect

- IV: 5–10 seconds
- IM: 2–5 minutes (dependent on absorption)
- Nebulised, intranasal and topical: on contact with the target site

Usual duration of effect

- Cardiovascular effects last 5–15 minutes
- Mast cell membrane effects may last for several hours

Common interactions

- Increased doses may be required if the patient is taking a beta-blocker or a calcium channel blocker. This effect is particularly prominent in the setting of poisoning if a large dose of a beta-blocker and/or calcium channel blocker has been taken.

Special notes

- When administering an IV infusion of adrenaline (epinephrine) using 1 mg of adrenaline (epinephrine) in a 1 litre bag of a crystalloid: 2 drops / second via a standard IV administration set will administer approximately 0.4 mg / hour of adrenaline (epinephrine).
- Infusion preparation (controlled delivery device):
  - 6 mg in 100 mL of a crystalloid solution or glucose 5% (60 micrograms / mL), OR
  - 3 mg in 50 mL of a crystalloid solution or glucose 5% (60 micrograms / mL).

Linked management

4.5.1 Asthma

4.5.3 Upper airway swelling

4.7.2 Severe allergy or anaphylaxis

4.17 Epistaxis

5.3 Amiodarone

Mechanism of action

- Amiodarone is an antidysrhythmic with a broad spectrum of activity.
- Amiodarone has predominantly class III activity. It prolongs the action potential duration, reduces automaticity and prolongs the refractory period of atrial, nodal and ventricular tissues.
- The electrophysiological effects result in a reduction in abnormal electrical activity (e.g. ectopy), a reduction in electrical conduction, a reduction in heart rate and a stabilisation of the SA and AV nodes.
- Amiodarone also causes a small increase in coronary blood flow (although this is not usually clinically significant) and a reduction in myocardial oxygen consumption by reducing inotropy (the force of cardiac contraction).

Indications

- Cardiac arrest with VF or VT at any time after the first dose of adrenaline (epinephrine).
- Sustained VT in the absence of cardiac arrest.
- Moderate cardiovascular compromise as a result of fast atrial fibrillation or fast atrial flutter.

Contraindications

- Known allergy to amiodarone or iodine.
- VT secondary to cyclic anti-depressant poisoning. In this setting, amiodarone administration can be associated with severe worsening of shock, without resolution of the rhythm.

Cautions

- None, if the patient is in cardiac arrest.
- Poor perfusion or signs of low cardiac output. Amiodarone reduces inotropy and may cause a significant fall in cardiac output, particularly when administered rapidly.
- Amiodarone causes vasodilation and may worsen hypotension, particularly when administered rapidly.
- Atrial fibrillation associated with severe sepsis. Amiodarone may cause a significant fall in cardiac output.
- Known sick sinus syndrome without an internal pacemaker in place. Amiodarone slows the heart rate and severe bradycardia may occur following reversion of a tachydysrhythmia.

5.3 Amiodarone

Cautions

- Previous 2nd or 3rd degree heart block without an internal pacemaker in place. Amiodarone slows the heart rate and severe bradycardia may occur following reversion of a tachydysrhythmia.
- Pregnancy.

Use in pregnancy or breastfeeding

- May cause harm during pregnancy. Do not administer amiodarone unless there is a strong clinical indication. May be administered if the patient is breastfeeding. Advise the patient to stop breastfeeding and seek further advice from their lead maternity carer.

Pharmacology

- Antiarrhythmic, which decreases sinus node and junctional automaticity, slows AV and bypasses tract conduction and prolongs refractory period of myocardial tissue.
- Weak beta-blocker activity.
- Amiodarone is metabolised in the liver. There are no significant effects from liver impairment on acute administration.

Presentation

- Ampoules 150 mg per 3 mL

Administration

- **Cardiac arrest**
  - Administer IV undiluted as a bolus.
- **Tachydysrhythmia**
  - Place 300 mg amiodarone in 100 mL of glucose 5% and label. 1 drop / second via a standard IV administration set will deliver 100 mL over approximately 30 minutes. Slow the rate of infusion if hypotension occurs.
  - The administration set will need to be flushed with a crystalloid to ensure that all of the amiodarone has been administered.
  - An IV infusion over 30 minutes is the preferred method of administration. However, it is acceptable to dilute 300 mg of amiodarone to a total volume of 20–30 mL using glucose 5%. Administer this IV over 30 minutes and slow the rate of infusion if hypotension occurs.
- A controlled delivery device (pump or syringe driver) is the preferred method for maintenance of medication infusions

5.3 Amiodarone

Dosage regimen

- Cardiac arrest
  - Adult: 300 mg
  - Child: 5 mg per kg to a maximum of 300 mg total dose.
- Tachydysrhythmia
  - Adult: 300 mg, IV, over 30 minutes.

Side effects

- nausea and vomiting, hypotension, light-headedness, bradydysrhythmia

Usual onset of effect

- 5–10 minutes.

Usual duration of effect

- 1–4 hours after a single dose. Amiodarone is taken up into tissues and slowly released. This may result in a prolonged half-life, particularly when more than one dose has been administered. This is why many texts quote a half-life of 10–60 days, but the clinical duration of effect is much shorter than this.

Common interactions

- May potentiate the action of cyclic antidepressants in cyclic poisoning.
- May cause bradycardia following reversion if the patient is on a beta-blocker and/or a centrally-acting calcium channel blocker (e.g. diltiazem).

Special notes

- If the indication is atrial fibrillation causing moderate cardiovascular compromise, the goal of treatment is to control the ventricular rate and not to revert the rhythm to sinus rhythm, although treatment with amiodarone may result in reversion of the rhythm to sinus rhythm. If a patient has been in atrial fibrillation for longer than a few days, there is a small risk that this may be associated with emboli leaving the left atrium. This is why amiodarone is reserved for patients with cardiovascular compromise that is clinically significant.
- If amiodarone is commenced, the full dose should be administered even if the rhythm reverts to sinus rhythm, unless severe hypotension or bradycardia occurs.
- Amiodarone is often described as relatively contraindicated in the presence of a prolonged QT interval but this only applies to long-term administration.

Linked management

4.6.3 Ventricular Tachycardia (VT)

5.4 Amoxicillin

Mechanism of action

- Amoxicillin interferes with bacterial cell wall peptidoglycan synthesis by binding to penicillin-binding proteins, eventually leading to cell lysis and death.

Indications

- treatment of infections when caused by susceptible organisms
- exacerbation of chronic bronchitis, community-acquired pneumonia
- acute otitis media, sinusitis
- gonococcal infection
- epididymo-orchitis, acute prostatitis, acute pyelonephritis, urinary tract infections
- non-surgical prophylaxis of endocarditis
- acute cholecystitis, peritonitis, eradication of H. pylori

Contraindications

- Beta-lactam antibiotic hypersensitivity

Cautions

- renal impairment
- prolonged or high dose use
- gonorrhoea with suspected syphilis

Use in pregnancy or breastfeeding

- Safe to use in pregnancy. Safe to use while breastfeeding, however may cause loose bowel actions in the child.

Side effects

- Gastrointestinal upset

Common adverse effects

- A widespread, erythematous maculopapular rash (pseudoallergic) is common. It often occurs after greater than 7 days treatment and resolves 1–7 days after treatment is stopped

Pharmacology

- Broad spectrum aminopenicillin. Bactericidal to sensitive organisms during the stage of active cell division

5.4 Amoxicillin

Usual preparation

- Tablet: 1000 mg
- Capsule: 250 mg; 500 mg
- Powder for reconstitution and injection: 1 g

Dosage regimen

- Adult
  - 250–500 mg, oral, every 8 hours OR 1 g tablet twice daily.
  - 1 g, IV, every 6 hours
- Child
  - 15–25 mg per kg (maximum 500 mg), oral, very 8 hours. For severe infections up to 30 mg per kg (maximum 1 g) every 8 hours.
  - For severe infections: up to 25 mg per kg (maximum 1 g), IM or IV, every 8 hours OR 50 mg / kg (maximum 2 g) every 4–6 hours.

Administration

- oral; IV

Linked management

4.2.1 Antibiotic recommendations

5.5 Amoxicillin with clavulanic acid

Mechanism of action

- Clavulanic acid inhibits beta-lactamase, which extends spectrum of activity of amoxicillin with clavulanic acid to cover many beta-lactamase-producing organisms

Indications

- hospital-acquired pneumonia
- epididymo-orchitis (urinary tract source)
- pelvic inflammatory disease (PID; not sexually acquired)
- urinary tract infections
- bites and clenched fist injuries
- acute otitis media (unresponsive to amoxicillin)
- acute sinusitis (unresponsive to amoxicillin)
- acute cholecystitis
- melioidosis

Contraindications

- history of cholestatic jaundice or hepatic dysfunction associated with amoxicillin with clavulanic acid, or ticarcillin with clavulanic acid (Timentin®, discontinued).
- history of immediate (e.g. urticaria, bronchospasm, anaphylaxis) or severe (e.g. interstitial nephritis) hypersensitivity to a penicillin
- Avoid in women with premature rupture of the membranes as there may be an increased risk of neonatal necrotising enterocolitis.

Cautions

- infectious mononucleosis, acute lymphoblastic leukaemia, chronic lymphocytic leukaemia, HIV infection, high incidence of rash.
- can cause cholestatic hepatitis (below); people more than 55 years of age have an increased risk. Pre-existing hepatic impairment is not a risk factor.
- cross-reactivity between penicillins, cephalosporins and carbapenems can occur.

Use in pregnancy or breastfeeding

- Safe to use in pregnancy and breastfeeding, however may cause loose bowel actions in the child.

Side effects

- transient increases in liver enzymes and bilirubin
- diarrhea, nausea, pain and inflammation at injection site
- superinfection (including candidiasis) especially during prolonged treatment with broad-spectrum penicillins
- allergy

5.5 Amoxicillin with clavulanic acid

Pharmacology

- Beta lactam

Usual preparation

- Tablet: 500 mg/125 mg; 875 mg/125 mg
- Vial: 500/100 mg; 1 g/200 mg; 2 g /200 mg

Dosage regimen

Doses are based on amoxicillin component.

Adult

- 500–875 mg, oral, every 12 hours for 5–10 days or longer, depending on the infection.
- 1 g every 8 hours, IV. Can increase to 1 g every 6 hours in serious infections. Maximum dose 2 g every 6 hours.

Child

- oral liquid
  - more than 1 month: 7.5–15 mg / kg (maximum 500 mg), oral, every 8 hours.
  - more than 2 months: 22.5 mg / kg (maximum 875 mg), oral, every 12 hours.
- Tablet: more than 40 kg (similar to adult dosage): 500–875 mg, oral, twice a dayl.
- IV
  - Birth (at term), 3 months and less than 4 kg: 25 mg / kg, IV, every 12 hours.
  - Birth (at term), 3 months and more than 4 kg: 25 mg / kg, IV, every 8 hours.
  - more than 3 months and less than 40 kg: 25 mg / kg (maximum 1 g), IV, every 8 hours. Can increase to 25 mg / kg (maximum 1 g) every 6 hours in serious infections.
  - more than 40 kg (similar to adult dosage): 1 g every 8 hours, IV. Can increase to 1 g every 6 hours in serious infections. Maximum dose 2 g every 6 hours.
- Acute bacterial sinusitis
  - Adult: 500 mg, oral, 3 times a day for 7–14 days.
  - Child: 22.5 mg / kg (maximum 500 mg), oral, 3 times a day for 7–14 days.

Administration

- oral; IV

Linked management

4.2.1 Antibiotic recommendations

5.6 Ampicillin sodium

Mechanism of action

- Bactericidal; interfere with bacterial cell wall peptidoglycan synthesis by binding to penicillin-binding proteins, eventually leading to cell lysis and death

Indications

- treatment of infections when caused by susceptible organisms
- exacerbation of chronic bronchitis, community-acquired pneumonia
- gonococcal infection; urinary tract infections
- non-surgical prophylaxis of endocarditis
- acute cholecystitis, peritonitis, epididymo-orchitis, acute pyelonephritis, acute prostatitis

Contraindications

- beta-lactam (e.g. penicillin, cephalosporin)
- hypersensitivity history

Cautions

- renal impairment
- prolonged or high dose use

Use in pregnancy or breastfeeding

- Safe to use in pregnancy. Safe to breastfeed, however may cause loose bowel actions in the child.

Side effects

- local pain, induration, tenderness at site of injection; phlebitis after iv administration; allergic reaction (usually rash); nausea, vomiting and diarrhoea, gastrointestinal upset

Pharmacology

- Bactericidal to sensitive organisms during the stage of active cell division

Usual preparation

- Vial (powder for reconstitution): 500 mg, 1 g

5.6 Ampicillin sodium

Dosage regimen

- Adult: 500 mg–1 g, IM or IV, every 4–6 hours. Use 200 mg per kg daily in divided doses every 4–6 hours in meningitis or septicaemia. Maximum 14 g daily.
- Child greater than 1 month: 25–50 mg per kg (maximum 1 g), IM or IV, every 6 hours. Use 50 mg per kg every 4–6 hours (maximum 12 g daily) in severe infections.

Administration

- IV: reconstitute with 10–20 mL of water for injection and give over 3–5 minutes.
- IM: may be dissolved in up to 1.5 mL of water for injection and administered into a large muscle mass.

Linked management

4.2.1 Antibiotic recommendations

5.7 Aspirin

Mechanism of action

- Aspirin (acetylsalicylic acid) has antiplatelet, antipyretic, anti-inflammatory and analgesic effects. In the out-of-hospital setting, aspirin is only administered for its antiplatelet activity.
- Aspirin inhibits the enzyme cyclooxygenase which results in a reduction in the formation of prostaglandins and thromboxane.

Indications

- headaches and migraine headaches
- platelet aggregation inhibitor
- myocardial ischaemia

Contraindications

- known severe allergy
- third trimester of pregnancy

Cautions

- Concomitant therapy with other gastric irritants (e.g. nonsteroidal anti-inflammatory medicines NSAIDs) may increase risk of gastric irritation
- Concomitant therapy with heparin, warfarin, other antiplatelet or anticoagulant as may increase risk of bleeding
- Avoid use in children less than or equal to12 years
- Known bleeding disorder. Aspirin will increase the risk of bleeding, however the balance of risk is usually in favour of administering aspirin.
- Clinically significant bleeding. Aspirin will increase the risk of bleeding and the nature and risk of the bleeding must be taken into account.
- Known worsening of bronchospasm with NSAIDs. Some patients with asthma or COPD have known worsening of bronchospasm with NSAIDs (including aspirin) and a decision must be made based on the balance of risk. If there is a clear history of significant bronchospasm with NSAIDs, aspirin should be withheld.

Common adverse effects

- Increased bleeding.
- Although indigestion, gastrointestinal ulceration and gastrointestinal bleeding are commonly listed as adverse effects, these are only associated with chronic administration.

5.7 Aspirin

Use in pregnancy or breastfeeding

- May cause harm during pregnancy. Aspirin has been associated with premature delivery and premature closure of the ductus arteriosus, when administered in the third trimester of pregnancy. The likelihood of clinically important myocardial ischaemia occurring in a woman who is pregnant is so low that the balance of risk is usually in favour of aspirin being withheld. May be administered if the patient is breastfeeding

Pharmacology

- antipyretic, antiplatelet, non-steroidal anti-inflammatory, analgesic
- absorption occurs in the stomach and small intestine. The presence of food in the stomach will delay absorption, but this is not usually clinically significant
- aspirin is predominantly metabolised in the liver. There are no significant effects from liver impairment on short term administration

Usual preparation

- Tablets: 100 mg and 300 mg dispersable, soluable

Dosage regimen

- Adult: 300–900 mg every 4–6 hours as required (**do not** exceed 4 doses in 24 hours).
- Can be dissolved in water. Platelet aggregation inhibition 300 mg

Administration

- Oral. Dispersible tablets may be chewed or dissolved in water.

Usual onset of effect

- 30–60 minutes

Usual duration of effect

- 3–5 days for the anti-platelet activity. This is because platelets exposed to aspirin are impaired for the life of the platelet which is 7–10 days. Approximately 10% of platelets are replaced each day.

Common interactions

- Aspirin displaces warfarin from binding sites and increases the activity of warfarin. However, this effect is most prominent with chronic administration and aspirin is indicated if a patient taking warfarin has clinically significant myocardial ischaemia.

Linked management

4.6.1 Ischaemic chest pain
4.6.2 Cardiogenic pulmonary oedema
4.6.5 Atrial Fibrillation

5.8 Atropine

Mechanism of action

- Atropine is an anticholinergic which is mostly used for the treatment of bradycardia.
- Atropine antagonises (blocks) muscarinic acetylcholine receptors, causing vagal inhibition resulting in an increase in heart rate, drying of salivary and bronchial secretions, bronchodilation, reduced gastrointestinal motility.

Indications

- narrow complex bradycardia causing clinically significant cardiovascular compromise
- anticholinergic syndromes
- organophosphate poisoning
- hypersalivation (e.g. Funnel-web spider bite; ketamine administration)

Contraindications

- known hypersensitivity to atropine or other anticholinergics

Cautions

- Myocardial ischaemia. Atropine will increase myocardial oxygen consumption.
- Breastfeeding

Use in pregnancy or breastfeeding

- Safe to use while pregnant and should be administered when indicated. May be administered if the patient is breastfeeding.

Common adverse effects

- tachycardia, confusion, particularly in the elderly or those with intellectual impairment; dry mouth, blurred vision

Common interactions

- The action of atropine may be potentiated if the patient is taking other medicines with anticholinergic properties, such as phenothiazines, some antihistamines (e.g. promethazine but not loratadine), tricyclic antidepressants and anti-Parkinsonian medicines. These interactions are rarely clinically significant.

5.8 Atropine

Pharmacology

- Anticholinergic agent, reduces secretions (saliva, bronchial). Increases heart rate and causes enlarged pupils. It reduces gastric and intestinal motility.
- Atropine is predominantly metabolised in the liver, but some is excreted in urine.
- There are no significant effects from liver or kidney impairment on short term administration.

Usual preparation

- Ampoule: 0.6 mg in 1 mL; 1.2 mg / mL
- Syringe: 1.0 mg per 10 mL (Min-I-Jet)

Dosage regimen

- Adult: 0.6 mg. Repeat as required without a maximum dose, if the bradycardia is responsive to atropine.
- Escalating doses are likely to be required for organophosphate poisoning - administer atropine 1.2 mg IV, doubled every 5 minutes until symptoms are controlled.

Administration

- administer undiluted as an IV bolus
- maybe administered by IM route, where IV per intraosseous access is unavailable
- slow administration may result in transient bradycardia

Usual onset of effect

- 5–10 seconds

Usual duration of effect

- cardiovascular effects last 15–60 minutes
- exocrine and smooth muscle effects last 4–6 hours

Linked management

4.11.4 Organophosphate poisoning

5.9 Azithromycin

Mechanism of action

- Bacteriostatic: azithromycin inhibits bacterial protein synthesis by binding to the 50S ribosomal subunit. They also have immunomodulatory and anti-inflammatory effects.

Indications

- treatment of choice for chlamydial infections (e.g. urethritis, cervicitis, trachoma)
- streptococcal pharyngitis/tonsillitis
- community-acquired pneumonia
- prevention and treatment of Mycobacterium avium complex (MAC) infection, with other agents
- Donovanosis (granuloma inguinale)
- typhoid, paratyphoid (enteric fever)
- Traveller's diarrhoea
- prevention and treatment of pertussis

Contraindications

- hypersensitivity

Cautions

- severe hepatic impairment; consider dose reduction
- associated with prolonged QT interval

Use in pregnancy or breastfeeding

- Safe to use during pregnancy or while breastfeeding

Side effects

- nausea, vomiting, diarrhoea, abdominal pain and cramps, candidal infection

Pharmacology

- Macrolide antibiotic

Usual preparation

- Tablet: 500 mg; 600 mg
- Injection (powder): 500 mg

5.9 Azithromycin

Dosage regimen

- Adult: 500 mg once, on day 1, oral. Then give 500 mg once daily for 2 days, OR 250 mg once daily for 4 days. The higher dose can be given for more than 3 days, depending on the infection.
- Child older than 6 months: 10 mg / kg (maximum 500 mg) once, on day 1, oral. Then give 10 mg / kg (maximum 500 mg) once daily for 2 days or 5 mg / kg (maximum 250 mg) once daily for 4 days. The higher dose can be given for more than 3 days, depending on the infection.
- Chlamydial infection, non-gonococcal genital infection
  - Adult: 1 g as a single dose, oral. Seek specialist advice if treating an infection due to Mycoplasma genitalium as it may be resistant to azithromycin.
- Trachoma and Chlamydia trachomatis conjunctivitis
  - Adult, child: 20 mg / kg (maximum 1 g) as a single dose, oral.
- Community-acquired pneumonia
  - Adult: 500 mg once daily, IV. Change to oral route when possible.
- Mycobacterium avium complex (MAC)

  Treatment
  - HIV-negative adult: 250 mg once daily, oral.
  - HIV-positive adult: 500–600 mg once daily, oral.
  - HIV-positive child: 10 mg / kg (maximum 500 mg) once daily, oral.

  Prevention
  - Primary prevention, adult:1.2 g taken once a week, oral.
  - Primary prevention, child: 20 mg / kg (maximum 1.2 g) once a week, oral, OR 5 mg / kg (maximum 250 mg) once daily, oral.
  - Secondary prevention, adult: 500–600 mg once daily, oral.
  - Secondary prevention, child: 5 mg / kg (maximum 250 mg) once daily, oral.
- Donovanosis (granuloma inguinale)
  - Adult: 500 mg once daily for 7 days, oral, OR 1 g as a single dose once a week for 4 weeks, oral, or until healed.
- Typhoid, paratyphoid
  - Adult: 500 mg once daily for 7 days, oral.
  - Child: 10 mg / kg (maximum 500 mg) once daily for 7 days, oral.

5.9 Azithromycin

- Traveller's diarrhoea
  - Adult: 1 g single dose, oral, OR 500 mg once daily for 3 days.
  - Child: 10 mg / kg (maximum 500 mg) once daily for 3 days, oral, has been suggested but evidence is lacking.
- Pertussis prevention and treatment
  - Adult: 500 mg on day 1, oral, then 250 mg once daily for 4 days.
  - Child under 6 months: 10 mg / kg once daily for 5 days, oral.
  - Child over 6 months: 10 mg / kg (maximum 500 mg) on day 1, oral, then 5 mg / kg (maximum 250 mg) once daily for 4 days.
  - Maximum: 1.2 g as a single dose, oral (in MAC).

Administration

- oral; IV

Special notes

- Give a 500 mg dose, IV, over at least 1 hour. Ideally, infuse a concentration of 1 mg / mL over 3 hours, and one of 2 mg / mL over 1 hour.

5.10 Benzatropine mesilate

Mechanisms of action

Block muscarinic actions of acetylcholine to produce a wide range of effects including:

- reduction of relative excess of cholinergic activity that accompanies dopamine deficiency in Parkinson's disease
- reduction of salivation and gastric secretions; inhibition of intestinal motility
- reduction of bladder muscle contractility and increase in bladder capacity
- tachycardia
- mydriasis and cycloplegia
- bronchodilation and decrease in bronchial secretions

Indications

- treatment of medicine induced extrapyramidal disorders (except tardive dyskinesia)
- treatment of acute dystonic reaction

Contraindications

- gastrointestinal obstruction
- urinary obstruction
- myasthenia gravis
- known hypersensitivity to benztropine

Cautions

- heart disease
- inflammatory bowel disease
- treatment with other medications that have anticholinergic effects
- elderly and children
- fever, high ambient temperatures, risk of hyperthermia

Use in pregnancy or breastfeeding

Safe to use while pregnant; appears safe if breastfeeding.

Side effects

- Gastrointestinal disturbances: dry mouth, nausea, vomiting, dyspepsia, constipation; CNS disturbances: dizziness, drowsiness, headache, confusion; visual disturbances: dry eyes, blurred vision, hallucinations; tachycardia, arrhythmia, flushed skin, dry skin, orthostatic hypotension

5.10 Benzatropine mesilate

Pharmacology

- Blocks the muscarinic actions of acetylcholine to produce a wide range of effects.

Usual preparation

- Ampoule: 2 mg per 2 mL
- Tablets: 2 mg

Dosage regimen

- Drug-induced extrapyramidal disorders
  - Adult: 1–4 mg once or twice daily, oral.
  - Child greater than 3 years: 20–50 micrograms / kg once or twice daily, oral. Maximum 6 mg daily.
- Acute dystonic reaction
  - Adult: 1–2 mg, IM or IV. Follow with oral treatment if necessary.
  - Child greater than 3 years: 20 micrograms / kg (maximum 1 mg), IM or IV. May repeat after 15 minutes. Follow with oral treatment if necessary

Administration

- IM, IV, oral

5.11 Benzylpenicillin

Mechanism of action

- Bactericidal; interfere with bacterial cell wall peptidoglycan synthesis by binding to penicillin-binding proteins, eventually leading to cell lysis and death

Indications

Treatment of following infections when caused by susceptible organisms:

- bacterial endocarditis
- meningitis
- aspiration pneumonia, lung abscess
- community-acquired pneumonia
- syphilis
- septicaemia in children

Contraindications

- known allergy to penicillins (Beta-Lactamase class of antibiotics)

Cautions

- persons with renal disease
- syphilis
- high doses or prolonged use

Use in pregnancy or breastfeeding

- Safe to use in pregnancy and breastfeeding, however may cause loose bowel actions in the child.

Side effects

- local pain; induration; tenderness at site of injection; phlebitis after IV administration; allergic reaction (usually rash), more severe reactions less frequently; gastrointestinal symptoms (e.g. diarrhoea; nausea, rash)

Pharmacology

- Broad spectrum beta-lactamase labile antibiotic

Usual preparation

- Vials (powder for reconstitution): 0.6 g; 1.2 g; 3 g

5.11 Benzylpenicillin

Dosage regimen

- Adult: 0.6–1.2 g, IV, every 4–6 hours. Maximum 18 g daily (e.g. endocarditis, meningitis). Higher doses may be used on specialist advice.
- Child: 30 mg per kg (maximum 1.2 g), IM or IV, every 6 hours. For severe infections use up to 60 mg per kg (maximum 2.4 g) every 4–6 hours.
- Suspected meningococcal meningitis before hospitalisation
  - Adult: 2.4 g, IV or IM.
  - Child: 60 mg per kg (maximum 2.4 g), IV or IM.

Administration

- IV: reconstitute in 5–10 mL water for injection and give over 3–5 minutes.
- IM: may be dissolved in 1% lidocaine as local anaesthetic solution and administered by deep intragluteal injection

Linked management

4.2.1 Antibiotic recommendations

4.15 Sepsis

5.12 Calcium chloride

Mechanism of action

- Calcium is the active ingredient in calcium chloride.
- Calcium is a mineral that is essential for a number of normal body functions including: cell membrane function, enzyme reactions, transmission of nerve impulses, cardiac electrophysiology, contraction of cardiac and skeletal muscle and coagulation.
- Calcium raises the cardiac action potential threshold and protects cardiac cell membranes from the effects of hyperkalaemia, resulting in a reduction in dysrhythmias associated with hyperkalaemia.

Indications

- crush injury in adults
- hyperkalaemia
- hypocalcaemia
- Calcium Channel Blocker toxicity
- Magnesium toxicity
- Biochemical testing diagnosed low serum calcium
- Shock associated with exsanguinating haemorrhage
- Blood product administration'

Contraindications

- none

Cautions

- none

Use in pregnancy or breastfeeding

- Safety has not been demonstrated, but calcium should be administered if indicated.

Dosage regimen

- Adult: 6.8 mmol (1 g of calcium), IV, over 1 minute. Repeat the dose if signs of hyperkalaemia persist or recur.
- Child: seek clinical advice

5.12 Calcium chloride

Administration

- Administer into a large vein via a running IV line if possible, as this reduces venous irritation. Do not mix with other medicines (particularly sodium bicarbonate) as precipitation will occur. If other medicines are being administered via the same vein, ensure a minimum flush of 50 mL of a crystalloid between medicines.

Common adverse effects

- Venous irritation including redness and pain at the site of injection; tingling sensation; rapid administration may cause dysrhythmias

Usual onset of effect

- 2–5 minutes

Usual duration of effect

- 1–4 hours

Usual presentation

- Ampoule: containing 6.8 mmol (1 g) in 10 mL.

Pharmacology

- 80% is excreted in faeces and 20% is excreted in urine. There are no significant effects from liver or kidney impairment on acute administration.

Common interactions

- None

Special notes

- Document the dose administered in mmol.
- calcium gluconate is the preferred formulation of calcium, usually containing 2.2 mmol per 10 mL.

