St John
Here for Life

Clinical Procedures and Guidelines

Comprehensive edition

2016 – 2018

Clinical Procedures and Guidelines - Comprehensive Edition

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Introduction

These are the Clinical Procedures and Guidelines (CPGs), incorporating standing orders for use of personnel within the New Zealand ambulance sector.

These CPGs are for the use of St John personnel with current authority to practise, when providing clinical care to patients on behalf of St John. These CPGs have been developed by the National Ambulance Sector Clinical Working Group and are issued to individual clinical personnel by Dr Tony Smith, the Medical Director for St John.

These CPGs will be reviewed at the end of 2017, with updates being issued at that time if required. These CPGs expire at the end of 2018 at which time they will be formally updated and reissued. They remain the intellectual property of the National Ambulance Sector Clinical Working Group and may be recalled or updated at any time. Any persons other than St John personnel using these CPGs do so at their own risk. Neither St John nor the National Ambulance Sector Clinical Working Group will be responsible for any loss, damage or injury suffered by any person as a result of, or arising out of, the use of these CPGs by persons other than authorised St John personnel.

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1.1 Authority to practise and practice levels

Ambulance personnel cannot legally supply or administer prescription medicines to patients unless they have authority to practise, or they are a Registered Health Practitioner with the ability to supply or administer prescription medicines described within their scope of practice. In addition, services restrict the use of some items of clinical equipment and the performance of some clinical procedures to personnel at specified practice levels.

Authority to practise is the authorisation of a person to use these CPGs by the ambulance service Medical Director. Personnel may not use these CPGs without authority to practise. Authority to practise is granted at a specified practice level and the practice levels are listed in the table. Each practice level has a delegated scope of practice. The delegated scopes of practice define the medicines and procedures that personnel may administer or perform when treating patients. First aid interventions that are not described within the delegated scopes of practice (for example CPR and automated defibrillation) may be provided by personnel without authority to practise.

Skill	EMT	Paramedic	ICP
Adrenaline IM, IN, nebulised and topical	✔	✔	✔
Entonox inhaled	✔	✔	✔
Glucagon IM	✔	✔	✔
GTN SL	✔	✔	✔
Ibuprofen PO	✔	✔	✔
Ipratropium nebulised	✔	✔	✔
Laryngeal mask airway	✔	✔	✔
Laryngoscopy (airway obstruction)	✔	✔	✔
Loratadine PO	✔	✔	✔
Methoxyflurane inhaled	✔	✔	✔
Ondansetron PO	✔	✔	✔
Paracetamol PO	✔	✔	✔
Prednisone PO	✔	✔	✔
PEEP	✔	✔	✔
Salbutamol nebulised	✔	✔	✔
Tramadol PO	✔	✔	✔
Urinary catheter troubleshooting	✔	✔	✔
Adrenaline IV (cardiac arrest only)		✔	✔
Amiodarone IV (cardiac arrest only)		✔	✔
Amoxicillin/clavulanic acid IM or IV		✔	✔
Clopidogrel PO		✔	✔
Enoxaparin SC		✔	✔
Fentanyl IN and IV		✔	✔
Gentamicin IV		✔	✔
Glucose IV		✔	✔
Heparin IV		✔	✔
IV cannulation		✔	✔
1% lignocaine SC		✔	✔
Manual defibrillation		✔	✔
Metoprolol IV		✔	✔

Skill	EMT	Paramedic	ICP
Midazolam IM (seizures or agitated delirium only)		✔	✔
Midazolam IV (seizures only)		✔	✔
Morphine IM and IV		✔	✔
Naloxone IM and IV		✔	✔
Olanzapine PO		✔	✔
Ondansetron IM and IV		✔	✔
Oxytocin IM		✔	✔
0.9% sodium chloride IV		✔	✔
Synchronised cardioversion		✔	✔
Tenecteplase IV		✔	✔
Valproate IV		✔	✔
Adenosine IV			✔
Adrenaline (all routes)			✔
Amiodarone IV			✔
Atropine IV			✔
Calcium chloride IV			✔
Chest decompression (needle)			✔
Cricothyroidotomy			✔
Endotracheal intubation			✔
Finger thoracostomy			✔
IO access			✔
Ketamine (all routes)			✔
1% lignocaine (all routes)			✔
Magnesium IV			✔
Midazolam IV			✔
Pacing			✔
Rocuronium IV			✔
8.4 % sodium bicarbonate IV			✔
Suxamethonium IV (RSI endorsed personnel only)			✔

1.2 General principles

Standing orders

- These CPGs incorporate standing orders and personnel are required to adhere to them.
- Use of these standing orders does not require the Medical Director to countersign each use. However, use will be subject to the audit process within St John and Wellington Free Ambulance.
- The words "must" and "should" appear throughout the CPGs. The word "must" means that personnel are always required to follow this instruction. The word "should" means that personnel are required to follow the instruction unless there is a good clinical reason not to.
- Some personnel have an expanded delegated scope of practice, for example personnel involved in providing urgent community care. Such personnel are provided with additional CPGs which supersede these CPGs in specific circumstances.

General principles of treatment

- Although not listed in each section, all patients require a primary and secondary survey with appropriate intervention as required.
- Unless specified otherwise, all of the medicine doses and fluid volumes in these CPGs are for adults, and children whose weight has been rounded to 50 kg or more. See the paediatric drug dose section for children weighing less than 45 kg.
- For the purposes of these CPGs a patient is an adult if they are aged 16 years or older.

Documentation

- The patient and incident details, the assessment of the patient, any treatment administered, any procedures performed and any advice given to the patient and/or caregivers must be documented on the patient report form (PRF).
- A PRF is always required when:
  a) A single patient is assessed following dispatch of an ambulance. For example, if an ambulance crew are dispatched to a single patient and the patient is assessed (including speaking to the patient) a PRF must be completed. Note: if more than one patient is assessed at an incident a PRF is not always required for each patient (see below).
  b) A vital sign is measured following dispatch of an ambulance. For example, at the scene of a road crash multiple patients may be assessed and not transported, but if a patient has a vital sign measured (for example a blood pressure) a PRF must be completed for that patient.
  c) A patient is transported to a medical facility. This includes arranged GP admissions and transfers to a hospice, but does not include DHB

inter-facility transfers unless personnel administer treatment, perform a significant clinical procedure (see below) or have any significant clinical concerns. A separate PRF is required for each patient transported.

d) A medicine other than paracetamol or ibuprofen is administered to the patient. For example, at an event a patient may be administered paracetamol for a headache without completing a PRF, but if tramadol is administered a PRF must be completed.

e) A significant treatment or procedure is provided, noting that this requires clinical judgement. For example, placing an ice pack on a soft tissue injury is not a significant treatment but administering 0.9% sodium chloride IV is, and placing a sticking plaster is not a significant clinical procedure but reducing a dislocated patella is.

Alternative care pathways (right care)

- A number of alternative care pathways are being developed, piloted or introduced in different areas of the country.
- The general principle behind alternative care pathways is to meet the healthcare needs of the patient in the most effective and efficient way possible.
- Where alternative care pathways have been formally introduced, the treatment and referral principles within them supersede those within these CPGs.

Clinical trials

- St John and Wellington Free Ambulance are committed to improving clinical knowledge and patient outcomes by taking part in clinical trials. Such involvement in clinical trials improves the overall care that patients receive.
- Personnel are required to adhere to protocols and enter all eligible patients into clinical trials undertaken within St John and Wellington Free Ambulance.

Seeking clinical advice from personnel that are not at the scene

- All requests for clinical advice must be sought from:
  a) The person described within these CPGs (for example the STEMI Coordinator if the patient has STEMI) or
  b) Personnel on the Clinical Desk, who will refer personnel to the on call doctor if required, or
  c) A registered healthcare provider (for example doctor, midwife or nurse) if the patient is well known to them.
- A hospital based doctor may be contacted for advice if personnel cannot contact the Clinical Desk, but this contact must be:
  a) Via radio or
  b) Via telephone by asking a Control/Comms Call Handler to conference call in the doctor. This ensures the conversation is recorded.
- The advice and who provided it must be recorded on the PRF.

1.3 Providing treatment that differs from that described in these CPGs

When the treatment is not described within any of the delegated scopes of practice

- For example, the administration of insulin or blood.
- This is permissible only when personnel are:
  a) In direct communication with the on call doctor via the Clinical Desk or
  b) Taking part in a clinical trial, feasibility trial or alternative care pathway that has been formally introduced by St John or Wellington Free Ambulance.

When the treatment is not within the delegated scope of practice of the person administering it

- For example, an EMT administering midazolam IM for seizures.
- This is permissible only in the following four circumstances:
  1. When instructed to do so by personnel on the Clinical Desk.
  2. When instructed to do so by the on call doctor via the Clinical Desk.
  3. When instructed to do so by a doctor at the scene:
     a) Personnel may follow the instructions of a doctor at the scene provided they believe the instructions are consistent with good clinical practice. If personnel are asked to provide treatment they believe is inconsistent with good clinical practice they should decline the request.
     b) The name and contact details of the doctor must be recorded on the PRF.
  4. When treatment is provided by a student or trainee under the direct supervision of ambulance personnel. See later in this section.

When the treatment is within the delegated scope of practice of the person administering it, but the administration differs from that described in these CPGs

- For example, administering higher doses than those described or using alternative indications.
- This is permissible only in the following four circumstances:
  1. An ICP may do so when it is in the best interest of the patient.
  2. When instructed to do so by personnel on the Clinical Desk.
  3. When instructed to do so by the on call doctor via the Clinical Desk.

4. When instructed to do so by a doctor at the scene:
    a) Personnel may follow the instructions of a doctor at the scene provided they believe the instructions are consistent with good clinical practice. If personnel are asked to provide treatment they believe is inconsistent with good clinical practice they should decline the request.
    b) The name and contact details of the doctor must be recorded on the PRF.

When the treatment is being provided by a registered health professional

- For example, an EMT who is also a registered nurse is replacing a urinary catheter.
- A registered health professional may choose to provide a treatment that is not within their delegated scope of practice as defined within these CPGs. Under these circumstances all of the following criteria must be met:
    a) The treatment must be within their scope of practice as defined by their registering authority and
    b) The treatment must be consistent with the principles contained within these CPGs.

When the treatment is being provided following instructions from a registered health professional

- For example, a Paramedic is administering midazolam IV to a patient following telephone advice from a hospice nurse or doctor.
- This is permissible only in the following three circumstances:
    1. A patient with specific needs may have their own medicines for self-administration or for administration by others, in the event of an emergency. For example, a patient may have buccal midazolam for seizures or hydrocortisone for preventing adrenal crisis. All personnel may administer such medicines (even if outside their delegated scope of practice) provided:
        a) The medicine appears to be indicated and
        b) There are clear instructions (including verbal instructions) and
        c) Personnel are capable of providing the treatment and
        d) If personnel are unsure they seek advice via the Clinical Desk.
    2. A patient with specific needs may have written instructions for a specific treatment plan and this may include deviating from the doses and/or indications described within these CPGs. All personnel may follow such instructions provided:
        a) The instructions apply to the current circumstances and
        b) The treatment described is within their delegated scope of practice and
        c) If personnel are unsure they seek advice via the Clinical Desk.

3. When instructed to do so (including over the phone) by hospice or palliative care personnel. All personnel may follow such instructions (including to provide treatments outside their delegated scope of practice) provided:
   a) The instructions are clear and
   b) Personnel are capable of providing the treatment described and
   c) If personnel are unsure they seek advice via the Clinical Desk.

When the problem is immediately life-threatening and no contact is possible with the Clinical Desk

- Rarely, a patient may have an immediately life-threatening problem and personnel may be unable to contact the Clinical Desk in order to gain permission to provide treatment that is immediately life saving* but is outside their delegated scope of practice.
- For example, a patient in VT with severe cardiovascular compromise is requiring urgent cardioversion and is awake. An ICP is not available and a Paramedic wishes to administer ketamine IV for sedation prior to cardioversion, but is unable to contact the Clinical Desk.
- Personnel may administer treatment in this circumstance provided they have made all reasonable attempts to make contact with the Clinical Desk and they have sufficient knowledge and skill to provide the treatment. In addition, as soon as practical they must:
  a) Notify personnel on the Clinical Desk to have a comment added to the incident notes and
  b) Notify their Operational Manager of the incident and
  c) Speak to the on call doctor via the Clinical Desk to discuss the incident.
- *There are very few treatments that are considered immediately life saving, but examples include:
  a) Amoxicillin/clavulanic acid for meningococcal septicaemia.
  b) Chest decompression for tension pneumothorax.
- *Examples of treatments that are not considered immediately life saving in this setting are:
  a) Endotracheal intubation.
  b) IV medicines during cardiac arrest.

When the treatment is being provided by a student/trainee

- Examples include:
  a) Personnel enrolled in the National Diploma in Ambulance Practice.
  b) Students enrolled in a paramedic degree programme with a tertiary institution undertaking clinical placements.
  c) Student doctors, student nurses and New Zealand Defence Force medics undertaking clinical placements and/or electives.

- Students/trainees may administer treatment under supervision from personnel provided all of the following criteria are met:
  a) The student/trainee is enrolled in the St John or Wellington Free Ambulance Supervised Clinical Practice Programme.
  b) The student/trainee has been taught how to provide the treatment.
  c) The person providing supervision has the treatment within their own delegated scope of practice.
  d) The person providing supervision takes responsibility for provision of the treatment.
  e) The supervising person is present and providing direct supervision in such a way that they can immediately intervene if required.
  f) The patient (if competent) is asked to consent to have treatment provided by a student/trainee.

The St John Supervised Clinical Practice Programme

- The following personnel are automatically enrolled in the Supervised Clinical Practice Programme and do not need to formally enrol:
  a) Personnel enrolled in the National Diploma in Ambulance Practice.
  b) Personnel enrolled in the St John Clinical Internship Programme.
  c) Personnel enrolled in the St John Sponsorship Programme.
  d) Non-St John personnel enrolled in a paramedic degree with a tertiary provider in New Zealand.
- All other personnel (including St John personnel enrolled in a paramedic degree, St John personnel intending to apply for an internship position when one is available, students and New Zealand Defence Force medics) must enrol in the Supervised Clinical Practice Programme.
- To enrol in the Supervised Clinical Practice Programme personnel must complete the enrolment form located on the ATP page of the Hub and submit it via **ATP@stjohn.org.nz**.
- The names of students/trainees enrolled in the Supervised Clinical Practice Programme will be published on the Hub, detailing the practice level at which they may provide treatment under supervision.

Audit

- The PRF must be sent for audit whenever treatment is provided that is not described within these CPGs, except when treatment is provided by a student/trainee under supervision.
- The person providing the treatment is responsible for ensuring the PRF is sent for audit.

1.4 Analgesia

Overall principles

- Analgesia is usually best achieved by a combination of 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.

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.
- Administer an opiate and/or methoxyflurane if pain is not adequately controlled.

For severe pain

- Start with methoxyflurane if opiate administration is going to be delayed.
- Administer an opiate and titrate further doses to effect.
- Administer ketamine if pain is not adequately controlled and titrate further doses to effect.
- Do not routinely administer paracetamol and/or ibuprofen, but consider doing so once pain is sufficiently controlled for the patient to swallow medicines, particularly if transport time is prolonged.
- Do not routinely administer tramadol, but consider doing so if no suitable personnel are available to administer an opiate.

Paracetamol

- Paracetamol is indicated for mild pain (usually in combination with ibuprofen) and in addition to other medicines for moderate pain.
- Paracetamol may be administered in addition to other medicines for severe pain, particularly if the transport time is long.
- Paracetamol is contraindicated if the patient has current paracetamol poisoning.

- Administer paracetamol with caution if the patient has:
  a) Taken paracetamol within the last four hours.
  b) Abdominal pain, particularly if the patient is very unwell or vomiting.
  c) Known severe liver disease.
- Dosage:
  a) 1.5 g PO for an adult weighing greater than 80 kg.
  b) 1 g PO for an adult weighing 80 kg or less.
  c) See the paediatric drug dose tables for a child.
- All personnel (including those without ATP) may provide paracetamol to a patient for self-administration, provided the package instructions are followed.
- A patient may be administered paracetamol for pain associated with a minor condition and be given a recommendation that immediate referral to a medical facility is not required.

Ibuprofen

- Is indicated (usually in combination with paracetamol) for mild or moderate pain, particularly soft tissue pain, musculoskeletal pain or headache.
- May be administered in addition to other measures for severe pain, particularly when the transport time is long.
- Ibuprofen is contraindicated in the third trimester of pregnancy.
- Administer ibuprofen with caution if the patient:
  a) Has taken ibuprofen within the last four hours.
  b) Has abdominal pain, particularly if the patient is very unwell or vomiting.
  c) Is aged greater than or equal to 75 years, particularly in the presence of illness, infection or dehydration.
  d) Is dehydrated or shocked.
  e) Has known renal impairment.
  f) Has a known bleeding disorder or clinically significant bleeding.
  g) Has known worsening of bronchospasm with NSAIDs.
  h) Is taking warfarin.
  i) Is pregnant.
- Dosage:
  a) 600 mg PO for an adult weighing greater than 80 kg.
  b) 400 mg PO for an adult weighing 80 kg or less.
  c) See the paediatric drug dose tables for a child.
- All personnel (including those without ATP) may provide ibuprofen to a patient for self-administration, provided the package instructions are followed.
- A patient may be administered ibuprofen for pain associated with a minor condition and be given a recommendation that immediate referral to a medical facility is not required.