5.13 Calcium gluconate

Mechanism of action

- Calcium is the active ingredient in calcium gluconate.
- Calcium is a mineral that is essential for a number of normal body functions including: cell membrane function, enzyme reactions, transmission of nerve impulses, cardiac electrophysiology, contraction of cardiac and skeletal muscle and coagulation.
- Calcium raises the cardiac action potential threshold and protects cardiac cell membranes from the effects of hyperkalaemia, resulting in a reduction in dysrhythmias associated with hyperkalaemia.

Indications

- crush injury in adults
- hyperkalaemia
- hypocalcaemia
- calcium channel blocker toxicity
- hydrofluoric acid exposure
- magnesium toxicity
- biochemical testing diagnosed low serum calcium
- shock associated with exsanguinating haemorrhage
- blood product administration'

Contraindications

- digitalis overdose
- hypercalcaemia

Cautions

- digoxin therapy

Use in pregnancy or breastfeeding

- Safe to use in pregnancy and while breastfeeding.

Dosage regimen

- Hyperkalaemia
  - Adult: 2.2 mmol (1 g of calcium), IV, over 1 minute. Repeat the dose if signs of hyperkalaemia persist or recur.
  - Child: seek clinical advice.

- Hydrofluoric acid: mix 2.5 mL of calcium gluconate 10% with a crystalloid, up to 10 mL (2.5% concentration). Apply topically to contact area.
- Inhaled: nebulise the 2.5% solution.
- Cutaneous burns: Consult **Poisons Information Centre (13 11 26)** for local infiltrate of 2.5% solution.

Administration

- Administer into a large vein via a running IV line if possible, as this reduces venous irritation.
- Do not mix with other medicines (particularly sodium bicarbonate) as precipitation will occur. If other medicines are being administered via the same vein, ensure a minimum flush of 50 mL of a crystalloid between medicines.

Common adverse effects

- venous irritation including redness and pain at the site of injection
- tingling sensation
- rapid administration may cause dysrhythmias

Usual onset of effect

- 2–5 minutes

Usual duration of effect

- 1–4 hours

Usual presentation

- Ampoule: 2.2 mmol (1 g) in 10 mL

Pharmacology

- 80% is excreted in faeces and 20% is excreted in urine.
- There are no significant effects from liver or kidney impairment on acute administration.

Common interactions

- None

Special notes

- Document the dose administered in mmol.
- Calcium gluconate is the preferred medicine over calcium chloride, usually containing 6.8 mmol per 10 mL. Calcium chloride is an alternative formulation of calcium for hyperkalaemia (not hydrofluoric acid exposure). Administer one ampoule at a time if only calcium chloride is available.

5.14 Cefalexin

Mechanism of action

- Interfere with bacterial cell wall peptidoglycan synthesis by binding to penicillin-binding proteins, eventually leading to cell lysis and death; bactericidal.

Indications

- treatment of infections when caused by susceptible organisms
- staphylococcal and streptococcal infections in people with mild-to-moderate penicillin allergy
- urinary tract infections
- epididymo-orchitis (urinary tract source)

Contraindications

- previous major penicillin allergy

Cautions

- renal impairment
- prolonged or high dose use
- gastrointestinal disease

Use in pregnancy or breastfeeding

- Safe to use in pregnancy and while breastfeeding however may cause loose bowel action in child.

Side effects

- headache, dizziness, fatigue, agitation, confusion, gastrointestinal upset (colitis, diarrhoea), nausea and vomiting, rash, uticaria

Pharmacology

- Inhibition of cell wall synthesis

Usual preparation

- Capsule: 250 mg; 500 mg

5.14 Cefalexin

Dosage regimen

- Adult: usually 250 mg, oral, every 6 hours OR 500 mg, oral every 6–12 hours. Maximum 4 g daily; if higher doses required consider parenteral therapy.
- Child: usual dose 6.25–12.5 mg per kg (maximum 500 mg), oral, every 6 hours.
- Uncomplicated urinary tract infection
  - Adult: 500 mg every 12 hours, oral, for 5 days for women; 7 days for men.
  - Child: 12.5 mg per kg (maximum 500 mg), oral, every 6 hours for 5 days (greater than 1 year old) or 3 days (less than 1 year old).

Administration

- Oral

Linked management

4.2.1 Antibiotic recommendations

5.15 Cefazolin

Mechanism of action

- Interfere with bacterial cell wall peptidoglycan synthesis by binding to penicillin-binding proteins, eventually leading to cell lysis and death; bactericidal.

Indications

- treatment of serious infections due to susceptible organisms
- staphylococcal and streptococcal infections in people with mild-to-moderate penicillin allergy
- surgical prophylaxis
- urinary tract infections

Contraindications

- previous major penicillin allergy

Cautions

- renal impairment
- prolonged or high dose use
- history of gastrointestinal disease

Use in pregnancy or breastfeeding

- Safe to use in pregnancy (no data for ceftaroline or ceftolozane). Safe to breastfeed, however may cause loose bowel actions in the child. (Although there are no data for ceftaroline or ceftolozane, there is no reason to suppose that they would be unsafe.

Side effects

- local pain, induration, tenderness at site of injection; phlebitis after IV administration
- allergic reaction (usually rash)
- nausea, vomiting and diarrhoea
- gastrointestinal upset

Pharmacology

- Semisynthetic cephalosporin; inhibition of cell wall synthesis

Usual preparation

- Vial (powder for reconstitution): 500 mg; 1 g; 2 g

5.15 Cefazolin

Dosage regimen

- Adult: 1–2 g, IV, every 6–8 hours. Usual maximum 6 g daily (up to 12 g daily has been used).
- Child: I10–15 mg per kg, IV, every 8 hours or 6.25–12.5 mg per kg every 6 hours (maximum 6 g daily).
- Serious infections: 33–50 mg per kg, IV, every 8 hours or 25 mg per kg every 6 hours (maximum 6 g daily).
- Surgical prophylaxis
  - Adult: 2 g (3 g if greater than 120 kg), IV, to be completed before skin incision.
  - Child: 25 mg per kg (maximum 1 g), IV, to be completed before skin incision.

Administration

- IV: reconstitute with 10 mL of water for injection and give over 3–5 minutes
- IM: may be dissolved water for injection OR a crystalloid OR lidocaine as local anaesthetic, and administered into a large muscle mass.

Linked management

4.2.1 Antibiotic recommendations

5.16 Ceftriaxone sodium

Mechanism of action

- Interfere with bacterial cell wall peptidoglycan synthesis by binding to penicillin-binding proteins, eventually leading to cell lysis and death; bactericidal

Indications

Treatment of following infections when caused by susceptible aerobic organisms:

- empirical treatment of severe pneumonia (with other agents)
- empirical treatment of orbital cellulitis (sometimes with other agents)
- empirical treatment of bacterial meningitis (with other agents)
- gonococcal infection
- pelvic inflammatory disease (pid)
- epiglottitis
- septicaemia
- acute cholecystitis (alternative to ampicillin sodium with gentamicin)
- acute peritonitis (with metronidazole)
- severe salmonella enteritis (if other antibacterials unsuitable)
- typhoid, paratyphoid (enteric fever)
- sexually-acquired epididymo-orchitis (with doxycycline)

Contraindications

- known allergy to the cephalosporin class of antibiotics
- major allergy to penicillin

Cautions

- Use with care in persons with renal or hepatic disease
- Should not be given to sick neonates at risk of developing bilirubin encephalopathy (especially premature infants)

Use in pregnancy or breastfeeding

- Safe to use in pregnancy (no data for ceftaroline or ceftolozane). Safe to breastfeed, however may cause loose bowel actions in the child. Although there are no data for ceftaroline or ceftolozane, there is no reason to suppose that they would be unsafe.

Side effects

- local pain; induration; tenderness at site of injection; phlebitis after IV administration; allergic reaction (usually rash), more severe reactions less frequently; haematological changes; gastrointestinal symptoms especially diarrhoea; hepatic and renal related biochemical disturbances; headache, dizziness, nausea, rash, diaphoresis, flushing

5.16 Ceftriaxone sodium

Pharmacology

- Broad spectrum cephalosporin antibiotic

Usual preparation

- Vials (powder for reconstitution): 0.25 g; 0.5 g; 1 g; 2 g

Dosage regimen

- Adult: 1–2 g once daily (or in 2 doses), IM or IV. Maximum 4 g daily.
- Child: 50–75 mg per kg (maximum 2 g) once daily, IM or IV.
- Bacterial meningitis
  - Adult: 1–2 g every 12 hours, IV.
  - Child: 100 mg per kg (maximum 4 g) once daily, IM or IV OR 50 mg per kg (maximum 2 g) every 12 hours.
- Orbital cellulitis
  - Adult: 2 g once daily, IV.
  - Child: 50 mg per kg (maximum 2 g) once daily, IM or IV.
- Gonococcal infection; urethritis, cervicitis, epididymo-orchitis and PID; and for uncomplicated infections due to beta-lactamase-producing N. gonorrhoeae
  - Adult: 250–500 mg, IM or IV, as a single dose (for epididymo-orchitis, give for 1–5 days; seek advice from local STI clinic). If in a high-risk group, add presumptive treatments for C. trachomatis and other non-gonococcal infections.
- Conjunctivitis
  - Adult: 1 g as a single dose, IM or IV.
  - Child: 50 mg per kg (maximum 1 g) as a single dose, IM or IV.

Administration

- IV: reconstitute in 5–10 mL water for injection and give over 3 to 5 minutes
- IM: may be dissolved in 1% lidocaine as local anaesthetic and administered by deep intragluteal injection.

Linked management

4.2.1 Antibiotic recommendations

4.15 Sepsis

5.17 Cetirizine

Mechanism of action

- Reduce the effects of histamine by binding to the H1 receptor and stabilising it in an inactive form

Indications

- allergic rhinitis
- chronic urticaria

Contraindications

- none

Cautions

- elderly
- increased risk of sedation and anticholinergic effects

Use in pregnancy or breastfeeding

- Safe to use in pregnancy, although there is more experience with older sedating antihistamines. Safe to use while breastfeeding.

Side effects

- drowsiness, fatigue, headache, nausea, dry mouth

Usual preparation

- Tablet: 10 mg
- Oral liquid: 1mg / mL
- Oral drops: 10 mg / mL

Dosage regimen

- Adult, child greater than 12 years: 10 mg once daily, oral.
- Child
  - 6–12 years: 10 mg once daily, oral, OR 5 mg twice daily, oral.
  - 2–6 years: 5 mg once daily, oral, OR 2.5 mg twice daily.
  - 1–2 years: 2.5 mg (5 drops) twice daily, oral drops.

Administration

- oral

Linked management

4.7.1 Mild or moderate allergy

5.18 Chlorpromazine

Mechanism of action

Antipsychotic actions are thought to be mediated (at least in part) by blockade of dopaminergic transmission in various parts of the brain (in particular the limbic system). Evidence suggests:

- all effective antipsychotics block D2 receptors
- differential blockade of other dopamine receptors (e.g. D1) may influence therapeutic and adverse effects
- antagonism of other receptors may influence antipsychotic activity (e.g. 5HT2antagonism with some agents)

Indications

- acute and chronic psychoses
- short term management of anxiety, agitation or disturbed behaviour in non-psychotic disorders
- intractable hiccup, if non-medicine treatment fails
- serotonin syndrome when cyproheptadine is not available
- intractable migraine not responding to other therapies

Contraindications

- circulatory collapse
- CNS depression
- hepatic failure
- known hypersensitivity to phenothiazines

Cautions

- epilepsy
- patients where QT interval may be prolonged
- myasthenia gravis
- elderly

Use in pregnancy or breastfeeding

- Pregnancy: epidemiological data suggest that antipsychotics are not associated with an increased risk of congenital malformations, however, there are limited data for other outcomes. Breastfeeding: what little information there is suggests that generally small amounts of antipsychotics pass into breast milk. There are few data regarding long-term effects.

5.18 Chlorpromazine

Side effects

- antiemetic effect
- extrapyramidal side effects
- incidence is dose-related and is lower with chlorpromazine and periciazine
- hypotension , especially with serotonin syndrome

Common adverse effects

- sedation, anxiety, agitation, extrapyramidal side effects (EPSE; below), orthostatic hypotension, tachycardia, blurred vision, mydriasis, constipation, nausea, dry mouth, urinary retention

Pharmacology

- Phenothiazine antipsychotic. Blockage of dopaminergic transmission in various parts of the brain (in particular the limbic system).

Usual preparation

- Ampoule: 50 mg per 2 mL

Dosage regimen

- Adult: 25–50 mg, IV, (by infusion after dilution with normal saline solution)

Administration

- IV (via infusion when diluted with normal saline solution)

Linked management

4.11.3 Serotonin syndrome

5.19 Ciprofloxacin

Mechanism of action

- A quinolone antibiotic; bactericidal. Inhibist bacterial DNA synthesis by blocking DNA gyrase and topoisomerase IV.

Indications

- treatment of infections when caused by susceptible organisms
- severe Salmonella enteritis
- typhoid, paratyphoid (e.g. enteric fever)
- shigellosis
- complicated urinary tract infections
- bone or joint infections
- epididymo-orchitis
- post-exposure prophylaxis of meningococcal disease
- P. aeruginosa infections (e.g. in cystic fibrosis)
- prostatitis
- febrile neutropenia (follow-up treatment in low-risk patients, with amoxicillin with clavulanic acid)
- keratitis or severe bacterial conjunctivitis,
- chronic suppurative otitis media

Contraindications

- previous major allergy
- quinolone hypersensitivity, G6PD deficiency

Cautions

- prolonged or high dose use
- CNS disorders and seizure disorders
- prepubertal children
- tendon damage
- pregnancy and breastfeeding

Use in pregnancy or breastfeeding

- Not recommended for use in pregnancy (based on potential effects on developing cartilage). However, available data do not suggest an increased risk of abnormalities. Reserve for severe or life-threatening infections for which safer medicines are inappropriate (see Indications above). Safe to use while breastfeeding, however may cause loose bowel actions in the baby.

Side effects

- ash, itch, nausea, vomiting, diarrhoea, abdominal pain, dyspepsia

5.19 Ciprofloxacin

Pharmacology

- fluoroquinolone antimicrobial.

Usual preparation

- Vial: 100 mg; 200 mg
- Tablet: 250 mg; 500 mg; 750 mg

Dosage regimen

- Adult
  - 250–500 mg twice daily, oral. Maximum 1.5 g daily.
  - 200–300 mg twice daily, IV, up to 300–400 mg every 8–12 hours. Maximum 1.2 g daily.
  - Bone and joint infections: 750 mg twice daily, oral.
  - Post-exposure prophylaxis of meningococcal disease: 500 mg as a single dose, oral.
- Child
  - greater than 1 month: 10–15 mg per kg (maximum 500 mg) twice daily, oral. For more serious infections, 20 mg per kg (maximum 750 mg) twice daily can be used.
  - greater than 1 month:10 mg per kg (maximum 400 mg) every 12 hours, IV. For more serious infections, give every 8 hours (maximum 1.2 g daily).
- Cystic fibrosis
  - greater than 1 month: 15–20 mg per kg (maximum 750 mg) twice daily, oral.
  - greater than 1 month: 10 mg per kg (maximum 400 mg) every 8 hours, IV.

Administration

- IV: administer via a large vein over 60 minutes
- Oral: administer with water

Special notes

- Absorbed best if taken1 hour before, or 2 hours after, meals. Drink plenty of fluids while taking it.
- Dairy products, antacids, iron, zinc or calcium supplements may reduce the absorption. Do not take within 2 hours of a dose.
- May increase the effects of caffeine in some people; may need to reduce caffeine intake.
- Avoid sun exposure, wear protective clothing and use sunscreen.

Linked management

4.2.1 Antibiotic recommendations

5.20 Clindamycin

Mechanism of action

- Bacteriostatic; inhibit protein synthesis by binding to the 50S ribosomal subunit.

Indications

- treatment of infections due to susceptible organisms
- alternative in patients with severe allergy to penicillins and cephalosporins including endocarditis prophylaxis, aspiration pneumonia, dental, skin, soft tissue and bone infections
- toxoplasma encephalitis per abscess, with pyrimethamine (second line)
- bacterial vaginosis
- anaerobic infections
- treatment of phencyclidine (PCP), with primaquine (second line)
- malaria (with quinine)

Contraindications

- Lincomycin hypersensitivity

Cautions

- prolonged or high dose use
- non-bacterial infection
- gastrointestinal disease (especially colitis)
- renal impairment
- hepatic impairment
- children
- elderly

Use in pregnancy or breastfeeding

- Safe to use in pregnancy and while breastfeeding, however may cause loose bowel actions in the baby.

Side effects

- diarrhoea (mild to severe), nausea, vomiting, abdominal pain or cramps, rash, itch

Pharmacology

- Lincomycin derivative

Usual preparation

- Capsule: 150 mg
- Vial: 300 mg; 600 mg

5.20 Clindamycin

Dosage regimen

- Adult: 150–450 mg, oral, every 6–8 hours. IV 600–2700 mg daily given in 2–4 doses, usually 450–900 mg every 8 hours. Maximum: 4.8 g daily, IV.
- Dental infections: 300–450 mg, oral, every 8 hours for 5–7 days.
- Pneumocystis (PCP treatment): Give with primaquine for 21 days.
  - 450 mg, oral, every 6–8 hours OR 600 mg every 8 hours. 600 mg every 6 hours, IV, OR 900 mg every 8 hours.
- Toxoplasma encephalitis per abscess: give with pyrimethamine.
  - Treatment length depends on factors such as immune status, clinical and radiological response. 600 mg, oral / IV, every 6 hours. Secondary prevention: 600 mg oral every 8 hours.
- Bacterial vaginosis: 300 mg, oral, twice a day for 7 days.
  - Child greater than 1 month: 5–10 mg per kg (maximum 450 mg), oral, every 8 hours (total daily dose can be given in 4 doses every 6 hours). 5–15 mg per kg (maximum 600 mg), IM or IV, every 8 hours. Usual dose 10 mg per kg (maximum 450 mg) every 8 hours.
- Toxoplasma encephalitis per abscess
  - Child greater than 1 month: give with pyrimethamine. Treatment length depends on factors such as immune status and clinical and radiological response. 5–7.5 mg per kg (maximum 600 mg), oral / IV, 4 times daily. Secondary prevention: 20–30 mg per kg daily, oral / IV, in 3–4 doses.
- Endocarditis prophylaxis
  - Adult: 600 mg, oral, 1 hour before procedure. 600 mg, IV, infusion complete before procedure starts.
  - Child greater than 1 month: 20 mg per kg (maximum 600 mg), oral, 1 hour before procedure.
- Malaria: give with quinine
  - Adult: 450 mg, oral, every 8 hours for 7 days.
  - Child greater than 1 month: 7 mg per kg (maximum 450 mg), oral, every 8 hours for 7 days.

Administration

- Oral

Linked management

4.2.1 Antibiotic recommendations

5.21 Clopidogrel

Mechanism of action

- Clopidogrel has antiplatelet activity.
- Clopidogrel antagonises (blocks) the binding of adenosine diphosphate (ADP) to platelets and impairs platelet function.
- Clopidogrel provides significantly more antiplatelet activity than aspirin.

Indications

- STEMI in conjunction with fibrinolytic therapy

Contraindications

- known severe allergy
- suspected aortic dissection

Cautions

- clinically significant bleeding. Clopidogrel will increase bleeding. Seek clinical advice prior to administration
- pregnancy and breastfeeding

Use in pregnancy or when breastfeeding

- Safety has not been demonstrated during pregnancy. The likelihood of STEMI occurring in a woman who is pregnant is so low that personnel must seek clinical advice prior to administration. May be administered if the patient is breastfeeding.

Dosage

- 300 mg if the patient is aged less than 75 years
- 75 mg if the patient is 75 years or more

Administration

- Oral

Common adverse effects

- Increased bleeding

Usual onset of effect

- 30–60 minutes

Usual duration of effect

- 3–5 days. This is because platelets exposed to clopidogrel are impaired for the life of the platelet which is 7–10 days. Approximately 10% of platelets are replaced each day.

5.21 Clopidogrel

Usual preparation

- Tablets: 75 mg; 300 mg

Pharmacokinetics

- Clopidogrel is a pro-medicine and must be metabolised to the active form in the liver.
- There are no significant effects from liver impairment on acute administration.

Common interactions

- The risk of bleeding will be increased if the patient is taking an anticoagulant (e.g. warfarin or dabigatran).

Linked management

4.6.5 Atrial Fibrillation

5.22 Codeine

Mechanism of action

- Opioid analgesics act on opioid receptors in the central nervous system and gastrointestinal tract, producing analgesia, respiratory depression, sedation and constipation. They act mainly at mu-opioid receptors in the CNS, reducing transmission of the pain impulse, and by modulating the descending inhibitory pathways from the brain. Cough suppression occurs in the medullary centre of the brain.

Indications

- mild-to-moderate pain (includes fixed-dose combinations with aspirin, ibuprofen, paracetamol)
- cough suppression

Contraindications

- CYP2D6 ultra-rapid metabolisers
- children less than 12 years

Cautions

- elderly and children
- reduced renal or hepatic function

Use in pregnancy or breastfeeding

- Opioid analgesics may cause respiratory depression in the newborn
- Withdrawal effects may occur in neonates of dependent mothers.
- Avoid codeine while breastfeeding.

Side effects

- nausea and vomiting, dyspepsia, drowsiness, dizziness, headache, orthostatic hypotension, itch, dry mouth, miosis, urinary retention, constipation

Usual preparation

- Tablet:
  - codeine 8 mg, aspirin 300 mg
  - codeine 12.8 mg, ibuprofen 200 mg,
  - codeine 8 mg, paracetamol 500 mg
  - codeine 30 mg, paracetamol 500 mg

5.22 Codeine

Dosage regimen

- Adult: 30–60 mg, oral, every 4 hours if needed. Maximum 240 mg in 24 hours.
- Child greater than 12 years: 0.5–1 mg per kg (up to 30–60 mg), oral, every 4–6 hours if needed. Maximum 240 mg in 24 hours.
- Fixed-dose combinations
  - Codeine with aspirin. Adult: 1–2 tablets every 4 hours if needed, up to a maximum of 8 tablets daily.
  - Codeine with ibuprofen. Adult: 1–2 tablets (of ibuprofen 200 mg and codeine 12.8 mg) every 4 hours if needed, up to a maximum of 6 tablets daily.
  - Codeine with paracetamol. Adult: 1–2 tablets (of paracetamol 500 mg and codeine 8–30 mg) every 4–6 hours if needed, up to a maximum of 8 tablets daily.

Administration

- Codeine (a pro-medicine) is metabolised to morphine by CYP2D6:
- People with normal codeine metabolism, metabolise 30 mg of codeine to approximately 3 mg of morphine.
- Some people are unlikely to obtain pain relief with codeine due to a genetic lack of CYP2D6 (e.g. 6–10% of Caucasians and 1–2% of Asians)
- Some people are ultra-rapid metabolisers and may achieve higher morphine concentrations, increasing their risk of toxicity (those affected include up to 10% of Caucasians, 1–2% of Asians, 21% of people from the Middle East [e.g. Saudi Arabians], and 29% of Ethiopians)
- Beware of potential for over-use leading to dependence with codeine fixed-dose combinations. This has resulted in toxicity from the non-opioid analgesic (e.g. acute renal failure and gastrointestinal perforation from ibuprofen).
- There is no conclusive evidence that products containing 8–15 mg of codeine per tablet with paracetamol, aspirin or ibuprofen have any benefits over these non-opioids alone.

Linked management

4.3 Pain control

5.23 Cophenylcaine Forte

Mechanism of action

- Reversibly interrupts impulse conduction in peripheral nerves and stabilisesexcitable cell membranes by blocking sodium channels, thus inhibiting depolarisation.

Indications

- topical anaesthesia

Contraindications

- hypersensitivity to amide type local anesthetics or sympathomimetics

Cautions

- cardiovascular disease, especially hypertension
- severe bradycardia, conduction disturbances
- digitalis intoxication
- hepatic, renal impairment
- asthma, especially sulfite sensitive
- malignant hyperthermia predisposition
- neurological disorders
- elderly
- debilitated

Use in pregnancy or breastfeeding

- Pregnancy: no accurate information. Safe to use while breastfeeding.

Side effects

- hypotension from lidocaine
- hypertension from phenylephrine
- local skin irritation in mucosa
- palpitations
- bitter taste on swallowing

Pharmacology

- topical anaesthetic

Usual preparation

- nasal mucosal spray (lidocaine 5%, phenylephrine 0.5%): 15 mL; 50 mL

5.23 Cophenylcaine Forte

Dosage regimen

- Adults and children more than 12 year: up to 5 sprays per nostril
- Children: give 1 dose only
  - 2–4 years: 1 spray per nostril
  - 4–8 years: 2 sprays per nostril
  - 8–12 years: 3 sprays per nostril

Administration

- nasal spray

Linked management

4.17 Epistaxis

5.24 Crystalloid solutions

- Compound sodium lactate
- PlasmaLyte 148
- Sodium chloride 0.9% (normal saline)

Compound sodium lactate (Hartmann's)

Indications

- as a replacement fluid in volume-depleted patients
- unresponsive non-hypovolaemic hypotension other than of cardiac origin

Contraindications

- volume overload
- ceftriaxone sodium administration

Cautions

- cardiac heart failure
- severe renal dysfunction

Use in pregnancy or breastfeeding

- Safe to use when pregnant or while breastfeeding.

Pharmacology

- Isotonic crystalloid solution, composing electrolytes: sodium, potassium, calcium, chloride and lactate in a similar concentration to those in extracellular fluid.

Usual preparation

- infusion pack: 500 mL per 1000 mL

Dosage

- The dose required will depend on the clinical status of the patient (e.g. degree of hypovolaemia).
- Resuscitation
  - 10 mL / kg rapidly infused intravenously and repeated as required to a maximum of 30 mL / kg. The infusion should be slowed when circulation is improved and the patient reassessed.

Administration

- IV infusion

Special notes

- May be used as substitute for sodium chloride 0.9% and PlasmaLyte 148.

5.24 Crystalloid solutions

PlasmaLyte 148

Mechanism of action

- Plasma-Lyte 148 is a source of water and electrolytes. It is capable of inducing diuresis depending on the clinical condition of the patient.
- Plasma-Lyte 148 produces a metabolic alkalinising effect. Acetate and gluconate ions are metabolised ultimately to carbon dioxide and water, which requires the consumption of hydrogen cations.

Indications

- Plasma-Lyte 148 is indicated as a source of water and electrolytes, or as an alkalinising agent

Contraindications

- known hypersensitivity to the product

Cautions

Plasma-Lyte 148 is not indicated for:

- the treatment of hypochloremic hypokalaemic alkalosis and should be used with caution in patients with hypochloremic hypokalaemic alkalosis
- the primary treatment of severe metabolic acidosis
- hypomagnesaemia

Use in pregnancy or breastfeeding

- There are no adequate data from the use of Plasma-Lyte 148 in pregnant or lactating women. The potential risks and benefits for each specific patient should be carefully considered before using Plasma-Lyte 148 in pregnant or lactating women.

Side effects

- Volume overload

Pharmacology

- Plasma-Lyte 148 Replacement IV Infusion is a sterile, clear, non-pyrogenic isotonic solution in a single dose container for intravenous administration.
  - hydrochloric acid pH adjustment
  - water for injections q.s. to 1000 mL
  - pH range: 4.0–6.5
  - approximately 294 mOsm
  - approximately 66 kJ

5.24 Crystalloid solutions - Plasma-Lyte 148

- Each 1000 mL of Plasma-Lyte 148 Replacement IV Infusion contains:
  - sodium chloride 5.26 g
  - sodium gluconate 5.02 g
  - sodium acetate 3.68 g
  - potassium chloride 370 mg
  - magnesium chloride 300 mg

Usual preparation

- soft infusion pack: 500 mL; 1000 mL

Dosage regimen

- Titrate to effect based on individual patient need

Administration

- IV; intraosseous

Special notes

- Compound sodium lactate or sodium chloride 0.9% can be used as a replacement.

Sodium chloride 0.9% (normal saline)

Mechanism of action

- Isotonic fluid

Indications

- for restoring the loss of water and electrolytes (i.e. sodium and chloride ions) as required by the clinical condition of the patient
- as a vehicle for the administration of intravenous medicines

Contraindications

- volume overload

Cautions

- impaired renal function

Use in pregnancy or breastfeeding

- Considered safe

Side effects

- Volume overload; hyperchloraemic acidosis is a consideration at volumes over 2000 mL

5.24 Crystalloid solutions - Sodium chloride 0.9% (normal saline)

Pharmacology

- An isotonic solution containing sodium chloride 0.9% in water

Usual preparation

- Infusion: 100 mL; 250 mL; 500 mL; 1000 mL

Dosage regimen

- Dependent on clinical need

Administration

- IV infusion

Special note

- PlasmLyte 148 and Compound Sodium Lactate (Hartmann's solution) can be used as a replacement

Linked management items

4.4.2 Wound cleansing
4.6.6 Cardiogenic shock
4.7.2 Severe allergy or anaphylaxis
4.9 Burns
4.10.1 Hyperglycaemia
4.11 Poisoning
4.11.1 Alcohol
4.11.3 Serotonin syndrome
4.15 Sepsis
4.20 SCUBA diving emergencies
4.21 Shock
4.24.1 Post-partum haemorrhage

5.25 Cyproheptadine

Mechanism of action

- Reduce the effects of histamine by binding to the H1 receptor and stabilising it in an inactive form.
- They also have anticholinergic activity, some have alpha-blocking activity (e.g. promethazine) and some have antiserotonin activity (e.g. cyproheptadine)

Indications

- allergic conditions (e.g. rhinitis, urticaria)
- itch
- serotonin toxicity

Contraindications

- none

Cautions

- elderly and children
- patients on SSRI and MAOI therapy

Use in pregnancy or breastfeeding

- Safe to use in pregnancy. Many of these antihistamines have been used extensively in pregnancy as antiemetics and in treatment of allergic disorders without evidence of fetal adverse effects. Limited data but short-term use while breastfeeding appears safe. Sedation of mother is the main concern.

Side effects

- increased appetite, weight gain
- sedation, psychomotor impairment (below), dizziness, confusion, headache, blurred vision, mydriasis, dry eyes, constipation, dry mouth, urinary retention

Usual preparation

- Tablet: 4 mg

Dosage regimen

- Allergy or itch
  - Adult or child greater than 7 years: initially 4 mg 3 times daily, oral. Maximum 32 mg daily (maximum 16 mg daily if less than 14 years).
  - 2–7 years: initially 2 mg 2 or 3 times daily, oral. Maximum 12 mg daily.

5.25 Cyproheptadine

Dosage regimen

- Serotonin toxicity

  Dosage regimen recommendations vary. The following dosage has been suggested for significant agitation and neuromuscular excitation:

  - Adult: 12 mg, oral. May be repeated once if partial response occurs. If treatment of ongoing symptoms is required (e.g. serotonin toxicity is due to a medicine with a long half-life), use 4–8 mg 3 times daily.

Administration

- oral; gastric tube

Linked management item

4.11.3 Serotonin syndrome

5.26 Dexamethasone

Mechanism of action

Corticosteroids regulate gene expression, which results in:

- glucocorticoid effect (e.g. gluconeogenesis, proteolysis, lipolysis, suppression of inflammation and immune responses)
- mineralocorticoid effects (e.g. hypertension, sodium and water retention, potassium loss)

Corticosteroids may have predominantly glucocorticoid effects (e.g. dexamethasone), mineralocorticoid effects (fludrocortisone), or a combination of both (e.g. hydrocortisone).

Indications

- adrenocortical insufficiency
- shock
- rheumatic disorders
- allergic states
- a wide range of other conditions characterised by inflammation

Contraindications

- systemic fungal infections
- hypersensitivity to sulfites or any other component of the medication

Cautions

- active tuberculosis
- active latent amoebiasis and strongyloidiasis
- pregnancy

Use in pregnancy or breastfeeding

- Considered safe to use in pregnancy as non-treatment may be more serious for the fetus and ongoing pregnancy. Use the lowest effective dose for the shortest possible time.
- hydrocortisone, prednisolone, prednisone and methylprednisolone are preferred for maternal disorders as placental transfer is limited while betamethasone and dexamethasone are preferred for fetal disorders as placental transfer is greater.
- Limited data is available for use while breastfeeding. Consider using alternative corticosteroid (e.g. prednisolone).

5.26 Dexamethasone

Side effects

- may mask some signs of infections; fluid and electrolyte imbalance; elevation of blood pressure; gastrointestinal (including peptic ulceration)

Common adverse effects

- transient itching, burning or tingling in perineal area (after IV bolus)

Pharmacology

- Dexamethasone is a synthetic adrenocortical steroid possessing basic glucocorticoid actions and effects. It has pronounced anti-inflammatory activity at the tissue level.

Usual preparation

- Tablet: 500 micrograms; 4 mg
- Ampoules: 4 mg / mL; 1 mL
- Vials: 4 mg / mL , 1 mL; 2 mL

Dosage regimen

- Cerebral oedema
  - Adult: initially 4–16 mg daily, oral per IV or IM, in 2–4 doses, depending on severity of symptoms (higher doses have been used). Gradually withdraw treatment or reduce to lowest effective dose.
  - Child greater than 1 month: 1–2 mg per kg (maximum 10 mg), IV. Then 0.25 mg / kg every 4–6 hours. Reduce dose over 5–7 days.
- Postoperative nausea and vomiting

  Give before induction of anaesthesia.
  - Adult: 4–10 mg, IV.
  - Child greater than 1 month: 0.1–0.2 mg per kg (maximum 8 mg), IV.
- Chemotherapy-induced nausea and vomiting

  Dosage regimen depends on emetogenicity of chemotherapy (refer to treatment protocols). The following doses may be use:
  - Adult: 4–20 mg, oral per IV, 30 minutes before chemotherapy. If delayed emesis is anticipated, follow with 8 mg, oral,once or twice daily for 2–4 day.
- Bacterial meningitis

  Start dexamethasone before or at the same time as antibacterials.
  - Adult: 10 mg, IV, every 6 hours for 4 days.
  - Child greater than 3 months: 0.15 mg per kg ,IV, every 6 hours for 4 days.

5.26 Dexamethasone

Dosage regimen

- Croup
  - Child greater than 1 month: 0.15–0.3 mg per kg as a single dose, oral per IV or IM, ; up to 0.6 mg per kg has been used for severe croup. Repeat dose after 12–24 hours if necessary.

Administration

- IM injection; IV injection per infusion

Special notes

- May be given directly from the vial without mixing or dilution.

Linked management items

4.5.1 Asthma

4.5.2 Chronic obstructive pulmonary disease (COPD)

4.7.2 Severe allergy or anaphylaxiss

4.8.5 Centipede bite

5.27 Diazepam

Mechanism of action

- Benzodiazepines potentiate the inhibitory effects of GABA throughout the CNS, resulting in anxiolytic, sedative, hypnotic, muscle relaxant and antiepileptic effects

Indications

- Short-term management of anxiety, agitation
- acute alcohol withdrawal
- muscle spasm or spasticity
- conscious sedation
- status epilepticus
- benzodiazepine withdrawal
- acute behavioural disturbance

Contraindications

- respiratory depression
- acute pulmonary insufficiency
- phobic or obsessional states
- head injury
- Myasthenia gravis

Cautions

- respiratory disease
- muscle weakness
- pregnancy, breastfeeding
- reduce dose in elderly and debilitated patients and in hepatic and renal impairment

Use in pregnancy or breastfeeding

- Pregnancy: weigh risk per benefit during pregnancy possible risk of teratogenicity based on conflicting human data. Administration of high doses (in particular if given IV) near-term or during labour may cause neonatal complications (e.g. respiratory depression; hypothermia; floppy infant syndrome: hypotonia, lethargy and poor suckling).
- Breastfeeding: little data, but benzodiazepines have been taken during breastfeeding without adverse effects in the baby. However, avoid repeated doses if possible, particularly of long-acting agents (which may accumulate in the baby), as lethargy and poor feeding in the baby may occur.

5.27 Diazepam

Side effects

- sedation, hypotension, respiratory depression–apnoea, dizziness and confusion, muscle weakness and ataxia

Pharmacology

- Benzodiazepine
- CNS depressant which has sedative, anxiolytic, muscle-relaxing and anticonvulsive effects

Usual preparation

- Ampoule: 10 mg / 2 mL
- Tablet: 2 mg; 5mg
- Oral liquid: 1 mg / mL (100 mL bottle)
- Rectal solution: 1 mg / mL (5 mL; 10 mL)

Dosage regimen

Adult

- Acute severe anxiety, agitation, behaviour disturbance: 5–10 mg, IV. Repeated if necessary every 5–10 minutes to a maximum of 30 mg.
- Anxiety, agitation: 2–5 mg as a single dose, oral. Dosage regimen may be repeated, if necessary, up to a maximum of 10 mg daily.

Benzodiazepine withdrawal

- Give an oral dose equivalent to estimated total daily benzodiazepine intake in 3 or 4 doses each day at fixed times. Gradually taper dosage (e.g. by 10–20%) each week over several weeks. Supervision is required (e.g. regular review when withdrawal is undertaken as an outpatient).
- Some approximate dose equivalents to diazepam 5 mg are: alprazolam 0.25–0.5 mg, bromazepam 3 mg, lorazepam 0.5 mg, nitrazepam 5 mg, oxazepam 15 mg and temazepam 10 mg.

Seizures

- Adult
  - 10 mg, IV. Repeat once after 10–15 minutes if necessary.
  - 10–20 mg, rectal solution. Repeat once after 10–15 minutes if necessary.
- Child
  - 0.2–0.3 mg per kg (maximum 10 mg), IV. Repeat once after 10–15 minutes if necessary.
  - 0.3–0.5 mg per kg (maximum 10 mg), rectal solution. Repeat once after 10–15 minutes if necessary.

5.27 Diazepam

Dosage regimen

Muscle spasm or spasticity (e.g. due to cerebral palsy)

- Adult
  - 2–15 mg daily in divided doses, oral; up to a usual maximum of 30 mg daily.
- Child 1 month–12 years
  - 0.1–0.3 mg per kg daily in 1–3 doses, oral, under specialist advice. Usual maximum 15 mg daily.

Elderly and debilitated

- Halve the usual adult dose.

Administration

- IV; oral; rectal solution (useful in children)

5.28 Doxycycline

Mechanism of action

- Bacteriostatic; inhibit bacterial protein synthesis by reversibly binding to 30S subunit of the ribosome.
- Effect of tetracyclines in acne vulgaris also involves mechanisms other than their antimicrobial activity.

Indications

- treatment of infections when caused by susceptible organisms
- acne
- rosacea (severe cases or failure of topical treatment)
- infections caused by M. pneumoniae
- community-acquired pneumonia
- exacerbation of chronic bronchitis
- acute bacterial sinusitis
- chlamydial (including lymphogranuloma venereum) and other non-gonococcal genital tract infections
- pelvic inflammatory disease
- Rickettsial infections
- melioidosis (with other agents)
- sexually-acquired epididymo-orchitis (with ceftriaxone)
- chronic prostatitis
- prophylaxis of malaria in areas of widespread mefloquine or chloroquine resistance, or in people in whom mefloquine or chloroquine is not tolerated
- treatment of P. falciparum malaria with quinine
- Q fever

Contraindications

- hypersensitivity to tetracyclines

Cautions

- prolonged or high dose use
- renal impairment
- pregnancy and breastfeeding
- children less than 8 years

5.28 Doxycycline

Use in pregnancy or breastfeeding

- Pregnancy: safe if used during the first 18 weeks of pregnancy (16 weeks post-conception). After this period, they are contraindicated as tetracyclines can inhibit bone growth in the fetus (reversible after stopping treatment; permanent bone defects do not appear to occur) and discolour deciduous teeth. Breastfeeding: courses of 7–10 days are considered safe

Side effects

- nausea, vomiting, diarrhoea, epigastric burning; tooth discolouration, enamel dysplasia, reduced bone growth (in children less than 8 years); photosensitivity (depends on tetracycline, dose and degree of sun exposure)

Pharmacology

- Tetracycline

Usual preparation

- Tablet: 50 mg; 100 mg
- Capsule: 50 mg; 100 mg

Dosage regimen

- Adult
  - 200 mg, oral, on day 1 (as a single dose or 100 mg twice daily), then 100 mg once daily.
  - In severe infections (e.g. acute Q fever), 100 mg twice daily can be used (maximum 200 mg daily).
- Child greater than 8 years
  - Initially 2 mg per kg, oral, twice daily on day 1 (maximum 200 mg daily); then 2 mg per kg once daily (maximum 100 mg daily). Round the dose to the nearest 25 mg.
  - In serious infections (e.g. acute Q fever), the dose can be increased to 4 mg / kg daily (maximum 200 mg) in 1 or 2 doses.
- Acne
  - Adult, child greater than 8 years: 50 mg, oral, once daily for at least 6 weeks. Then, if necessary, increase to 100 mg once daily.
- Rosacea
  - Adult: 50 mg, oral, once daily.
- Chlamydial infection, non-gonococcal genital infection
  - Adult: 100 mg, oral, twice daily for 1–3 weeks depending on the site and severity of the infection.

5.28 Doxycycline

Dosage regimen

- Prophylaxis of malaria

  Start 2 days before entering an endemic area. Continue taking doxycycline until 4 weeks after leaving the area.

  - Adult: 100 mg, oral, once daily
  - Child greater than 8 years: 2 mg per kg (maximum 100 mg), oral, once daily
- Treatment of uncomplicated P. falciparum malaria
  - Adult: 100 mg, oral, every 12 hours for 7 days with quinine
  - Child greater than 8 years: 2 mg per kg (maximum 100 mg), oral, every 12 hours for 7 days with quinine.

Administration

- Oral

Linked management item

4.2.1 Antibiotic recommendations

5.29 Droperidol

Mechanism of action

Antipsychotic actions are thought to be mediated (at least in part) by blockade of dopaminergic transmission in various parts of the brain (in particular the limbic system). Evidence suggests:

- all effective antipsychotics block D2 receptors
- differential blockade of other dopamine receptors (e.g. D1) may influence therapeutic and adverse effects
- antagonism of other receptors may influence antipsychotic activity (e.g. 5HT2 antagonism with some agents)

Indications

- short-term management of severe acute anxiety, agitation or disturbed behaviour in psychoses, mania and non-psychotic disorders
- nausea and vomiting

Contraindications

- prolonged QT interval or taking one of the medicines that may prolong it

Cautions

- respiratory failure
- hypotension
- elderly and children

Use in pregnancy or breastfeeding

- Pregnancy: epidemiological data suggest that antipsychotics are not associated with an increased risk of congenital malformations, however,there are limited data for other outcomes
- Neonatal: adverse effects include generalised hypertonicity and dystonic reactions. These may be part of a withdrawal syndrome that can also include sedation, poor sucking and feeding difficulties. There is very little information regarding long-term effects
- Breastfeeding: what little information there is suggests that generally small amounts of antipsychotics pass into breast milk. There are few data regarding long-term effects.

Side effects

- prolonged QT interval
- torsades de pointes, sudden cardiac death

5.29 Droperidol

Common adverse effects

- sedation, anxiety, agitation, orthostatic hypotension, tachycardia, blurred vision, mydriasis, constipation, nausea, dry mouth, urinary retention

Usual preparation

- Ampoule: 2.5 mg / mL; 1 mL; 2 mL

Dosage regimen

- Adult

  Ensure that cardiorespiratory resuscitation facilities are available

  - 2.5–10 mg single dose, IM. Repeat every 20 minutes as necessary. Maximum 20 mg / 24 hours.
  - 2.5–5 mg single dose, IV. Repeat every 5–20 minutes as necessary. Maximum 20 mg / 24 hours.
- Nausea / vomiting
  - 0.5 mg–0.625 mg, IV. Repeat every 5–20 minutes as necessary.

Administration

- IM; IV

5.30 Enoxaparin

Mechanism of action

- Enoxaparin is a low molecular weight heparin (LMWH) anticoagulant.
- Enoxaparin potentiates the activity of anti-thrombin lll (a naturally occurring anticoagulant) causing inhibition of multiple coagulation factors, particularly factor Xa.

Indications

- STEMI in conjunction with fibrinolytic therapy

Contraindications

- known severe allergy

Cautions

- clinically significant bleeding; enoxaparin will increase bleeding
- at risk of bleeding. Seek clinical advice prior to administration
- pregnancy

Use in pregnancy or breastfeeding

- Safety has not been demonstrated. The likelihood of STEMI occurring in a woman who is pregnant is so low that personnel must seek clinical advice prior to administration. May be administered if the patient is breastfeeding. Advise the patient to stop breastfeeding and seek further advice from their lead maternity carer.

Dosage regimen

Dosage regimen is based on age and known (or estimated) weight.

	Age less than 75 years		Age ≥75 years	
Weight	**Enoxaparin (dose SC)**	**Enoxaparin (volume SC)**	**Enoxaparin (dose SC)**	**Enoxaparin (volume SC)**
less than 60 kg	60 mg	0.6 mL	45 mg	0.45 mL
60–69 kg	70 mg	0.7 mL	50 mg	0.5 mL
70–79 kg	80 mg	0.8 mL	60 mg	0.6 mL
80–89 kg	90 mg	0.9 mL	70 mg	0.7 mL
≥90 kg	100 mg	1 mL	75 mg	0.75 mL

(SC, subcutaneously)

5.30 Enoxaparin

Administration

- Administer subcutaneously into the abdominal wall.
- There is no need to sterilise the skin at the site of injection unless the skin is visibly contaminated.
- Discard unwanted medicine from the syringe before administration. Pinch a fold of skin over the anterior abdominal wall between thumb and forefinger. Introduce the entire length of the needle using a dart technique and inject.
- If an error is made in discarding unwanted medicine, and the dose remaining in the syringe is less than planned, administer the remaining dose.

Common adverse effects

- Increased bleeding

Usual onset of effect

- 10–30 minutes

Usual duration of effect

- 12–24 hours

Usual preparation

- Prefilled syringe containing 20 mg; 40 mg; 60 mg; 80 mg; 100 mg; 120 mg; 150 mg

Pharmacology

- Enoxaparin is predominately excreted in urine.
- Clearance is prolonged if the patient has significant renal impairment, but this does not alter the initial (loading) dose.

Common interactions

- The risk of bleeding will be increased if the patient is taking an anticoagulant (e.g. warfarin or dabigatran).

Linked management item

4.6.5 Atrial Fibrillation

5.31 Entonox

Mechanism of action

- Nitrous oxide is the active ingredient in entonox.
- Nitrous oxide is an analgesic. The action is poorly understood but includes:
  - suppression of CNS impulses
  - blockade of N-methyl-d-aspartate (NMDA) receptors
  - stimulation of gamma amino-butyric acid (GABA) receptors

Indications

- Moderate to severe pain, usually in addition to other measures

Contraindications

- known severe allergy
- unable to obey commands
- suspected pneumothorax
- suspected bowel obstruction
- SCUBA diving in the past 24 hours
- SCUBA diving-related emergency

Cautions

- Administration within a confined space
- Repeated use has been associated with psychological dependence, bone marrow suppression and neurological disorders
- Patients with chronic pain syndromes who call an ambulance frequently are at high risk of developing adverse effects from repeated entonox administration and entonox should be avoided in these patients

Use in pregnancy or breastfeeding

- Safe, and may be administered if indicated

Dosage regimen

- Inhaled as required

Administration

- Administer via a mouth piece or a mask and always use a filter
- Whenever possible have the patient self-administer entonox
- If the cylinder has been subjected to low temperatures (for example below 4°), the nitrous oxide and oxygen may separate out; the cylinder should be inverted 3–5 times before administration to remix them

5.31 Entonox

Administration

- Maximising ventilation (e.g. having ventilation fans on) reduces occupational exposure

Common adverse effects

- sedation and/or light-headedness; euphoria; metallic taste

Usual onset of effect

- 1–2 minutes

Usual duration of effect

- 2–5 minutes after stopping administration

Usual preparation

- 50% nitrous oxide and 50% oxygen in a cylinder

Pharmacology

- Entonox is rapidly absorbed via inhalation
- Metabolism of entonox is minimal and it is mostly eliminated, unchanged, through exhalation

Common interactions

- The effects will be increased in the presence of other analgesic medicines or sedatives (e.g. opioids, benzodiazepines or alcohol)

Special notes

- The nitrous oxide in entonox expands gas-filled spaces in the body. This is the reason for many of its contraindications.
- Entonox is not contraindicated in a patient with chest injury but is contraindicated if a pneumothorax is suspected. Entonox administration should be discontinued if it is associated with worsening respiratory distress in a patient with chest injury.
- Entonox is not contraindicated in a patient with abdominal pain but is contraindicated if a bowel obstruction is suspected. Bowel obstruction may present with vomiting and abdominal discomfort. Abdominal distension and reduced frequency of bowel motions or passing of gas may be present.

Linked management item

4.3 Pain control

5.32 Fentanyl

Mechanism of action

- Fentanyl is an opioid analgesic. It is an opioid agonist (or stimulator) that binds to opioid receptors in the brain and spinal cord causing analgesia.

Indications

Moderate to severe pain when the patient:

- requires intense analgesia for a short period of time only (e.g. joint relocation) OR
- has clinically significant shock OR
- does not have IV access

Contraindications

- known severe allergy
- unable to obey commands (exceptions: administration for rapid sequence intubation, agitated delirium and post-intubation)
- current respiratory depression

Cautions

- badycardia
- use with caution in patients with hepatic or renal dysfunction
- hypotension or shock
- children 1 year old or less are at increased risk of respiratory depression following opioid administration.
- at high risk of respiratory depression (e.g. severe COPD, morbid obesity or on home BiPAP). Such patients may develop respiratory depression following opioid administration
- during labour, opioids cross the placenta and may cause drowsiness and/or respiratory depression in the baby, particularly when administered within 1–2 hours of birth. Discuss administration with the lead maternity carer if possible. Following birth, close observation of the baby is required and personnel must be prepared to treat respiratory depression.

Use in pregnancy or breastfeeding

- Safety has not been demonstrated in pregnancy, but fentanyl should be administered if indicated. May be administered if the patient is breastfeeding.

Side effects

- rash, erythema, bradycardia, nausea

5.32 Fentanyl

Common adverse effects

- respiratory depression
- bradycardia
- hypotension (though less than morphine)
- sedation
- nausea and vomiting
- itch (though less than morphine)
- euphoria

Dosage regimen

- IV for analgesia
  - Adult: 10–50 microgram every 3–5 minutes. Use a dose at the lower end of the range if the patient is small, frail or cardiovascularly unstable.
- Intranasal for analgesia
  - Adult weighing 80 kg or less: 100 microgram, IN. Further doses of 50 microgram may be administered every 10 minutes without a maximum dose. Halve these doses if the patient is frail or cardiovascularly unstable.
  - Adult weighing greater than 80 kg: 200 microgram, IN. Further doses of 100 microgram may be administered every 10 minutes without a maximum dose. Halve these doses if the patient is frail or cardiovascularly unstable.
  - Paediatric: 1–2 microgram / kg
- IV for rapid sequence intubation.

Administration

- The preferred route for administration in adults is IV.

Usual onset of effect

- IV: 2–5 minutes. The maximal analgesic and respiratory depressant effects may not occur until 10–15 minutes and this may be longer in the elderly.
- IN: 5–10 minutes.

Usual duration of effect

- 30–60 minutes. The effect on respiration may last for several hours.

Usual preparation

- Ampoule: 100 microgram per 2 mL

5.32 Fentanyl

Pharmacology

- Fentanyl is more lipophilic (fat soluble) than morphine and this is why fentanyl is well absorbed through the nasal mucosa.
- Fentanyl is metabolised in the liver.
- There are no significant effects from liver impairment on acute administration.

Common interactions

- The effects will be increased in the presence of other opioids and sedatives (e.g. benzodiazepines or alcohol).

Linked management

4.16 Autonomic dysreflexia
4.3 Pain control
4.24.2 Rapid sequence intubation (RSI)

5.33 Fexofenadine

Mechanism of action

- Reduce the effects of histamine by binding to the H_1 receptor and stabilising it in an inactive form.

Indications

- mild allergic reaction (e.g. rash, urticaria, allergic rhinitis)

Contraindications

- known hypersensitivity to fexofenadine

Cautions

- use with caution in children
- severe renal impairment

Use in pregnancy or breastfeeding

- Safe to use although there is more experience with older sedating antihistamines.

Side effects

- dry mouth, headache, drowsiness, nausea

Pharmacology

- antihistamine, minimally sedating
- antagonises the action of histamine on the H1 receptors

Usual preparation

- Tablets: 30 mg; 60 mg; 120 mg; 180 mg
- Oral liquid: 6 mg / mL

Dosage regimen

- Rhinitis
  - Adult and child greater than 12 years: 120 mg daily in 1 or 2 doses, oral, OR 180 mg once daily.
- Urticaria
  - 180 mg once daily, oral.
  - Child 2–12 years: 30 mg twice daily, oral
  - 6 months–2 years (chronic urticaria only):15 mg twice daily, oral.

Administration

- Oral

5.33 Fexofenadine

Usual onset of effect

- 30–60 minutes

Usual duration of effect

- Greater than 12 hours

Linked management

4.7.1 For mild or moderate allergy

5.34 Flucloxacillin

Mechanism of action

- Bactericidal; interfere with bacterial cell wall peptidoglycan synthesis by binding to penicillin-binding proteins, eventually leading to cell lysis and death

Indications

- Staphylococcal skin infections including folliculitis, boils, carbuncles, bullous impetigo, mastitis, crush injuries, stab wounds, infected scabies
- pneumonia
- osteomyelitis, septic arthritis
- septicaemia
- empirical treatment for endocarditis
- surgical prophylaxis

Contraindications

- history of cholestatic hepatitis associated with dicloxacillin or flucloxacillin.
- history of immediate (e.g. urticaria, bronchospasm, anaphylaxis) or severe (e.g. interstitial nephritis) hypersensitivity to a penicillin.

Cautions

- cross-reactivity between penicillins, cephalosporins and carbapenems can occur
- sodium restriction, heart failure (injection contains approximately 50.6 mg sodium / gram)

Use in pregnancy or breastfeeding

- Safe to use in pregnancy and breastfeeding, however may cause loose bowel actions in the baby.

Side effects

- transient increases in liver enzymes and bilirubin
- cholestatic hepatitis
- diarrhoea
- nausea
- pain and inflammation at injection site
- superinfection (including candidiasis) especially during prolonged treatment with broad-spectrum penicillins
- allergy

5.34 Flucloxacillin

Pharmacology

Beta lactam

Usual preparation

- Capsule: 250–500 mg
- Vial: 500 mg; 1 g

Dosage regimen

Adult

- 250–500 mg every 6 hours, oral. Maximum 4 g daily.
- 1–2 g every 6 hours, IV. Maximum 12 g daily (e.g. endocarditis, staphylococcal pneumonia).

Child >1 month

- 12.5–25 mg per kg (maximum 1 g) every 6 hours, oral .
- Usually 25 mg per kg (maximum 1 g) every 6 hours, IV. Use up to 50 mg per kg (maximum 2 g) every 4–6 hours in severe infections.

Surgical prophylaxis

- Adult or child > 1 month
  - 50 mg per kg (maximum 2 g), IV. To be completed before skin incision.

Administration

- oral, IV

Linked management

4.2 Antibiotic stewardship

5.35 Frusemide

Mechanism of action

- Inhibit reabsorption of sodium and chloride in the ascending limb of the loop of Henle. This site accounts for retention of approximately 20% of filtered sodium; therefore, these are potent diuretics.
- Produce a rapid and intense diuresis and have a short duration of action (4–6 hours). They are effective over a wide dose range with a dose-related response.

Indications

- oedema associated with congestive heart failure, hepatic cirrhosis, renal impairment and nephrotic syndrome
- severe hypercalcaemia (with adequate rehydration)

Contraindications

- complete anuria
- known hypersensitivity to sulfonamides
- severe sodium and fluid depletion
- untreated hypokalaemia and hyponatraemia

Cautions

- pregnancy
- may cause hypokalaemia and hyponatraemia
- aggravates diabetes mellitus and gout
- liver failure
- prostatic enlargement
- rapid IV injection or infusion can cause ototoxicity

Use in pregnancy or breastfeeding

- Avoid use in pregnancy as may cause electrolyte disturbances in the fetus; possible neonatal thrombocytopenia. Little data for use while breastfeeding; use with caution (unlikely to suppress lactation).

Side effects

- electrolyte disturbances (e.g. hyponatraemia, hypokalaemia, hypomagnesaemia, hypochloraemia, hypocalcaemia)
- dehydration, metabolic alkalosis, increased creatinine concentration, hyperuricaemia, gout, dizziness, orthostatic hypotension, fainting

Pharmacology

- Potent loop diuretic

5.35 Frusemide

Usual preparation

- Ampoule: 20 mg per 2 mL; 40 mg per 4 mL; 250 mg per 25 mL
- Tablet: 20 mg; 40 mg; 500 mg

Dosage regimen

Oedema

- Adult
  - Initially 20–40 mg once or twice daily. oral, adjusted according to clinical response to maintenance dose of 20–400 mg daily. Maximum dose 1 g daily.
  - 20–40 mg, IV or IM. Repeat at intervals of at least 2 hours until the desired diuretic effect is obtained (increase dose by 20 mg each time if necessary).
- Child
  - Initially 1–2 mg per kg, oral. If necessary, increase dose by 1–2 mg per kg every 6–8 hours (maximum dose 6 mg per kg). Once diuresis is satisfactory, adjust to the lowest effective dose (usually unnecessary to use a dose greater than 4 mg per kg or to give greater than 2 doses daily).
  - Initially 0.5–1 mg per kg, IV or IM. If necessary, increase dose by 1 mg per kg at intervals of at least 2 hours until the desired diuretic effect is obtained (maximum dose 6 mg per kg).