Tramadol

- Tramadol is indicated (usually in combination with paracetamol and/or ibuprofen) for moderate pain.
- Tramadol may be administered for severe pain if no suitable personnel are available to administer an opiate, but do not administer tramadol if an opiate has been administered.
- Tramadol is contraindicated if the patient is aged less than 12 years.
- Administer tramadol with caution if the patient:
  a) Has taken tramadol within the last four hours.
  b) Has abdominal pain, particularly if the patient is very unwell or vomiting.
  c) Is aged greater than or equal to 75 years, particularly if there is a previous history of dementia or confusion.
  d) Is confused.
- Dosage: 50 mg PO.
- A patient may be administered tramadol (in combination with paracetamol and/or ibuprofen) for pain associated with a minor condition and be given a recommendation that immediate referral to a medical facility is not required provided:
  a) Adequate pain control is achieved and
  b) The patient is advised to see a GP (preferably their own) for a review of their condition within 24 hours.

Methoxyflurane

- Methoxyflurane is indicated for moderate or severe pain, in addition to other medicines.
- Methoxyflurane is contraindicated if the patient:
  a) Has a personal or family history of malignant hyperthermia.
  b) Is unable to obey commands.
  c) Has known renal impairment.
  d) Has received methoxyflurane within the last week.
- Administer methoxyflurane with caution if the patient:
  a) Is aged greater than or equal to 75 years.
  b) Has pre-eclampsia.
  c) Is in a confined space.
- Dosage:
  a) A maximum of two doses (6 ml) if aged 12 years and over.
  b) A maximum of one dose (3 ml) if aged less than 12 years.

Entonox

- Entonox is indicated for moderate or severe pain, in addition to other medicines.
- Entonox is contraindicated if the patient:
  a) Is unable to obey commands.
  b) Has a suspected pneumothorax.
  c) Has a suspected bowel obstruction.
  d) Has been SCUBA diving in the last 24 hours.
  e) Has a SCUBA diving related emergency.
- Administer Entonox with caution if the patient:
  a) Is in a confined space.
  b) Has a chronic pain disorder and calls an ambulance frequently.

Morphine

- Morphine is indicated for moderate or severe pain, in addition to other medicines.
- Morphine is contraindicated if the patient:
  a) Is unable to obey commands (exceptions: 'end of life care' and 'agitated delirium' sections).
  b) Has current respiratory depression (exception: 'end of life care' section).
- Administer morphine with caution if the patient is:
  a) Aged less than one year.
  b) At high risk of respiratory depression.
  c) In labour.
- Dosage:
  a) 1-5 mg IV every 3-5 minutes for an adult.
  b) 5-10 mg IM for an adult if IV access cannot be obtained. This may be repeated once after 10 minutes.
  c) See the paediatric drug dose tables for a child.
- A patient administered morphine must be given a firm recommendation to be transported to a medical facility by ambulance, unless the patient is being treated using the 'end of life care' section. Transport should usually be to an ED unless the patient has a known chronic problem and can be taken to a GP that knows the patient well.

Fentanyl

- Is the preferred opiate for moderate or severe pain, in addition to other measures, when the patient:
  a) Requires intense analgesia for a short period of time only or
  b) Has clinically significant signs of shock or
  c) Does not have IV access.

- Fentanyl is contraindicated if the patient:
  a) Is unable to obey commands (exceptions: 'end of life care' and 'agitated delirium' sections).
  b) Has current respiratory depression (exception: 'end of life care' section).
- Administer fentanyl with caution if the patient is:
  a) Aged less than one year.
  b) At high risk of respiratory depression.
  c) In labour.
- IV dosage:
  a) 10-50 mcg IV every 3-5 minutes for an adult.
  b) See the paediatric drug dose tables for a child.
- Intranasal dosage:
  a) 200 mcg IN for an adult weighing greater than 80 kg. Further doses of 100 mcg may be administered every 10 minutes without a maximum dose. Halve these doses if the patient is frail or physiologically unstable.
  b) 100 mcg IN for an adult weighing 80 kg or less. Further doses of 50 mcg may be administered every 10 minutes without a maximum dose. Halve these doses if the patient is frail or physiologically unstable.
  c) See the paediatric drug dose tables for a child. Further doses may be administered every 10 minutes without a maximum dose.
- A patient administered fentanyl must be given a firm recommendation to be transported to a medical facility by ambulance, unless the patient is being treated using the 'end of life care' section or 'joint dislocation and fracture realignment' section. Transport should usually be to an ED unless the patient has a chronic condition and can be taken to a GP that knows the patient well.

Ketamine

- Ketamine is indicated (usually in addition to other medicines) for severe pain, particularly musculoskeletal or burn pain that has not been adequately controlled with an opiate.
- Ketamine is contraindicated if the patient:
  a) Is aged less than one year.
  b) Has current myocardial ischaemia.
- Administer ketamine with caution if the patient:
  a) Is unable to obey commands.
  b) Has active psychosis.
  c) Is hypertensive.
  d) Has a clinical condition that may be made worse by hypertension.
- Dosage:
  a) 10-50 mg IV every 3-5 minutes for an adult.
  b) 1 mg/kg IM (rounded off to nearest 10 mg) for an adult, up to a maximum

of 100 mg if IV access cannot be obtained. This may be repeated once after 10 minutes.

c) See the paediatric drug dose tables for a child.

- A patient administered ketamine must be given a firm recommendation to be transported to an ED by ambulance.

Midazolam

- Midazolam does not have analgesic properties. However, midazolam may have a role for reducing pain associated with muscle spasm, particularly if the patient has severe back pain or a dislocated joint.
- ICPs may administer midazolam in such a setting if adequate analgesia is not being achieved with an opiate and ketamine is not indicated.
- The patient should receive sufficient opiate until further doses are not providing additional analgesia and then midazolam should be administered in in 1-2 mg doses IV.
- Routinely administer oxygen and task one person to continually monitor the patient's SpO_2, breathing and level of consciousness.
- The patient must be able to obey commands at all times.

Intraosseous lignocaine

- Is indicated for significant bone pain associated with intraosseous infusion.
- Dosage:

  a) 5 ml of 1% lignocaine over two minutes for an adult. Wait one further minute before administering intraosseous fluid.

  b) See the paediatric drug dose tables for a child.

  c) The dose may be repeated once after 15 minutes.

Lignocaine ring blocks

- Are indicated for isolated injuries to fingers or toes.
- Examine and record the presence of sensation before administering a ring block and administer additional analgesia if required.
- Use 1% lignocaine without added adrenaline.
- The maximum dose for an adult is 200 mg (20 ml), noting that reaching such a dose would be most unusual, as most patients only require a total of 2-4 ml per digit.
- See the paediatric drug dose tables for maximum doses for a child.

Additional information

Backup

- Backup from a Paramedic should be sufficient for the majority of patients.
- If it is likely that ketamine administration will be required, backup from an ICP should be requested early.
- Backup for analgesia should usually be provided at normal road speed unless clinically significant time is going to be saved by travelling under lights.

Acute exacerbations of chronic pain

- Check if the patient has a management/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/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.
- If a patient is calling frequently and does not have a management/care plan, forward the patient's details to an appropriate manager asking that a management/care plan be developed.

1.5 Advance directives and advance care plans

Introduction

There are four types of plans or documents personnel must be aware of. These are:

- Advance directives.
- Advance care plans.
- Do not resuscitate or do not attempt resuscitation orders/requests.
- Allow natural death orders/requests.

Advance directives

An advance directive is a written or oral instruction by which a patient indicates their choices regarding possible future treatments. An advance directive becomes effective when a patient is no longer competent to make decisions, or is unable to communicate. Most commonly an advance directive is used to indicate that a patient does not want specific treatments, for example a patient may not want resuscitation in the event of cardiac arrest.

A patient cannot legally demand or refuse treatments in an advance directive, which they cannot legally demand or refuse when they are competent. For example, a patient cannot demand that a particular treatment is provided if personnel believe that the treatment is not clinically indicated and a patient cannot refuse treatment for self-harm.

Advance care plans

Advance care plans are a means by which a patient indicates their wishes and choices regarding their dying process. Advance care plans often contain more detailed information than an advance directive regarding the patient's wishes.

Do not resuscitate orders/requests

Do not resuscitate (DNR) and do not attempt resuscitation (DNAR) orders are terms usually used to describe a medical decision that a patient should not be resuscitated in the event of cardiac arrest. Such decisions are commonly made in hospitals and rest homes if the patient is at the end of their natural life.

DNR and DNAR are imprecise terms when used in isolation. For example, there are many patients in whom some form of resuscitation (for example treatment for choking or anaphylaxis) would be appropriate, but resuscitation in the event of cardiac arrest would be inappropriate. When treating a patient described as having a DNR or DNAR order, always clarify what the order means in terms of the treatments that are appropriate for that patient.

Allow natural death orders/requests

Allow natural death (AND) is a term that is commonly promoted as a more useful and precise term than DNR or DNAR. An allow natural death request is usually made for a patient who is at the end of their natural life and in whom life saving

treatments should be withheld in the event of a life-threatening illness or injury. Treatments for relief of pain and suffering are never withheld and a patient with an allow natural death request should:

- Receive usual treatments (for example IV pain relief for a fractured neck of femur) in the event of an illness or injury that is not immediately life-threatening.
- Not receive resuscitative treatments (for example 0.9% sodium chloride IV for shock, ventilation or CPR) in the event of an illness or injury that is immediately life-threatening.

Locating directives and plans

The patient's advance directive or advance care plan (or instructions on where they are) may sometimes be located on the front of the fridge.

Complying with directives and plans

Ambulance personnel must take into account the information in an advance directive or an advance care plan. These are usually written, but a clearly described verbal advance directive or advance care plan must also be taken into account. Ambulance personnel must comply with the requests in an advance directive or advance care plan provided that:

- They are available, preferably in written form and
- They apply to the current situation and
- They are clear.

If there is uncertainty, resuscitation and/or treatment should commence when personnel believe it is in the best interest of the patient. At the same time personnel should urgently seek additional information from the family and if available, advice from a doctor who knows the patient well.

1.6 Assessing 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.
- 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:
  a) Appears unable to understand information or
  b) Appears unable to understand the consequences of their decisions or
  c) Appears unable to remember information or
  d) Has attempted suicide or
  e) Has expressed serious thoughts of attempting suicide.
- If personnel believe the patient is not competent to make informed decisions, treatment may be provided against the patient's will if:
  a) Personnel believe treatment is in the patient's best interests and
  b) Personnel believe the risks associated with providing treatment are less than the risks of not providing treatment and
  c) The treatment is not contradicting a valid advance directive.

Additional information

Children

- The law in New Zealand is not clear on the age at which children become competent to make decisions regarding their healthcare. However for the purposes of assessing competency, children aged 16 years and over can be treated as an adult.
- If a child aged younger than 16 years is making a decision which in the opinion of personnel is putting the child at significant risk, then the child should be deemed to be not competent. Personnel should seek clinical advice if the situation is difficult to resolve.
- Parents or guardians may make decisions (including declining recommendations regarding treatment and/or transport) on behalf of a child. However, personnel should insist on providing treatment and/or transport if they believe parents or guardians are placing the child at significant risk and should seek clinical advice if the situation is difficult to resolve.

Attempted or threatened suicide

- It is possible for a patient who has attempted suicide to be competent to make informed decisions. However, determining this requires detailed clinical evaluation that cannot be undertaken by ambulance personnel and this is why the patient should be considered to be not competent until such an evaluation can be undertaken.
- It is not possible to define what 'serious thoughts' are when determining that a patient has expressed serious thoughts of attempting suicide and clinical judgement is required. For the threat to be considered serious, personnel must believe that the patient is at genuine risk of attempting to commit suicide.

When the patient appears to be not competent

- Personnel should insist on treatment and/or transport if they believe this is in the best interest of a patient who appears to be not competent to make decisions.
- The risks of treatment and/or transport against the patient's will must be balanced against the risks of their illness or injury. Personnel must:
  - Encourage the patient to accept recommendations and
  - Involve the patient's family, friends or GP when appropriate and
  - Take into account the patient's views and wishes if these are known and
  - Fully document their assessment, interventions, recommendations and interactions.
- Family members do not have the right to make decisions on behalf of the patient unless they have been legally appointed as either a Welfare Guardian or a Power of Attorney. However, personnel should insist on providing treatment and/or transport if they believe a Welfare Guardian or Power of Attorney is making a decision which is placing the patient at significant risk and should seek clinical advice if the situation is difficult to resolve.
- The views of family members that have not been legally appointed as either a Welfare Guardian or a Power of Attorney must be taken into account, but they cannot determine the treatment provided to the patient.
- All competency assessments are decision specific. A patient may be not competent to make some treatment decisions, but retains the right to make other decisions to the extent that is appropriate for their level of competency. For example, a patient with dementia may not be competent to refuse treatment for a fractured neck of femur but may be competent to refuse paracetamol.

When a competent patient declines recommendations given to them

- 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 and
  - Involve the patient's family, friends or GP, provided the patient consents to this and it is appropriate to do so and
  - Provide the patient with appropriate advice on what to do if they do not improve and
  - Ask the patient to sign the 'patient declined transport' section of the PRF and
  - Fully document their assessment, interventions, recommendations and interactions and
  - Provide the patient with a copy of the PRF or instructions on how to access a copy of the PRF.

1.7 Calling the Clinical Desk

Communicate using the ISBAR template

- **I** is for identify yourself. State your name, practice level, vehicle call sign and where you are calling from.
- **S** is for situation. State a succinct reason for calling. For example: "I am calling for permission to administer IM adrenaline" or "I am calling for advice".
- **B** is for background. Briefly describe the background of the incident.
- **A** is for assessment. Describe your assessment of the patient. Ensure that any information that is likely to be required (for example vital signs or a 12 lead ECG) is available.
- **R** is for recommend and review. State what you think is required and then listen carefully to instructions from personnel on the Clinical Desk. Review and confirm the plan before ending the call.

If your call is not answered immediately

- Ensure you are using the designated phone number.
- Hang up and call the dispatcher by radio if urgent advice is required. Ask for Clinical Desk personnel to phone you immediately and include the number to call.
- Clinical Desk personnel are commonly already on a call when road personnel ring the desk:
  - The call will be diverted to one of the other Clinical Desks.
  - If the call still cannot be answered, the call will be diverted to the next available Call Handler who will transfer the call to the Clinical Desk.
  - Stay on the line and pass the phone to someone else if necessary. You will be connected to the Clinical Desk as soon as possible.
  - If your call is not answered within 60 seconds, hang up and try again. If your call is still not answered within 60 seconds, call the dispatcher by radio. Ask for Clinical Desk personnel to phone you and include the number to call.

1.8 Personnel on the Clinical Desk providing advice

This section provides instructions to personnel on the Clinical Desk when providing advice to personnel to administer treatments. These instructions are in addition to the section 'providing treatment that differs from that described within these CPGs' and should be read in conjunction with it.

When the treatment is within the delegated scope of practice of the person at the scene

- Personnel on the Clinical Desk may authorise treatment that is within the delegated scope of practice of the person at the scene, even though the treatment is not described in the CPGs, provided they believe the treatment is in the best interest of the patient.
- Examples of when personnel on the Clinical Desk may authorise treatment include:
  a) An EMT wants to administer oxygen for cluster headache.
  b) A Paramedic wants to administer nebulised salbutamol for suspected hyperkalaemia.

When the treatment is not within the delegated scope of practice of the person at the scene

- Personnel on the Clinical Desk may authorise treatment that is not within the delegated scope of practice of the person at the scene, provided no other suitable personnel are available, the treatment is within their own delegated scope of practice* and they believe the treatment is in the best interest of the patient.
- *RSI is excluded. All calls for permission to perform out of scope RSI must be forwarded to the on call doctor.
- Examples of when personnel on the Clinical Desk may authorise treatment include:
  a) A Paramedic is authorising a First Responder to administer adrenaline IM.
  b) A Paramedic is authorising an EMT to administer midazolam IM.
  c) An ICP is authorising a Paramedic to administer amiodarone for VT.
- If the treatment is not within the delegated scope of practice of personnel on the Clinical Desk, they must forward the call to the on call doctor. Examples of when personnel on the Clinical Desk must forward the call to the on call doctor include:
  a) A Paramedic wants to administer IV amiodarone for VT and the person on the Clinical Desk is a Paramedic.
  b) An EMT, Paramedic or ICP wants to alter the dose of a patient's long acting oral morphine.