Hypercalcaemia

- Adult: 80–100 mg every 1–2 hours, IV.

Dosage regimen equivalence

- The oral bioavailability of frusemide is about 50% (i.e. 20 mg, IV, is equivalent to 40 mg, oral), however, it may be even lower in severe heart failure and renal disease; individualise dose according to clinical response.

Administration

- IM injection
- slow IV injection
- IV infusion

Special notes

- Following intravenous administration, frusemide has initial effect within some minutes, and peak effect within 30 minutes. Duration of effect is about 2 hours.
- 250 mg ampoule for infusion ONLY.
- Rate of injection SHOULD NOT exceed 4 mg per minute.

Linked management

4.6.2 Cardiogenic pulmonary oedema

5.36 Gentamicin

Mechanism of action

- Gentamicin is an aminoglycoside antibiotic with broad activity against gram negative bacteria and some activity against gram positive bacteria.
- Gentamicin inhibits bacterial cell protein synthesis, causing bacteria to die.

Indications

- treatment of serious infections due to susceptible organisms
- empirical treatment for less than 48 hours of serious gram-negative infections
- serious systemic enterococcal infections (with beta-lactams or vancomycin)
- serious infections due to sensitive organisms that are resistant to other antibacterials
- surgical prophylaxis
- P. aeruginosa infections, including cystic fibrosis, bronchiectasis (inhalation)
- brucellosis
- eye infections

Contraindications

- known severe allergy
- previous toxic reaction to aminoglycoside
- pregnancy

Cautions

- renal impairment
- prolonged or high dose use
- dehydration
- pregnancy and breastfeeding
- children
- elderly

Use in pregnancy or breastfeeding

- May cause foetal harm during pregnancy and should not be administered. May be administered if the patient is breastfeeding. Advise the patient to stop breastfeeding and seek further advice from their lead maternity carer.

Side effects

- gastrointestinal upset, rash, purpura, visual disturbance, lethargy, confusion

5.36 Gentamicin

Common adverse effects

- None when administered at the appropriate rate.
- Although renal impairment is commonly listed, this is usually not of significant concern unless there is repeated dosing.
- Ototoxicity (damage to the inner ear) has been reported, but this usually only happens with rapid boluses and/or prolonged dosing.

Common interactions

- Gentamicin may potentiate the actions of neuromuscular blockers, resulting in a longer duration of action from these medicines.

Pharmacology

- Aminoglycoside antibiotic
- Gentamicin is excreted in urine
- Clearance is prolonged if the patient has significant kidney impairment, but this does not alter the initial (loading) dose.

Usual preparation

- Ampoule: 80 mg in 2 mL.

Dosage regimen

- Adults
  - 240 mg if weighs less than 60 kg
  - 320 mg if weighs 60–80 kg
  - 400 mg if weighs greater than 80 kg.
- Child
  - 1 month–10 years: 7.5 mg per kg (maximum 320 mg) once daily, IM or IV.
  - greater than 10 years: 6–7 mg per kg (maximum 560 mg) once daily, IM or IV.

Administration

- IV: dilute in 100–200 mL of a crystalloid; administer over 15–30 minutes.
- IM: injection administered into a large muscle mass.
- Do not administer as an IV bolus as this increases the risk of adverse effects.

Usual onset of effect - 30–60 minutes.

Usual duration of effect - 24 hours.

Linked management

4.2 Antibiotic stewardship

5.37 Glucagon

Mechanism of action

- Glucagon increases the blood glucose level by stimulating glycogenolysis (the breakdown of glycogen into glucose), predominantly within the liver.

Indications

- Hypoglycaemia when the patient cannot swallow glucose or food, and IV access cannot be obtained.
- Adjunct in treatment of beta-blocker or calcium channel blocker overdose
- Adjunct in treatment of anaphylaxis refractory to adrenaline (epinephrine) infusion

Contraindications

- known severe allergy.
- phaeochromocytoma
- glucagonoma
- insulinoma
- known hypersensitivity to glucagon

Cautions

- the presence of solid particles in the reconstituted solution is a contraindication to its use at any time
- less effective in chronic hypoglycaemia, starvation and adrenal insufficiency

Use in pregnancy or breastfeeding

- Safe and should be administered if indicated

Side effects

- transient nausea and vomiting
- rarely, hypersensitivity reaction

Dosage

- Adult or child greater than 5 years and over: 1 mg, IM. Do not repeat the IM dose.
- Child less than five years: 0.5 mg, IM. Do not repeat the IM dose.

Administration

- IM injection. Dissolve the powder using the syringe within the kit. The preferred site is the mid-lateral thigh. If this site is not available use the lateral upper arm.
- Adjunctive therapy: 1–5mg, IV bolus. Repeat after 5–10 minutes

Common adverse effects

- None.

5.37 Glucagon

Usual onset of effect

- 5–10 minutes (depending on absorption)

Usual duration of effect

- 15–60 minutes

Usual preparation

- Ampoule containing 1 mg (1 units) of glucagon as a powder for reconstitution. Reconstitute with diluent provided or as instructed by the specific product literature.

Pharmacology

- Glucagon is an insulin antagonist.
- Glucagon is predominantly excreted unchanged into bile and urine.
- There are no significant effects from liver or kidney impairment on acute administration.
- Hyperglycaemic agent that mobilises hepatic glycogen which is released into the blood stream as glucose
- Glucagon relies on stored glycogen being available to exert its effect. If glycogen stores are not available, glucagon may be ineffective. Examples include, if the patient:
  - has undergone strenuous exercise
  - has not eaten food for more than 12 hours
  - is suffering from adrenal insufficiency
  - is suffering from chronic hypoglycaemia
  - is suffering from alcohol-induced hypoglycaemia.
- Following glucagon administration, the patient's glycogen stores will be depleted. For this reason it is important the patient eats food. See Hypoglycaemia.

Special note

- 1 unit of glucagon = 1 mg glucagon

Linked management

4.10.2 Hypoglycaemia

5.38 Glucose gel

Mechanism of action

- Glucose gel provides a source of glucose that can be easily swallowed and is rapidly absorbed.

Indications

- Hypoglycaemia provided the patient is conscious enough to be able to swallow.

Contraindications

- None

Cautions

- None

Use in pregnancy or breastfeeding

- Safe

Dosage regimen

- 10–20 g for all ages.
- Administer one tube. Repeat every 10 minutes if hypoglycaemia persists or recurs.

Administration

- Oral. The gel may be spread on the gums, tongue and inside of the cheeks of a baby or small child.

Usual onset of effect

- 5–10 minutes.

Usual duration of effect

- 30–60 minutes.

Usual preparation

- There are multiple different brands. Most are a tube containing 15 g of glucose.

Pharmacokinetics

- Glucose is absorbed in the stomach and small intestine. Glucose is rapidly metabolised by cells.

Special notes

- Document the approximate number of grams of oral glucose administered.

Linked management

4.10.2 Hypoglycaemia

5.39 Glucose 5%

Indications

- as a dilutant fluid in infusion preparations

Contraindications

- none

Cautions

- none

Use in pregnancy or breastfeeding

- Safe to use while pregnant and when breastfeeding.

Pharmacology

- Hypotonic crystalloid solution
- Composition: water, glucose.

Usual preparation

- infusion pack: 100 mL; 500 mL; 1000 mL

Dosage

- used to dilute medicines for infusion only
- not intended as an IV infusion solution

Administration

- IV infusion

Special notes

- may NOT be used as substitute for other crystalloid

5.40 Glucose 10% and 50%

Mechanism of action

- Immediate-release sugar to combat hypoglycaemia

Indications

- Symptomatic hypoglycaemia

Contraindications

- none

Cautions

- inject slowly

Use in pregnancy or breastfeeding - Safe to use.

Side effects - hyperglycaemia

Pharmacology

- A 50% solution of glucose is STRONGLY HYPERTONIC and will promote diuresis by increasing the osmotic pressure of the glomerular filtrate

Usual preparation

- Predrawn syringe: 25 g per 50 mL
- Vial: 25 g per 50 mL (50%)
- Ampoule: 5 g per 10 mL (10%)
- IV infusion: 25 g per 250 mL; 50 g per 500 mL; 100 g per 1000 mL (10%)

Dosage regimen

- Adults: 50% solution up to 25 mL by slow (3 mL per minute), IV injection; OR 10% solution 3–5 mL / kg, IV infusion (maximum 250 mL). Total dose will vary according to response.
- Children and neonates: 50% solution 1 mL / kg, IV. Adjust as required; OR 10% solution 3–5 mL / kg, IV infusion (maximum 250 mL).

Administration - IV

Special notes

- The rate of use of glucose varies considerably from patient to patient. After 25 g of glucose has been given it is advisable to evaluate the effect. Review product information for incompatibilities.

Linked management

4.10.2 Hypoglycaemia

5.41 Glyceryl trinitrate

Mechanism of action

- Glyceryl trinitrate (GTN) is a vasodilator. It acts on vascular smooth muscle to cause venous and arterial vasodilation, with the predominant effect being on veins.
- The action is not clear, but it appears that GTN results in the formation of nitric oxide which is a vasodilator. GTN causes:
  - a reduction in venous return (preload) to the heart. This reduces ventricular filling and cardiac output which reduces myocardial oxygen demand.
  - arterial dilation which reduces peripheral resistance (after load). This reduces the force the left ventricle must overcome to eject blood into the arteries which reduces myocardial oxygen demand.
  - dilation of the coronary arteries which may increase coronary blood supply, though this is not usually clinically significant.

Indications

- myocardial ischaemia
- cardiogenic pulmonary oedema
- hypertension associated with autonomic dysreflexia

Contraindications

- ventricular tachycardia
- a medicine for erectile dysfunction has been taken within the last 24 hours.

Cautions

- heart rate:
  - less than 40 per minute
  - more than 150 per minute
- systolic BP less than 100 mmhg
- STEMI, particularly involving the right ventricle. GTN may cause a significant fall in cardiac output and if there are signs of low cardiac output GTN should be withheld
- the patient is small, frail, or physiologically unstable
- known aortic or mitral stenosis

Use in pregnancy or breastfeeding

- Safety has not been demonstrated. The likelihood of a pregnant or breastfeeding patient requiring GTN is very low, but GTN should be administered if indicated.

5.41 Glyceryl trinitrate

Dosage regimen

- Sublingual tablet
  - Adult: 300–600 micrograms. Repeat every 5 minutes as required.
- Sublingual spray
  - Adult: 400 micrograms (1 spray). Repeat after 5 minutes as required.
- Patch
  - Adult: 5 mg patch for up to 14 hours daily. May be increased up to 15 mg patch.
- IV infusion
  - Adult: titrate to effect. Start at 5 micrograms per minute. Increase by 5 micrograms per minute every 3–5 minutes until desired clinical response. Usual dose in heart failure is 20–80 micrograms per minute.

Administration

- Spray or place tablet under the tongue.

Common adverse effects

- hypotension
- flushing
- headache
- tachycardia
- light-headedness

Usual onset of effect

- 1–2 minutes

Usual duration of effect

- 15–30 minutes

Usual preparation

- Transdermal patch: 5 mg; 10 mg; 15 mg
- Pump spray: 400 micrograms per spray
- Sublingual tablets: 300 micrograms; 600 micrograms
- Ampoule: 5 mg / mL

Pharmacology

- GTN is rapidly absorbed from the oral mucosa and reaches the vascular system without passing through the liver.
- GTN is predominantly metabolised in the liver.
- There are no significant effects from liver impairment on acute administration.

5.41 Glyceryl trinitrate

Common interactions

- The effects may be increased if the patient is taking an anti-hypertensive medicine.

Special notes

- GTN is susceptible to heat and moisture. Make sure that tablets are stored in their original light-resistant, tightly sealed bottle. Tablets should be discarded 3 months after opening the bottle.
- There is a range of medicines with different names used for erectile dysfunction and some of them (particularly sildenafil [Viagra]) are also used in the treatment of pulmonary hypertension. Significant and prolonged hypotension can occur if GTN is used within 24–48 hours of the use of these medicines

Comments

- Aiming to simplify the considerations given there is variability of advice in this space and no clear HR defined across the reference materials
- The discussion related to the right ventricle is being tested in the literature currently, with some challenge to the assumptions in this regard. There is insufficient evidence to support any change to this comment at this time.

Linked management

4.6.1 Ischaemic chest pain

4.6.2 Cardiogenic pulmonary oedema

4.8.8 Irukandji stings

4.16 Autonomic dysreflexia

5.42 Granisetron

Mechanism of action

- Central and peripheral 5HT3 receptor blockade

Indications

- nausea and vomiting, associated with chemotherapy, cancer, or radiotherapy

Contraindications

- none

Cautions

- 5ht antagonist sensitivity
- subacute intestinal obstruction
- electrolyte abnormality
- prolonged QT interval
- pregnancy and breastfeeding

Use in pregnancy or breastfeeding

- May be used after the first trimester of pregnancy if other medicines are inadequate for nausea and vomiting. Ondansetron is preferred because of greater experience. Limited data for Granisetron (human data lacking for tropisetron and palonosetron). For breastfeeding, no data are available, although 1 or 2 doses after delivery should not be a concern.

Side effects

- agitation, anxiety, somnolence, rash, taste disturbance

Pharmacology

- Central and peripheral 5HT receptor blockade leading to reduction in nausea and vomiting.

Usual preparation

- Ampoule for injection: 1 mg per 1 mL; 3 mg per 3 mL

Dosage regimen

- Adult: 1 mg, IV. Give doses of 1 mg or less by slow IV injection (at least 1 minute). Consider IV infusion over 5 minutes. Dosage regimens of greater than 1 mg MUST be by IV infusion over at least 15 minutes.

Administration - IV. Do not give by IM route.

Linked management

4.18 Nausea and vomiting

5.43 Haloperidol

Mechanism of action

Antipsychotic actions are thought to be mediated (at least in part) by blockade of dopaminergic transmission in various parts of the brain (in particular the limbic system). Evidence suggests:

- all effective antipsychotics block D2 receptors
- differential blockade of other dopamine receptors (e.g. D1) may influence therapeutic and adverse effects
- antagonism of other receptors may influence antipsychotic activity (e.g. 5HT2antagonism with some agents)

Indications

- acute and chronic psychoses
- acute mania
- Tourette syndrome and other choreas
- adjunct in treatment of hallucinations due to alcohol withdrawal (if diazepam inadequate)
- intractable nausea and vomiting associated with cancer chemotherapy or radiotherapy
- short-term management of acute, severe anxiety, agitation or disturbed behaviour in non-psychotic disorders

Contraindications

- comatose states
- in the presence of CNS depression due to alcohol and other depressant medicines
- Parkinson's disease
- known hypersensitivity to haloperidol
- children less than 3 years
- basal ganglia lesions

Cautions

- thyrotoxic patients may be more prone to side effects
- caution in patients where QT interval may be prolonged
- neuroleptic malignant syndrome (rare)
- pregnancy and lactation
- elderly and children

5.43 Haloperidol

Use in pregnancy or breastfeeding

- Epidemiological data for pregnancy suggest that antipsychotics are not associated with an increased risk of congenital malformations, however, there are limited data for other outcomes.
- In neonatals, adverse effects may include generalised hypertonicity and dystonic reactions. These may be part of a withdrawal syndrome that can also include sedation, poor sucking and feeding difficulties.
- What little information there is suggests that generally small amounts of antipsychotics pass into breast milk.

Side effects

- sedation, anxiety, agitation, orthostatic hypotension, tachycardia, blurred vision, mydriasis, constipation, nausea, dry mouth, urinary retention

Pharmacology

- Butyrophenone antipsychotic. Selective effect on CNS by competitive blockade of D2 receptors resulting in antipsychotic effects.

Usual preparation

- Ampoule: 5 mg / 1 mL; 50 mg / 1 mL
- Tablets: 0.5 mg; 1.5 mg; 5 mg
- Oral liquid: 2 mg / mL

Dosage regimen

- Acute psychoses and mania
  - 5–10 mg, oral. Every 2 hours as needed.
  - 2–10 mg, short-acting IM. Every hour as needed.
- Agitation, anxiety, disturbed behaviour, hallucinations due to alcohol withdrawal
  - 1–5 mg, oral, 2 or 3 times daily.
  - 2–10 mg single dose, short-acting IM or IV. Repeat every 2–6 hours (or more often) if needed. Maximum 15 mg in 24 hours.
- Nausea and vomiting in oncology
  - 1–2 mg, oral, every 8 hours as needed.

Administration

- IV; IM; oral

5.44 Heparin

Mechanism of action

- Heparin is an anticoagulant. It has the potential to activate anti-thrombin lll (a naturally occurring anticoagulant) causing inhibition of multiple coagulation factors.

Indications

- STEMI in conjunction with fibrinolytic therapy

Contraindications

- known severe allergy
- age 75 years or older. When heparin is administered in combination with fibrinolytic therapy in patients aged 75 years or older, there is an increased risk of fatal intracerebral haemorrhage

Cautions

- clinically significant bleeding; heparin will increase bleeding
- if at risk of bleeding, seek clinical advice prior to administration
- pregnancy and breastfeeding

Use in pregnancy or breastfeeding

- Safety has not been demonstrated during pregnancy. May be administered if the patient is breastfeeding.

Dosage

- IV bolus: 60 units / kg (up to 4000 units)
- IV infusion: 12 units / kg / hour (up to 1000 units / hour)

Administration

- Dilute to a total volume of 5–10 mL using a crystalloid.
- Administer IV bolus. Commence infusion approximately 15 minutes after the fibrinolytic therapy.
- If infusion not available: 1000 units as a bolus each hour (after initial 5000 units bolus) until patient arrives at hospital with preferably a percutaneous coronary intervention (PCI) centre.

Common adverse effects

- Increased bleeding

Usual onset of effect

- 5–15 minutes

5.44 Heparin

Usual duration of effect

- 2–4 hours

Usual preparation

Ampoule:

- 1000 units in 1 mL
- 5000 units in 0.2 mL;1 mL; 5 mL
- 25,000 units in 5 mL

Common interactions

- The risk of bleeding will be increased if the patient is taking an anticoagulant (e.g. Warfarin or Dabigatran)

Linked management

4.6.5 Atrial Fibrillation

5.45 Hydrocortisone sodium succinate

Mechanism of action

- Corticosteroids regulate gene expression, which results in:
  - glucocorticoid effects (e.g. gluconeogenesis, proteolysis, lipolysis, suppression of inflammation and immune responses)
  - mineralocorticoid effects (e.g. hypertension, sodium and water retention, potassium loss)
- Corticosteroids may have predominantly glucocorticoid effects (e.g. dexamethasone), mineralocorticoid effects (fludrocortisone), or a combination of both (e.g. hydrocortisone)

Indications

- asthma
- acute allergic reactions including anaphylactic reaction
- acute adrenal crisis per insufficiency

Contraindications

- hypersensitivity to hydrocortisone
- systemic fungal infections

Cautions

- active tuberculosis

Use in pregnancy or breastfeeding

- Pregnancy: considered safe to use as non-treatment may be more serious for the fetus and ongoing pregnancy. Use the lowest effective dose for the shortest possible time. Breastfeeding: safe to use; caution with high doses.

Side effects

- sodium retention
- fluid retention
- congestive heart failure in susceptible patients
- potassium loss
- hypokalaemic alkalosis
- hypertension

5.45 Hydrocortisone sodium succinate

Pharmacology

- Hydrocortisone (cortisol) is a corticosteroid formed and secreted by the adrenal cortex.
- It is a glucocorticoid corticosteroid with mineralocorticoid properties and as such has numerous and widespread effects including metabolic and anti-inflammatory actions.

Usual preparation

- Vials (powder for reconstitution): 100 mg; 250 mg

Dosage regimen

- Adult
  - 100–250 mg, initial dose IV or IM, depending on severity of condition. May be repeated up to 3–4 times per day as indicated.
  - 100 mg, IV, over 30 seconds
- Child: 2–4 mg per kg, IV or IM, every 6 hours for 24 hours then reduce.

Administration

- IV injection per infusion
- IM injection

Linked management

4.5.1 Asthma

4.5.2 COPD

4.7.2 Severe allergy or anaphylaxis

5.46 Hyoscine butylbromide

Mechanism of action

- Smooth muscle relaxant; reduces gastrointestinal motility and spasm

Indications

- gastrointestinal spasm
- renal and biliary spasm

Contraindications

- gastrointestinal obstruction or atony
- urinary obstruction
- myasthenia gravis

Cautions

- elderly and children
- heart disease (including arrhythmias, coronary heart disease, heart failure): may be exacerbated
- prostatic hypertrophy: symptoms may worsen
- inflammatory bowel disease: risk of paralytic ileus
- gastro-oesophageal reflux: may be aggravated
- fever, high ambient temperature: risk of hyperthermia

Use in pregnancy or breastfeeding

Safe to use in pregnancy. Appears safe while breastfeeding.

Dosage regimen

- Adult: 10–20 mg, oral, 3 or 4 times daily
- Child greater than 6 years: 10 mg, oral, 3 times daily
- Acute spasm

  Dosage regimens can be repeated after 30 minutes if needed (may need to be repeated more frequently in endoscopy).
  - Adult: 20–40 mg, IV or IM. Maximum 100 mg daily.
  - Child greater than 6 years: 5–10 mg, IV or IM. Maximum 30 mg daily.
  - Child 2–6 years: 5 mg, IV or IM. Maximum 15 mg daily.

Administration

- oral; IM; IV

5.46 Hyoscine butylbromide

Special notes

- benefit of anticholinergic agents in irritable bowel syndrome is questionable. It may be useful in patients with abdominal pain but is likely to cause adverse effects.
- a trial found no difference between hyoscine butylbromide and paracetamol for relief of recurrent cramping abdominal pain.

5.47 Ibuprofen

Mechanism of action

- Ibuprofen is a NSAID that is predominantly used for treating pain.
- Ibuprofen inhibits the activity of the enzyme prostaglandin synthetase, reducing prostaglandin production and causing a reduction in inflammation, pain and fever.

Indications

- mild to moderate pain (usually in combination with paracetamol), particularly inflammation, fever, soft tissue pain, musculoskeletal pain or headache
- may be administered in addition to other measures for severe pain

Contraindications

- known severe allergy
- sensitivity to NSAIDs (including aspirin)
- administration to infants less than 3 month is not recommended
- third trimester of pregnancy.

Cautions

- Gastrointestinal bleeding history, ulcers, or inflammatory bowel disease.
- The patient has taken ibuprofen within the past 4 hours. Ibuprofen is contained in many products such as cold and flu tablets per drinks, combination analgesics and migraine tablets. Additional ibuprofen may be administered provided it is clear that the total dose taken within a 4 hour period does not exceed the dose described within the CPGs. Withhold ibuprofen if there is any doubt.
- Abdominal pain, particularly if the patient is very unwell or vomiting. Clinical judgment is required, but if the patient is very unwell or vomiting the possibility of significant intra-abdominal pathology exists and oral medicines should usually be withheld.
- Age greater than or equal to 75 years, particularly in the presence of illness, infection or dehydration. In this setting renal impairment is likely and ibuprofen may worsen renal impairment.
- Dehydration or shock. Renal impairment is likely and ibuprofen may worsen renal impairment.
- Known renal impairment. Ibuprofen may worsen renal impairment.
- Known bleeding disorder. Ibuprofen will increase the risk of bleeding and because other forms of analgesia are available, the balance of risk is usually in favour of withholding ibuprofen.

- Clinically significant bleeding. Ibuprofen will increase the risk of bleeding and the nature and risk of the bleeding must be taken into account.
- Known worsening of bronchospasm with NSAIDs. Some patients with asthma or COPD have known worsening of bronchospasm with NSAIDs. If there is a clear history of significant bronchospasm with NSAIDs, ibuprofen should be withheld.
- Pregnancy and breastfeeding

Use in pregnancy or breastfeeding

- May cause harm during pregnancy. Ibuprofen has been associated with premature delivery and premature closure of the ductus arteriosus, when administered during the third trimester of pregnancy. Because other forms of analgesia are available ibuprofen should be usually be withheld during pregnancy. Maybe administered if the patient is breastfeeding.

Dosage regimen

- Adult: 200–400 mg, oral, 3–4 times a day. Maximum 2400 mg daily.
- Child greater than 3 months: 5–10 mg per kg (maximum 400 mg), oral, 3–4 times a day.

Administration

- Oral

Common adverse effects

- Renal impairment
- Increased bleeding
- Although indigestion, gastrointestinal ulceration and gastrointestinal bleeding are commonly listed as adverse effects, these are only associated with chronic administration

Usual onset of effect

- 30–60 minutes

Usual duration of effect

- 4–6 hours

Usual preparation

- Tablets, caplets, capsules: 100 mg; 200 mg; 400 mg
- Elixir, suspension: 20 mg / mL; 40 mg / mL

5.47 Ibuprofen

Pharmacology

- Ibuprofen is absorbed in the stomach and small intestine. The presence of food in the stomach will delay absorption, but this is not usually clinically significant.
- Ibuprofen is metabolised by the liver. There are no significant effects from liver impairment on acute administration.

Common interactions

- Warfarin: ibuprofen displaces warfarin from binding sites and increases the activity of warfarin.

Special notes

- Ibuprofen is not indicated for pain associated with myocardial ischaemia.

Linked management

4.3 Pain control

5.48 Insulin

Mechanism of action

- Increase or restore ability to metabolise glucose by enhancing cellular glucose uptake; inhibit endogenous glucose output and lipolysis.
- Insulin drives potassium into cells and administering glucose prevents hypoglycaemia
- High-dose Insulin Euglycaemic Therapy (HIET). HIET may allow the heart to overcome the 'metabolic starvation' that results from calcium channel blocker toxicity (and other poisonings, such as beta-blockers), which compounds the direct cardiotoxic effects.

Indications

- Type 1 diabetes
- Type 2 diabetes inadequately controlled with diet, exercise and oral antidiabetic medicines, and where oral antidiabetic medicines cannot be used (e.g. pregnancy, surgery)
- Resuscitation of toxicologic emergency (e.g. calcium channel blocker overdose) or hyperkalaemia not responding to standard therapies

Contraindications

- hypoglycaemia

Cautions

- acute trauma or illness: insulin requirement may increase

Use in pregnancy or breastfeeding

- Safe to use when pregnant or while breastfeeding.

Side effects

- hypoglycaemia, hypokalaemia, hypomagnesaemia, weight gain, allergic reactions, local reactions including erythema, itching, lipodystrophy, lipoatrophy

Pharmacology

- Insulin drives potassium into cells and administering glucose prevents hypoglycaemia
- HIET may be best used adjunctively with other measures such as catecholamines, for two reasons:
  1. insulin-mediated inotropy is not catecholamine-mediated, and is not affected by beta-blockers, so additive effects are likely
  2. although insulin appears to improve myocardial contractility, it has no chronotropic effect and may cause vasodilation.

5.48 Insulin

Usual preparation

- Vials (human neutral insulin e.g. Humulin R (slow-acting); Actrapid (fast-acting)): 10 mL (100 units / mL)

Dosage regimen

- Hyperkalaemia
  - IV fast-acting insulin (Actrapid):10–20 units (~0.02 units / kg) and glucose per dextrose 50 g 25–50 mL . Monitor glucose closely
  - IV infusion fast-acting insulin (Actrapid): 0.05 units / kg / hour and glucose 10% titrated to effect
- High-dose insulin euglycaemic therapy (HIET)

  Commence therapy with:
  - Glucose 25 g (50 mL of 50% solution) IV bolus, unless marked hyperglycaemia (blood glucose greater than 22 mmol / L) is present
  - Short-acting insulin 1 unit / kg bolus to maximally saturate insulin receptors

  Continue therapy with:
  - Short-acting insulin infusion starting at 0.5 units / kg / hour and titrated every 30 minutes to a maximum of 5 units per kg per hour (The maximum safe and effective rate of infusion is unknown but may be even higher than 5 units / kg / hour.)
  - Dextrose 25 g / hour IV infusion titrated to maintain euglycaemia (blood glucose, 5.5–14 mmol / L); central venous access may be required to allow use of concentrated solutions (e.g. 50% dextrose) and limit excess volume administration

  Monitor
  - Glucose every 20 minutes for first hour, then every 1 hour
  - Potassium: replace only if less than 2.5 mmol / L and there is a source of potassium loss

  Therapeutic endpoints
  - Improvement in myocardial ejection fraction (greater than 50%); increased BP (systolic BP greater than 90 mmHg in adults)
  - Adequate heart rate (greater than 60 beats per minute)
  - Resolution of acidaemia; euglycaemia; adequate urine output (1–2 mL per kg / hour)
  - Reversal of cardiac conduction abnormalities (QRS interval less than 120 milliseconds)
  - Improved mentation

Therapy is weaned after the withdrawal of other vasopressors, as cardiotoxicity resolves. Dextrose may be required after cessation of insulin.

5.48 Insulin

Administration

- IV, subcutaneous

Linked management

4.10.1 Hyperglycaemia

5.49 Ipratropium bromide

Mechanism of action

- Ipratropium bromide is a bronchodilator.
- Ipratropium bromide is an anticholinergic agent with predominantly antimuscarinic activity. It antagonises (blocks) acetylcholine receptors, causing vagal inhibition resulting in bronchodilation.

Indications

- bronchospasm secondary to asthma or COPD
- prominent bronchospasm secondary to airway burns or smoke inhalation

Contraindications

- known severe allergy

Cautions

- may aggravate glaucoma

Use in pregnancy or breastfeeding

Pregnancy: limited experience; not expected to be a concern. Safe to use while breastfeeding.

Side effects

- tachycardia, dry mouth, throat irritation, blurred vision

Pharmacology

- Anticholinergic bronchodilator: promotes bronchodilatation by inhibiting cholinergic bronchomotor tone.
- Only a small amount of the nebulised dose is absorbed, with most of the dose being nebulised to the atmosphere. The inhaled ipratropium bromide is absorbed through the lungs and some is swallowed.
- Excretion is predominantly via the urine. Kidney impairment does not significantly alter the acute administration of Ipratropium bromide.

Usual preparation

- MDI (metered dose inhaler): 20 micrograms / dose
- Nebuliser solution: 250 micrograms / mL; 500 micrograms / mL

5.49 Ipratropium bromide

Dosage regimen

- Adult

  COPD or asthma

  - MDI: 2 inhalations (42 micrograms) 3–4 times daily when required; up to 4 inhalations (84 micrograms) 3–4 times daily may be needed.
  - Nebulise: 250–500 micrograms up to 3–4 times daily.

  Severe acute asthma; in addition to salbutamol dosing:

  - MDI with spacer: 8 inhalations (168 micrograms).
  - Nebulise: 500 micrograms.
  - Repeat as necessary every 20 minutes for up to 3 doses.
- Child

  Severe acute asthma; in addition to salbutamol dosing:

  - greater than 6 years: MDI with spacer, 8 inhalations (168 micrograms)
  - less than 6 years: MDI with spacer, 4 inhalations (84 micrograms)
  - greater than 6 years: nebulise 500 micrograms
  - less than 6 years: nebulise 250 micrograms

  Repeat as necessary every 20 minutes for up to 3 doses.

Administration

- MDI, nebuliser

Usual onset of effect

- 2–5 minutes.

Usual duration of effect

- 6 hours

Linked management

4.5.1 Asthma

4.5.2 COPD

5.50 Ketamine

Mechanism of action

- Ketamine is an analgesic. It has complex actions, but is predominantly an N-methyl-d-aspartate (NMDA) receptor antagonist (blocker), resulting in inhibition of excitatory neurotransmitters in the brain.
- Low doses cause analgesia, larger doses cause amnesia and dissociation, and high doses cause anaesthesia.

Indications

- Severe pain (in addition to other medicines), particularly musculoskeletal or burn pain that has not been adequately controlled with an opioid
- inducing dissociation (e.g. cardioversion, joint relocation or limb alignment)
- severe agitated delirium
- rapid sequence intubation (RSI)
- significant movement during CPR that is interfering with resuscitation

Contraindications

- known severe allergy to ketamine
- age less than 1 year
- current myocardial ischaemia

Cautions

- unable to obey commands: ketamine will reduce the level of consciousness
- active psychosis: ketamine may make this worse
- hypertension
- clinical conditions that may be made worse by hypertension (e.g. haemorrhagic stroke)
- dilute dose with an equal volume of water for injection, sodium chloride 0.9% or glucose 5% before IV injection

Use in pregnancy or breastfeeding

- Safety has not been demonstrated during pregnancy, but ketamine should be administered if indicated. May be administered if the patient is breastfeeding. Advise the patient to stop breastfeeding and seek further advice from their lead maternity carer.

Common adverse effects

- transient hypertension, tachycardia, apnoea, nausea and vomiting, sedation, hallucinations, increased oral secretions

5.50 Ketamine

Dosage regimen

- Induction
  - 1.0–4.5 mg per kg, IV. Usually 2 mg per kg over 60 seconds provides anaesthesia within 30 seconds, lasting for 5–10 minutes.
  - 0.5–2.0 mg per kg initially, IV infusion, then 10–45 micrograms / kg per minute.
- Maintenance: IV increments of half to full dose. Repeated as required.
- For analgesia
  - 0.1 mg per kg, IV, every 5 minutes until desired response. Use a dose at the lower end of the range if the patient is small or frail. Dosage regimens at the upper end of the range should be reserved for when dissociation is required.
  - 1 mg per kg (rounded off to nearest 10 kg), IM or oral, up to a maximum of 100 mg, if IV access cannot be obtained. This may be repeated once after 10 minutes.
- For dissociation: titrate to effect. Most patients will need approximately 0.5 mg per kg.
- For severe agitated delirium
  - 1-1.5 mg per kg ketamine, IV, every 5 minutes.
  - 3-4 mg per kg of ketamine, IM, which may be repeated once after 10 minutes.
- For significant movement during CPR that is interfering with resuscitation
  - Adult: administer 50 mg of ketamine, IV once.
  - Child: administer 0.5 mg per kg, IV once.
- See rapid sequence intubation for further information.

Usual onset of effect

- IV: 1–2 minutes
- IM: 5–10 minutes
- oral: 10–20 minutes

Usual duration of effect

- 10–60 minutes

Usual preparation

- Ampoule: 200 mg in 2 mL
- Vial: 200 mg in 2 mL

Pharmacology

- Ketamine is predominantly metabolised in the liver.

5.50 Ketamine

Common interactions

- The effects will be increased in the presence of other analgesic medicines or sedatives (e.g. opioids, benzodiazepines or alcohol).

Linked management

4.3 Pain control
4.24.2 Rapid sequence intubation (RSI)

5.51 Ketorolac

Mechanism of action

- Have analgesic, antipyretic and anti-inflammatory actions. They inhibit synthesis of prostaglandins by inhibiting cyclo-oxygenase (COX) present as COX-1 and COX-2:
  - Inhibition of COX-1 results in impaired gastric cytoprotection and antiplatelet effects
  - Inhibition of COX-2 results in anti-inflammatory and analgesic action
  - Reduction in glomerular filtration rate and renal blood flow occurs with both COX-1 and COX-2 inhibition.
- Most NSAIDs are nonselective, inhibiting both COX-1 and COX-2. Although selective COX-2 inhibitors have little or no effect on COX-1 at therapeutic doses, they are still associated with gastrointestinal adverse effects.

Indications

- pain due to inflammatory arthropathies(e.g. rheumatoid arthritis, osteoarthritis, juvenile idiopathic arthritis, gout, ankylosing spondylitis, psoriatic arthritis and Reiter's syndrome)
- pain, especially due to inflammation and tissue injury (e.g. dysmenorrhoea, pericarditis, bone metastases, renal colic, headache, migraine, postoperative pain)
- fever

Contraindications

- conditions where risk of bleeding is increased or haemostasis is critical
- dehydration or hypovolaemia
- treatment with probenecid
- active peptic ulcer disease or gastrointestinal bleeding

Cautions

- cardiovascular disease
- dehydration
- asthma (especially with rhinitis or nasal polyps)
- coagulation disorders
- elderly

5.51 Ketorolac

Use in pregnancy or breastfeeding

- Pregnancy: some studies link NSAID use during pregnancy with an increased rate of miscarriage. Risk appears highest when NSAIDs are taken around the time of conception. When given during the latter part of pregnancy, NSAIDs may cause closure of the fetal ductus arteriosus, fetal renal impairment, decrease in volume of amniotic fluid, inhibition of platelet aggregation, and may delay labour and birth. Seek specialist advice for use in the second half of pregnancy; do not use during the last few days before expected birth.
- Breastfeeding: nonselective NSAIDs are safe to use; selective NSAIDs (COX-2-inhibitors) have limited data but appear safe.

Side effects

- pain at injection site, itching, sweating, purpura

Usual preparation

- Tablet: 10 mg
- Ampoule: 10 mg / mL
- Prefilled syringe: 30 mg / mL

Dosage regimen

Manufacturer limits treatment to a maximum of 5 days, irrespective of route.

- Adult
  - 10 mg initially IM or IV, followed by 10–30 mg every 4–6 hours (maximum 90 mg daily). Stop or change to oral route as soon as possible.
  - 10 mg Oral every 4–6 hours (maximum 40 mg daily).
- Adult greater than 65 years, or less than 50 kg, or mild renal impairment
  - initially 10 mg IM or IV, followed by 10–15 mg every 4–6 hours (maximum 60 mg daily). Stop or change to oral route as soon as possible.
  - 10 mg, oral, every 6–8 hours (maximum 30–40 mg daily).

Administration

- IM: inject slowly and deeply into the muscle; apply pressure at injection site for 15–30 seconds (minimises local reactions).
- IV: inject over at least 15 seconds.

5.52 Levetiracetam

Mechanism of action

- Exact mechanism unknown. May modulate neurotransmission by binding to synaptic vesicle protein 2A.

Indications

- monotherapy of focal (partial) seizures with or without secondary generalisation
- adjunctive therapy of:
  - focal (partial) seizures with or without secondary generalisation
  - primary generalised tonic-clonic seizures in idiopathic generalised epilepsy
  - myoclonic seizures in juvenile myoclonic epilepsy in patients greater than 12 years

Contraindications

- hypersensitivity

Cautions

- learning disability
- history of psychiatric problems: increase risk of behavioural adverse effects

Use in pregnancy or breastfeeding

- Pregnancy: plasma concentrations may decrease during pregnancy and may increase rapidly postpartum. Avoid where possible. Breastfeeding: passes into breast milk; avoid where possible.

Side effects

- behavioural effects (include depression, emotional lability, hostility, aggression, agitation, anxiety and nervousness)
- drowsiness, weakness, dizziness, headache, vertigo, insomnia, amnesia, ataxia, diplopia, anorexia

Pharmacology

- Antieplieptic

Usual preparation

- Tablet: 250 mg; 500 mg; 1000 mg
- Injection: 5 mg / mL; 10 mg / mL; 15 mg / mL; 100 mg/ mL

5.52 Levetiracetam

Dosage regimen

- Single therapy
  - Adult greater than 16 years: 250 mg initially, oral/IV, twice daily for 2 weeks. Increase to 500 mg twice daily. Then increase dose according to response, by 250 mg twice daily every 2 weeks; up to 1.5 g twice daily.
- Adjunctive therapy
  - Adult and child greater than 50 kg: 500 mg initially, oral/IV, twice daily. Then increase dose according to response by 500 mg twice daily every 2–4 weeks; up to 1.5 g twice daily.
  - Child 4–17 years and less than 50 kg: 10 mg / kg initially, oral/IV, twice daily. Then increase dose according to response, by 10 mg / kg twice daily every 2 weeks; up to a maximum dose of 30 mg / kg twice daily.

Administration

- oral; IV

Special notes

- IV infusion over 15 minutes: dilute the 100 mg / mL injection with at least 100 mL of a crystalloid or glucose 5%.

Linked management

4.12 Seizures and convulsions

5.53 Levonorgestrel

- Within the St John environment, patients seeking emergency contraceptives should be referred to their local community provider to access the treatment and the ongoing supports associated with this intervention.

Mechanism of action

- When used as contraceptives, progestogens thicken cervical mucus to impede the passage of sperm and change endometrium, reducing the potential for implantation. They act on the hypothalamus and suppress pituitary LH surge and may inhibit ovulation. Depot injection and implant reliably suppress ovulation; oral progestogen-only contraceptive suppresses ovulation in <50% of women.
- Progestogens also induce atrophy within ectopic endometrium.

Indications

- emergency contraception

Contraindications

- There are no absolute contraindications to its use as emergency contraception. It acts mainly by preventing or delaying ovulation. It cannot disrupt an implanted fertilised egg (and evidence suggests it will not prevent implantation). It does not provide contraception for the remainder of the cycle. Although there is no limit to recurrent use (even within a cycle), repeated use is less effective at preventing pregnancy than a regular method of contraception.
- Breast cancer (current or recent): generally contraindicated although medroxyprogesterone is used to treat breast cancer in selected patients.
- Unexplained vaginal bleeding: avoid until fully investigated, as progestogens can cause irregular vaginal bleeding.

Cautions

- Malabsorption syndromes: efficacy of oral levonorgestrel may be reduced due to poor absorption.
- Obesity: it is unclear if efficacy as an emergency contraceptive is reduced in obese women as data are conflicting.
- Treatment (currently or in the previous 4 weeks) with drugs that induce CYP3A4: may reduce effectiveness of oral levonorgestrel.
- VTE (current or history of): progestogens may be used (any increased risk of thromboembolism is small and is substantially less than with COCs).
- Systemic lupus erythematosus: progestogens may be used (seek specialist advice for women with antiphospholipid antibodies).
- Post-partum: progestogens (except levonorgestrel IUD) may be started at any time after delivery.

5.53 Levonorgestrel

Cautions

- Treatment (currently or in the previous 5 days) with ulipristal: progestogens may reduce effectiveness of ulipristal; combination is not recommended. After ulipristal use for emergency contraception, wait at least 5 days before starting progestogen-containing hormonal contraception (including levonorgestrel for emergency contraception).

Use in pregnancy or breastfeeding

- Emergency contraception has no effect on an established pregnancy. The failure of emergency contraception is not thought to increase the risk of birth defects or ectopic pregnancy. It is safe to use while breastfeeding.

Side effects

- nausea, vomiting, breast tenderness, vaginal bleeding, headache

Pharmacology - Progestogen

Usual preparation - Tablet: 30 microgram; 1.5 mg

Dosage regimen

- 1.5 mg, oral, as a single dose (1 x 1.5 mg tablet OR 50 x 30 microgram tablets). Repeat dosage if vomiting occurs within 2 hours.
- Give levonorgestrel as soon as possible after unprotected intercourse, as its efficacy decreases with time. Give it within 96 hours (4 days) afterwards, but preferably within 72 hours (3 days). Levonorgestrel can still be considered 96–120 hours afterwards (as its risks are minimal) but its efficacy is uncertain.

Administration - Oral

Special notes

- Do not use levonorgestrel and ulipristal together for emergency contraception (levonorgestrel may reduce the effectiveness of ulipristal).
- Does not induce a withdrawal bleed, although irregular bleeding or spotting may occur occasionally (not to be confused with normal menses).
- Next menses occurs within 3 days of expected time in more than 50% of women. If menses delayed by more than 1 week, or if it is unusually light or heavy, advise patient to see their personal physician.
- Does not increase the likelihood of ectopic pregnancy if emergency contraception fails.
- In women who, in the previous 4 weeks, have taken drugs that induce CYP3A4 (particularly rifamycins), a copper IUD is preferred for emergency contraception. Increasing the dose of levonorgestrel to 3 mg has been suggested, but evidence of efficacy is lacking. Refer patient to their personal physician.

5.54 Lidocaine (anti-arrhythmic)

Mechanism of action

Reduces automaticity of myocardial tissue with little effect on cardiac conduction. It has a mild negative inotropic effect and weak neuromuscular blocking activity

Indications

- treatment and prophylaxis of life-threatening ventricular arrhythmia

Contraindications

- known history of hypersensitivity (allergy) to amide local anaesthetics
- treatment with flecainide or disopyramide
- lignocaine should not be used intravenously in patients with Stoke-Adam's syndrome or with severe degrees of sinoatrial, atrioventricular or intraventricular block (unless patient has an artificial pacemaker)

Cautions

- use cautiously in patients with known medicine allergies or sensitivities
- hypovolaemia and shock, all forms of heart block, epilepsy, hepatic or renal disease, cardiac failure, severe respiratory depression
- dosage regimens may need to be reduced in the elderly

Use in pregnancy or breastfeeding

- Safe to use in pregnancy and while breastfeeding

Side effects

- CNS symptoms: light-headedness, drowsiness, dizziness, apprehension, euphoria, tinnitus, blurred per double vision, vomiting, sensations of heat, cold or numbness, twitching, tremors, convulsions, unconsciousness, respiratory depression and arrest
- Hypotension, cardiovascular collapse, and bradycardia which may lead to cardiac arrest
- Allergic reactions

Pharmacology

- An antiarrhythmic effect is exerted by increasing the electrical stimulation threshold of the ventricle during diastole

Usual preparation

- Ampoule: 10mg / mL; 20 mg/ mL; 100 mg/ mL

5.54 Lidocaine (anti-arrhythmic)

Dosage regimen

- Adult loading dose: 50–100 mg, IV, (1 mg / kg body weight) give over 1–2 minutes. A second dose may be given after 5 minutes.
- Maintenance dose: 10–50 micrograms / kg / minute, IV infusion.

Administration

- IV injection per infusion

Linked management

4.6.3 Ventricular Tachycardia

5.55 Lidocaine (local anaesthetic)

Mechanism of action

- Lignocaine is a local anaesthetic
- Lignocaine blocks the initiation and transmission of nerve impulses by blocking the movement of sodium ions across the nerve cell membrane

Indications

- production of local or regional anaesthesia by infiltration
- subcutaneous injection for prophylaxis of pain associated with IV cannulation
- subcutaneous injection for digital ring blocks for analgesia
- intraosseous injection for bone pain associated with fluid infusion via an intraosseous needle
- topical for pain associated with IV cannulation, wound cleaning, or catheter insertion
- oral ingestion for upper GIT discomfort

Contraindications

- known history of hypersensitivity (allergy) to local anaesthetics of the amide type

Cautions

- when any local anaesthetic agents are used, resuscitative equipment and medicines including oxygen should be immediately available
- local infection in the area of injection

Use in pregnancy or breastfeeding

- Safe. May be administered if indicated

Dosage regimen

- Subcutaneous
  - 3 mg / kg maximum. May be repeated once after an hour.
- Intraosseous
  - Adult: 50 mg for an adult
  - Child: 1 mg / kg
  - The intraosseous dose may be repeated once after 15 minutes

Administration

- Infiltration, nerve block
- Subcutaneous for IV insertion: administer into the subcutaneous tissue at the site of cannulation. Raise a bleb and wait approximately 1 minute before insertion.

5.55 Lidocaine (local anaesthetic)

Administration

- Ring blocks: administer approximately 1–2 mL into the tissue on either side of the web space of the digit.
- Intraosseous: administer slowly over 1–2 minutes and wait 1 further minute before infusing fluid. This is intended to limit the amount of lignocaine flushed into the circulation.
- Topical: EMLA or ANGEL apply generous amount for up to 60 minutes and cover with IV dressing. For IDC insertion: use 2% gel.
- Oral: viscous gel up to 10 mL with antacid.

Side effects

- Use of lignocaine as a local anaesthetic may result in systemic adverse reactions
- CNS symptoms: light-headedness, drowsiness, dizziness, apprehension, euphoria, tinnitus, blurred per double vision, vomiting, sensations of heat, cold or numbness; twitching, tremors, convulsions, unconsciousness,respiratory depression and arrest
- Hypotension; cardiovascular collapse; and bradycardia which may lead to cardiac arrest
- Allergic reactions

Common adverse effects

- Stinging at the time of injection

Usual onset of effect

- 1–2 minutes for IV cannulation
- 5–10 minutes for ring blocks

Usual duration of effect

- 30–60 minutes

Usual preparation

- Ampoules: 1%: 50 mg / 5 mL; 2%: 100 mg / 5 mL
- Oral liquid: 2%
- Oral gel: 2%
- Gel (lidocaine 2%, chlorhexidine 0.05%): 10 mL (syringe)

Pharmacology

- Lignocaine is metabolised in the liver
- There are no significant effects from liver impairment on acute administration

5.55 Lidocaine (local anaesthetic)

Special notes

- Do not apply lignocaine topically to the eye because the solution contains a preservative that may cause harm.
- Warming lignocaine (e.g. in your pocket or hand) may reduce the stinging associated with subcutaneous injection.
- Overdose of lignocaine when administered subcutaneously is very rare, but can occur if doses exceed 3 mg / kg or more than 1 mg / kg is inadvertently administered intravenously. If this occurs the following may develop: tingling around the mouth, seizures, dysrhythmias (particularly bradydysrhythmias), hypotension, cardiac arrest.

Linked management

4.4.4 Wound closure

5.56 Lidocaine with adrenaline (epinephrine)

Mechanism of action

- Lignocaine is a local anaesthetic
- Lignocaine blocks the initiation and transmission of nerve impulses by blocking the movement of sodium ions across the nerve cell membrane

Indications

- production of local or regional anaesthesia by infiltration

Contraindications

- known history of hypersensitivity (allergy) to local anaesthetics of the amide type

Cautions

- when any local anaesthetic agents are used, resuscitative equipment and medicines including oxygen should be immediately available
- local infection in the area of injection

Use in pregnancy or breastfeeding

- Safe. May be administered if indicated

Dosage regimen

- Maximum dose
  - With adrenaline (epinephrine) 5 micrograms / mL (1:200 000): lidocaine 5 mg / kg
- Infiltration
  - Adult: up to 500 mg of lidocaine 0.5% (100 mL) or 1% (50 mL) or 2% (25 mL) with adrenaline (epinephrine) 5 micrograms / mL (1:200 000)
- Nerve block
  - Adult: 30–500 mg of lidocaine 1% (3–50 mL) or 1.5% (2–30 mL) with adrenaline (epinephrine) micrograms / mL (1:200 000)

Administration

- Infiltration

Side effects

- Use of lignocaine as a local anaesthetic may result in systemic adverse reactions
- CNS symptoms: light-headedness, drowsiness, dizziness, apprehension,euphoria; tinnitus, blurred per double vision, vomiting, sensations of heat, cold or numbness; twitching, tremors, convulsions, unconsciousness; respiratory depression and arrest

5.56 Lidocaine with adrenaline (epinephrine)

Side effects

- Hypotension; cardiovascular collapse; and bradycardia which may lead to cardiac arrest
- Allergic reactions

Common adverse effects

- Stinging at the time of injection

Usual onset of effect

- 1–2 minutes for IV cannulation
- 5–10 minutes for ring blocks

Usual duration of effect

- 30–60 minutes

Usual preparation

- Injection
  - lidocaine 0.5%, adrenaline (epinephrine) 1:200 000, 20 mL
  - lidocaine 1%, adrenaline (epinephrine) 1:200 000, 20 mL
  - lidocaine 1%, adrenaline (epinephrine) 1:100 000, 5 mL
  - lidocaine 2%, adrenaline (epinephrine) 1:200 000, 20 mL
  - lidocaine 2%, adrenaline (epinephrine) 1:80 000, 5 mL

Pharmacology

- Lignocaine is metabolised in the liver
- There are no significant effects from liver impairment on acute administration

Special notes

- Do not apply lignocaine topically to the eye because the solution contains a preservative that may cause harm
- Warming lignocaine (e.g. in your pocket or hand) may reduce the stinging associated with subcutaneous injection
- Overdose of lignocaine when administered subcutaneously is very rare, but can occur if doses exceed 3 mg / kg or more than 1 mg / kg is inadvertently administered intravenously. If this occurs the following may develop: tingling around the mouth, seizures, dysrhythmias (particularly bradydysrhythmias), hypotension, cardiac arrest

Linked management

4.4.4 Wound closure

5.57 Lincomycin

Mechanism of action

- Bacteriostatic: inhibit protein synthesis by binding to the 50S ribosomal subunit

Indications

- treatment of infections due to susceptible organisms
- alternative in patients with severe allergy to penicillins and cephalosporins including endocarditis prophylaxis, aspiration pneumonia, dental, skin, soft tissue and bone infections
- toxoplasma encephalitis per abscess (alternative to sulfadiazine)
- bacterial vaginosis (clindamycin)
- anaerobic infections

Contraindications

- clindamycin hypersensitivity
- minor bacterial and viral infections

Cautions

- gastrointestinal disease (especially colitis)
- renal impairment
- hepatic impairment
- elderly

Use in pregnancy or breastfeeding

- Pregnancy: safe to use. Breastfeeding: safe to use, although may cause loose bowel actions in the baby

Side effects

- diarrhoea (mild-to-severe), nausea, vomiting, abdominal pain or cramps, rash, itch

Pharmacology - Lincosamide antibiotic

Usual preparation - Ampoule: 300 mg in 2 mL

Dosage regimen

- Adult: 600 mg–1 g IV every 8–12 hours (usually 600 mg every 8 hours). Maximum 8 g daily.
- Child greater than 1 month: 15 mg per kg (maximum 600 mg), IM or IV, every 8 hours.
- Endocarditis prophylaxis: adult: 600 mg, IV, completed before procedure starts.

5.57 Lincomycin

Administration

- Dilute 600 mg in at least 100 mL of glucose 5% or a crystalloid, and infuse slowly over at least 1 hour to reduce the risk of cardiac adverse effects (e.g. hypotension, cardiac arrest)
- IM: injection administered into a large muscle mass

Special notes

- clindamycin is more potent than lincomycin
- some clinicians use higher than the recommended doses of IV lincomycin for serious infections. At these doses, lincomycin has equal efficacy to clindamycin and is considerably cheaper

Linked management

4.2.1 Antibiotic recommendations

5.58 Loratadine

Mechanism of action

- Loratadine is a non-sedating antihistamine
- Loratadine antagonises (blocks) peripheral histamine receptors, blocking the action of histamine and reducing itching and redness

Indications

- minor allergic reactions confined to skin involvement (e.g. rash, urticaria, allergic rhinitis)
- prominent itch associated with anaphylaxis, provided all systemic signs of anaphylaxis have resolved

Contraindications

- known severe allergy per hypersensitivity to loratadine
- age less than 1 year

Cautions

- pregnancy
- use with caution in children

Use in pregnancy or breastfeeding

- Safety has not been demonstrated during pregnancy. Because minor allergic reactions rarely require specific treatment, the balance of risk is such that loratadine should usually be withheld
- May be administered if the patient is breastfeeding. Advise the patient to stop breastfeeding and seek further advice from their lead maternity carer

Dosage regimen

- 10 mg for an adult or child greater than 12 years
- 5 mg for a child 1–11 years

Administration

- Administer orally
- Always ask a parent (or guardian) if a young child can swallow tablets. Loratadine may be crushed and placed in a soft food (e.g. jam or honey)

Side effects

- dry mouth, headache, drowsiness, nausea

Usual onset of effect

- 30–60 minutes

5.58 Loratadine

Usual duration of effect

- 12–24 hours

Usual preparation

- 10 mg tablets

Pharmacology

- Loratadine is predominantly metabolised by the liver. There are no significant effects from liver impairment on acute administration.

Linked management

4.7.1 For mild or moderate allergy

5.59 Magnesium sulphate

Mechanism of action

- Magnesium is the active ingredient in magnesium sulphate
- Magnesium reduces bronchial smooth muscle contraction resulting in bronchodilation

Indications

- bronchospasm secondary to severe or life-threatening asthma
- biochemical testing diagnosed low serum magnesium
- torsades de pointes
- pre-eclampsia and eclampsia

Contraindications

- Known severe allergy

Cautions

- Hypotension. Magnesium is a vasodilator and may make hypotension worse

Use in pregnancy or breastfeeding

- Safe and should be administered when indicated. Muscle weakness may occur in the baby if administered within 2 hours of birth and this may cause respiratory depression

Dosage regimen

- Adult: 10 mmol (2.47 g) IV. Repeat at 30 minutes if required
- Child" 25–50 mg / kg (0.1–0.2 mmol / kg) IV with maximum of 2 gm (8 mmol)

Administration

- Administer IV over 10–15 minutes. A controlled delivery device (e.g. IV pump or syringe driver) is the preferred method for administration.
- Alternatively, dilute to a total of 10 mL using crystalloid. Administer 1 mL every 1–2 minutes into a running IV line.