1.9 Crew resource management

Introduction

- Also known as crisis resource management, crew resource management (CRM) is a set of principles focusing on the non-technical skills of communication, leadership, decision making and teamwork.
- This is a brief overview of CRM and does not replace training in this area.
- Good CRM reduces the likelihood that human factors and/or human error will result in harm, while helping ensure the patient receives timely, efficient and effective treatment.
- Good CRM is just as important as good knowledge and/or good technical skills.
- It is the responsibility of all personnel to utilise the principles within CRM to reduce the risk of error and/or harm, irrespective of clinical hierarchy, organisational position, experience or interpersonal challenges.
- Although CRM is most important during an emergency, the principles of good CRM should be used at all times as this helps ensure that good CRM becomes 'business as usual'.
- The CRM principles can be summarised under five broad headings:
  a) Call for help if required.
  b) Establish a team leader.
  c) Communicate effectively.
  d) Utilise resources appropriately.
  e) Step back and reassess.

Call for help

- Do not delay calling for help if it is needed.
- Have a low threshold for calling for help if you are uncertain.
- Have a low threshold for seeking clinical advice.

Establish a team leader

- A clearly identified person must take on the role of team leadership.
- The team leader should be the most appropriate person. The 'most appropriate' person cannot be defined and will be determined by the composition of the team.
- The team leader is responsible for directing the actions of the team and keeping the team updated on the 'big picture' (also called maintaining situational awareness).
- The team leader must task specific people to specific tasks. For example, "John would you gain IV access" and not "would someone gain IV access".
- The team leader should avoid performing tasks unless this is absolutely

necessary, as this risks the team leader becoming task-focused and losing situational awareness.

- Changing the team leader during the incident should be avoided unless this is necessary. However, if this needs to occur it is important that there is a clear handover process and that all team members are aware that the team leader has changed.

Communicate effectively

- Use clear and concise language.
- Use communication that 'closes the loop'. For example, if you are tasked to gain IV access, state when this is complete.
- All communication must go via the team leader. For example, if you notice that the patient's blood pressure has dropped significantly, tell the team leader and not another member of the team.
- The team leader should do most of the talking.
- A flattened hierarchy is one in which the most junior person feels comfortable raising a concern with the most senior person, without fear that they will be criticised or humiliated. A flattened hierarchy is important because a fear of speaking up is a common contributing factor to adverse events causing preventable patient harm.

Utilise resources appropriately

- Utilise all members of the team.
- Tasks should be performed simultaneously by multiple team members whenever possible.
- Utilise bystanders and other healthcare providers as appropriate.

Step back and reassess

- Reassess the patient frequently, especially if there is a significant change.
- Ensure all team members have an opportunity to contribute ideas on how to resolve a problem.
- Utilise checklists and algorithms as appropriate.

Additional information

Graded escalation of concerns

- Even in the presence of a flattened hierarchy, it is important to take a graded approach to escalation of concerns. This is also called graded assertiveness.
- Follow the steps below to escalate a concern. Move to the next step if your concern is not resolved and move straight to the last step if there is an immediate risk of severe harm.

a) Make a suggestion, or offer to help. For example, “have you considered..?” or “would you like me to..?”
b) State how you feel. For example, “I am concerned that...” or "I feel that..."
c) Make a strong statement. For example, “stop, we must...” or “stop, we need to...”

Interaction with other healthcare personnel

- Other healthcare personnel, for example doctors and nurses, may be able to provide additional skills and/or assistance when ambulance personnel are assessing or treating a patient.
- Personnel should utilise such support, including allowing access to medicines and/or equipment, in good faith provided other healthcare personnel:
  a) Identify themselves (verbally is acceptable – documentation is not routinely required) and
  b) Are following good clinical practice and
  c) Appear to be acting in the best interest of the patient.
- The name and contact details of other healthcare personnel treating the patient must be recorded on the PRF.
- If other healthcare personnel appear to be following poor clinical practice or appear to be failing to act in the best interest of the patient, ambulance personnel must politely (but firmly) decline their assistance.

Debriefing

- A short debrief following the job should occur.
- Involve all team members.
- Review the five principles of CRM. 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.
- 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 per day to help embed the culture of regular self-review and continual improvement into business as usual.

1.10 Handover

Use the IMIST AMBO handover when handing over a patient to another healthcare provider:

- **I** is for identification of the patient.
- **M** is for mechanism of injury or the medical complaint.
- **I** is for injuries identified or information related to the medical complaint.
- **S** is for signs and symptoms.
- **T** is for treatment provided and trends.
- **A** is for allergies.
- **M** is for medicines.
- **B** is for background, including previous medical history.
- **O** is for other, including information on family and social situation.

Additional information

- Handover is a very important part of the patient's care. Loss of important information during handover impacts negatively on the patient.
- Prior to handover, 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.
- When handing over to a team, ask the team leader if they want the handover before or after moving the patient from the stretcher. Pause at the end of the handover and ask if there are any questions.
- Complete the PRF and ask if there are any further questions before leaving.

1.11 Informed consent

Introduction

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.

Personnel have a statutory obligation to abide by The Code of Health and Disability Services Consumers' Rights ('the code'). 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. Additional relevant information is contained within the sections titled 'assessing competency' and 'treatment and referral decisions'.

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) including:
  - 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.
  - The estimated costs if relevant and appropriate.
  - Introducing the people who will be providing treatment. The patient must be explicitly informed if a student is present or will perform any interventions and 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.

Providing information

Good communication is the key factor in obtaining informed consent. It is important to take the time required to ensure the patient understands the issues as much as possible. Utilise a translator if required.

Clinical judgement is required when providing information to a patient:

- It is not feasible to provide all of the information relating to each condition.
- The patient should receive the information that another patient in the same setting would reasonably expect to receive.

- The clinical setting must be taken into account. For example, detailed discussion is inappropriate if a patient has an immediately life-threatening problem or is in severe pain. In such settings it is appropriate to initiate treatment while explaining the treatment that is being provided.

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.

1.12 Initial management of a major incident

This is a summary of the initial management of a major incident. Further details are contained within ambulance service operational plans and procedures.

- Establish a clear command structure utilising a central incident control point.
- Establish clear communication with Control/Comms through one single point.
- Triage the patients.
- Prioritise the patients for treatment and transport.
- Distribute the patients across hospitals/facilities, provided this is feasible.

Major incident folder

Each vehicle has a major incident folder within it, containing vests, task cards and documentation. Begin by donning a major incident vest and taking a radio and the appropriate task card with you.

Situation report (sitrep)

Place a sitrep using METHANE as soon as possible:

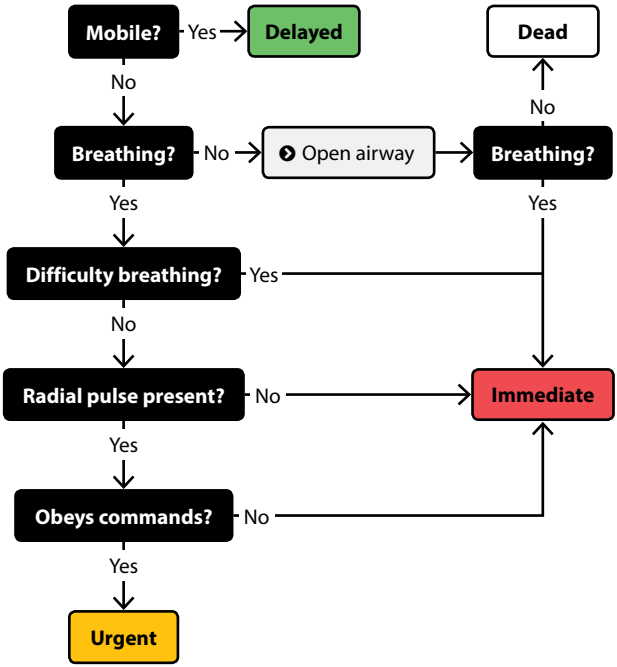
- **M**ajor incident declaration.
- **E**xact location of incident.
- **T**ype of incident.
- **H**azards (significant) identified.
- **A**ccess and egress.
- **N**umber (estimated) of patients.
- **E**mergency services already present and extra resources required.

Primary triage

Perform primary (or initial) triage using status codes.

Status	Condition	Triage colour
Status zero	Dead	**Black/white**
Status one	Immediate threat to life	**Red**
Status two	Potential threat to life	**Orange/yellow**
Status three	Unlikely threat to life	**Green**
Status four	No threat to life	**Green**

Alternatively perform primary (or initial) triage using the process shown in the flow diagram on the following page. Begin by asking all patients that can walk to move to a specified area.



During primary triage the only interventions provided to patients are opening airways (using positioning) and compressing life-threatening external bleeding. Whenever possible other emergency service personnel and/or bystanders should be utilised to provide these initial interventions.

Move patients to a casualty clearing point following initial triage.

Secondary triage

Perform secondary triage at the casualty clearing point, utilising a primary and secondary survey on all patients in order of their priority as determined by primary triage. If a patient's triage colour changes as a result of secondary triage, replace the triage tag with a new tag, noting on the new tag what the change was.

Treatment

Initiate treatment on patients in order of priority as determined by their triage colour following secondary triage. Appropriate prioritisation of treatments optimises outcomes. The general principles are:

- Group patients with the same triage colour together around a central equipment pool, when feasible.
- Treatment decisions should be made by experienced personnel who task others to provide those treatments.
- Patients who have the greatest chance of survival with the least expenditure of time, equipment and personnel should be treated first.

- Treatments that are highly unlikely to be successful (for example CPR) should not usually be performed unless there are sufficient personnel and a good clinical reason to do so.
- Treatments that take significant time (for example rapid sequence intubation) should not usually be performed unless there are sufficient personnel and a good clinical reason to do so.
- The greater the number of patients, the greater the importance of restricting the treatments to those that are immediately life saving.

Transport

Transport patients in order of priority as determined by their triage colour following secondary triage. The general principles are:

- Patients should be distributed across hospitals/facilities in proportion to the capacity of those facilities, provided it is feasible to do so. Clinically experienced personnel should be tasked to coordinate transportation and this may occur off site, particularly if the incident is a large one. If coordination is occurring off site, personnel must not commence transport until informed of the destination.
- Document all transport using the casualty tracking form.
- Patients should be transported to hospitals/facilities capable of meeting their immediate resuscitation and treatment/intervention needs, provided it is feasible to do so.
- Consideration should be given to utilising medical centres for patients allocated to green if the number of patients taken to hospital is high.
- Family members should be transported to the same hospital/facility, provided it is feasible to do so.

Patients considered unsalvageable

It is impossible to predict with certainty which patients will die no matter what treatment they receive. However, in the setting of a major incident some patients have injuries that are so severe that death is highly likely. Examples include patients with:

- Respiratory arrest.
- Severe shock with a falling heart rate.
- A GCS of 3 with bilateral dilated and unreactive pupils.

Patients considered unsalvageable are allocated a red triage colour. However, if the number of severely injured patients is high, it is appropriate for patients considered unsalvageable to have treatment and transport initially withheld, allowing other immediate and urgent patients to be treated and transported first. Patients considered unsalvageable should then be reassessed and further decisions made regarding treatment and transport, noting that only very clinically experienced personnel should make these decisions.

Scenes that are large but a major incident is not declared

The same principles apply to a large scene where a major incident is not declared. In this setting have a low threshold for using triage tags and documenting transport using the casualty tracking form.

If triage tags are not used, the casualty tracking form is still a useful way of documenting transport. In this setting consider labelling each patient with a capital letter, for example patient A, patient B etc.

1.13 End of life care

This section is for patients receiving end of life care.

- Locate and follow the patient's advance care plan if possible.
- Contact healthcare personnel coordinating the patient's care and seek their advice whenever possible.
- Provide treatment for relief of symptoms. For example:
  a) Administer an opiate for pain or shortness of breath.
  b) Administer midazolam for anxiety, agitation or symptoms that do not respond to an opiate.
- The patient may have been issued with medicines for administration in the event of severe distress. All personnel may administer such medicines, even if outside their delegated scope of practice, provided:
  a) There are clear written instructions and
  b) No other suitable personnel are available to administer the medicine and
  c) The PRF is sent for audit.
- All personnel may administer medicines outside their delegated scope of practice if instructed to do so (including over the phone) by hospice or palliative care personnel.

Referral

- Ambulance personnel may administer medicines (including opiates, midazolam or the patient's own medicines) and recommend (in discussion with the patient and family) that transport to a medical facility is not required, provided there is a clear plan for adequate continuing symptom control.
- Whenever possible follow the wishes of the patient regarding transport to a medical facility, taking into account the views of the family and the patient's healthcare providers. If transport is required the preferred destination is a hospice provided this is arranged prior to arrival.

Additional information

- The terms 'palliative care' and 'end of life care' do not mean the same thing.
- A patient may be under the care of a palliative care team or hospice team for many months before reaching a point where their treatment becomes focused on end of life care. It may be appropriate to institute some resuscitative treatments for a patient that is receiving palliative care, but is not yet receiving end of life care and clinical advice should be sought if there is any doubt.
- A summary of the patient's advance care plan (or instructions on where the plan can be found) may sometimes be on the front of the fridge.

- The most important aspects of end of life care are to ensure that:
  - The patient and their family feel safe and supported.
  - There is good communication with the patient, their family and the patient's healthcare providers.
  - The patient is provided with adequate comfort and relief of symptoms.
- It is inappropriate to provide treatments that artificially prolong the process of dying, for example CPR, IV fluid or assisted ventilation.
- It is inappropriate to measure vital signs or to perform an examination that could cause additional unnecessary discomfort and/or will not change the treatment that the patient receives. For example, it is inappropriate to measure the patient's blood pressure before administering an opiate or midazolam.
- Most hospice and palliative care staff utilise the subcutaneous route for administration of medicines:
  - Personnel may choose to administer medicines via the IV route provided IV access is easy to obtain.
  - However, administration of medicines via the subcutaneous route is usually effective and is a viable option. Personnel may choose to administer medicines via the subcutaneous route, noting that the doses administered should be similar to an IM dose.
  - A subcutaneous access line may be in place and personnel may utilise this noting that a flush is not required.
- If IV access has been gained and the patient is not being transported, discuss the possibility of leaving the IV access in place with the patient and/or family, particularly if it is likely that an ambulance may be requested again within 24 hours. This allows the option of additional IV treatment by ambulance personnel.

1.14 Verification of death

Death may be verified when:

a) There are clear and obvious signs of death such as decomposition, rigor mortis or decapitation or
b) All of the clinical criteria below are met.

Clinical criteria

- To verify death using clinical criteria:
  a) There must be no signs of breathing for one minute and
  b) There must be no palpable central pulse and
  c) There must be no audible heart sounds and
  d) The pupils must be dilated and unreactive to light.
- After 10 minutes all of the above examinations (a-d) must be repeated and at this time a 3 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:
  a) There may be slow broad complexes consistent with a dying heart. If this is the case wait until asystole is present before verifying death.
  b) 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.

Additional information

General

- The process described in this section is for verifying that death has occurred. It is not to be used to determine whether or not resuscitation attempts are futile as these two decisions are very different.
- Death must be clear and unequivocal if the condition of the body is used to verify death.
- A clinical assessment confirming the absence of signs of life must occur if death is not clear and unequivocal.
- The entire chest and abdomen should be exposed when examining the patient for signs of breathing and this examination must occur over an uninterrupted period of one minute.
- Either the carotid or femoral site may be used when examining for a palpable central pulse in a patient aged over one year. In a patient aged up to one year palpation of the brachial pulse is recommended. No duration is specified for the palpation of a pulse, but there must be certainty that the pulse is not

palpable and in most circumstances this will require palpation for a minimum of 10 seconds.

- Auscultation for heart sounds should occur over the expected site of the apex beat of the heart. In most patients this will be over the fourth intercostal space in the mid-clavicular line. No duration is specified when listening for heart sounds, but there must be certainty that heart sounds cannot be heard and in most circumstances this will require listening for a minimum of 10 seconds.
- The pupils must be dilated but no pupil size is specified. The pupils must be unreactive to light and this requires the use of a focal light source, for example a torch.
- The clinical assessment must be performed twice, with a minimum of 10 minutes between the two assessments. The reason for this is that the patient may be in asystole for 5-10 minutes and then spontaneously develop return of a beating heart. This is sometimes called auto-resuscitation or the Lazarus reflex.

Deaths that must be reported to the Coroner

- Deaths meeting any of the following criteria must be reported to the Coroner via police:
  - Suicide.
  - Trauma or violence.
  - Unnatural cause. For example drowning, poisoning or asphyxiation.
  - A Registered Medical Practitioner confirms they are unable to complete a Medical Certificate of Cause of Death.
  - During or as a result of a complication of a surgical, dental or medical procedure.
  - During birth or as a result of a complication of pregnancy/birth.
  - In custody. For example in prison or a police cell.
  - In compulsory care. For example detained under the Mental Health Act.

After death has been verified

- Inform those present that the patient has died and provide support as required.
- Request police if the death needs to be reported to the Coroner or if death has occurred in a public place.
- If death has occurred in a private place and does not need to be reported to the Coroner, contact a Medical Practitioner who knows the patient (this will usually be the patient's GP) and ask if they are able to complete a Medical Certificate of Cause of Death:
  - If the Medical Practitioner confirms they are able to complete a Medical Certificate of Cause of Death, inform the family they are able to proceed with funeral arrangements by contacting a funeral director.
  - If the Medical Practitioner confirms they are unable to complete a Medical

Certificate of Cause of Death, inform the family that the death will need to be reported to the Coroner and request police.
  - If the Medical Practitioner cannot be contacted and the death was expected, inform the family that they will need to contact the Medical Practitioner as soon as possible. In this setting it is acceptable for the body to remain in the house for several days and a written summary of the clinical events must be left with the family. If however, the death was not expected or the family do not want the body to remain in the house, police will need to be called.
- Clinical equipment (for example endotracheal tubes and IV lines) should usually be removed unless:
  - Doing so may disturb evidence at a crime scene or
  - The clinical equipment could have contributed to death or
  - Police request that clinical equipment is left in place.

1.15 Oxygen administration

- Few sections contain specific instructions on oxygen administration and clinical judgement is required.
- Oxygen should usually only be administered if the patient has one of the following clinical conditions:
  a) An SpO_2 less than 94% on air (exceptions – see high risk patients below and the 'neonatal resuscitation' section).
  b) Airway obstruction.
  c) Respiratory distress (exception – see high risk patients).
  d) Shock.
  e) Severe traumatic brain injury.
  f) Carbon monoxide poisoning.
  g) Smoke inhalation.
  h) Decompression illness.
  i) A condition requiring sedation to be administered.
- Use the simplest device and lowest flow rate required to achieve an SpO_2 of 94-97%. If pulse oximetry is unreliable or unavailable, administer oxygen as appropriate for the patient's clinical condition.
- The oxygen flow rates to be used are:
  a) Nasal prongs 1-4 litres/minute.
  b) Simple mask 6-8 litres/minute.
  c) Nebuliser mask 8 litres/minute.
  d) Reservoir mask 10-15 litres/minute.
  e) Manual ventilation bag 10-15 litres/minute.

Patients at high risk

- Patients at high risk may have carbon dioxide clearance that is altered by oxygen administration and excess oxygen administration may cause hypercarbia.
- Patients at high risk include patients with CORD, morbid obesity, those on home oxygen, neonates and those on home CPAP or BIPAP.
- Oxygen flow rates should be titrated to the patient's normal SpO_2 if this is known. If this is not known, titrate the oxygen flow rate to an SpO_2 of 88-92%.

Additional information

Oxygen administration

- Oxygen is a treatment for hypoxia and not a general treatment for patients that are ill or injured.
- Oxygen administration is restricted to those patients that have an indication to receive it, because when oxygen levels within blood are higher than normal:

- Blood vessels (particularly small arteries) vasoconstrict. This has the potential to lower blood flow to tissues and organs.
- Inflammation is increased and this may worsen inflammatory states.

Delivery devices

- For most patients nasal prongs or a simple mask will be sufficient.
- Reservoir masks should be reserved for patients with severe hypoxia. For most patients 10 litres/minute is sufficient oxygen flow through a reservoir mask. The oxygen flow is sufficient if the reservoir bag is not completely deflating.
- Manual ventilation bags should be reserved for patients requiring assistance with their breathing or requiring PEEP. For most patients 10 litres/minute is sufficient oxygen flow through a manual ventilation bag. The oxygen flow is sufficient if the reservoir bag is not completely deflating.

Pulse oximetry

- A pulse oximeter gives a reading of how much oxygen (as a percentage of maximum capacity) is bound to haemoglobin within arterial blood.
- A pulse oximetry reading provides a much better indication of a patient's oxygenation than clinical examination.
- A pulse oximetry reading does not indicate how well a patient is breathing. How well a patient is breathing is determined by clinical examination and end tidal carbon dioxide ($ETCO_2$) measurement if this is available.
- Pulse oximetry can be unreliable if the patient is very vasoconstricted, shaking, moving, has very dirty fingers, or has been exposed to carbon monoxide.
- Do not spend long periods of time trying to get a pulse oximetry reading, noting that a common cause of failure to get a reading is severe vasoconstriction.
- Low pulse oximetry readings may be invalid if the plethysmograph waveform (the SpO_2 graphical waveform on the monitor) is damped, flat or irregular. A wide and regular plethysmograph waveform is a sign that the pulse oximetry reading is likely to be valid.

Cyanosis

- Cyanosis is blue discolouration of skin or mucous membranes. It is due to the presence of haemoglobin that does not have oxygen bound to it.
- A patient may be significantly hypoxic without being cyanosed because cyanosis is usually only detectable with an SpO_2 less than 80%.
- Cyanosis is much more difficult to detect in a patient who is anaemic, has brown or black skin, or has been exposed to carbon monoxide.
- Central cyanosis (for example of the mouth and lips) is usually due to severe hypoxia. Peripheral cyanosis (for example of the extremities) in the absence of central cyanosis is usually due to vasoconstriction.

Oxygen administration and CORD

- Some patients have carbon dioxide clearance that is altered by oxygen administration. Excess oxygen administration in these patients may cause hypercarbia and bronchodilators should be nebulised without using oxygen if possible. If oxygen is administered, titrate the oxygen flow rate to an SpO_2 of 88-92%.
- The mechanisms by which excess oxygen administration causes hypercarbia are controversial and complex. They include:
  - Reversal of hypoxic pulmonary vasoconstriction, causing high levels of CO_2 in poorly ventilated alveoli to diffuse back into the circulation.
  - Decreased ventilatory drive.
  - Decreased CO_2 buffering capacity of haemoglobin.
  - Absorption of CO_2 from alveoli beyond obstructed airways.
  - The higher density of oxygen compared with air causing increased work of breathing.
- Patients at risk of hypercarbia often have a card or letter describing specific instructions for oxygen therapy. These instructions should be followed.
- If using oxygen to nebulise bronchodilators, alternating five minutes with the mask on and five minutes with the mask off should only occur if the SpO_2 climbs above 92% during nebuliser delivery. This is done to limit oxygen exposure whilst delivering most of the nebulised bronchodilator. If the SpO_2 remains at or below 92% during nebulisation, this alternating does not need to occur.
- The signs of a rising carbon dioxide level are usually confusion, drowsiness, agitation and then a falling level of consciousness. If a patient is suspected of developing hypercarbia, oxygen administration should not be discontinued immediately. Instead, oxygen administration should be reduced to a lower flow rate (targeting an SpO_2 of 88-92%) and the patient reassessed.
- Consider assisting the patient's ventilation early (without added oxygen unless hypoxia is severe), using a manual ventilation bag if:
  - SpO_2 continues to fall below 80% despite treatments or
  - The patient is becoming exhausted or
  - The patient is suspected of developing hypercarbic respiratory failure despite lowering the oxygen flow.
- A T-piece may be used (T-pieces are not available on all ambulances) to administer nebulised medications if the patient's ventilation is being assisted with a manual ventilation bag, noting that the administration of nebulised medicines is not a priority in this setting.

Oxygen administration following bleomycin treatment or paraquat poisoning

- Oxygen administration can cause severe lung inflammation in patients previously treated with bleomycin (a chemotherapy drug) and should usually only be administered for an SpO_2 less than 88%. This sensitivity to oxygen is following exposure to bleomycin. Most patients that have received bleomycin have been specifically warned about this and know to tell healthcare personnel that oxygen should only be administered if necessary.
- Oxygen administration following paraquat poisoning worsens outcomes in animal experimental models and 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 and oxygen should be administered if required, with the minimum flow needed to achieve an SpO_2 of 94-97%.

Oxygen administration in confined spaces

- Use caution when administering oxygen in a confined space, for example in a tank, pipe or silo.
- Oxygen administration in a confined space may lead to an increased oxygen concentration within the ambient gas. An increase in the oxygen concentration within ambient gas to as little as 24% may significantly increase the risk of fire and/or explosion.
- Only administer oxygen within a confined space if:
  - The clinical indication is very strong and
  - Fire service personnel are present and are monitoring the oxygen concentration within the space.

1.16 Status codes

Status	Condition	Triage colour
Status zero	Dead	**Black/white**
Status one	Immediate threat to life	**Red**
Status two	Potential threat to life	**Orange/yellow**
Status three	Unlikely threat to life	**Green**
Status four	No threat to life	**Green**

Status codes are:

- A numerical estimate of the severity of a patient's clinical condition.
- Qualitative and require clinical judgement.
- Allocated to a patient after taking into account the nature of the illness or injuries, the vital signs and the potential threat to life.
- Not directly altered by the mechanism of injury, the physical environment (for example trapped or not trapped) or the patient's age.

Status codes are not ideal for pregnant women in that the code cannot always be used to describe the potential threat to life for the unborn baby and the mother. Consideration should be given to adjusting the status code of the mother to take into account the threat to life for the unborn baby if the baby is at risk.

Examples

The examples below are indicative only and are not a complete list.

Status one

- Obstructed airway or airway needing intervention to prevent obstruction.
- Severe stridor.
- Severe respiratory distress.
- Severe shock that is unresponsive to fluid loading.
- Multi-system trauma with abnormal vital signs.
- Spinal cord injury with quadriplegia.
- Cardiac arrest or post cardiac arrest.
- Cardiogenic shock.
- ST elevation myocardial infarction.
- Ventricular tachycardia.
- Dysrhythmia causing severe cardiovascular compromise.
- Status epilepticus.
- GCS less than or equal to 9.

Status two

- Moderate stridor.
- Moderate respiratory distress.
- Flail chest.
- Moderate shock that is responsive to fluid loading.
- Multi-system trauma with normal or near normal vital signs.
- Two or more fractures (including closed fractures) involving the shaft of the femur, the tibia or the humerus.
- Fractures or dislocations with signs of limb ischaemia. Note: there may be abnormal sensation or movement distal to the injury but there must be signs of limb ischaemia for the patient to be status two.
- Spinal cord injury with paraplegia.
- Dysrhythmia causing moderate cardiovascular compromise.
- Myocardial ischaemia with clinically significant symptoms, or signs on 12 lead ECG, which persist following treatment with nitrates. Note: the patient is status two if opiates are administered for the pain of myocardial ischaemia.
- Abnormal level of consciousness with GCS 10-13.
- Stroke, provided the patient can reach a designated stroke hospital within four hours of the onset of symptoms.

Status three

- Mild stridor.
- Mild respiratory distress.
- Dysrhythmia causing mild cardiovascular compromise.
- Myocardial ischaemia with symptoms, or signs on 12 lead ECG, that have resolved following treatment with nitrates. Note: the patient is status two if the symptoms or signs return and further administration of nitrates is required.
- Isolated fracture of one bone. This includes the shaft of the femur and compound fractures, provided there are no signs of limb ischaemia.
- Dislocations of joints without distal limb ischaemia.
- Spinal pain, with or without altered sensation provided there are no signs of paraplegia or quadriplegia.
- Loss of consciousness with normal or near normal (GCS 14 or 15) recovery.
- Stroke, when the patient cannot reach a designated stroke hospital within four hours of the onset of symptoms.
- Transient ischaemic attack.

Status four

- Isolated minor fractures.
- Isolated hand injuries.
- Strains and sprains.
- Lacerations where bleeding has been controlled.
- Fever without systemic signs of sepsis.
- Headache with normal neurological findings.

1.17 Requesting a helicopter

Request criteria

- **Access:** access is difficult and a helicopter is the most appropriate means of extrication.
- **Number:** the number of patients at the scene exceeds the capacity of road resources.
- **Time:** the patient has a time sensitive condition and a helicopter will result in a clinically significant time saving* in the patient arriving in hospital.
- **Skill:** the patient requires personnel with specific skills and a helicopter will result in a clinically significant time saving* in appropriately skilled personnel reaching the patient.

*The time saving must be clinically significant:

- More than 15 minutes time saving if the patient is status one and has a time critical condition.
- More than 30 minutes time saving if the patient is status two and has a time sensitive condition.
- More than 60 minutes time saving if the patient is status three and has a time sensitive condition.

Making the request

- Contact Control/Comms and provide the following information:
  a) The reason a helicopter is required, including the main request criteria.
  b) A brief summary of the patient's clinical condition.
  c) The expected immediate treatment needs of the patient.
  d) The expected hospital destination.
  e) Whether or not there are any specific requirements, for example winching.

Preparing for helicopter arrival

- Designate personnel to secure an appropriate landing site.
- As soon as possible update the helicopter crew with:
  a) A description of the landing site and any obvious hazards.
  b) The patient's age and vital signs.
  c) Any significant changes in the patient's condition.

Additional information

The advantages and disadvantages of using a helicopter

- Deciding to use a helicopter requires clinical judgement that balances the advantages and disadvantages.
- Helicopters can help save lives. They can enable patients to be extricated from difficult terrain, deliver skilled personnel to the patient and reduce the time for the patient to reach hospital.
- However, when used inappropriately helicopters can compromise the treatment provided to the patient and in some situations can increase the time for the patient to get to hospital.
- Transporting a patient by helicopter compromises the ability to provide treatment to the patient, in comparison to the same level of personnel treating the patient in a road ambulance. This is because helicopters:
  - Have significantly less space than a road ambulance.
  - Are noisy and this restricts communication, even with modern headsets.
  - Have reduced light at night in order to maintain night vision for the helicopter crew.
- Unless access is the indication, the restricted ability to treat a patient in the helicopter must be outweighed by the advantage of a clinically significant reduction in the time it takes for the patient to receive skilled personnel, or to be transported to hospital.

Request criteria

- **Access:** access is difficult and a helicopter is the most appropriate means of extrication. Examples include extrication from mountains, forests and other areas with inadequate road access.
- **Number:** the number of patients at the scene exceeds the capacity of road resources. This should be an uncommon indication for calling for a helicopter because the limited transport capacity of helicopters means that additional road ambulances are usually a better option. In this setting road personnel should inform Control/Comms of the number of patients requiring transport, leaving Control/Comms to dispatch the most appropriate resources, which may include a helicopter.
- **Time:** the patient has a time sensitive condition and a helicopter will result in a clinically significant time saving in the patient arriving in hospital.
- **Skill:** the patient requires specific skills and a helicopter will result in a clinically significant time saving in appropriately skilled personnel reaching the patient. This should be an uncommon indication for requesting a helicopter and road personnel should request the skills required, leaving Control/Comms to dispatch skilled personnel by the most appropriate means, which may be by helicopter.

Requesting a helicopter

- When a helicopter is requested, Control/Comms are required to dispatch the most appropriate helicopter and this is not always the closest helicopter to the scene. The following factors are taken into account when dispatching a helicopter:
  - The availability of personnel to crew the helicopter.
  - The composition of the clinical crew.
  - The clinical interventions required by the patient.
  - The type of helicopter, in particular the space available for clinical interventions.
  - Specific helicopter requirements, for example winching.
  - The hospital the patient is being transported to.
  - Other incidents occurring at the same time.
- In order to make the most appropriate dispatch decision, Control/Comms require as much information as possible from road personnel. For example, what is dispatched to the scene may be quite different if the request is for a patient with an isolated compound fracture requiring IV pain relief versus a patient with a GCS of 5 and an obstructed airway requiring RSI.
- Requesting a helicopter does not guarantee that one will be dispatched. If a helicopter is not dispatched, road personnel will be contacted by Control/Comms to discuss the alternative options.

Time critical and time sensitive conditions

- Not all patients that are status one have a time critical condition and clinical judgement is required. For example, a patient with severe hypovolaemic shock secondary to intra-abdominal bleeding has a time critical condition, but a patient with coma secondary to a stroke who lives in an aged care residential facility and is receiving end of life care does not.
- Cardiac arrest is not usually an indication to request a helicopter:
  - It is uncommon for a helicopter to be able to locate within a time frame that could make a difference to the patient.
  - In approximately 70% of cases return of spontaneous circulation (ROSC) will not be achieved and thus the helicopter will not be required for transport in the majority of cases.
  - Control/Comms personnel may decide to utilise a helicopter to deliver specific personnel to the scene in some circumstances.
  - If the patient achieves ROSC it is appropriate to consider calling for a helicopter, noting that if the patient has another cardiac arrest it is usually safer if the patient is in a road ambulance because CPR cannot be adequately performed in a helicopter, unless a mechanical CPR device is available. For this reason a patient that is post cardiac arrest should usually be transported by road unless a very significant time saving will be achieved by using a helicopter.