Common adverse effects

- Flushing, particularly if administered rapidly
- Hypotension, particularly if administered rapidly
- Muscle weakness: usually only seen with doses exceeding 20 mmol

Usual onset of effect

- 5–10 minutes

5.59 Magnesium sulphate

Usual duration of effect

- 30–60 minutes

Pharmacology

- Magnesium is primarily excreted in the urine
- There are no significant effects from kidney impairment on acute administration

Usual preparation

- 5 mL ampoule containing 10 mmol (2.47 g) of magnesium

Common interactions

- May increase the effect of neuromuscular blockers

Special notes

- Do not administer magnesium into an IV line that has an adrenaline (epinephrine) infusion running through it concurrently, because precipitation may occur.
- Rarely, magnesium may have a role in the treatment of torsade de pointes, severe pre-eclampsia and eclampsia. In these settings, seek clinical advice.
- Document the dose administered in mmol.

Linked management

4.5.1 Asthma

5.60 Metaraminol

Mechanism of action

- Metaraminol is a vasoconstrictor and increases blood pressure.
- It may also cause arrhythmias, and the risk may increase if it is given with other arrhythmogenic medicines.

Indications

- prevention and treatment of hypotension due to anaesthesia
- hypotension

Contraindications

- sulphite sensitivity
- hypovolaemia
- patients taking monoamine oxidase inhibitors (MAOIs)

Cautions

- heart, thyroid, or liver disease
- hypertension
- ensure adequate circulating volume (normovolaemia)

Side effects

- arrhythmia, hypertension

Pharmacology

- potent sympathomimetic amine

Usual preparation

- Ampoule: 10 mg / 1 mL
- Prefilled syringe: 0.5 mg / mL

Dosage regimen

- Adult: 0.5–1 mg, IV, every 2 minutes titrated to effect

Administration

- IV; IV infusion

Linked management

4.6.6 Cardiogenic shock

4.21 Shock

5.61 Methoxyflurane

Mechanism of action

- Methoxyflurane is an inhalational analgesic

Indications

- moderate to severe pain

Contraindications

- known severe allergy
- malignant hyperthermia
- unable to obey commands
- known renal impairment
- has received 6 mL methoxyflurane within the last week. Frequent administration increases the risk of renal impairment

Cautions

- age 75 years and greater, particularly in the presence of illness, infection or dehydration
- pre-eclampsia
- administration within a confined space
- pregnancy and breastfeeding

Use in pregnancy or breastfeeding

- Safety has not been formally demonstrated in pregnancy, but methoxyflurane may be administered. It may cause temporary drowsiness in the baby. May be administered if the patient is breastfeeding.

Dosage regimen

- Adult and child 12 years and greater: maximum of 6 mL (2 doses)
- Child less than 12 years: maximum of 6 mL (2 doses)

Administration

- Whenever possible have the patient self-administer
- Administer 3 mL (1 dose) at a time
- Do not administer supplementary oxygen via the inhaler as this significantly increases the amount of methoxyflurane lost through evaporation
- Place the inhaler in a closed plastic bag if the methoxyflurane has not been fully used. It may subsequently be reused by the same patient

5.61 Methoxyflurane

Common adverse effects

- sedation, light-headedness, nausea, dislike of the taste or smell

Usual onset of effect

- 1–2 minutes

Usual duration of effect

- 2–5 minutes after stopping administration

Usual preparation

- 3 mL bottle accompanying a plastic inhaler

Pharmacology

- Approximately 20% is exhaled. The remainder is metabolised in the liver
- One of the metabolites is fluoride ions. High concentrations of fluoride ions have been associated with renal impairment and this is the reason for known renal impairment being a contraindication and for having a maximum dose

Common interactions

- The effects will be increased in the presence of other pain-relieving medicines or sedatives (e.g. opioids, benzodiazepines or alcohol)

Special notes

- Renal failure with dialysis is not a contraindication or a caution to methoxyflurane administration because once a patient is receiving dialysis, further renal impairment is of no clinical consequence
- Kidney stones and/or renal colic are not a contraindication or a caution to methoxyflurane administration because these are rarely associated with renal impairment

Linked management

4.3 Pain control

5.62 Metoclopramide

Mechanism of action

- Used to prevent and treat nausea and vomiting
- Also has prokinetic activity, which may be useful in nausea and vomiting due to gastroparesis

Indications

- nausea and vomiting (not of labyrinthine origin)
- migraine

Contraindications

- whenever stimulation of gastrointestinal motility may be dangerous (e.g. haemorrhage, obstruction, perforation)
- phaeochromocytoma

Cautions

- hepatic and renal impairment (reduce dose)
- avoid in porphyria
- use in patients under 20 years should be restricted to the following situations: severe intractable vomiting of unknown cause vomiting associated with radiotherapy and intolerance to cytotoxic medicines

Use in pregnancy or breastfeeding

- Safe to use in pregnancy. Metoclopramide has been used for lactation stimulation but is not recommended due to safety and efficacy concerns; use non-pharmacological measures

Side effects

- hypotension (usually associated with rapid administration)
- dystonic reactions (more frequent in young adults and children and may occur after a single dose) especially oculogyric crisis
- hyperprolactinaemia
- occasional tardive dyskinesia on prolonged administration
- drowsiness, dizziness, headache, restlessness

Pharmacology

- Antiemetic which acts both centrally and peripherally. It stimulates the motility of the upper gastrointestinal tract increasing gastric emptying. It also has central dopamine antagonist activity

5.62 Metoclopramide

Usual preparation

- Ampoules: 10 mg / 2 mL
- Tablets: 10 mg

Dosage regimen

- Adults: 10 mg–20 mg, oral, IM or slow IV (over 1–2 minutes), every 6–8 hours as needed.

Administration

- IM injection
- IV injection per infusion
- oral

Usual onset of effect

- IV: initial effect in 1–3 minutes
- IM: initial effect in 10–15 minutes

Linked management

4.18 Nausea and vomiting

5.63 Metoprolol

Mechanism of action

- Metoprolol is a beta-blocker. It antagonises (blocks) beta-1 receptors in the heart, causing a decrease in heart rate, cardiac output and blood pressure

Indications

- control of hypertension prior to fibrinolytic therapy for STEMI
- hypertension
- supraventricular tachyarrhythmia

Contraindications

- known severe allergy
- bradycardia: metoprolol will further reduce the heart rate
- hypotension: metoprolol will further reduce the blood pressure

Cautions

- 1st degree heart block. Metoprolol may cause bradycardia
- known sick sinus syndrome without an internal pacemaker in place. Metoprolol may cause bradycardia
- previous 2nd or 3rd degree heart block without an internal pacemaker in place. Metoprolol may cause heart block
- asthma or COPD. Metoprolol may cause bronchospasm

Use in pregnancy or breastfeeding

- Safety has not been demonstrated during pregnancy. The likelihood of STEMI occurring in a woman who is pregnant is so low that personnel must seek clinical advice prior to administration.
- May be administered if the patient is breastfeeding. Advise the patient to stop breastfeeding and seek further advice from their maternity carer.

Dosage regimen

- 5 mg (1 mg / minute), IV. Repeat at 5 minute intervals up to a maximum of 20 mg.
- 25–50 mg initial dose, oral.

Administration

- IV bolus undiluted.

Common adverse effects

- hypotension, bradycardia, bronchospasm

5.63 Metoprolol

Usual onset of effect

- 2–3 minutes

Usual duration of effect

- 1–2 hours

Usual preparation

- Ampoule: 5 mg in 5 mL
- Tablets: 50 mg, 100 mg

Pharmacology

- Cardioselective beta-blocker
- Metoprolol is metabolised in the liver

Special notes

- The blood pressure effects will be potentiated by other medicines that lower blood pressure. For example, glyceryl trinitrate, morphine, anti-hypertensive medicines and amiodarone.
- The heart rate effects will be potentiated by other medicines that lower heart rate. For example, amiodarone and centrally acting calcium channel blockers such as diltiazem

Linked management

4.6.4 Supraventricular tachycardia (SVT)

5.64 Metronidazole

Mechanism of action

- Metronidazole is metabolised to active metabolites that are thought to interfere with DNA synthesis.

Indications

- treatment of infections when caused by susceptible organisms
- gram-positive and gram-negative anaerobic bacterial infections (e.g. B. fragilis)
- protozoal infections (e.g. giardiasis, trichomoniasis)
- clostridium difficile-associated disease
- dental infections including acute gingivitis
- intra-abdominal infections
- aspiration pneumonia
- lung abscess
- bacterial vaginosis
- pelvic inflammatory disease
- amoebiasis (intestinal and extra-intestinal)
- surgical prophylaxis
- eradication of H. pylori (as part of a multimedicine regimen)
- rosacea
- fungating wounds

Contraindications

- previous major allergy to metronidazole
- nitroimidazole hypersensitivity
- Cockayne syndrome

Cautions

- prolonged or high dose use
- renal impairment
- hepatic impairment
- elderly
- pregnancy (particularly first trimester)
- breastfeeding
- children

5.64 Metronidazole

Use in pregnancy or breastfeeding

- Pregnancy: safe to use (take in divided doses if possible). Breastfeeding: safe to use. May cause some bitterness in milk. Use in divided doses after breastfeeding rather than single daily doses

Side effects

- nausea, anorexia, abdominal pain, vomiting, diarrhoea, metallic taste, CNS effects (e.g. dizziness, headache)

Pharmacology

- anaerobic, antiprotozoal

Usual preparation

- IV infusion: 500 mg in 100 mL
- Tablet: 200 mg; 400mg

Dosage regimen

- Adult: 200–400 mg, oral, every 8–12 hours, up to 4 g daily OR 1 g, rectal, every 8–12 hours

Severe infections

- 500 mg, IV, every 8–12 hours as part of multi-medicine regimen. Maximum 4 g daily.
- Child greater than 1 month
  - 7.5 mg / kg (maximum 400 mg), oral, every 8 hours OR 10 mg / kg (maximum 400 mg) every 12 hours
  - 7.5 mg / kg (maximum 500 mg), IV, every 8 hours OR 12.5 mg / kg (maximum 500 mg) every 12 hours (every 8 hours for clostridial or CNS infections)

Rectal

  - 1 month–1 year: 125 mg 3 times a day for 3 days, then twice daily
  - 1–5 years: 250 mg 3 times a day for 3 days, then twice daily
  - 5–12 years: 500 mg 3 times a day for 3 days, then twice daily

Clostridium difficile-associated disease

- Adult: 400 mg, oral, every 8 hours for 10 days
- Child: 10 mg / kg (maximum 400 mg), oral, every 8 hours for 10 days
- Give IV if unable to tolerate oral treatment, or with vancomycin in severe disease:
  - Adult: 500 mg, IV, every 8 hours for 10 days
  - Child: 12.5 mg / kg (maximum 500 mg), IV, every 8 hours for 10 days

5.64 Metronidazole

Surgical prophylaxis

- Adult
  - 500 mg, IV, to be completed before skin incision
  - 1 / g, rectal, as a single dose 8 hours before surgery
  - 400 mg, oral, as a single dose 1–2 hours before surgery
- Child greater than 1 month: 12.5 mg / kg (maximum 500 mg), IV, to be completed before skin incision

Bacterial vaginosis

- Adult: 400 mg, oral, twice daily for 7 days.

Trichomoniasis

- Adult: 2 g single dose, oral. Or, if this fails: 400 mg twice daily for 5 days. Use the 5 day course in pregnancy and breastfeeding. Treat sexual partner(s) as well.

Giardiasis

- Adult: 2 g, oral, once daily for 3 days. Or, if this fails: 400 mg every 8 hours for 7 days. Use the 7 day course in pregnancy and breastfeeding.
- Child greater than 1 month: 30 mg / kg oral, once daily (maximum 2 g) for 3 days. Or, if this fails: 10 mg / kg (maximum 400 mg) 3 times a day for 5–7 days.

Eradication of H. pylori

- Adult
  - with amoxicillin: 400 mg, oral, 3 times daily for 14 days

Administration

- IV: administer via infusion over 15–30 minutes
- Oral: administer with water

Linked management

4.2.1 Antibiotic recommendations

5.65 Midazolam

Mechanism of action

- Midazolam is a benzodiazepine.
- Midazolam enhances the activity of gamma-aminobutyric acid (GABA) at GABA receptors within the CNS, resulting in anticonvulsant activity, sedation, amnesia, anxiolysis and muscle relaxation.

Indications

- prolonged seizures
- moderate agitated delirium
- pain associated with severe muscle spasm
- conscious sedation prior to various procedures
- sedation post-intubation
- induction of anaesthesia
- severe anxiety

Contraindications

- known severe allergy
- myasthenia gravis
- hypersensitivity to benzodiazepines

Cautions

- IV should only be used where appropriate equipment and personnel are available for continuous monitoring of cardiorespiratory function and for resuscitation
- concurrent administration of opioids or ketamine; this will increase the effects of midazolam
- intoxication; this will increase the effects of midazolam.
- renal or hepatic insufficiency
- elderly: low doses are required, as older age will increase and prolong the effects of midazolam

Use in pregnancy or breastfeeding

- Safety has not been demonstrated during pregnancy, but midazolam should be administered if indicated. May be administered if the patient is breastfeeding. Advise the patient to stop breastfeeding and seek further advice from their lead maternity carer.

Common adverse effects

- sedation, respiratory depression, hypotension, amnesia

5.65 Midazolam

Common interactions

- The effects will be increased in the presence of other sedatives or pain relieving medicines (for example other benzodiazepines, opioids, ketamine and alcohol).

Pharmacology

- Midazolam is predominantly metabolised by the liver.
- There are no significant effects from liver impairment on acute administration.

Usual prepartion

- Ampoules: 15 mg / 3 mL; 5 mg / 1 mL; 5 mg / 5 mL; 50 mg / 10 mL

Dosage regimen

The dose of midazolam is dependent on the indication and the route. See the individual sections.

Conscious sedation

- Adult: 2.5 mg initial dose, IV, with further doses of 1 mg if required. Dosage regimens greater than 5 mg are not usually required (initial dose of 1 mg, IV, for elderly or severely ill patients)

Induction of anaesthesia

- 0.15–0.35 mg per kg (10–15 mg) with maximum sedation after 2–3 minutes

Acute behavioural disturbance

- 5–10 mg, IM OR 0.1 mg / kg if patient less than 50 kg
- 1-5 mg, IV, repeat 2–5 minutes

Seizures

- 0.1 mg / kg to a maximum of 10 mg, IM. Repeat at 5 minutes if required to a maximum of 3 administrations
- 0.05-0.1 mg / kg to a maximum of 10 mg, IV. Repeat at 5 minutes if required to a maximum of 3 administrations . If more than 3 doses are required, escalate care or consider using an alternative medicine
- 0.2-0.3 mg / kg, intranasal, to maximum of 15 mg (concentrated solution will be required: 5 mg / mL). Repeat at 5 minutes if required to a maximum of 3 administrations . If more than 3 doses are required, escalate care or consider using an alternative medicine.

Usual onset of effect

- IV: 2–3 minutes
- IM: 3–5 minutes, dependent on absorption

5.65 Midazolam

Usual duration of effect

- 30–60 minutes. The sedative effect may be longer, particularly in the elderly.

Linked management

4.11.3 Serotonin syndrome
4.12 Seizures and convulsions
4.24.2 Rapid sequence intubation (RSI)

5.66 Misoprostol

Mechanism of action

- Softens and dilates the cervix and induces uterine contractions via their actions on smooth muscle
- May also have other effects, for example on blood vessels, bronchi, gastrointestinal tract.

Indications

- medical management of miscarriage in 1st or 2nd trimester
- intrauterine fetal death
- post-partum haemorrhage (PPH)

Contraindications

- unexplained uterine bleeding after 24 weeks during this pregnancy
- multiple pregnancy
- previous pregnancies: manufacturer of pessary contraindicates use in women with 3 or more previous pregnancies (does not apply to PPH management).

Cautions

- treatment with oxytocin
- asthma, COPD (may cause bronchospasm)

Pregnancy and breastfeeding

- Breastfeeding: appears safe; theoretical possibility of diarrhoea in child

Side effects

- nausea, vomiting, diarrhoea, back pain, transient hypertension or hypotension, bronchoconstriction, headache, epigastric pain, vasovagal symptoms (e.g. flushing, shivering), blurred vision, fever, altered fetal heart rate, uterine hypercontractility and hypertonus

Usual preparation

- Tablet: 200 microgram

Dosage regimen

First trimester miscarriage

- 400 micrograms, sublingual, initial course every 3 hours to maximum of 4 doses.
- If no progress within 3 hours of last dose of misoprostol: after a 12 hour break from treatment, insert 800 micrograms (4 tablets) / vaginal (PV), then insert 400 micrograms (2 tablets), PV, every 3 hours to maximum of 3 doses. (Total dose 2000 micrograms.)

5.66 Misoprostol

Dosage regimen

Second trimester miscarriage

- 400 micrograms, sublingual, every 3 hours to maximum of 4 doses. Course may be repeated if no progress after 24 hours.
- 400 micrograms (2 tablets), PV, every 6 hours to maximum of 4 doses. Course may be repeated if no progress after 24 hours.

Intrauterine fetal death

- less than 34 weeks gestation: 200 micrograms (1 tablet), sublingually or PV every 3–6 hours until delivery. If response is inadequate after giving 1200 micrograms over 24 hours, consider alternative treatments or repeat the regimen after 24 hours.
- greater than 34 weeks gestation: 100 micrograms (half a tablet), sublingually or PV every 3–6 hours until delivery. If response is inadequate after 5 doses, consider alternative treatments or repeat the regimen after 24 hours.

Post-partum haemorrhage

- 800–1000 micrograms (4–5 tablets) either sublingual or / rectum (PR).

Administration

- Sublingual; per rectum (PR); / vaginal (PV)

Linked management

4.24.1 Post-partum haemorrhage

5.67 Morphine

Mechanism of action

- Morphine is an opioid analgesic. It is an opioid agonist (or stimulator) that binds to opioid receptors in the brain and spinal cord causing analgesia.

Indications

- moderate to severe pain
- sedation post-intubation

Contraindications

- known severe allergy
- unable to obey commands (exceptions: agitated delirium and post-intubation)
- current respiratory depression

Cautions

- age less than 1 year. Children under the age of 1 year are at increased risk of respiratory depression following opioid administration
- at high risk of respiratory depression (e.g. severe COPD, morbid obesity or on home BiPAP). Such patients may develop respiratory depression following opioid administration
- in labour, opioids cross the placenta and may cause drowsiness and/or respiratory depression in the baby, particularly when administered within an hour or two of birth. Discuss administration with the lead maternity carer if possible. Following birth, close observation of the baby is required and personnel must be prepared to treat respiratory depression

Use in pregnancy or breastfeeding

- Safety has not been demonstrated in pregnancy, but morphine should be administered if indicated.
- May be administered if the patient is breastfeeding. Advise the patient to stop breastfeeding and seek further advice from their lead maternity carer.

Dosage regimen

IV for analgesia

- Adult: 1-5 mg every 3–5 minutes. Use a dose at the lower at end of the range if the patient is small, frail or physiologically unstable.
- Child: 0.05–0.2 mg / kg.

5.67 Morphine

Dosage regimen

IM for analgesia (administer undiluted)

- Adult: 5-10 mg repeated once after 10 minutes. Use a dose at the lower end of the range if the patient is small, frail or physiologically unstable.
- Child: 0.05–0.2 mg / kg.

Sedation post-intubation

- Adult: 1–5 mg morphine in combination with 1–5 mg of midazolam, IV, every 10–15 minutes.
- Child: 0.1–0.2 mg / kg of morphine and midazolam.

Administration

- The preferred route for administration is IV.
- IM administration: the preferred site is the mid-lateral thigh as this has the best absorption, but if this site is not suitable use the lateral upper arm.

Common adverse effects

- respiratory depression
- hypotension
- sedation
- nausea and vomiting
- histamine release and itch

Usual onset of effect

- IV: 2–5 minutes. The maximal analgesic and respiratory depressant effects may not occur until 10–15 minutes and this may be longer in the elderly.
- IM: 5–10 minutes (depending on absorption).

Usual duration of effect

- 30–60 minutes.
- The effect on respiration may last for several hours, particularly in the elderly.

Usual preparation

- Ampoule: 10 mg in 1 mL; 15 mg in 1 mL; 30 mg in 1 mL

Pharmacology

- Morphine is metabolised in the liver

Common interactions

- The effects will be increased in the presence of other opioids and sedatives (e.g. benzodiazepines or alcohol)

5.67 Morphine

Special notes

- Histamine release and/or itch are common. This is not an allergy provided it is confined to skin involvement.
- True allergy to morphine is rare. However, some patients may experience severe side effects, including nausea and vomiting and may refuse to have it again. Consider administering fentanyl if this is the case.

Linked management

4.3 Pain control

4.16 Autonomic dysreflexia

4.24.2 Rapid sequence intubation (RSI)

5.68 Mylanta

Mechanism of action

- Neutralise hydrochloric acid secreted by gastric parietal cells.

Indications

Symptomatic relief of:

- dyspepsia
- peptic ulcer disease (PUD)
- gastro-oesophageal reflux disease (GORD)

Contraindications

- kidney failure

Cautions

- Patient has taken medication for heart disease, diabetes, high blood pressure, epilepsy, arthritis, gout, bacterial or fungal infection during the past two hours
- Patient had taken antacid tablets continuously for previous 7 or more days

Use in pregnancy or breastfeeding

- Safe to use in pregnancy, in usual antacid doses.

Side effects

- diarrhoea

Pharmacology

Three main active ingredients:

1. aluminium hydroxide: reacts to help reduce stomach acidity
2. magnesium hydroxide: reacts to help reduce stomach acidity.
3. simethicone in Mylanta Plus: acts as an antiflatulent and reduces built-up gas in the stomach

Usual preparation

- tablet
  - aluminium hydroxide 200 mg; 400 mg
  - magnesium hydroxide 200 mg; 400 mg
  - simethicone 20 mg (chewable); 40 mg (chewable)
- oral liquid
  - aluminium hydroxide 40 mg / mL; 80 mg / mL
  - magnesium hydroxide 40 mg / mL; 80 mg / mL
  - simethicone 4 mg / mL; 6 mg / mL

5.68 Mylanta

Dosage regimen

- Refer to the package insert

Administration

- oral

Special notes

- Always check the dose before administration as different concentrations exist.

5.69 Naloxone

Mechanism of action

- Naloxone is an opioid receptor antagonist (blocker). By blocking opioid receptors naloxone inhibits the effects of opioids, particularly respiratory depression and sedation.

Indications

- opioid poisoning is suspected and the patient has a significantly impaired level of consciousness or significant respiratory depression
- excess adverse effects from administration of opioids

Contraindications

- known severe allergy

Cautions

- chronic opioid use. If the patient is taking an opioid chronically, there is a risk of adverse physiological effects associated with opioid withdrawal

Use in pregnancy or breastfeeding

- Safety has not been demonstrated in pregnancy, but naloxone should be administered if indicated
- May be administered if the patient is breastfeeding. Advise the patient to stop breastfeeding and seek further advice from their lead maternity carer

Dosage regimen

- Adult
  - 0.1–0.4 mg IV every 1–5 minutes
  - 0.4–0.8 mg IM. This may be repeated every 5 minutes
  - 0.1–0.4 mg intranasal every 3–5 minutes
  - 2 mg nebulised
- Child
  - 0.01 mg / kg to a maximum of 0.4 mg IM

Administration

- Intramuscular
- Intravenous (adults, children and neonates)
- Subcutaneous (neonates)
- The preferred route for administration is IV
- IM: administer undiluted. The preferred site is the mid-lateral thigh as this has the best absorption. If this site is not suitable use the lateral upper arm

5.69 Naloxone

Common adverse effects

- sweating; tachycardia; hypertension

Usual onset of effect

- IV: 1–2 minutes
- IM: 5–10 minutes (depending on absorption)

Usual duration of effect

- 30–60 minutes
- The duration of action of naloxone may be shorter than the duration of action of the opioid it is being used to antagonise and naloxone may need to be repeated

Usual preparation

- Ampoules (adult): 400 microgram / mL; 1 mL

Pharmacology

- Naloxone is predominantly metabolised by the liver.

Special notes

- There is no role for naloxone in the treatment of cardiac arrest associated with opioid poisoning. In this setting cardiac arrest is secondary to respiratory arrest and once cardiac arrest has occurred naloxone has no useful effect.
- The best treatment is CPR that includes a focus on ventilation. If return of spontaneous circulation (ROSC) occurs, naloxone should still not be administered because it may be associated with seizures, hypertension, pulmonary oedema or severe agitation.

5.70 Noradrenaline

Mechanism of action

- Sympathomimetics partially or completely mimic the agonistic actions of noradrenaline or adrenaline (epinephrine) on the alpha and/or beta adrenoreceptors. The effect of a specific agent is determined by receptor specificity, compensatory reflexes evoked and dose.
- Sympathomimetics have a range of therapeutic uses (e.g. treating hypotension, arrhythmias, heart failure, anaphylactic reactions and bronchospasm)

Indications

- acute hypotension

Contraindications

- hypertension

Cautions

- hypovolaemia: correct before using noradrenaline
- hyperthyroidism
- ischaemic heart disease

Use in pregnancy or breastfeeding

- During pregnancy, use with caution if required (placental perfusion may be reduced). There is no data available for use during breastfeeding.

Side effects

- anxiety, palpitations, headache
- hypertension, bradycardia (reflex consequence of increased BP)
- extravasation may cause necrosis

Usual preparation

- Ampoule: 1mg / mL
- Vial: 1 mg / mL

Dosage regimen

- Adult
  - initially 4–5 micrograms / minute IV
  - titrate to haemodynamic response in steps of 2–4 micrograms / minute

5.70 Noradrenaline

Administration

- Only to be administered using a controlled delivery device.
- Administer into a large vein, through a clearly patent (preferably) large bore IV.
- Dilute in a crystalloid OR glucose 5%. Give via central vein if possible. If using a peripheral vein, flush dose with at least 20 mL IV crystalloid solution.
- Infusion preparation
  - 6 mg in 100 mL of a crystalloid solution or glucose 5% (60 microgram / mL) OR
  - 3 mg in 50 mL of a crystalloid solution or glucose 5% (60 microgram / mL)

5.71 Olanzapine

Mechanism of action

- Olanzapine is an atypical anti-psychotic.
- Olanzapine has actions at multiple receptors within the brain causing a reduction in agitation, sedation, anxiolysis and stabilisation of mood.

Indications

- mild agitation

Contraindications

- known severe allergy
- age less than 12 years

Cautions

- pregnancy
- in the elderly, olanzapine has increased and prolonged effects
- breastfeeding

Use in pregnancy or breastfeeding

- Safety has not been demonstrated during pregnancy and the balance of risk is such that olanzapine should usually be withheld. May be administered if the patient is breastfeeding. Advise the patient to stop breastfeeding and seek further advice from their lead maternity carer.

Dosage regimen

- greater than or equal to 80 kg: 10 mg, oral. The dose may be repeated once after 20 minutes.
- less than 80 kg: 5 mg, oral. The dose may be repeated once after 20 minutes.

Administration

- Administer orally. The tablet is dispersible and will dissolve in the mouth. A sip of liquid will aid absorption but is not routinely required. The tablet may be dissolved in liquid. For example in water, tea or coffee.

Common adverse effects

- Sedation

Usual onset of effect

- 10–20 minutes

Usual duration of effect

- 12–24 hours

5.71 Olanzapine

Usual preparation

- Oral dissolving tablet: 2.5 mg; 5 mg; 7.5 mg; 10 mg; 15 mg; 20 mg

Pharmacology

- Olanzapine is predominantly metabolised by the liver.

Common interactions

Intoxication

- Olanzapine will have increased effects if the patient is intoxicated with alcohol or has taken recreational medicines.

Sedative medicines

- Concurrent administration with other sedative medicines (such as midazolam) will result in an increased effect.

5.72 Ondansetron

Mechanism of action

- Ondansetron is an antiemetic.
- Ondansetron antagonises (blocks) serotonin receptors centrally in the brain and peripherally in the gastrointestinal tract, resulting in a reduction in nausea and vomiting.

Indications

- clinically significant nausea and/or vomiting

Contraindications

- known severe allergy
- age less than 1 year

Cautions

- known prolonged QT syndrome. Ondansetron may prolong the QT interval, particularly if a patient with pre-existing prolongation of the QT interval is administered high doses of ondansetron. In most patients ondansetron is safe, but only one dose should be administered if the patient is known to have a prolonged QT syndrome.
- 5HT antagonist sensitivity
- elderly

Use in pregnancy or breastfeeding

- Safety has not been demonstrated during pregnancy, but ondansetron may be administered if nausea or vomiting is severe. May be administered if the patient is breastfeeding. Advise the patient to stop breastfeeding and seek further advice from their lead maternity carer.

Dosage regimen

- Adult
  - 4-8 mg, oral.
  - 4 mg, IV or IM. This may be repeated once after 10 minutes.
  - A maximum of 2 parenteral (IV or IM) doses may be administered in addition to 1 oral dose.
- Child
  - 0.1 mg / kg to a maximum of 4 mg

5.72 Ondansetron

Administration

- Administer IV undiluted.
- Administer IM undiluted. The preferred site is the lateral thigh as this has the best absorption. If this site is not suitable use the lateral upper arm.

Common adverse effects

- headache, flushing, metallic taste

Usual onset of effect

- IV: 2–5 minutes
- IM: 5–10 minutes (depending on absorption)
- Oral: 10–20 minutes

Usual duration of effect

- 4–8 hours

Usual preparation

- Tablets and oral dissolving tablet: 4 mg; 8 mg
- Ampoule for injection: 4 mg / 2 mL; 8 mg / 4 mL

Pharmacology

- Ondansetron is predominantly metabolised by the liver.

5.73 Oxycodone

Mechanism of action

- Opioid analgesics act on opioid receptors in the CNS and the gastrointestinal tract producing analgesia, respiratory depression, sedation and constipation. They act mainly at mu-opioid receptors in the CNS, reducing transmission of the pain impulse, and by modulating the descending inhibitory pathways from the brain.
- Cough suppression occurs in the medullary centre of the brain.

Indications

- moderate to severe pain

Contraindications

- known severe allergy
- unable to obey commands
- current respiratory depression

Cautions

- Children under the age of 1 year are at increased risk of respiratory depression following opioid administration.
- At high risk of respiratory depression (e.g. severe COPD, morbid obesity or on home BiPAP). Such patients may develop respiratory depression following opioid administration.
- In labour, opioids cross the placenta and may cause drowsiness and/or respiratory depression in the baby, particularly when administered within an hour or two of birth. Discuss administration with the lead maternity carer if possible. Following birth, close observation of the baby is required and personnel must be prepared to treat respiratory depression.

Use in pregnancy or breastfeeding

- Safety has not been demonstrated in pregnancy, but morphine should be administered if indicated. May be administered if the patient is breastfeeding. Advise the patient to stop breastfeeding and seek further advice from their lead maternity carer.

Side effects

- nausea and vomiting (below), dyspepsia, drowsiness, dizziness, headache, orthostatic hypotension, itch, dry mouth, miosis, urinary retention, constipation

5.73 Oxycodone

Usual preparation

- Tablet: 5 mg (scored); 20 mg (Endonea)
- Capsule: 5 mg; 10 mg; 20 mg (OxyNorm)
- Oral liquid: 1 mg / mL; 250 mL (OxyNorm Liquid)
- Fixed-dose combination / controlled release oxycodone and naloxone tablets (Targin):
  - 2.5 mg per 1.25 mg
  - 5 mg per 2.5 mg
  - 10 mg per 5 mg

Dosage regimen

The following are approximate dose ranges for opioid-naive patients.

Acute pain

- Adult
  - Oral: do not use controlled release tablets for treatment of acute pain.
  - Conventional oral product: initially 5–15 mg every 4 hours (start with 5 mg in those greater than 70 years). Titrate dose according to response and sedation score. More frequent administration and/or higher doses may be required for severe acute pain.
- Child greater than 1 year
  - Conventional oral product: initially 0.1–0.2 mg / kg (maximum 5 mg) every 4–6 hours. Titrate dose depending on response.

Fixed-dose combination: oxycodone and naloxone

- Chronic pain: adult
  - Oral: 5 mg / 2.5 mg–10 / 5 mg every 12 hours. Should not exceed 80 mg daily.
  - Opioid-naive or elderly patients: start at the lower end of the dosage range.
  - Switching from oxycodone alone: start with half the total daily oxycodone dose every 12 hours.

Administration

- oral

5.74 Oxygen

- Oxygen should usually only be administered if the patient has one of the following clinical conditions:
  - a SpO2 less than 94% on air
  - in COPD and SpO_2 less than 88%
  - any patient with respiratory failure likely to benefit from oxygen therapy.
- Oxygen administration following bleomycin treatment or paraquat poisoning:
  - Oxygen administration can cause severe lung inflammation in patients previously treated with bleomycin (a chemotherapy medicine) and should usually only be administered for an SpO2 less than 88%.
  - Most patients that have received bleomycin have been specifically warned about a sensitivity to oxygen, and know to tell health personnel that oxygen should only be administered if necessary.

Administration

- The oxygen flow rates to be used are:
  - nasal prongs: 1–4 L / minute
  - simple mask: 6–8 L / minute
  - nebuliser mask: 8 L / minute
  - reservoir mask: 10–15 L / minute
  - manual ventilation bag 10–15 L / minute
- Oxygen flow rates should be titrated to the patient's normal SpO2 if this is known. If this is not known, titrate the oxygen flow rate to an SpO2 of 88–92%.

5.75 Oxytocin

Mechanism of action

- Oxytocin is a synthetic version of the naturally occurring hormone oxytocin which is normally released from the pituitary gland.
- Oxytocin stimulates oxytocin receptors on the uterus, causing increased uterine contraction and reducing blood loss from the uterus.

Indications

- following normal birth
- postpartum haemorrhage

Contraindications

- known severe allergy

Cautions

- none

Use in pregnancy or breastfeeding

- Safe and should be administered if indicated.

Dosage regimen

- IM: 10 units after normal birth
- Post-partum haemorrhage only:
  - 10 mg, IM bolus. Repeat after 5 minutes if bleeding continues
  - 40 units over 4 hours, IV infusion (10 units per hour)

Administration

- Administer IM undiluted. The preferred site is the lateral thigh as this has the best absorption. If this site is not suitable use the lateral upper arm.
- If multiple babies are present administration must occur after delivery of the last baby.
- If oxytocin has already been administered as part of routine treatment following normal birth, an additional 10 units of oxytocin should be administered (in the other thigh) if post-partum haemorrhage develops.

Common adverse effects

- abdominal cramping, tachycardia, flushing

Usual onset of effect

- 5–10 minutes

5.75 Oxytocin

Usual duration of effect

- 30–60 minutes

Usual preparation

Ampoule: 10 units in 1 mL

Pharmacology

- Oxytocin is metabolised in the liver and kidneys.
- There are no significant effects from liver or kidney impairment on acute administration.

5.76 Pancuronium bromide

Mechanism of action

- Acetylcholine receptor antagonists, which act at the neuromuscular junction preventing depolarisation of the muscle membrane.

Indications

- skeletal muscle relaxation in anaesthesia

Contraindications

- seizures not previously controlled with anticonvulsants
- myasthenia gravis

Cautions

- use with caution in patients with hepatic or renal dysfunction
- neuromuscular diseases

Use in pregnancy or breastfeeding

- Safe to use in pregnancy, and while breastfeeding.

Side effects

- hypertension, tachycardia

Pharmacology

- Non-depolarising neuromuscular blocking agent

Usual preparation

- Injection: 4 mg / mL

Dosage regimen

- Adult: 0.05–0.1 mg / kg IV (average adult dose 8 mg)
- Child: 0.05–0.1 mg / kg IV

Administration

- IV

5.77 Paracetamol

Mechanism of action

- Paracetamol inhibits the production of prostaglandins resulting in a reduction in pain and fever.

Indications

- mild or moderate pain, usually in combination with other medicines
- may be administered in addition to other medicines for severe pain

Contraindications

- known severe allergy
- current paracetamol poisoning
- known severe liver disease

Cautions

- the patient has taken paracetamol within the past 4 hours

Use in pregnancy or when breastfeeding

- Safe and may be administered if indicated

Dosage regimen

- Adult: 1000 mg (2 x 500 mg tablets), oral, every 4–6 hours; maximum 4 g daily.
- IV infusion
  - greater than 50 kg: 1 g every 4–6 hours; maximum 4 g daily.
  - less than 50 kg: 15 mg / kg every 4–6 hours; maximum 60 mg / kg daily.
- Children: 15 mg / kg every 4–6 hours maximum 60 mg / kg daily

Administration

- oral; IV

Usual onset of effect

- 30–60 minutes

Usual duration of effect

- 4–6 hours

Usual preparation

- Tablet: 500 mg
- Syrup: 24 mg / mL; 48 mg / mL; 100 mg / mL (St John recommends use of the 48 mg / mL only)
- Vial for IV infusion: 10 mg / mL

5.78 Potassium chloride

Mechanism of action

Potassium is the principal intracellular cation, and:

- is involved in cell function and metabolism
- helps in the maintenance of intracellular acid per base balance and isotonicity
- aids in transmission of nerve impulses, contraction of muscle and maintenance of renal function
- is involved in the contraction of cardiac, skeletal and smooth muscle.

Indications

- prevention and treatment of potassium depletion in patients with hypokalemia
- biochemical testing confirmation of the diagnosis is required to use this medication

Contraindications

- hyperkalemia of any aetiology

Cautions

- treatment of low potassium levels, particularly in patients with cardiac disease, renal disease or acidosis, requires close monitoring of acid-base balance, serum electrolytes, creatinine (and creatinine clearance in the elderly with renal failure) ECG and clinical status.
- if administering peripherally, be cautious about the risk of extravasations. IV potassium chloride solutions can cause pain if given peripherally. This can be avoided by ensuring adequate dilution of potassium chloride solution.
- renal impairment with oliguria or uraemia can cause increase in serum potassium level.
- acute dehydration and heat cramps are common associating factors that may increase serum potassium levels.
- where excretion of potassium may be an issue, concomitant administration of potassium may lead to hyperkalemia and cardiac arrest, especially if potassium is administered intravenously

Common adverse effects

The symptoms and signs of potassium intoxication include:

- paraesthesiae of the extremities, flaccid paralysis
- nausea, vomiting, diarrhoea and abdominal discomfort
- listlessness, mental confusion, weakness and heaviness of the legs
- fall in blood pressure, cardiac dysrhythmias and heart block

5.78 Potassium chloride

Common adverse effects

Hyperkalemia may exhibit the following ECG abnormalities:

- tall-peaked T waves, changes of the ST segment
- disappearance of the P wave; widening and slurring of QRS complex; sine wave
- ventricular tachycardia (VT), ventricular fibrillation (VF)

Common interactions

The following medicines are associated with either an increase or decrease in potassium levels, therefore caution is advised and concomitant use requires frequent measurement of potassium levels.

- Adrenaline, amphotericin B, atropine, captopril, cephalothin, chloramphenicol, sodium succinate; chlorpromazine, diazepam; mannitol, phenytoin, suxamethonium, sulfadiazine sodium, thiopentone.
- Insulin and sodium bicarbonate (decreases serum potassium)
- Salbutamol administration by either IV or nebulizer can decrease serum potassium concentration.
- Heparin may increase serum potassium level from the reduction of aldosterone synthesis.

Usual preparation

- Ampoule: 10 mmol (0.75 g) / 10 mL (potassium chloride)
- Premixed bags: 10 mmol / 100 mL; 30 mmol / 1000 mL

Administration

- Infuse using crystalloid solution solution, as glucose solutions decrease serum potassium concentrations.
- Monitor ECG continuously.
- The total dose should generally not exceed 200 mmol / 24 hours or 20 mmol / hr.
- If urgent treatment is required (serum potassium concentration less than 2 mmol / L with ECG changes or paralysis), infuse potassium at a rate of up to 40 mmol / hour, to a total of 400 mmol / 24 hour period, with frequent serum potassium measurements and continuous ECG monitoring.
- Administer magnesium replacement, so that magnesium level is in the upper range of normal (greater than 0.95 mmol / L).
- For potassium replacements of 20–40 mmol / hour: assess serum potassium levels hourly to every 2nd hourly.

5.78 Potassium chloride

Dosage regimen

Serum potassium level	Replacement
Normal 3.5–5.2 mmol / L	—
Mild 3.0–3.5 mmol / L	• Administer 10 mmol potassium over 1 hour. • Dosage regimen can be continued at 10 mmol per hour to maintain normal serum potassium levels (3.5–5.2 mmol / L). • The dose is dependent on individual patient requirement.
Moderate 2.5–3.0 mmol / L	• Administer 20 mmol potassium over 1 hour. • Dosage regimen can be continued at the rate of 10–20 mmol over 1–2 hours depending on patient requirement, until K+ greater than 3.2 mmol / L
Severe 2.0–2.5 mmol / L	• Administer 20–30 mmol potassium over 1 hour. • Dosage regimen can be continued at 20–30 mmol over 1–2 hours. Regularly check serum potassium every 1–2 hours until K+ greater than 2.8 mmol / L
Critical less than 2.0 mmol / L	• Administer 30–40 mmol potassium over 1 hour. • Dosage regimen can be 30–40 mmol over 1–2 hours. Regularly check serum potassium every 1–2 hours until K+ greater than 2.8 mmol / L • Monitor closely for ECG changes, arrhythmias and paralysis due to severe hypokalemia.
Frequent checking of serum potassium levels is necessary during replacement.	

Special notes

- Premixed bags are the preferred method of storage for this high risk medicine.
- Use of polyamps and dilution in the field setting are strongly discouraged.
- This medicine must only be administered by a controlled delivery device.

5.79 Prednisolone / prednisone

Mechanism of action

- Prednisolone is a corticosteroid with anti-inflammatory and immuno-suppressant actions. It inhibits the production of inflammatory mediators, including prostaglandins and leukotrienes, resulting in a reduction in the inflammatory and immune response.

Indications

- bronchospasm associated with asthma or COPD
- prominent rash associated with anaphylaxis, provided all systemic signs of anaphylaxis have resolved
- minor allergy associated with rash
- croup

Contraindications

- known severe allergy
- age less than 1 year

Cautions - age less than 5 years with asthma

Use in pregnancy or when breastfeeding

- Prednisone can be administered if there is severe bronchospasm, but should be withheld if the clinical problem is minor (e.g. rash or itch).
- Can be administered if the patient is breastfeeding. Advise the patient to stop breastfeeding and seek further advice from their personal physician.

Dosage regimen

- Adult: 50 mg
- Children: 1–2 mg / kg; maximum 60 mg

Administration - Oral

Common adverse effects - Fatigue

Usual onset of effect - 30–60 minutes

Usual duration of effect - 24 hours

Usual preparation - Tablets: 5 mg; 25 mg

Pharmacokinetics - Prednisone is predominantly metabolised by the liver.

5.80 Prochlorperazine

Indications

- nausea and vomiting due to various causes, including migraine
- vertigo due to Meniere's syndrome, labyrinthitis and other causes

Contraindications

- circulatory collapse
- CNS depression (coma or medicine intoxication)
- previous history of hypersensitivity reaction to phenothiazines

Cautions

- avoid in patients with renal dysfunction, Parkinson's disease, hypothyroidism, pheochromocytoma, myasthenia gravis, prostate hypertrophy
- use with care in elderly patients, epileptic patients
- avoid use in pregnancy
- do not use in children under 10 kg or less than 2 years, as acute extrapyramidal reactions are more likely to occur

Use in pregnancy or breastfeeding

- Safe to use in early pregnancy; risk of neurological disturbance in infants when taken in late pregnancy. Safe to use while breastfeeding.

Side effects

- constipation, dry mouth, drowsiness, akathisia, Parkinsonism, blurred vision, hypotension

Pharmacology

- Prochlorperazine is a phenothiazine that acts on several neurotransmitter systems. It possesses strong antiemetic and antipsychotic activity with less sedative action than chlorpromazine.

Usual preparation

- Tablets: 5 mg
- Ampoules: 12.5 mg / mL; 1 mL

5.80 Prochlorperazine

Dosage regimen

Nausea and vomiting

- Adult
  - initially 20 mg, oral, then 10 mg 2 hours later. If still needed, 5–10 mg 3 times daily.
  - 12.5 mg, IM or IV, every 8 hours as needed.
- Child greater than 2 years: 250 micrograms / kg, oral, 2–3 times daily

Vertigo

- Adult
  - 5–10 mg, oral, 2–3 times daily.
  - 12.5 mg initially, IM or IV, then every 8 hours as needed

Administration advice

- IV: give over 2 minutes.

Administration

- oral; deep IM injection; slow IV injection

Special notes

- Prochlorperazine can cause very serious dystonic reactions in children .

5.81 Promethazine

Mechanism of action

- Reduce the effects of histamine by binding to the H1 receptor and stabilising it in an inactive form.

Indications

- allergic conditions (e.g. rhinitis, urticaria)
- itch
- nausea and vomiting, including motion sickness

Contraindications

- high doses of other CNS depressants
- coma
- jaundice induced by phenothiazines
- children less than 2 years

Cautions

- hypertensive crisis
- epilepsy
- narrow angle glaucoma
- prostatic hypertrophy
- cardiovascular disease
- impaired hepatic, respiratory function
- obstructive gastrointestinal or urinary tract condition
- children
- elderly

Use in pregnancy or breastfeeding

- Safe to use in pregnancy. Short-term use while breastfeeding appears safe. Sedation of mother is main concern.

Side effects

- pronounced sedative effects (confusion, disorientation)
- oculogyric crisis
- excitation, nervousness, hysteria
- tremors, seizures
- catatonic-like states

5.81 Promethazine

Pharmacology

- phenothiazine derivative
- potent, long-lasting antihistamine (H_1 receptor antagonist) with the following actions: antiallergy, antiemetic, anti-motion sickness, anticholinergic, sedative (usual effect at therapeutic doses)

Usual preparation

- Tablet: 10 mg; 25 mg
- Ampoule: 50 mg / 2 mL
- Syrup: 5 mg / 5 mL

Dosage regimen

Allergy

- Adult: 25–75 mg, oral, once daily, or 10–25 mg 2 or 3 times daily OR IM 25–50 mg single dose
- Children greater than 2 years: IM per oral 0.125 mg per kg (maximum 12.5 mg) 3 times daily, or 0.5 mg per kg (maximum 25 mg) at night.

Nausea and vomiting

- Adult: oral 25 mg or IM 12.5–25 mg every 4–6 hours as needed; maximum 100 mg daily.
- Children greater than 2 years: oral 0.25–1 mg per kg (maximum 25 mg) every 4–6 hours as needed; maximum 100 mg daily.

Motion sickness

- Adult: oral 25 mg the night before or 1–2 hours before travel. Repeat dose after 6–8 hours if required.
- Children greater than 2 years: oral 0.5 mg per kg (maximum 25 mg) the night before or 1–2 hours before travel. Repeat dose after 6–8 hours if required (maximum 3 doses in 24 hours).

Sedation

For short-term use under medical supervision. Give 1–2 hours before procedure or as a single dose at night.

- Adult: oral 25–75 mg.
- Children greater than 2 years: oral 0.5–1 mg per kg (maximum 25 mg).

Administration

- oral; IV injection; deep IM injection

5.82 Propofol

Mechanism of action

- Uncertain, but its main CNS depressant action is thought to be via the GABA receptor at a site different to that of barbiturates and benzodiazepines. May also shorten channel opening times at nicotinic acetylcholine receptors and sodium channels in the cerebral cortex.

Indications

- Induction of anaesthesia
- maintenance of anaesthesia in adults and children greater than 3 years; and for procedures less than 60 minutes in children 1 month–3 years
- sedation during ventilation
- conscious sedation

Contraindications

- conscious sedation in children
- hypersensitivity to soya or soya extracts

Cautions

- patients with severe respiratory compromise
- muscular dystrophies and myotonias
- hyperlipidaemia and fat metabolism disorders
- elderly

Use in pregnancy or breastfeeding

- In pregnancy, may be associated with neonatal CNS and respiratory depression. Appears safe while breastfeeding.

Side effects

- Pain at injection site, bradycardia; hypotension; flushed skin or rash

Pharmacology

- Uncertain; the main CNS depressant action is thought to be via the GABA receptor.

Usual preparation

- Ampoule and vial for injection: 200 mg / 20 mL
- Syringe: 500 mg per 50 mL

5.82 Propofol

Dosage regimen

Anaesthesia: induction

- Healthy age 9–55 years: 1.5–2.5 mg per kg, IV, titrate to response over 30–60 seconds
- Healthy child 1 month–8 years: I2.5–3.5 mg per kg, IV, titrate to response over 30–60 seconds
- Age greater than 55 years or debilitated, and age 3–55 years: 1–1.5 mg per kg, IV, titrate to response over 30–90 seconds

Maintenance

- Adult: 4–12 mg per kg per hour, IV infusion OR 25–50 mg IV bolus, as required.
- Child 1 month and over: 7.5–15 mg per kg / hour, IV infusion

Sedation during ventilation

- Adult: 1–3 mg per kg every hour, IV infusion, maximum 4 mg per kg per hour.

Conscious sedation

- Adult: 0.5–1 mg per kg over 1–5 minutes, IV, then infuse 1.5–3 mg per kg per hour. A bolus of 10–20 mg may be given if a rapid increase of sedation is required (less in debilitated and those greater than 55 years).

5.83 Ranitidine

Mechanism of action

- Histamine (H2) receptor antagonist
- Competitively blocks H2 receptors on parietal cells, reducing gastric acid secretion.

Indications

- acute treatment of dyspepsia
- adjunctive treatment of:
  - anaphylaxis already treated with IM or IV adrenaline
  - urticaria/angioedema refractory to treatment with H1 receptor antagonist
- therapeutic acid suppression therapy in:
  - treatment of suspected gastric bleeding
  - preparation for endotracheal intubation in patients at high risk of gastric reflux

Contraindications

- previous allergic reaction to ranitidine

Cautions

- renal

Use in pregnancy or breastfeeding

- Safe to use when pregnant or while breastfeeding

Side effects

- bradyarrhythmia (following rapid IV administration)

Usual preparation

- Oral tablets: 150 mg; 300 mg tablets
- IV: 10 mg / mL; 25 mg / mL

Dosage regimen

- Adult
  - 150 mg, oral, twice daily; 150–300 mg initial dose
  - 50 mg, IV, 6–8 hourly
- Child: treatment not recommended for children less than 12 years.

Administration

- oral; IV

5.84 Rocuronium

Mechanism of action

- Rocuronium is a neuromuscular blocker. It antagonises (blocks) nicotinic acetylcholine receptors at the neuromuscular junction (motor nerve end plate) of skeletal muscle. This results in the inability of skeletal muscles to contract.

Indications

- neuromuscular blockade
- as a replacement for suxamethonium when it is contraindicated (e.g. hyperkalaemia)

Contraindications

- endotracheal placement has not been confirmed by capnography
- known severe allergy

Cautions

- chronic muscle weakness

Use in pregnancy or breastfeeding

- Safe and should be administered when indicated.

Dosage regimen

Maintenance if intubated patient

- Adults and children over 1 month: 0.15 mg / kg, IV. Repeat as required.
- Infusion: 5–10 micrograms / kg per minute (0.3–0.6 mg / kg / hour)

Induction as replacement for suxamethonium

- 1.2–1.6 mg / kg, IV bolus

Usual onset of effect

- 1–2 minutes

Usual duration of effect

- 30–60 minutes

Usual preparation

- Ampoule: 50 mg in 5 mL

Pharmacology

- Rocuronium is metabolised in the liver and excreted in urine. Significant hepatic or renal impairment will delay clearance and prolong the duration of effect.

5.85 Salbutamol

Mechanism of action

- Salbutamol is a bronchodilator. It is an agonist (stimulator) of beta-2 receptors.

Indications

- bronchospasm secondary to asthma, COPD or anaphylaxis
- prominent bronchospasm secondary to airway burns or smoke inhalation
- premature labour

Contraindications

- known severe allergy

Cautions

- hyperthyroidism
- myocardial insufficiency
- arrhythmias
- hypertension
- elderly patients

Use in pregnancy or when breastfeeding

- Safe and may be administered if indicated.

Dosage regimen (acute exacerbation)

- Adult
  - inhaled: 4 puffs (400 microgram), via spacer. Repeat after 4 minutes.
  - IV: 200–300 microgram over 1 minute. Repeat after 15 minutes if required
  - infused: starting dose of 5 microgram per minute with dose increased to 10–20 microgram per minute (loading dose of 200 microgram may be given)
  - nebulised: 5 mg
- Child 2–12 years
  - IV: 50–200 microgram over 1 minute and repeated after 15 minutes if required.
  - infused: loading dose of 5–7.5 microgram / kg, followed by infusion at rate of 5–7.5 microgram / kg per hour.
- Nebulised
  - Child 4–12 years: 2.5 mg
  - Child under 4 years: 0.1 mg per kg.

5.85 Salbutamol

Dosage regimen (acute exacerbation)

- Obstetric (IV infusion only)
  - Premature labour: 10–45 microgram per minute. Start at 10 microgram per minute and increase at 10 minute intervals. Maternal heart rate should be monitored.

Administration

- Administer nebulised undiluted
- Inhalation of nebulised solution
- IV injection per infusion

Side effects

- Fine tremor (usually hands), headache, peripheral vasodilatation, tachycardia, hypokalaemia after high doses

Usual onset and duration of effect

- Inhalation: initial effect 5 minutes; maximal effect 15–50 minutes.
- IV: initial effect 1–2 minutes; maximal effect 30–60 minutes.

Usual duration of effect

- 1–2 hours

Usual preparation

- Puffer metered dose inhaler (pMDI): 100 microgram per puff
- Nebules: 2.5 mg per 2.5 mL; 5 mg per 2.5 mL
- Respirator solution: 5 mg per 1 mL
- Ampoules: 500 microgram / mL
- Ampoules (obstetric): 5 mg per 5 mL

Pharmacology

- A selective beta2-adrenoreceptor stimulant which causes bronchodilation. It also relaxes smooth muscle of the uterus.
- Salbutamol is metabolised in the liver and excreted in urine.

Common interactions

- Salbutamol will be less effective in the presence of a beta-blocker, with the reduction in effect being most pronounced with a non-selective beta-blocker such as propranolol.

5.86 Sodium bicarbonate

Mechanism of action

- 8.4% sodium bicarbonate is a systemic alkalinising agent. It increases plasma bicarbonate, buffers hydrogen ions and raises the blood pH.

Indications

- tricyclic antidepressant overdose
- clinical signs of hyperkalemia
- treatment of metabolic acidosis
- crush injury in a patient with a lower limb (or more) trapped under a weight for more than 60 minutes, prior to release of the weight.

Contraindications

- renal failure

Cautions

- 8.4% sodium bicarbonate is hyperosmolar and will cause venous irritation if administered via a small vein
- hypernatraemia
- hypokalaemia, hypocalcaemia

Use in pregnancy or breastfeeding

- Safety has not been demonstrated, but 8.4% sodium bicarbonate should be administered if indicated.

Dosage regimen

- Adult: 50 mmol–100mmol (50 mL–100 mL), IV infusion. Repeat the dose if the clinical signs of hyperkalaemia or tricyclic antidepressant toxicity persist or recur.
- Child: 1 mmol / kg

Administration

- Administer IV injection per infusion over 1 minute, preferably into a large vein via a running line.
- Do not mix with other medicines as precipitation will occur. If other medicines are being administered via the same vein, ensure a minimum IV flush of 50 mL of crystalloid solution between medicines.

Side effects

- alkalosis, hypokalaemia

Usual onset of effect

- 1–2 minutes

5.86 Sodium bicarbonate

Usual duration of effect

- 1–2 hours

Usual preparation

- Ampoule per vial: 1 mmol / mL; 10 mL; 50 mL; 100 mL

Pharmacology

- Sodium bicarbonate is a systematic alkalising agent. When given IV, increases plasma bicarbonate, buffers excess hydrogen ion concentration, raises blood pH, and reverses the clinical manifestations of acidaemia.
- 8.4% sodium bicarbonate dissociates into sodium and bicarbonate ions which are excreted in urine.
- There are no significant effects from kidney impairment on acute administration.

5.87 Sodium chloride 3% (hypertonic saline)

Mechanism of action

- Elevation of the serum sodium (Na+) in blood.

Indications

- severe (life-threatening) sodium depletion when electrolyte restoration is required to sustain life or avoid permanent neurological sequelae
- traumatic brain injury

Contraindications

- when hyponatraemia is asymptomatic, or biochemical analysis is unavailable
- traumatic brain injury without evidence of raised intracranial pressure

Cautions

- impaired renal function
- very young and elderly patients
- decompensated cardiovascular system
- patients receiving corticosteroids or medicines causing sodium retention
- congestive heart failure
- chronic hyponatraemia

Use in pregnancy or breastfeeding

- Nil evidence. Use with caution.