- Not all patients that are status two have a time sensitive condition and clinical judgement is required. For example, a patient with myocardial ischaemia in the absence of STEMI or significant complications does not have a time sensitive condition.
- It is rare for a patient that is status three to have a time sensitive condition and clinical judgement is required. For example, a patient with a dislocated large joint has a time sensitive condition but a patient with an isolated long bone fracture (including a compound fracture) does not have a time sensitive condition. However, clinical judgement should be used and if a patient is in significant pain (for example from a long bone fracture or severe back pain) and road transport time to hospital is very long (for example more than two hours) it may be appropriate to use a helicopter.

Selecting a landing site

- In many areas of New Zealand there are commonly used landing sites that are well known to the helicopter crews and these should be used whenever feasible.
- If it is not feasible to use a commonly used landing site, select a landing site that is:
  - As large as possible. A minimum of 30 metres by 30 metres is preferred (approximately two tennis courts).
  - As flat as possible. Less than five degrees of slope is preferred.
  - Free of surrounding wires, poles and trees if possible.
  - Free of loose objects. Remove loose objects that may move with the helicopter downwash prior to helicopter arrival.
  - Free of long grass. Less than 30 cm is preferred.
  - Free of livestock.
- It is not necessary to mark the outer edges of the landing site. In particular do not use objects such as cones that may move in the helicopter downwash. Low intensity lights may be used to mark the landing site at night but this is not routinely required.
- At night do not use headlights to mark the landing site or shine lights toward the helicopter, both of which may impair the night vision of the helicopter crew.
- Be prepared for the possibility that the helicopter crew may choose an alternative landing site.

Prior to the helicopter arriving

- Contact the helicopter crew and notify them of the location of the landing site and describe any obvious hazards, including the position of surrounding wires/poles and the presence of low cloud/fog. Discuss whether or not a liaison radio channel will be used as the helicopter approaches the scene.
- Turn vehicle beacons on as this helps the helicopter crew locate the site.
- Consider moving the patient toward the landing site (if appropriate), if the landing site is a significant distance from the patient.
- Make radio contact with the helicopter crew when you hear/see it approaching, using a liaison radio channel if appropriate. When on approach the pilot may ask for a 'sterile cockpit' (a term used to describe restricted communication within the helicopter) and this may prevent the helicopter crew from talking to ground personnel during this time.
- Have a designated person wearing a high visibility jacket/jerkin stand in the middle of the landing site with the wind behind their back. When the helicopter crew has clearly seen them, this person should move upwind to one end of the landing site, stand with the wind behind their back and extend their arms at a 45 degree angle upward and outward, to signal the landing site to the helicopter crew.

1.18 Treatment and referral decisions

Whenever personnel are assessing a patient, the following initial decisions must be made:

a) Is treatment required?
b) Is referral to a medical facility required?
c) If referral to a medical facility is required, what type of medical facility is most appropriate?
d) If referral to a medical facility is required, what mode of transport is most appropriate?

Obligations of personnel

Personnel must convey these decisions to the patient as firm recommendations. When making decisions and conveying recommendations personnel must:

- Fully assess the patient including taking a history, performing a primary and secondary survey and measuring appropriate vital signs.
- Fully assess the patient's competency to make informed decisions.
- Take into account all available information, including non-clinical information such as social factors.
- Obtain informed consent by fully informing the patient regarding their condition, the recommendations being made to them, the reasons for the recommendations and the benefits and risks of any alternative courses of action.
- Act in the patient's best interest, while allowing a competent and informed patient to decline recommendations.
- Insist on treatment and/or transport if it is in the best interest of a patient who is not competent to make decisions.
- Fully document the assessment, interventions and recommendations.
- Seek clinical advice if the situation is difficult to resolve.

Deciding if the patient requires referral to a medical facility

Not all patients assessed by ambulance personnel require referral to a medical facility. It is appropriate for a patient with minor illness or minor injury to be managed in the community provided:

- The obligations previously outlined have all been followed and
- The patient receives appropriate advice on what to do if they do not improve, including when to see their GP and
- Appropriate documentation is completed.

Criteria for immediate referral to a medical facility

Personnel always recommend immediate referral to a medical facility if any of the following criteria are met:

- Personnel are unable to reasonably exclude serious illness or injury or
- There is a significant abnormality in any vital sign recording.

Further details on specific referral criteria are contained within each section.

Non-transport pause and checklist

If a patient is being given a recommendation by ambulance personnel that transport to a medical facility by ambulance is not required, the crew must pause briefly (preferably away from the patient) to go through the non-transport checklist (below) and agree that non-transport is the right decision. If consensus is unable to be easily achieved, personnel should have a low threshold for seeking clinical advice or transporting the patient.

The following non-transport checklist must be completed prior to leaving the scene:

- The patient has been fully assessed including a set of vital signs and appropriate investigations and
- None of the vital signs are significantly abnormal and
- Serious illness or injury has been reasonably excluded and
- No red flags are present if the clinical condition is one that is contained within the red flag section and
- The patient is seen to mobilise (when able to normally do so), noting that if the patient is unable to mobilise there must be a minor or long-standing condition preventing this and
- The patient and/or caregivers have been given an explanation of when to seek further help and
- A PRF has been completed and a copy is being left with the patient or the patient is given instructions on how to access a copy of their PRF.

Deciding where the patient should be referred

If a patient is being referred to a medical facility, referral should be to the most appropriate medical facility taking into account:

- The patient's expected healthcare requirements, including investigation and treatment and
- The most effective and efficient way of meeting those requirements.

The patient may not require referral to an ED. It is preferable to refer the patient to their GP or an accident and medical clinic, provided that:

- The patient's healthcare requirements can be reasonably met by that medical facility and
- It is reasonable and practical to refer the patient to that medical facility.

When a competent adult patient declines recommendations given to them

- 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 and
  - Involve the patient's family, friends or GP, provided the patient consents to this and it is appropriate to do so and
  - Provide the patient with appropriate advice on what to do if they do not improve and
  - Ask the patient to sign the 'patient declined transport' section of the PRF and
  - Fully document the assessment, interventions, recommendations and interactions (consider utilising the recording function on ePRF if available) and
  - Provide the patient with their copy of the PRF or instructions on how to access a copy of the PRF.

When an adult patient appears to be not competent

- Personnel should insist on treatment and/or transport if they believe this is in the best interest of a patient who appears to be not competent to make decisions.
- 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 and
  - Involve the patient's family, friends or GP when appropriate and
  - Take into account the patient's views and wishes if these are known and
  - Fully document the assessment, interventions, recommendations and interactions.
- Family members do not have the right to make decisions on behalf of the patient, unless they have been legally appointed as either a Welfare Guardian or a Power of Attorney. However, personnel should insist on providing treatment and/or transport if they believe a Welfare Guardian or Power of Attorney is making a decision which is placing the patient at significant risk and should seek clinical advice if the situation is difficult to resolve.
- The views of family members that have not been legally appointed as either a Welfare Guardian or a Power of Attorney must be taken into account, but they cannot determine the treatment provided to the patient.
- All competency assessments are decision specific. A patient may be not competent to make some treatment decisions, but has the right to make other decisions to the extent that is appropriate for their level of competency. For example, a patient with dementia may not be competent to refuse treatment for a fractured neck of femur, but may be competent to refuse paracetamol.

When the patient is a child

- The law in New Zealand is not clear on the age at which a child becomes competent to make decisions regarding their healthcare. For the purposes of making transport and referral decisions a child aged 16 years and over can be treated as an adult.
- If a child aged younger than 16 years is making a decision which in the opinion of personnel is putting the child at significant risk, then the child should be deemed to be not competent. Personnel should seek clinical advice if the situation is difficult to resolve.
- Parents or guardians may make decisions (including declining recommendations regarding treatment and/or transport) on behalf of a child. However, personnel should insist on providing treatment and/or transport if they believe parents or guardians are placing the child at significant risk and should seek clinical advice if the situation is difficult to resolve.

The mode of transport

Not all patients requiring transport to a medical facility require transport in an ambulance. It is appropriate to recommend private transport provided all of the following criteria are met:

- The patient is very unlikely to require treatment or intervention during transport and
- The referral guidelines within each section are followed and
- A reasonable and appropriate alternative form of transport is available and
- Personnel are reasonably assured the patient will comply with transport arrangements.

When the patient or family members insist on transport by ambulance

A competent patient has the right to decline recommendations but neither a patient nor family members have the right to insist on transport that personnel do not think is clinically indicated.

However, if the insistence appears to be based upon genuine concern and no other reasonable transport option is available, then the patient should be transported by ambulance. If the insistence appears to be based on maliciousness, convenience or petty concerns, then personnel may decline to transport the patient provided they:

- Explain the reasons for not providing transport and
- Fully document their involvement with the patient and family and
- Seek a second opinion via the Clinical Desk and
- Forward the PRF for audit.

When a nurse at an aged residential care facility insists on transport by ambulance

A nurse at an aged care residential facility (for example a rest home or private hospital) may insist on transport that personnel do not think is clinically indicated. Personnel should try to resolve this by achieving consensus via collegial discussion, taking into account that the nurse will usually know the patient well. However, if consensus cannot be achieved, personnel should follow the principles contained within the previous paragraph.

Documentation

Comprehensive documentation is always important, but this is particularly the case when the patient is not being transported to a medical facility. As a general rule a third party, for example The Health and Disability Commissioner, will assume that if something is not written down it did not occur.

When a patient is not transported to a medical facility, the documentation must include all of the following:

- Details of the assessment and findings.
- An assessment of the patient's competence.
- All treatment and interventions provided.
- A copy of the 12 lead ECG if one was acquired.
- What was recommended and the reasons why.
- A summary of the communication between personnel, the patient and/or family members.

When a patient is not transported to a medical facility, their copy of the PRF (or instructions on how to obtain a copy) must be given to:

- The patient when competent.
- An appropriate person (for example a caregiver) if the patient appears to be not competent.
- A parent or guardian if the patient is a child.

1.19 Vital signs

When vital signs must be recorded

- Vital signs must be recorded when a single patient is being given a recommendation that transport to a medical facility is not required:
  - A set of vital signs that includes: respiratory rate, heart rate, blood pressure, capillary refill time, SpO_2 and GCS must be recorded.
  - In addition, a temperature must be recorded if the patient has a clinical condition that is not a traumatic injury.
  - Personnel should have a lowered threshold for recording two sets of vital signs if any of the first set were at the outer limits of normal.
- Vital signs must be recorded when they are a prerequisite to providing treatment. For example, a blood pressure must be recorded before administering GTN.
- Vital signs must be recorded following treatment that has been initiated in response to abnormal vital signs. For example, if 0.9% sodium chloride has been administered for tachycardia and a narrowed pulse pressure, these 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 the results will not change the treatment that is provided. For example:
  - Not all vital signs need to be recorded for a patient that is very close to hospital with a severe TBI, an obstructed airway and poor breathing. This is because a rapid approach to commencing transport and treating en route is expected, with a focus on maintaining airway and breathing and recording a blood pressure will not change the treatment that is provided.
  - Not all vital signs need to be recorded prior to adrenaline administration if a patient has anaphylaxis that is clearly immediately life-threatening.
- Vital signs do not need to be routinely recorded if multiple patients are being assessed at the scene. Most commonly this will be a road crash scene where multiple patients appear to be uninjured. However if a patient appears to be injured, a set of vital signs must be recorded before making a recommendation that transport to a medical facility is not required.
- Clinical judgement 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 PRF.

The frequency of vital sign recordings

- Clinical judgement 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 status one or status two, noting that vital signs are not required if the patient has a time critical problem and the result will not change the treatment that is provided.
  - Vital signs should usually be recorded every 20-30 minutes for patients that are status three.
- Some vital signs are monitored continually (for example 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 (such as blood pressure) are being recorded.
- It is usually inappropriate to stop a moving ambulance for the purpose of measuring and/or recording vital signs.

Specific vital signs

- **Respiratory rate.** Tachypnoea is a subtle but important sign that a patient is unwell or injured. 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 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 and non-transport is being considered.
- **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.
- **GCS.** Carefully determine each component noting that the motor score is the most important component of the GCS.
- **SpO_2.** This measures how much oxygen is bound to the haemoglobin in arterial blood as a percentage of maximum. It measures how well a patient is oxygenated, but does not measure how well a patient is breathing (ventilating). How well a patient is breathing is determined by clinical examination and use of $ETCO_2$. Failure of the pulse oximeter probe to record an SpO_2 is often an indication that the patient is vasoconstricted and poorly perfused.

- **Blood glucose.** The blood glucose concentration does not need to be routinely recorded in all patients. It should be recorded to rule out hypoglycaemia or hyperglycaemia, taking into account the overall clinical picture. For example, a blood glucose should be recorded in all:
  - Patients with diabetes.
  - Patients with an altered level of consciousness.
  - Patients who are unwell without an obvious cause.
  - Children with significant signs of infection. In particular, children under five years of age are particularly prone to hypoglycaemia if they have severe infection.
  - Patients with poisoning where hypoglycaemic medicines may have been taken.
  - Patients with signs or symptoms of stroke.
- **Temperature.** Hyperthermia is most commonly due to infection, but normothermia does not rule out infection. There is no specific temperature that correlates well with severity of illness, however:
  - A temperature greater than 39 degrees should usually result in a patient being given a recommendation to be transported to a medical facility.
  - Hypothermia is an important clinical sign as it is often a sign of low cardiac output. A temperature below 36 degrees should usually result in a patient being given a recommendation to be transported to a medical facility.
- **End tidal CO_2.** End tidal CO_2 ($ETCO_2$) must be measured continually via capnography and regularly recorded if the patient has been intubated with an ETT. $ETCO_2$ 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. $ETCO_2$ 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 $ETCO_2$. $ETCO_2$ should not usually be measured if the patient is being ventilated via a face mask as it is significantly affected by any leak and does not usually alter treatment.

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 and include:
  - Features of general concern such as pallor or sweating.
  - Airway noise such as stridor or grunting.
  - Lung sounds such as wheeze or crackles.
  - Signs of increased work of breathing such as indrawing and nasal flaring.
  - Interaction and activity, particularly in small children.
  - The ability to mobilise normally without assistance.

1.20 The primary and secondary survey

The primary survey

- The primary survey is a rapid assessment of the patient, looking for immediate threats to life and providing immediate treatment as required.
- The primary survey 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.

Performing a primary survey

- **Airway:**
  a) Look and listen for signs of airway obstruction.
  b) Open the airway using head tilt, chin lift and/or jaw thrust if required.
  c) Utilise airway adjuncts such as an oropharyngeal airway and/or a nasopharyngeal airway if required.
  d) Consider the possibility of cervical spine injury if the patient is suffering from trauma, but the airway takes priority.
- **Breathing:**
  a) Look and feel for adequate chest rise and fall.
  b) Look for obvious signs of respiratory distress.
  c) Assist breathing using a manual ventilation bag and mask if required.
- **Circulation:**
  a) Compress (or pack and compress) significant external bleeding.
  b) Feel the pulse rate and strength.
  c) Look and feel for abnormal peripheral perfusion/capillary refill time.
- **Disability:** Check the level of consciousness using:
  a) The motor score of the GCS or
  b) AVPU (awake, responding to voice, responding to pain or unresponsive).
- **Exposure, examination and environmental control:**
  a) This is the transition point between the primary and secondary survey.
  b) Appropriately expose and examine the patient, while keeping them warm.

The secondary survey

- The secondary survey follows the primary survey and 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.
- The secondary survey should take 2-3 minutes.
- Do not conduct a detailed secondary survey if there are significant abnormalities in the primary survey.

Performing a secondary survey

- **Central nervous system:**
  a) Record the GCS. Individually examine and record each component.
  b) Examine the pupils for asymmetry and reaction to light if the patient has an altered level of consciousness.
  c) Examine movement by checking the patient can move their face and move all four limbs normally. Look for focal signs such as unilateral weakness.
  d) Examine sensation by checking the patient can feel soft touch on all four limbs.
  e) Watch the patient walk if appropriate.
  f) Assess short term memory, balance and coordination if appropriate.
- **Head, neck and face:**
  a) Look and feel for abnormality such as deformity, tenderness, bleeding or infection.
  b) Look at the jugular veins for distension.
  c) Look for a medical information adjunct such as a necklace.
  d) Examine the cervical spine if appropriate.
- **Chest:**
  a) Look and feel for symmetry of air entry, tenderness and crepitus.
  b) Look for abnormal chest wall movement.
  c) Look for subtle signs of respiratory distress.
  d) Listen anteriorly and posteriorly for symmetry of air entry and added sounds.
- **Abdomen and pelvis:**
  a) Look and feel for abnormal masses, distension or tenderness.
  b) Look at the pelvis and feel for tenderness, but do not examine the pelvis for signs of instability.
- **Extremities:**
  a) Look and feel for wounds and fractures.
  b) Look and feel for abnormality such as signs of infection or oedema.
  c) Look at colour and feel warmth.
  d) Re-examine peripheral capillary refill time.
  e) Look for a medical information adjunct such as a bracelet.
- **Back and spine:**
  a) Look and feel for tenderness or deformity.
  b) Look and feel for sacral oedema.