Side effects

- central pontine myelinosis ('locked-in' syndrome) if sodium chloride corrected too quickly in hyponatraemia
- fluid overload, hypernatraemia, hyperchloraemic acidaemia, hypokalaemia, renal failure, phlebitis
- tissue necrosis if extravasates

Pharmacology

- hypertonic solution containing sodium chloride 3% in water

Usual preparation

- soft pack infusion: 1000 mL

Dosage regimen

- Use large arm vein

5.87 Sodium chloride 3% (hypertonic saline)

Hyponatraemia

- Intravenous infusion of 3% sodium chloride solution should not exceed 100 mL / hour (10 mL per min in exercise-associated hyponatraemia).
- Serum electrolyte concentrations should be repeated after every 100 mL to assess the need for further administration
- Treatment is aimed at addressing immediate life-threatening symptoms (e.g. seizures, coma) and not at biochemical restoration of normal plasma sodium. This can usually be achieved with a serum sodium greater than 115 mmol / L

Traumatic brain injury with signs of raised ICP (intracranial pressure)

- 100 mL, IV infusion. Should not exceed 100 mL given over 1 hour.

Administration

- IV infusion

Special notes

- 3% sodium chloride is hypertonic. To reduce risk of inadvertent administration, it should not be stored with or near any other intravenous fluid.
- Should be stored in a manner that requires controlled access to reduce risk of inadvertent administration (e.g. in a locked box, limited to senior staff, with double checking).
- Storage container should be clearly labelled with the name of the solution and the warning 'Caution: Hypertonic'.
- In hyponatraemia must only be administered after biochemical confirmation and consultation with a critical care professional.
- Requires controlled delivery with infusion device or burette: no more than 100 mL must ever be available for infusion into a patient at the bedside .
- All patients treated with 3% sodium chloride must be transported to hospital for medical review as soon as possible.

5.88 Sodium thiopental

Mechanism of action

- Potentiates action of the inhibitory neurotransmitter GABA at multiple sites in the CNS, resulting in sedative, hypnotic, anaesthetic and anticonvulsant effects.
- It also depresses the actions of excitatory neurotransmitters in the CNS. Redistribution of cerebral blood flow to injured areas may also be involved in its neuroprotective effect

Indications

- induction of general anaesthesia
- seizures, short-term control
- raised intracranial pressure (seek specialist advice)

Contraindications

- allergy to barbiturates
- porphyria

Cautions

- asthma: bronchospasm may occur
- severe respiratory compromise: further respiratory depression occurs; consider alternatives, including ketamine
- myasthenia gravis, muscular dystrophies and myotonias: respiratory depression prolonged or potentiated; reduce dose
- renal and hepatic impairment

Use in pregnancy or breastfeeding

- Safe to use while pregnant, however, if used close to delivery, respiratory depression may occur in the neonate. Safe to use while breastfeeding although small amounts may pass into breast milk.

Side effects

- transient erythema noted as blushing, garlic taste during induction, hypotension, respiratory and myocardial depression, prolonged somnolence

Usual preparation

- Vial of powder for reconstitution: 500 mg

5.88 Sodium thiopental

Dosage regimen

Administered as a 2.5% solution (25 mg / mL).

Induction and maintenance

- Adult: 3–5 mg per kg according to response, IV bolus. 1–2.5 mg per kg in debilitated or elderly patients. Maintain (sole anaesthetic agent) with additional injections of 25–50 mg when needed.
- Child: 5–6 mg per kg, IV bolus
- Neonates: 2–3 mg per kg, IV bolus

Seizure control

- Adult: 50–125 mg, IV bolus, given in increments of 25 mg. For seizures after use of a local anaesthetic, 125–250 mg given over 10 minutes may be needed. If seizures continue, IV infusion with ventilation support may be required; seek specialist advice.
- Child: 3–5 mg per kg, IV bolus, then 1–4 mg per kg per hour with ventilation support.

Cerebral protection

- Adult: 1.5–3.5 mg per kg, IV bolus; repeat as required.

Administration

- IV

5.89 Sodium valproate

Mechanism of action

- The active ingredient in sodium valproate is valproate.
- Valproate is an anticonvulsant. It predominantly blocks sodium channels but also enhances the activity of gamma-aminobutyric acid (GABA) at GABA receptors within the CNS.

Indications

- status epilepticus that has not responded to 2 doses of midazolam

Contraindications

- known severe allergy
- hypersensitivity to valproate
- pancreatic dysfunction
- porphyria
- urea cycle disorders
- mitochondrial disorders with mutations of POLG gene (e.g. Alpers-Huttenlocher syndrome)

Cautions

- treatment with topiramate, phenobarbital (phenobarbitone), carbamazepine, phenytoin; may increase risk of hyperammonaemic encephalopathy.
- hepatic impairment
- children

Use in pregnancy or when breastfeeding

- Valproate has been demonstrated to increase the risk of harm to the unborn baby. However, this has only been demonstrated with chronic administration and the balance of risk is in favour of administration if the mother has status epilepticus. Small amounts are excreted in breast milk but the balance of risk is in favour of administration if the mother has status epilepticus.

Dosage regimen

- Adult: initial dose 10 mg per kg up to 800 mg, slow IV push, followed by 1–2 mg / kg / hour to a maximum of 2500 mg per day
- Children: 15–30 mg per kg up to 800 mg, slow IV push, followed by 40 mg / kg per day up to 2500 mg per day.

5.89 Sodium valproate

Administration

- Administer IV over 10–15 minutes, preferably into a running IV line.
- Do not administer IM as this causes muscle necrosis.

Common adverse effects

- None

Usual onset of effect

- IV: 10–20 minutes

Usual duration of effect

- 6–12 hours

Usual preparation

- Ampoule containing 400 mg as powder for reconstitution.

Pharmacology

- Valproate is predominantly metabolised in the liver.

5.90 Suxamethonium chloride

Mechanism of action

- Suxamethonium is a neuromuscular blocker.
- Suxamethonium is a nicotinic acetylcholine receptor antagonist. It blocks cholinergic receptors within the neuromuscular junction, resulting in inability of skeletal muscles to contract.

Indications

- rapid neuromuscular blockade as a part of rapid sequence intubation (RSI)

Contraindications

- known severe allergy
- known personal or family history of malignant hyperthermia (MH)
- pre-existing paraplegia or quadriplegia. Long-term muscle weakness causes proliferation of acetylcholine receptors on skeletal muscle and suxamethonium may cause life-threatening hyperkalaemia.
- muscle disorder with long-term weakness (e.g. muscular dystrophy, congenital myopathies and motor neurone disease)
- hyperkalaemia.

Cautions

- acute narrow angle glaucoma
- phaeochromocytoma
- renal impairment

Use in pregnancy or breastfeeding

- Safe and should be administered if indicated.

Dosage regimen

- 1.5–2 mg per kg, maximum 200 mg

Administration

- Administer IV as a bolus

Side effects

- Muscle fasciculations; bradycardia (particularly with repeated dosing); excessive salivation; increased intraocular, intracranial and intragastric pressures; bronchospasm; hyperkalaemia; arrhythmias

Adverse effect

- Malignant hyperthermia (rarely)

5.90 Suxamethonium chloride

Usual onset of effect

- 30–60 seconds. This is predominantly affected by cardiac output and will be prolonged if cardiac output is low.

Usual duration of effect

- 4–8 minutes.

Usual preparation

- Ampoule: 100 mg per 2 mL

Pharmacology

- Suxamethonium is metabolised by the enzyme pseudocholinesterase. Metabolism is rapid and in most patients suxamethonium is cleared within 4–8 minutes.
- Ultrashort-acting depolarising neuromuscular blocking medicine. The neuromuscular blocking effects of suxamethonium can be increased to 4–12 hours if the patient has pseudocholinesterase deficiency.
- Pseudocholinesterase deficiency is rare.

Special notes

- Burn injury is often quoted as a contraindication to the administration of suxamethonium because life-threatening hyperkalaemia may occur. However, this is not a contraindication IMMEDIATELY following burn injury or once the patient is well enough to be discharged from hospital.
- If suxamethonium is contraindicated, rocuronium at a higher initial dose can be substituted to initial intubation

5.91 Tenecteplase

Mechanism of action

- Tenecteplase is a fibrinolytic that accelerates the breakdown of blood clots. It converts the plasma protein plasminogen into the active enzyme plasmin, which breaks down fibrin within blood clots.

Indications

- STEMI when primary percutaneous coronary intervention is not the chosen reperfusion strategy

Contraindications

- known severe allergy
- suspected aortic dissection
- major surgery, major trauma or severe brain injury within the past 6 weeks
- intracranial surgery within the past 6 months
- ischaemic stroke within the past 6 months
- previous intracerebral haemorrhage
- known cerebral aneurysm, arterio-venous malformation or tumour

Cautions

All of the contraindications and cautions relate to the risk of bleeding following the administration of a fibrinolytic agent.

- clinically significant bleeding
- more than 10 minutes of CPR
- non-compressible vascular puncture within the last 24 hours
- internal bleeding within the last six weeks
- lumbar puncture or epidural insertion within the last 6 weeks
- transient ischemic attack (TIA)within the last 3 months
- known bleeding disorder
- taking anticoagulant medication (e.g. warfarin or dabigatran)
- systolic blood pressure greater than 180 mmHg or diastolic blood pressure greater than 110 mmHg
- known to be pregnant, or less than 2 weeks post-partum
- breastfeeding

Use in pregnancy or breastfeeding

- Administration during pregnancy or within 2 weeks of birth carries a significant risk of bleeding. May be administered if the patient is breastfeeding. Advise the patient to stop breastfeeding and to seek further advice.

5.91 Tenecteplase

Dosage regimen

Dosage regimen is based on age and known (or estimated) weight.

	Age less than 75 years		Age 75 years or greater	
Weight	**Tenecteplase (dose IV)**	**Tenecteplase (volume IV)**	**Tenecteplase (dose IV)**	**Tenecteplase (volume IV)**
less than 60 kg	30 mg	6 mL	15 mg	3 mL
60–69 kg	35 mg	7mL	17.5 mg	3.5 mL
70–79 kg	40 mg	8 mL	20 mg	4 mL
80–89 kg	45 mg	9 mL	22.5 mg	4.5 mL
90 kg or greater	50 mg	10 mL	25 mg	5 mL

Administration

- Dissolve the powder using the syringe within the kit.
- Discard unwanted medicine from the syringe before administration.
- Administer undiluted as an IV bolus.

Common adverse effects

- Bleeding. Tenecteplase commonly causes superficial bleeding, including epistaxis, bruising and bleeding from IV sites.
- Dysrhythmia. It is common for dysrhythmia to occur if the coronary artery reperfuses. Most commonly the rhythm is accelerated idio-ventricular rhythm (AIVR) which does not require specific treatment. Other dysrhythmias should be treated if they are sustained.

Usual onset of effect

- 5–10 minutes

Usual duration of effect

- 2–6 hours

Pharmacology

- Tenecteplase is metabolised by the liver.
- There are no significant effects from liver dysfunction on acute administration.

5.91 Tenecteplase

Usual preparation

- Glass ampoule containing 50 mg of tenecteplase, in powder form with a pre-filled syringe containing 10 mL of sterile water.

Special notes

- Do not place additional IV lines after the administration of tenecteplase unless absolutely necessary, as this further increases the risk of bleeding.
- Rarely, tenecteplase may be associated with severe internal bleeding and this is why frequent vital sign recording is required post-administration.
- The most common life-threatening bleeding following tenecteplase administration is spontaneous intracerebral bleeding. Patients over the age of 75 years are particularly at risk and this is why the dose is reduced in this age group.

5.92 Tetanus immunoglobulin-VF

Indications

- Prevention of tetanus in inadequately immunised people with a tetanus-prone wound.

Contraindications

- Tetanus immunoglobulin-VF is contraindicated in individuals:
  - with isolated ImmunoglobulinA (IgA) deficiency, unless they have been tested and shown not to have circulating anti-IgA antibodies
  - who have severe thrombocytopenia or any coagulation disorder that would contraindicate intramuscular injections.

Cautions

- Tetanus immunoglobulin-VF (for intramuscular use) MUST NOT be administered IV because of the potential for anaphylactic reactions.
- Tetanus immunoglobulin-VF should be given with caution to patients with a history of prior systemic allergic reactions following the administration of human immunoglobulin preparations.

Use in pregnancy and breastfeeding

- The safety of this medicinal product for use in human pregnancy or during lactation has not been established in controlled clinical trials. Tetanus immunoglobulin-VF should therefore only be given with caution to pregnant women and breast-feeding mothers.
- Immunoglobulins are excreted in breast milk, however, it is not known whether this applies to passively administered Tetanus immunoglobulin-VF

Side effects

- Local tenderness, erythema and stiffness may occur at the site of injection and may persist for several hours

Pharmacology

- Tetanus immunoglobulin-VF is a sterile, preservative-free solution containing 160 mg / mL human plasma proteins, and 22.5 mg / mL glycine. The solution has a pH of 6.6.
- At least 98% of the protein is immunoglobulins (mainly IgG), with a tetanus antitoxin activity of not less than 100 IU / mL.

Usual preparation

- IM injection: 250 IU

5.92 Tetanus immunoglobulin-VF

Dosage regimen

- IM injection: 250 IU

Administration

- IM

Special notes

- Patients receiving immunoglobulin should also receive Tetanus toxoid.

5.93 Tetracaine (amethocaine) hydrochloride

Mechanism of action

- Block nerve conduction reversibly

Indications

- production of local anaesthesia in the eye. Reduces pain to facilitate adequate eye exam

Contraindications

- known hypersensitivity to amethocaine

Cautions

- may give rise to dermatitis in hypersensitive patient
- protect anaesthetised eye from dust and bacterial contamination
- patients should be warned not to rub or touch the eye while anaesthesia persists

Use in pregnancy or breastfeeding

- Safe to use in pregnancy, and while breastfeeding

Dosage regimen

- Adult and child: 1 eye drop. Repeat in 5 minutes if necessary. Up to 3 doses may be used for foreign body removal or minor surgery

Presentation

- A sterile eye drop ('minim') in a single use unit: 0.5% minims 0.5 mL; 1% minims 0.5 mL

Pharmacology

- Local anaesthetic which, when used in the eye, does not dilate the pupil.
- Duration of anaesthesia is approximately 30 minutes.

Side effects

- An initial burning sensation may be complained of, but this passes in less than 30 seconds.

5.94 Tramadol hydrochloride

Mechanism of action

- Tramadol is an analgesic. It has multiple actions within the CNS, including opioid receptor stimulation and inhibition of the re-uptake of noradrenaline and serotonin.

Indications

- moderate to severe pain, usually in combination with paracetamol and ibuprofen.
- may be administered for severe pain if opioids are not available. However, do not administer if an opioid has been administered because tramadol does not usually provide significant additional pain relief and may worsen side effects

Contraindications

- known severe allergy
- age less than 12 years

Cautions

- tramadol has been taken within the past 4 hours
- acute abdominal conditions, particularly if the patient is very unwell or vomiting
- age 75 years and greater, particularly if there is a previous history of dementia or confusion. Tramadol has anti-cholinergic activity and this may cause confusion, particularly in the elderly
- confusion
- pregnancy

Use in pregnancy or breastfeeding

- Safety has not been demonstrated in pregnancy and tramadol should usually be withheld. May be administered if the patient is breastfeeding. Advise the patient to stop breastfeeding and seek further advice from their lead maternity carer.

Dosage regimen

- 50–100 mg, IV or IM, every 4–6 hours up to a total daily dose of 600 mg.
- 50–100 mg, oral capsule (immediate release), every 4–6 hours when necessary. Maximum 400 mg daily.

Administration

- oral; IM
- IV: side effects are reduced when diluted in large volumes of crystalloid solution (e.g. 100 mg in 1000 mL) and administered over 30–60 minutes

5.94 Tramadol hydrochloride

Side effects

- nausea and vomiting; dizziness, lightheadedness or feeling unusual; dry mouth; sedation

Usual onset of effect

- 30–60 minutes

Usual duration of effect

- 4–8 hours; peaks at about 2–4 hours

Usual preparation

- Capsule (immediate release): 50 mg
- Ampoule: 50 mg per 1 mL; 100 mg per 2 mL

Pharmacology

- Tramadol is metabolised in the liver and excreted by the kidneys.
- There are no significant effects from liver impairment or kidney impairment on acute administration.

Common interactions

- Tramadol can potentially interact with a large number of medicines.
- Tramadol has been reported to cause serotonin syndrome in patients taking other medicines or recreational medicines that also raise serotonin levels within the brain. Examples include: selective serotonin re-uptake inhibitors (SSRIs), tricyclic anti-depressants and Ecstasy. However, this usually only occurs when doses of tramadol, higher than 50 mg, are taken chronically.

Special notes

- Tramadol is not indicated for pain associated with myocardial ischaemia.
- Some patients experience nausea and/or feel unusual with tramadol and may refuse to have it again. These are side effects, not an allergy and are most likely to occur with doses higher than 50 mg when administered intravenously.
- Tramadol has been reported to lower the seizure threshold in patients with epilepsy. However, this usually only occurs with doses higher than 50 mg taken chronically.

5.95 Tranexamic acid

Mechanism of action

- Tranexamic acid (TXA) forms a reversible complex that displaces plasminogen from fibrin resulting in inhibition of fibrinolysis. It also inhibits the proteolytic activity of plasmin. With reduction in plasmin activity, tranexamic acid also reduces activation of complement and consumption of C1-esterase inhibitor (C1-INH), thereby decreasing inflammation associated with hereditary angio oedema

Indications

- hereditary angioedema
- reduction of bleeding in:
  - minor surgery (cervical conisation, prostatectomy, dental surgery) in patients with mild-to-moderate coagulopathy
  - heavy menstrual bleeding
  - traumatic hyphaema
  - cardiac surgery
  - knee or hip arthroplasty
  - trauma

Contraindications

- active intravascular clotting

Cautions

- predisposition to thrombosis
- subarachnoid haemorrhage

Pregnancy and breastfeeding

- No information is available for use in pregnancy. Appears safe to use while breastfeeding.

Side effects

- thrombosis, visual disturbances

Usual preparation

- Ampoule 100 mg / mL

Dosage regimen

- 1 g over 10 minutes, IV bolus. Follow with 1 g over 8 hours, IV infusion.

Administration

- IV

5.95 Tranexamic acid

Special notes

- The current evidence strongly suggests a time sensitivity to the survival benefit. TXA should be commenced within 3 hours of injury, and as soon as possible within that 3 hour window.

5.96 Trimethoprim with sulfamethoxazole

Mechanism of action

- Sulfamethoxazole and trimethoprim are bacteriostatic. They competitively inhibit bacterial folate production essential for bacterial growth.

Indications

- treatment, and primary and secondary prevention, of phencyclidine (PCP)
- infections caused by L. monocytogenes (alternative to ampicillin or benzylpenicillin), Nocardia spp., Stenotrophomonas maltophilia
- melioidosis (with other agents)
- shigellosis
- primary prevention of cerebral toxoplasmosis in HIV patients
- prevention and treatment of pertussis (if a macrolide unsuitable)
- community-acquired MRSA infections (e.g. skin and soft tissue infections)

Contraindications

- serious allergic reaction to sulfonamides
- treatment with oral typhoid vaccin. Trimethoprim with sulfamethoxazole is active against S. typhi and may inactivate the vaccine
- megaloblastic anaemia
- severe hepatic impairment

Cautions

- HIV infection: increases frequency of allergic reactions to medicines. These are often intolerable and may require use of an alternative
- Systemic lupus erythematosus: may worsen due to sulfonamide
- Avoid use: increased risk of severe adverse effects

Use in pregnancy or breastfeeding

- Avoid in the first trimester of pregnancy as trimethoprim has been associated with congenital anomalies, e.g. oral clefts, cardiovascular and neural tube defects. It is unlikely to pose a risk in the second and third trimesters.
- Sulfamethoxazole is contraindicated in late pregnancy due to the risk of haemolytic anaemia, jaundice and, theoretically, kernicterus in the neonate.
- Safe to breast feed if neonate is healthy and full-term. Avoid if ill, stressed or preterm infant, and in those with hyperbilirubinaemia or G6PD deficiency.

Side effects

- fever, nausea, vomiting, diarrhoea, anorexia, rash, itch, sore mouth

5.96 Trimethoprim with sulfamethoxazole

Usual preparation

- Tablet: 80/400 mg; 160/800 mg
- Vial: 16/80 mg / mL

Dosage regimens

- Ratio of trimethoprim to sulfamethoxazole is 1:5.
- Doses are expressed as: 160/800 mg = trimethoprim 160 mg with sulfamethoxazole 800 mg (equivalent to 1 double-strength tablet).

Mild-to-moderate infections

- Adult: 80/400–160/800 mg, oral, every 12 hours.
- Child: 4/20 mg per kg, oral, every 12 hours (for 3 days for impetigo).

Severe infections

- Adult: 160/800–320/1600 mg, IV, every 12 hours.
- Child: 5/25 mg per kg, IV, every 12 hours.
- Maximum: 20/100 mg per kg, oral/IV, daily in divided doses (in PCP).

Phencyclidine (PCP)

- Adult
  - Treatment: 5/25 mg per kg, oral/IV, every 6–8 hours until improvement occurs, followed by oral (at the same dose) for a total of 21 days. Oral treatment can be used in mild-to-moderate disease when pO2 >70 mmHg on room air.
  - Primary or secondary prevention: 80/400–160/800 mg, oral once daily OR 160/800 mg once daily on 3 days a week.
- Child
  - Treatment of severe disease: 5/25 mg per kg (maximum 320/1600 mg), oral/IV, every 6 hours for 21 days.
  - Primary or secondary prevention: 5/25 mg per kg (usual adult dose 160/800 mg), oral, in 1–2 doses on 3 days a week.

Shigellosis

- Adult: 160/800 mg, oral, every 12 hours for 5 days.
- Child: 4/20 mg per kg (maximum 160/800 mg), oral, every 12 hours for 5 days.

5.96 Trimethoprim with sulfamethoxazole

Dosage regimens

Primary prevention of toxoplasmosis

- Adult: 80/400–160/800 mg, oral, once daily OR 160/800 mg once daily on 3 days a week.
- Child: 5/25 mg per kg, oral, daily in 2 doses OR 5/25 mg per kg in 1 or 2 doses on 3 days a week.

Pertussis prevention and treatment

- Adult: 160/800 mg, oral, every 12 hours for 14 days.
- Child: 4/20 mg per kg (maximum 160/800 mg), oral, every 12 hours for 14 days.

Administration

- oral

5.97 Tropisetron

Mechanism of action

- Central and peripheral 5HT3 receptor blockade

Indications

- nausea and vomiting

Contraindications

- 5HT antagonist sensitivity

Cautions

- cardiac rhythm or conduction disturbance
- renal impairment

Use in pregnancy or breastfeeding

- May be used after the first trimester of pregnancy if other medicines are inadequate for nausea and vomiting. Ondansetron is preferred because of greater experience. Human data lacking for tropisetron. Breastfeeding: no data available, although 1–2 doses after delivery should not be a concern.

Side effects

- constipation, headache, dizziness, transient rise in hepatic aminotransferases

Pharmacology

- Central and peripheral 5HT receptor blockade leading to reduction in nausea and vomiting.

Usual preparation

- Ampoule for injection: 2 mg / 2 mL; 5 mg / 5 mL

Dosage regimen

- Adult: 2 mg, IV, once daily.
- Child greater than 2 years: 0.05–0.2 mg per kg, IV, once or twice daily. Maximum: 2 mg daily.

Administration

- IV

Special notes

- Give doses of 2 mg or less by slow IV injection (over at least 1 minute). Consider IV infusion over 15 minutes
- Dosage regimens of greater than 2 mg MUST be by IV infusion over at least 15 minutes.

5.98 Ulipristal

- Within the St John environment, patients seeking emergency contraceptives should be referred to their local community provider to access the treatment and the ongoing supports associated with this intervention.

Mechanism of action

- Progesterone receptor modulator with antagonist and partial agonist effects, which prevents or delays ovulation. Reversibly alters endometrial epithelium, and decreases fibroid size by inhibiting cell proliferation and inducing apoptosis.

Indications

- emergency contraception

Contraindications

- unexplained vaginal bleeding; contraindicated when treating uterine fibroids
- uterine, cervical, ovarian or breast cancer; contraindicated when treating uterine fibroids (these women were excluded from trials)

Cautions

- obesity: it is unclear if efficacy as an emergency contraceptive is reduced in obese women as data are conflicting. Consider referral for a copper IUD for emergency contraception
- treatment (in the previous 4 weeks) with drugs that induce CYP3A4: may reduce effectiveness of ulipristal; combination is not recommended. Consider referral for a copper IUD for emergency contraception
- treatment with progestogens: may reduce effectiveness of ulipristal; combination is not recommended. After ulipristal use for emergency contraception, wait at least 5 days before starting progestogen-containing hormonal contraception (including levonorgestrel for emergency contraception). During treatment for uterine fibroids, ulipristal may not inhibit ovulation in all women; advise use of non-hormonal contraception.

Use in pregnancy or breastfeeding

- Limited information for use during pregnancy, but ulipristal is not thought to increase the risk of birth defects.
- Emergency contraception: it does not appear to increase the risk of ectopic pregnancy if emergency contraception fails.
- Excreted into breast milk while breastfeeding (no other clinical data). Manufacturer recommends avoiding breastfeeding for 7 days after taking ulipristal; consider an alternative agent if possible.

5.98 Ulipristal

Side effects

- nausea, abdominal pain, dysmenorrhoea, breast tenderness, headache, dizziness

Pharmacology

- Progesterone receptor modulator

Usual preparation

- Tablet: 5 mg; 30 mg

Dosage regimen

- Give ulipristal as soon as possible, up to 120 hours (5 days) after unprotected intercourse or contraception failure
- 30 mg as a single dose, oral.

Administration

- oral

Special notes

- If vomiting within 3 hours of taking the tablet, go back to your doctor/clinic so that you can obtain more.
- Next menstrual cycle is likely to be on time but it may be slightly early or late. If it is more than 1 week late, or is unusually light or heavy, advise a pregnancy test or see their doctor.
- Advise to wait at least 5 days before taking hormonal contraception. Use a barrier method (e.g. condoms) during this time and for another 7 days with a combined hormonal contraceptive (9 days for Qlaira®), or 2 days for progestogen-only pills.
- Do not use ulipristal and levonorgestrel together for emergency contraception (levonorgestrel may reduce the effectiveness of ulipristal).

5.99 Vecuronium

Mechanism of action

- Acetylcholine receptor antagonists, which act at the neuromuscular junction preventing depolarisation of the muscle membrane.

Indications

- skeletal muscle relaxation as an adjunct to anaesthesia

Contraindications

- allergy to vecuronium

Cautions

- renal and hepatic impairment; action may be prolonged
- myasthenia gravis
- children

Pregnancy and breastfeeding

- Safe to use in pregnancy and breastfeeding

Pharmacology

- Non-depolarising neuromuscular blocker

Usual preparation

- Injection (powder form): 10 mg

Dosage regimen

- Adult
  - 0.1 mg per kg, IV bolus, for intubation. Incremental doses 0.02–0.04 mg per kg.
  - 1 microgram / kg / minute (0.06 mg per kg / hour), IV infusion. Adjust according to response
- Child: 0.1 mg per kg, IV bolus for intubation. Repeat as required for maintenance.

Administration

- IV; IV infusion

Usual onset of effect

- 2–3 minutes

Usual duration of effect

- 20–40 minutes

5.100 Verapamil

- Blocks inward current of calcium into cells in vascular smooth muscle, myocardium and cardiac conducting system via L-type calcium channels.
- Acts on coronary arteriolar smooth muscle to reduce vascular resistance and myocardial oxygen requirements, relieving angina symptoms.
- Dihydropyridines act mainly on arteriolar smooth muscle to reduce peripheral vascular resistance and BP. They have minimal effect on myocardial cells.
- Non-dihydropyridines: diltiazem and verapamil act on cardiac and arteriolar smooth muscle. They reduce cardiac contractility, heart rate and conduction, with verapamil having the greater effect. Diltiazem has a greater effect on arteriolar smooth muscle than verapamil.

Indications

- supraventricular tachycardia with AV nodal re-entry
- atrial fibrillation per flutter
- hypertension
- angina

Contraindications

- cardiogenic shock
- severe bradycardia
- sick sinus syndrome
- complicated acute myocardial infarction
- 2nd and 3rd heart block
- wide complex tachycardia

Cautions

- renal and hepatic impairment
- pregnancy and breastfeeding
- treatment with other agents that may cause bradycardia

Use in pregnancy and breastfeeding

- Pregnancy: no information. Breastfeeding: limited data for verapamil but appears safe to use

Side effects

- bradycardia; constipation; developing or worsening congestive cardiac failure

Pharmacology

- Calcium channel blocker

5.100 Verapamil

Usual preparation

- Injection: 5 mg / 2 mL

Dosage regimen

- Adult: initially 5 mg (over 2–3 minutes) IV injection, repeated after 5–10 minutes as required

Administration

- oral; IV injection per infusion

Special notes

- Rapid IV can result in hypotension, bradycardia, heart block and asystole

Clinical practice guidelines for health professionals

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