2.1 Asthma

Mild asthma

- Administer bronchodilators:
  a) Use the patient's metered dose inhaler (MDI) if it is available.
  b) Administer 5 mg of salbutamol nebulised in combination with 0.5 mg of ipratropium nebulised if the patient's MDI is unavailable.
- Administer prednisone PO:
  a) 40 mg for an adult.
  b) See the paediatric drug dose tables for a child.
  c) Do not administer prednisone to a child aged less than five years unless there is a clear history of asthma and the child has previously been prescribed oral steroids.
- Consider the likelihood that transport may not be required.

Moderate asthma

- Administer 5 mg of salbutamol nebulised in combination with 0.5 mg of ipratropium nebulised.
- Administer further doses of salbutamol as required.
- Gain IV access if the patient is deteriorating.
- Administer prednisone as above.
- Consider the possibility that transport may not be required if the patient rapidly improves with only one dose of nebulised bronchodilators.

Severe asthma

- Administer 5 mg of salbutamol nebulised in combination with 0.5 mg of ipratropium nebulised and administer continuous salbutamol until improvement occurs.
- Administer adrenaline IM if the patient is not rapidly improving:
  a) Administer 0.5 mg IM for an adult.
  b) See the paediatric drug dose tables for a child.
- Adrenaline IM may be repeated every 10 minutes if IV access cannot be obtained.
- Gain IV access.
- Begin transport without delay, providing most treatments en route.
- Administer magnesium IV:
  a) Administer 10 mmol (2.47 g) IV over 10-15 minutes for an adult.
  b) Administer the paediatric dose IV over 10-15 minutes for a child.
  c) A second dose may be administered if transport time is longer than 30 minutes and the patient is not improving.

- Prednisone administration is not a priority, but may occur if the patient is able to swallow tablets.

Life-threatening asthma

- Administer adrenaline IV in addition to the treatments for severe asthma.
- Place 1 mg of adrenaline into a 1 litre bag of 0.9% sodium chloride:

  For an adult:

  a) Administer this as an IV infusion. Start at 2 drops per second and adjust the rate to the patient's condition or
  b) Administer 0.01 mg (10 ml) IV every 1-2 minutes.

  For a child aged 5-14 years:

  a) Administer this as an IV infusion. Start at 1 drop per second and adjust the rate to the patient's condition or
  b) Administer IV boluses (see the paediatric drug dose tables) every 1-2 minutes.

  For a child aged less than five years:

  a) Administer IV boluses (see the paediatric drug dose tables) every 1-2 minutes.
  b) Do not administer adrenaline as an IV infusion.

Referral

- EMTs must firmly recommend that the patient is transported to a medical facility by ambulance, if the patient is administered any bronchodilator (including their own).
- Paramedics and ICPs may recommend that a patient aged 10 years or older, with mild or moderate asthma remain at home, provided the patient:

  a) Has known asthma and
  b) Has only received bronchodilators via MDI, or has received a maximum of one administration of nebulised bronchodilators and
  c) Is talking in full sentences and
  d) Has an SpO_2 on air greater than or equal to 94% and
  e) Is observed by ambulance personnel for a minimum of 20 minutes following the completion of the last bronchodilator administration and
  f) Is observed to mobilise normally and
  g) Has a peak expiry flow rate (PEFR) greater than 70% of their normal PEFR (do not use this if the patient does not normally use a PEFR meter) and
  h) Is able to see a doctor (preferably their own GP) within two days and
  i) Is provided with a prednisone pack (if appropriate), an information sheet and the information within it is explained to them and to any carers.
- If the patient has signs of a chest infection (for example fever or purulent sputum), the patient should be seen by a doctor within 12 hours. This could be a GP (preferably their own) if all of the other criteria to remain at home are met.

Additional information

General

- Asthma is characterised by reversible bronchospasm. It is caused by an inflammatory state within the lungs resulting in recurrent attacks of breathlessness and wheezing. It is often associated with mucus plugging of small airways.
- Patients with mild asthma are short of breath but are able to speak in full sentences.
- Patients with moderate asthma are short of breath, usually moving enough air to generate a loud wheeze and are able to speak in short sentences with each breath. They do not have significant chest or neck indrawing.
- Patients with severe asthma are very short of breath, may only be moving enough air to generate a quiet wheeze and are only able to speak a few words with each breath. They usually have significant chest or neck indrawing.
- Patients with immediately life-threatening asthma are extremely short of breath, moving very little air (and may not be moving enough air to create wheeze) and are only able to speak a word or two. They usually have marked indrawing but this may not be present if they are exhausted.
- A T-piece may be used (T-pieces are not available on all ambulances) to administer nebulised medications if the patient's ventilation is being assisted with a manual ventilation bag, noting that the administration of nebulised medicines is not a priority in this setting.

Spacers

- If the patient has mild or moderate asthma, it is preferable to administer their own bronchodilator via MDI and a spacer (if available). If a spacer is being used, a common approach is to administer one puff at a time, with six breaths to empty the spacer after each puff, to a total of 6-12 puffs.
- Spacers that are visibly cloudy or dirty on the inside may have reduced effectiveness. In this setting advise the patient to clean their spacer and consider administering nebulised bronchodilators instead.
- Turbuhalers (e.g. Bricanyl) must not be used with a spacer.

Children

- Children aged less than one year have poorly developed bronchial smooth muscle and fewer beta-2 receptors than adults and for these reasons bronchodilators provide very little benefit.
- Children aged less than one year who are short of breath and wheezy usually have bronchiolitis and not asthma. Treating hypoxia is the most important aspect of treating bronchiolitis. Bronchodilators do not have a significant role and should not usually be administered.

- Gaining IV access in small children is a balance of risk. It may cause distress and worsen their work of breathing, but will be required if their exacerbation is life-threatening.
- An attempt should be made to gain IV access in all children who receive IM adrenaline.
- Prednisone does not usually have a role in children aged less than five years because it does not generally alter the course of their asthma exacerbation. However, prednisone is indicated if the child has a clear history of asthma and has previously received oral steroids.

Adrenaline administration

- Adrenaline IM is reserved for severe asthma that is not rapidly improving with nebulised bronchodilators.
- A dose of 0.5 mg adrenaline IM is appropriate for the majority of adults. ICPs may make a decision to reduce the dose, particularly if the patient is small, frail, or has ischaemic heart disease.
- Adrenaline administration (particularly IV bolus administration) can make the patient tachypnoeic and look or feel awful. It is important to differentiate this from a worsening of their asthma and not to automatically respond by administering more adrenaline.
- Adrenaline IV is reserved for immediately life-threatening asthma.
- When administering adrenaline IV to patients aged five years and over, an IV infusion is preferred over IV boluses because this reduces the adverse effects of adrenaline.

Magnesium administration

- Adrenaline IV has a higher priority than magnesium IV if asthma is life-threatening.
- If an adrenaline IV infusion has been commenced, consider obtaining IV access in a second site for magnesium administration, but do not stop an adrenaline IV infusion in order to administer magnesium IV.
- There is no role for more than two doses of magnesium.

Differentiating asthma from cardiogenic pulmonary oedema

- Pulmonary oedema may produce a wheeze that sounds like asthma.
- If the patient does not have a history of asthma, the possibility of cardiogenic pulmonary oedema should be considered. Cardiogenic pulmonary oedema is the likely diagnosis when the patient has been supine (for example in bed), the onset has been gradual over hours to days and the wheeze is worse bilaterally in the lower zones. The patient is often hypertensive, clammy and peripherally vasoconstricted.

- The patient may have a history of both asthma and pulmonary oedema. In this setting the patient may be able to tell you which condition is causing the shortness of breath.
- Asthma is the likely diagnosis if the onset is relatively rapid, associated with a cough and the wheeze is heard evenly through all lung fields. The patient is usually normotensive and not peripherally vasoconstricted.

Differentiating asthma from CORD

- It is necessary to distinguish CORD from asthma because the treatments are different.
- Patients with asthma are usually symptom free between attacks.
- Patients with CORD usually have a history of smoking and are not symptom free between attacks.

Differentiating asthma from a chest infection

- Wheeze that is unilateral, limited to one lobe/area only, or exists in the presence of a productive cough or elevated temperature, is most likely to be due to a chest infection and not asthma.

Dynamic hyperinflation

- Dynamic hyperinflation (gas trapping) occurs when the amount of gas within the lungs increases in the presence of severe bronchoconstriction.
- This occurs because the resistance to gas leaving the lungs during expiration is higher than the resistance to gas entering the lungs during inspiration.
- Dynamic hyperinflation rarely causes pneumothorax, but it commonly causes reduced venous return to the heart by increasing intra-thoracic pressure.
- Dynamic hyperinflation occurs in spontaneously breathing patients when their asthma is severe, but those most at risk of life-threatening dynamic hyperinflation are those receiving assisted ventilation. For this reason the ventilation rate must be kept at six breaths per minute in patients receiving assisted ventilation.
- External chest compression (or bilateral external chest pressure) during expiration may reduce dynamic hyperinflation. However, it is controversial and there is no clear evidence that it is effective. Most of the evidence for external chest compression is from case reports in patients that had been intubated and ventilated and it may cause harm if it impairs inspiration in a spontaneously breathing patient. External chest compression is not recommended, but may be performed provided the following criteria are met:
  - It is timed with expiration and
  - It is clearly not impeding inspiration and
  - It should not be performed by unrestrained personnel during transport.

Tension pneumothorax

- Tension pneumothorax due to asthma is very rare unless the patient is receiving positive pressure ventilation.
- Needle chest decompression in the setting of life-threatening asthma carries a significant risk of causing pneumothorax. Chest decompression should only be undertaken if there are very convincing clinical signs of a tension pneumothorax and the preferred technique is open finger thoracostomy, provided the patient is ventilated.
- Diagnosing tension pneumothorax can be very difficult in the presence of life-threatening asthma:
  - Breath sounds are already reduced because the patient is moving very little air.
  - The jugular veins are already distended because of raised intra-thoracic pressure.
  - Cardiac output is already reduced because of dynamic hyperinflation.
  - The percussion note is already hyper-resonant because of dynamic hyperinflation.
- In the setting of life-threatening asthma the convincing signs of tension pneumothorax are most likely to be:
  - A very clear difference in breath sounds and percussion note between the two sides and
  - Signs of a progressively falling cardiac output in the absence of signs of dynamic hyperinflation.

Other causes of bronchospasm

- Bronchodilators do not have a significant role in the treatment of bronchospasm as a result of smoke, toxic gas inhalation or chest infection. However, bronchodilators (but not adrenaline or prednisone) may be administered if bronchospasm is prominent.

Referral

- Clinical judgement should be used if the patient has moderate asthma and is close to a medical facility. In this setting it may be more efficient for the patient to be transported to a medical facility by ambulance, rather than spending time at the scene determining that the patient is safe to remain at home.

Backup

- Backup from an ICP must be requested if the patient has severe or life-threatening asthma.

2.2 Chronic obstructive respiratory disease (CORD)

General principles of oxygen and nebulised bronchodilator administration

- Only administer oxygen if the patient has an SpO_2 less than 88%. Titrate the oxygen flow to maintain an SpO_2 of 88-92%.
- Avoid using oxygen to nebulise bronchodilators if air or an alternative nebuliser device is available. If supplemental oxygen is required when using air as the nebulising gas, place nasal prongs under the nebuliser mask and titrate the oxygen flow to maintain an SpO_2 of 88-92%.
- If oxygen is required to nebulise bronchodilators and the SpO_2 climbs above 92% during nebuliser delivery, alternate five minutes with the nebuliser mask on and five minutes with the nebuliser mask off.

Mild CORD

- Administer bronchodilators:
  a) Use the patient's metered dose inhaler (MDI) if it is available.
  b) Administer 5 mg of salbutamol nebulised in combination with 0.5 mg of ipratropium nebulised if the patient's MDI is unavailable.
- Administer 40 mg of prednisone PO.
- Consider the likelihood that transport may not be required.

Moderate CORD

- Administer 5 mg of salbutamol nebulised in combination with 0.5 mg of ipratropium nebulised.
- Administer 40 mg of prednisone PO.
- Consider the possibility that transport may not be required if the patient rapidly improves with only one dose of nebulised bronchodilators.
- Administer further doses of salbutamol as required.
- Gain IV access if the patient is deteriorating.

Severe CORD

- Administer 5 mg of salbutamol nebulised in combination with 0.5 mg of ipratropium nebulised and administer continuous salbutamol until improvement occurs.
- Gain IV access.
- Begin transport without delay, providing most treatments en route.
- Midazolam may be administered in 0.5 mg doses IV, sparingly for severe anxiety provided the patient is able to obey commands at all times.

- Prednisone administration is not a priority. Administer 40 mg of prednisone PO if the patient improves sufficiently to be able to swallow tablets.

Imminent respiratory arrest

- Administer adrenaline IV in addition to the treatments for severe CORD, but do not administer midazolam.
- Place 1 mg of adrenaline into a 1 litre bag of 0.9% sodium chloride:
  a) Administer this as an IV infusion. Start at 2 drops per second and adjust the rate to the patient's condition or
  b) Administer 0.01 mg (10 ml) IV every 1-2 minutes.

Referral

- EMTs must firmly recommend that the patient is transported to a medical facility by ambulance, if the patient is administered any bronchodilators (including their own).
- Paramedics and ICPs may recommend that a patient with mild to moderate CORD remain at home, provided the patient:
  a) Has known CORD and
  b) Has only received bronchodilators via MDI, or has received a maximum of one administration of nebulised bronchodilators and
  c) Rapidly improves to their usual respiratory state and
  d) Has an SpO_2 on air greater than or equal to 88% and
  e) Is observed by ambulance personnel, for a minimum of 20 minutes following the completion of the last bronchodilator administration and
  f) Is observed to mobilise in a way that is normal for them and
  g) Is able to see a doctor (preferably their own GP) within two days and
  h) Is provided with a prednisone pack (if appropriate), an information sheet and the information within it is explained to them and to any carers.
- If the patient has signs of a chest infection (for example fever or purulent sputum), they should be seen by a doctor within 12 hours. This could be a GP if all of the other criteria to remain at home are met.

Additional information

General

- CORD is a term used to encompass chronic inflammatory and destructive diseases within the lung, including chronic bronchitis and emphysema. The bronchoconstriction present in CORD is not completely reversible.
- Patients with mild CORD are short of breath, are moving enough air to generate wheeze and are able to speak in full sentences with each breath. They may have some chest and/or neck indrawing.

- Patients with moderate CORD are short of breath, are moving enough air to generate wheeze and are able to speak in short sentences with each breath. They usually have moderate chest and/or neck indrawing.
- Patients with severe CORD are very short of breath, may not be moving enough air to generate wheeze and are usually only able to speak a few words with each breath. They usually have severe chest and/or neck indrawing.
- Patients with imminent respiratory arrest are extremely short of breath, often unable to speak and/or have a falling level of consciousness and/or signs of severe exhaustion. They may have a silent chest as they may not be moving enough air to generate wheeze or to have chest and/or neck indrawing.
- Many patients with CORD are short of breath and have signs of indrawing, even when well and it is easy to over-estimate the severity of their CORD. If possible, ask how their shortness of breath compares with their usual state.
- CORD should be suspected in patients with chronic respiratory illness, particularly if they have risk factors such as: age over 50 years, long term exposure to cigarette smoke (including second hand exposure), or long term exposure to dust or chemicals.

Spacers

- If the patient has mild or moderate CORD, it is preferable to administer their own bronchodilator via MDI and a spacer (if available). If a spacer is being used, a common approach is to administer one puff at a time, with six breaths to empty the spacer after each puff, to a total of 6-12 puffs.
- Spacers that are visibly cloudy or dirty on the inside may have reduced effectiveness. In this setting advise the patient to clean their spacer and consider administering nebulised bronchodilators instead.
- Turbuhalers (e.g. Bricanyl) must not be used with a spacer.

Oxygen administration and hypercarbia

- Some patients have carbon dioxide clearance that is altered by oxygen administration. Excess oxygen administration in these patients may cause hypercarbia and bronchodilators should be nebulised without using oxygen as the driving gas, provided equipment is available to do this. If oxygen is administered, titrate the oxygen flow to an SpO_2 of 88-92%.
- The mechanisms by which excess oxygen administration causes hypercarbia are controversial and complex. They include:
  - Reversal of hypoxic pulmonary vasoconstriction, causing high levels of CO_2 in poorly ventilated alveoli to diffuse back into the circulation.
  - Decrease in ventilatory drive.
  - Decreased CO_2 buffering capacity of haemoglobin.
  - Absorption of CO_2 from alveoli beyond obstructed airways.
  - The higher density of oxygen compared with air causing increased work of breathing.

- Patients at risk of hypercarbia often have a card or letter describing specific instructions for oxygen therapy and these instructions should be followed.
- If using oxygen to nebulise bronchodilators, alternating five minutes with the mask on and five minutes with the mask off should only occur if the SpO_2 climbs above 92% during nebuliser delivery. This is done to limit oxygen exposure whilst delivering most of the nebulised bronchodilator. If the SpO_2 remains at or below 92% during nebulisation, alternating does not need to occur.
- The signs of a rising carbon dioxide level are usually confusion, drowsiness, agitation and a falling level of consciousness. If the patient is suspected of developing hypercarbia, oxygen administration should not be discontinued immediately. Instead, oxygen administration should be reduced to a lower flow rate (targeting an SpO_2 of 88-92%) and the patient reassessed.
- Consider assisting the patient's ventilation (without added oxygen unless hypoxia is severe), using a manual ventilation bag if:
  - SpO_2 continues to fall below 80% despite treatments or
  - The patient is becoming exhausted or
  - The patient is suspected of developing hypercarbic respiratory failure despite lowering the oxygen flow.
- A T-piece may be used (T-pieces are not available on all ambulances) to administer nebulised medications if the patient's ventilation is being assisted with a manual ventilation bag, noting that the administration of nebulised medicines is not a priority in this setting.

Differentiating CORD from asthma

- It is necessary to distinguish CORD from asthma because the treatments are different.
- Patients with asthma are usually symptom free between attacks.
- Patients with CORD usually have a history of smoking and are not symptom free between attacks.
- Age is not a very useful factor for differentiating CORD from asthma. Some young patients have CORD and some older patients have asthma.

Differentiating CORD from cardiogenic pulmonary oedema

- Cardiogenic pulmonary oedema may produce a wheeze that sounds like CORD. Differentiating CORD from cardiogenic pulmonary oedema is not always easy:
  - Cardiogenic pulmonary oedema is the likely diagnosis when the patient has been supine (for example in bed), has gradual onset over hours to days and the wheeze is worse bilaterally in the lower zones. The patient is often hypertensive, clammy and peripherally vasoconstricted.
  - CORD is the likely diagnosis if it is associated with a productive cough and the wheeze is evenly heard through all lung fields. The patient is usually

normotensive and not peripherally vasoconstricted.

- Some patients may have a history of both CORD and cardiogenic pulmonary oedema. In this setting they may be able to tell you which condition is causing their shortness of breath.

Adrenaline administration

- Adrenaline administration is reserved for imminent respiratory arrest.
- The decision to administer adrenaline must weigh up the potential benefits against the potential risks. Adrenaline may result in bronchodilation, but it may also cause tachydysrhythmias and myocardial ischaemia. Patients with CORD are at very high risk of the adverse effects of adrenaline and this is why it is reserved for imminent respiratory arrest.
- Adrenaline administration (particularly IV bolus administration) can make the patient tachypnoeic and look or feel awful. It is important to differentiate this from a worsening of their CORD and not to automatically respond by administering more adrenaline.
- When administering adrenaline IV, an IV infusion is preferred over IV boluses because this reduces the adverse effects of adrenaline.

Midazolam administration

- Midazolam administration in patients with an exacerbation of CORD should be rare, noting that midazolam is not a treatment for CORD but may be administered for symptom relief of severe anxiety.
- It is important to differentiate between severe anxiety and severe respiratory distress, noting that midazolam has a role in treating anxiety but not in treating respiratory distress.
- The decision to administer midazolam requires clinical judgement that balances the possible benefit from a reduction in anxiety against the possible risk of worsening the patient's respiratory effort.
- Midazolam must be administered sparingly and the patient must be able to obey commands at all times.

Magnesium administration

- There is no role for magnesium administration in patients with CORD.

Referral

- Clinical judgement should be used if the patient has moderate CORD and is close to a medical facility. In this setting it may be more efficient for the patient to be transported to a medical facility by ambulance, rather than spending time at the scene determining that the patient is safe to remain at home.
- Formalised alternative care pathways are being introduced in some areas of the country. If the patient is in such an area the pathway should be followed.

2.3 Continuous positive airway pressure (CPAP)

- Apply CPAP at 10 cmH_2O if an adult patient with cardiogenic pulmonary oedema has:
  - Severe respiratory distress despite treatment or
  - An SpO_2 less than 92% despite treatment.
- Note that a lower SpO_2 threshold of less than 88% should be used if the patient also has CORD.
- Use CPAP with caution if the patient has an altered level of consciousness or signs of shock.

Additional information

General

- CPAP is not available in all vehicles.
- It is important to ensure the face mask is fitted correctly and that there is an adequate mask seal.
- CPAP usually lowers cardiac output and this is why CPAP must be used with caution if there are signs of shock.

The physiological effects of CPAP

- CPAP improves oxygenation, improves ventilation and reduces the workload of breathing via the following physiological effects:
  - Fluid within the airways causes areas of lung to collapse, causing shunting of blood because these areas have blood supply but do not contribute to gas exchange. CPAP reduces shunting because the inspiratory pressure assists areas of the lung that have collapsed to expand (also called recruitment).
  - Wet lungs become stiff and this increases the workload of breathing. CPAP reduces this workload because the inspiratory pressure assists inspiration.
  - The expiratory pressure assists small and medium sized airways to remain open during expiration, preventing lung collapse by splinting the airways open. Preventing areas of lung from collapsing is important because once collapsed, significant additional pressures are required to re-expand them.
  - The positive pressure in the thoracic cavity reduces the preload (filling) of the right ventricle by reducing venous return to the heart (this will be further compounded by administration of GTN).
  - The positive pressure in the thoracic cavity increases the afterload (the pressure the ventricle must contract against) of the right ventricle. In combination with reduced venous return to the heart, this reduces blood flow through lung vessels, reducing the amount of fluid entering the lungs.

- The expiratory pressure increases the amount of air remaining in the lungs at the end of expiration (also called the functional residual capacity) and this causes the lungs to be more expanded. From this more expanded resting position, less work is required to inspire as a result of the non-linear compliance of the lungs, particularly when the lungs are wet.

CPAP being provided during transport

- During transport the patient and personnel should be safely restrained.
- It is not always possible for a patient to be provided with CPAP during transport with personnel restrained. The risk to personnel of being unrestrained during transport must be balanced against the risk to the patient of not receiving CPAP.
- If the patient is rapidly improving, personnel should consider remaining on scene for an additional period of time, so that the patient does not require CPAP during transport.
- The following principles must be applied if personnel are unrestrained:
  - There must be an explicit decision that the balance of risk is such that it is appropriate to transport the patient with personnel unrestrained and
  - The vehicle must travel at normal road speed (even if under lights) and
  - The driver must ensure that the nature of their driving is modified to keep personnel as safe as possible during transport.

2.4 Foreign body airway obstruction

If the patient is conscious and moving sufficient air

- Do not provide any specific intervention.
- Be prepared to treat full obstruction.

If the patient is conscious and not moving sufficient air

- Perform up to five back blows.
- Perform up to five chest thrusts.
- Alternate between cycles of back blows and chest thrusts until the obstruction is cleared, or the patient becomes unconscious.

If the patient is unconscious and not moving sufficient air

- Try to remove the foreign body under direct vision with a finger sweep.
- Try to remove the foreign body using a laryngoscope and Magill forceps.
- Perform five chest compressions and recheck the airway using a laryngoscope and Magill forceps.
- Commence CPR and try to ventilate using a manual ventilation bag and mask.
- Intubate with an endotracheal tube, inserting the tube as far as possible and then withdrawing the tube to the usual position.
- Perform a cricothyroidotomy.

Additional information

General

- Foreign body airway obstruction occurs most commonly in young children, the elderly, the intoxicated and the intellectually impaired.
- A patient that is moving sufficient air and/or coughing does not require immediate intervention.
- Check the patient for signs of relief of the obstruction between back blows and chest thrusts.
- Position the patient with their head below their shoulders when performing back blows, provided this is easy to achieve.
- Abdominal thrusts (also known as the Heimlich manoeuvre) are no longer recommended because they are associated with a risk of intra-abdominal injury and do not appear to be associated with a higher chance of success than chest thrusts.
- During intubation, the reason the endotracheal tube is inserted as far as possible and then withdrawn is to try to push the foreign body down one bronchus, allowing ventilation to occur through the other bronchus.

Oesophageal obstruction

- Commonly, the foreign body is lodged at the top of the oesophagus and the patient does not have airway obstruction.
- The patient is often in significant distress and/or is unable to swallow saliva.
- Providing the patient has a normal airway and normal breathing, encouraging the patient to take small sips of fluid may cause the obstruction to dislodge.
- If oesophageal obstruction persists, the patient requires transport to a hospital with surgical facilities as anaesthesia and endoscopy is usually required to remove the foreign body.
- Although glucagon may reduce oesophageal contraction, there is no role for glucagon administration in patients with oesophageal obstruction.

Foreign body ingestion

- This is most common in young children.
- The patient must be given a firm recommendation to be seen in an ED if the patient is symptomatic, for example: drooling, gagging, difficulty swallowing, a sensation of the foreign body, sore throat, cough or abdominal pain.
- The patient must be given a firm recommendation to be seen in an ED if the swallowed object is potentially dangerous, such as a battery, a magnet (especially if there is more than one) or a sharp object such as a pin:
  - This is the case even if the patient is asymptomatic.
  - Batteries and in particular button (or disc) batteries can cause severe injury to the oesophagus or bowel and may need to be surgically removed. If a battery of the same size is available it should be taken to the ED with the patient.
  - Patients that have swallowed button batteries are time sensitive and should be assessed in an ED without significant delay, noting that transport by ambulance may not be required.
  - Button (or disc) batteries can be mistaken for coins. If the patient is thought to have swallowed a coin, but it is possible a button battery has been swallowed instead, the patient should be treated as if a battery has been swallowed.
- The patient may be given a firm recommendation to remain at home if the patient is asymptomatic and there is clear evidence that the swallowed object is not dangerous, for example a button or marble. In this setting the patient should be advised that the object will most likely pass through the bowel and that medical advice should be sought if symptoms develop.

Backup

- Backup from an ICP must be requested for patients with any degree of foreign body airway obstruction.

2.5 Positive end expiratory pressure (PEEP)

- Apply PEEP using the following settings if a manual ventilation bag is being used to provide ventilation:

  For an adult:

  a) Do not attach PEEP during cardiac arrest.
  b) Apply PEEP set to 5 cmH_2O if the patient has TBI.
  c) Apply PEEP set to 10 cmH_2O for all other adults.

  For a child:

  a) Do not attach PEEP during cardiac arrest.
  b) Apply PEEP set to 5 cmH_2O for all other children.

  For a neonate:

  a) Apply PEEP set to 5 cmH_2O, including during cardiac arrest.
- Apply PEEP using the following settings if CPAP is indicated in an adult with cardiogenic pulmonary oedema, but CPAP is not available:

  b) Apply PEEP set to 10 cmH_2O. Focus on ensuring a tight seal with the mask and do not assist the patient's breathing unless it is ineffective.
  c) Increase the PEEP to 15 cmH_2O if the patient is not improving.
- Use PEEP with caution if the patient has signs of shock.

Additional information

General

- PEEP is not applied to adults and children during CPR because an increase in intra-thoracic pressure reduces the blood flow achieved during CPR. If ROSC is achieved it is appropriate to apply PEEP, but this is not an immediate priority.
- PEEP is applied to neonates during CPR because the cause of the cardiac arrest is usually respiratory failure and the balance of risk is in favour of improving ventilation, even though this may reduce the blood flow achieved during CPR.
- PEEP increases intracranial pressure in patients with TBI by reducing venous return from the brain. In this setting there is a balance between the benefit of PEEP improving oxygenation and the risk of PEEP increasing intracranial pressure. This is why PEEP is set to 5 cmH_2O for these patients.
- PEEP reduces cardiac output and should be used with caution in patients showing signs of shock. The reduction in cardiac output may be significant if PEEP is combined with positive pressure ventilation in patients with:
  - A clinical condition reducing right ventricular filling, such as hypovolaemia, tension pneumothorax or cardiac tamponade.
  - A clinical condition increasing right ventricular afterload, such as pulmonary embolism.

- Patients with a clinical condition reducing right ventricular filling or increasing right ventricular afterload require correction of the underlying problem (if possible) and expansion of their intra-vascular volume with 0.9% sodium chloride. This should occur prior to the application of positive pressure ventilation and/or PEEP, whenever it is feasible to do so.

The physiological effects of PEEP

- PEEP has similar physiological effects to CPAP, but does not provide additional inspiratory pressure during inspiration.
- PEEP improves oxygenation, improves ventilation and reduces the workload of breathing, via the following physiological effects:
  - The expiratory pressure assists small and medium sized airways to remain open during expiration, preventing lung collapse by splinting the airways open. Once collapsed, significant additional pressures are required to re-expand them.
  - The positive pressure in the thoracic cavity reduces the preload (filling) of the right ventricle by reducing venous return to the heart (this will be further compounded by administration of GTN).
  - The positive pressure in the thoracic cavity increases the afterload of the right ventricle. In combination with reduced venous return to the heart, this reduces blood flow through lung vessels, reducing the amount of fluid entering the lungs.
  - The expiratory pressure increases the amount of air remaining in the lungs at the end of expiration (also called the functional residual capacity) and this causes the lungs to be more expanded. From this more expanded resting position, less work is required to inspire as a result of the non-linear compliance of the lungs, particularly when the lungs are wet.

PEEP being provided during transport

- During transport the patient and personnel should be safely restrained.
- It is not always possible for a patient that is spontaneously breathing to be provided with PEEP during transport with personnel restrained. The risk to personnel of being unrestrained during transport must be balanced against the risk to the patient of not receiving PEEP.
- If the patient is rapidly improving, personnel should consider remaining on scene for an additional period of time, so that the patient does not require PEEP during transport.
- The following principles must be applied if personnel are unrestrained:
  - There must be an explicit decision that the balance of risk is such that it is appropriate to transport the patient with personnel unrestrained and
  - The vehicle must travel at normal road speed (even if under lights) and
  - The driver must ensure that the nature of their driving is modified to keep personnel as safe as possible during transport.

2.6 Stridor

This section is for any form of upper airway obstruction secondary to infection or swelling.

- Administer 5 mg of adrenaline nebulised if stridor is causing moderate or severe respiratory distress.
- Repeat adrenaline as required every 10 minutes.

Referral

- All patients receiving adrenaline must be given a firm recommendation to be transported to a medical facility by ambulance.
- Transport should usually be to an ED, but may be to a primary care provider if the patient is rapidly improving and only one dose of adrenaline is administered.

Additional information

General

- Stridor is an abnormal high pitched noise created when air is moving through a narrowed airway. It is a clinical sign and not a diagnosis or a disease.
- Stridor is predominantly inspiratory, but may have an expiratory component (biphasic stridor).
- Below the larynx the adult trachea is well supported by cartilages that prevent airway collapse and reduce expiratory stridor.
- Children are at higher risk of airway obstruction than adults because they have narrower airways with less cartilaginous support.
- Stridor must be distinguished from wheeze.
- It is important to keep children as calm as possible, because stridor will usually get worse if they become upset or cry. Although young children are more likely to remain calm if they are kept in the arms of a parent, they must be transported in an approved restraint and not in the arms of a parent.
- The dose of nebulised adrenaline is the same for children and adults.
- Do not treat stridor with nebulised water or nebulised saline.

The differential diagnosis

- In the absence of an obvious cause such as trauma or burns, the differential diagnosis of stridor includes:
  - Croup.
  - Epiglottitis.
  - Tracheitis.
  - Foreign body.

  - Pharyngeal abscess.
  - Anaphylaxis.
  - Angioedema.
- Croup is a viral infection of the upper airway. It is the most common cause of stridor in children; especially children aged six months to two years. The patient usually has an onset of illness over days, a barking cough that is worse at night and a low fever.
- Epiglottitis is a bacterial infection of the upper airway. It is now relatively rare as a result of immunisation. Historically it was most common in children aged 2-7 years, but is now common in adults. The patient usually has an onset of illness over a day or two, a very sore throat, difficulty swallowing (which may cause drooling) and a high fever. Epiglottis is an emergency because the risk of airway occlusion is relatively high.
- Tracheitis is a bacterial infection of the trachea. It is relatively uncommon and mainly affects children. It is most commonly due to secondary bacterial infection following a viral infection.
- Foreign body aspiration is most common in young children, the elderly, the intoxicated or the intellectually impaired. A history of coughing and/or choking that precedes development of stridor may be present. See the 'foreign body airway obstruction' section for more information.
- Pharyngeal abscess formation is usually associated with an onset of illness over days, a very sore throat, difficulty swallowing and a high fever. It is usually a complication of:
  - Bacterial pharyngitis in young children or
  - Tonsillitis in young adults or
  - Trauma from a foreign body.
- Anaphylaxis causing stridor is always associated with signs of systemic involvement, for example hypotension, bronchospasm or rash.
- Angioedema is a condition that results in intermittent, unpredictable and isolated swelling of the mouth, tongue and/or face, in the absence of systemic signs of anaphylaxis. Angioedema often occurs in patients taking aspirin or angiotensin-converting enzyme inhibitors. Angioedema may respond to nebulised adrenaline but do not administer adrenaline IM or IV. This is because angioedema does not improve with parenteral adrenaline and the risks from the adverse effects of adrenaline outweigh any possible benefits.

Backup

- Backup is rarely required provided personnel at the scene are able to administer nebulised adrenaline.
- Backup from an ICP should be requested if the patient is deteriorating despite nebulised adrenaline.

3.1 Assessment of non-traumatic chest pain

Introduction

Non-traumatic chest pain in patients over 35 years of age must be considered to be possible myocardial ischaemia until proven otherwise. The distribution of the autonomic nerve supply to the intra-thoracic and upper abdominal organs is such that the pain from myocardial ischaemia may mimic the pain from many other causes in terms of location, sensation and radiation. Personnel must have a very low threshold for firmly recommending that a patient with non-traumatic chest pain is transported to a medical facility by ambulance.

History

Taking a good history is usually the key to making a correct provisional diagnosis. Always begin by asking open questions.

Symptoms

Patients with myocardial ischaemia will usually describe central chest pain or discomfort which is dull, heavy or compressing in nature and radiates to their neck, jaw or arms. However, myocardial ischaemia may present with atypical symptoms including:

- Pleuritic or sharp pain.
- Epigastric (upper abdominal) pain.
- Burning or indigestion-like pain.
- Pain in the tongue or mouth.
- Breathlessness without pain.
- Fatigue.
- A feeling of impending doom.

Some patients have silent myocardial ischaemia without typical pain or discomfort. Patients with autonomic neuropathy are at particular risk of this because the pain of myocardial ischaemia is carried by autonomic nerves. Patients who are elderly or have diabetes are at increased risk of having autonomic neuropathy. They may present with shortness of breath, fatigue, weakness, non-specific malaise or light-headedness. However, it is rare for a patient to develop silent ST elevation myocardial infarction (STEMI) and if this is suspected personnel should seek clinical advice prior to treating the patient as having STEMI.

Women, in comparison to men, are more likely to have myocardial ischaemia under-recognised and more likely to present with atypical features. Women are also less likely to have a 12 lead ECG acquired and this appears to be partly due to a higher threshold to acquire a 12 lead ECG. It is important that the investigations are determined by the nature of the clinical presentation and not by the gender of the patient.

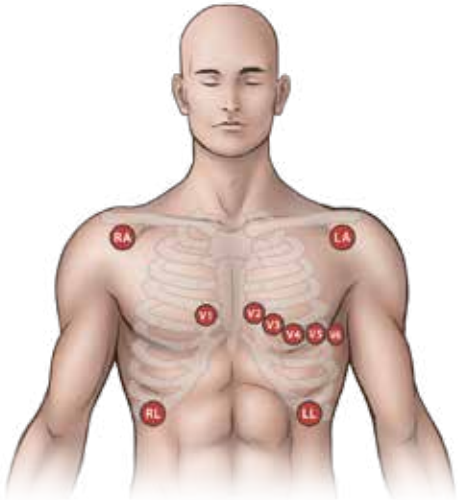
Investigations and examination

A 12 lead ECG should be obtained in all patients with either typical or atypical symptoms, noting that a normal 12 lead ECG does not rule out myocardial ischaemia. Up to 50% of patients having an acute myocardial infarction have a 12 lead ECG that is normal initially. In the absence of a clear diagnosis, a 12 lead ECG should be repeated every 10-15 minutes, up to three times looking for evolving ECG changes.

Although a patient with myocardial ischaemia may be pale and sweaty, physical examination usually reveals no significant abnormality.

12-lead ECG lead placement

- Limb leads:
  a) Place the RA (right arm), LA (left arm), RL (right leg) and LL (left leg) electrodes on the torso if feasible. If placement on the torso is not feasible, place the electrodes on the limbs.
  b) Ensure the leads are an equal distance from the centre of the chest.
- Precordial leads:
  a) V1: find the sternal angle. Directly lateral to this is the second rib and below this is the second intercostal space. Move down to the fourth intercostal space and place on the right side of the sternum.
  b) V2: place on the left side of the sternum in the fourth intercostal space, opposite V1.
  c) V4: move down to the fifth intercostal space and place in the mid-clavicular line.
  d) V3: place midway between V2 and V4.
  e) V6: move along the fifth intercostal space and place in the mid-axillary line.
  f) V5: place midway between V4 and V6 in the fifth intercostal space.



Additional leads

- V4R:
  a) Shift the V4 lead to the fifth intercostal space in the midclavicular line on the right side of the chest.
  b) Leave all of the other leads in the usual position.
  c) Clearly label the V4 lead on the 12 lead ECG as V4R.
- Posterior leads:
  a) V8: place just below the tip of the left scapula.
  b) V7: place in the left posterior axillary line in the same intercostal space as V8.
  c) V9: place midway between V8 and the spine.
  d) Move the V4-V6 leads to the new electrodes: V4 to V7, V5 to V8 and V6 to V9.
  e) Clearly label the 12 lead ECG as a posterior ECG and label V4 as V7, V5 as V8 and V6 as V9.

12 lead ECG acquisition in women

- Specific consent is required prior to acquiring a 12 lead ECG in women.
- The absence of a female within the crew or the presence of a single crew member (including a male) must not prevent a 12 lead ECG from being acquired if one is indicated.
- It is preferable that a second person is present when the 12 lead ECG is acquired and this could include a family member.
- The patient's bra should remain on and the patient asked to undo the bra to aid accurate lead placement.
- ECG electrodes should be placed over breast tissue, rather than under breast tissue.

Troubleshooting

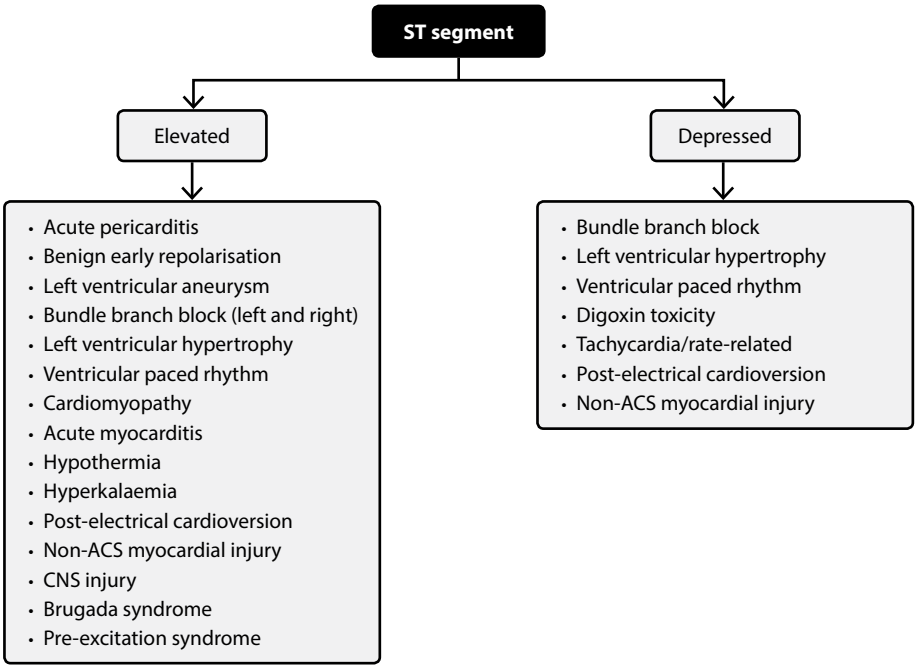
- Wandering baseline can be caused by patient movement, poor skin contact with electrodes, respiratory interference or lead movement.
- When placing electrodes, avoid placing on large muscles or over bony prominences.
- Artifact can be caused by: loose connections, crossed cables, patient movement and electrical interference, for example from an electric blanket.
- Limb lead reversal: the aVR lead complex should be primarily below the isoelectric line. If it is primarily above the isoelectric line, it is likely the limb leads have been placed on the wrong limb.

12 lead ECG interpretation

- All monitors provide an automated analysis of the 12 lead ECG. Although useful, this can be misleading and personnel must always independently analyse the ECG and take into account the clinical scenario before making a provisional diagnosis.
- EMTs must seek clinical advice or call for backup if the patient has significant symptoms and the automated analysis of the ECG is indicating STEMI.
- The 12 lead ECG criteria for STEMI are:
  a) More than or equal to 2 mm of ST elevation in two or more leads V1-3 or
  b) More than or equal to 1 mm of ST elevation in two or more contiguous leads in any other area (V4-6, I, II, III, aVL or aVF) or
  c) More than or equal to 1 mm of ST elevation in two or more contiguous posterior leads (V7-9) or
  d) Left bundle branch block that is known to be new.
- While clinically significant ST segment elevation is required for STEMI, other concurrent ECG changes can support the diagnosis, including T wave changes, evolving ST elevation, pathological Q waves and reciprocal changes.
- T wave changes:
  a) Early in STEMI the T waves may be tall and peaked. These are often referred to as hyperacute T waves.
  b) As STEMI progresses (over hours to a few days) the T waves may reduce and then invert.
  c) Myocardial ischaemia without STEMI is often associated with flattened or inverted T waves.
- Evolving ST elevation: if STEMI is present, the ST elevation will usually be evolving (changing or progressing) and this is often most evident when two or more ECGs are acquired approximately 15 minutes apart.
- Pathological Q waves:
  a) A Q wave that is one third (or more) of the height of the R wave and/or greater than 0.03 seconds wide is considered pathological.
  b) STEMI with a pathological Q wave is associated with increased tissue damage and higher mortality.
- Reciprocal changes:
  a) Two electrodes viewing the same area of the heart from opposite angles produce a mirror image on the ECG. Thus, ST elevation associated with STEMI should be mirrored by ST depression in reciprocal leads.
  b) For example, inferior and lateral (including high lateral) leads are reciprocal, as are septal and posterior leads.
  c) Reciprocal changes are not always required to diagnose STEMI, but if absent reduce the likelihood of STEMI.
- Isolated ST elevation in aVR may be associated with proximal occlusion of the left anterior descending artery.

STEMI mimics

- Only approximately 20% of patients with chest pain and ST elevation on their 12 lead ECG will be having STEMI. The other approximately 80% will have a STEMI mimic.
- There are a number of clinical conditions other than STEMI, which can cause ST elevation on a 12 lead ECG. Examples include left ventricular hypertrophy, pericarditis, myocarditis, left ventricular aneurysm, ventricular pacing, subarachnoid hemorrhage and myocardial contusion.
- There are a number of ECG abnormalities other than STEMI, which can cause ST elevation on a 12 lead ECG and most produce septal or anterior ST elevation. Examples include LBBB, RBBB and benign early repolarisation.
- LBBB is a very common mimic of septal and anterior STEMI.
  a) STEMI should only be considered likely if the LBBB is known to be new and the clinical presentation is consistent with STEMI.
  b) In most cases, there will not be a previous ECG to compare with and thus it will not be possible to confirm that the LBBB is new. In this setting the patient should not be treated as having STEMI unless there is clearly evolving ST elevation and the clinical presentation is consistent with STEMI.
  c) Recognition of STEMI with LBBB is possible using the Sgarbossa and modified Sgarbossa criteria. However, these criteria are complex, are not routinely taught and personnel are not expected to use them.



- Taking into account the information from automated analysis, consider a STEMI mimic to be likely if:
  a) The clinical presentation is inconsistent with STEMI or
  b) There is an absence of reciprocal ST depression or
  c) There is an absence of dynamic ST segment or T wave changes.

12 lead ECG territories

Lead I High Lateral	**aVR**	**Lead V1 Septal**	**Lead V4 Anterior**
Lead II Inferior	**Lead aVL High Lateral**	**Lead V2 Septal**	**Lead V5 Lateral**
Lead III Inferior	**Lead aVF Inferior**	**Lead V3 Anterior**	**Lead V6 Lateral**

Additional 12 lead ECG territory nomenclature:

- Anteroseptal: V1-V4.
- Anterolateral: V3-V6, I, and aVL.
- Extensive anterior: V1-V6.
- Inferolateral: II, III, aVF, V5, V6 and/or I, and aVL.
- Posterior: V7-V9.

Risk factors

Risk factors such as family history, smoking, obesity, hypertension, diabetes and hypercholesterolaemia are important. However, many patients without risk factors develop myocardial ischaemia and the presence or absence of risk factors should not form part of clinical decision making as to the likelihood of the patient having myocardial ischaemia.

Myocardial ischaemia can occur in relatively young people. Patients are at higher risk if they:

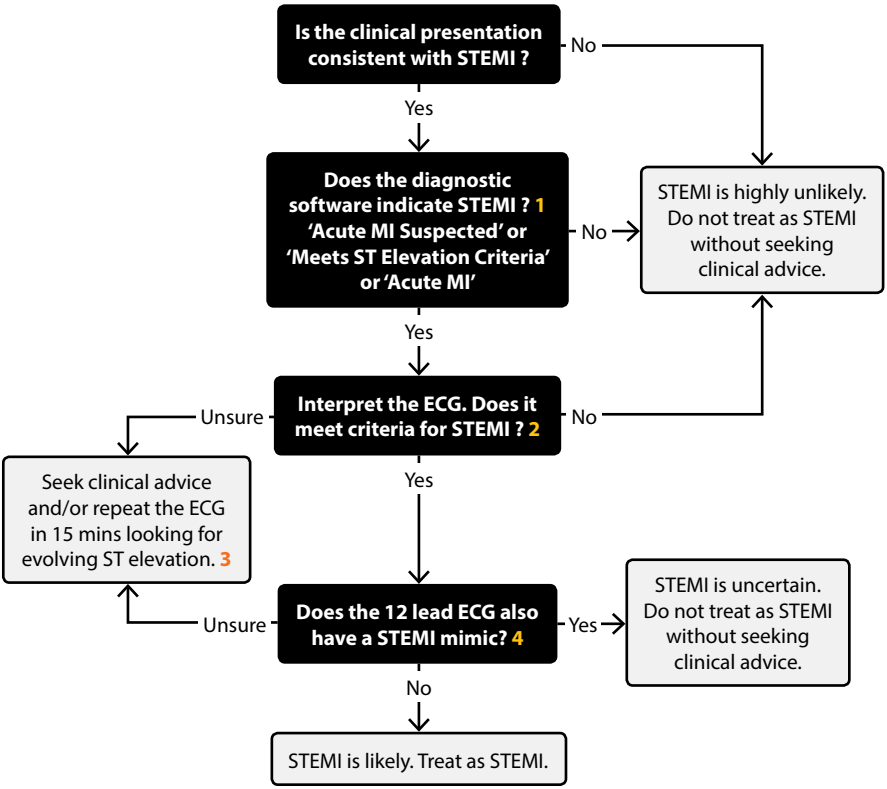
- Have a family history of ischaemic heart disease or
- Are diabetic or
- Have a personal or family history of a connective tissue disorder or
- Come from a high risk ethnic group. Indians and Fijian Indians are at very high risk. Māori and Pacific People are at increased risk.

It is possible for patients under 36 years of age to have myocardial ischaemia. The cause is not usually atherosclerosis of the coronary arteries, but may be from other conditions such as coronary artery spasm, coronary artery dissection or aortic dissection. If a patient less than 36 years of age has symptoms suggesting myocardial ischaemia the patient must be given a firm recommendation to be transported to a medical facility by ambulance.

Response to treatment

An apparently good response to antacid does not reliably indicate that the discomfort is caused by indigestion and an apparently good response to GTN does not reliably indicate that the discomfort is caused by myocardial ischaemia. The discomfort associated with myocardial ischaemia may change with time and the administration of medication may have a placebo effect.

STEMI diagnosis summary



1 EMTs should call for backup or seek clinical advice.
2 The presence of ST depression in reciprocal leads increases the likelihood of STEMI.
3 The presence of evolving ST elevation increases the likelihood of STEMI.
4 In particular: LBBB (anterior STEMI), RBBB (anterior STEMI), LVH (anterior STEMI), paced rhythm, benign early repolarisation.

3.2 Myocardial ischaemia

This section is for adults, including those with silent myocardial ischaemia.

- Acquire a 12 lead ECG.
  a) Acquire an additional 12 lead ECG using a V4R lead position if an inferior STEMI is suspected.
  b) Acquire an additional 12 lead ECG using V7-9 posterior lead positions if a posterior STEMI is suspected.
- See the 'STEMI' section if the patient has STEMI.
- Administer oxygen if required to achieve an SpO_2 ≥94%.
- Administer 300 mg of aspirin PO provided the patient is not in the third trimester of pregnancy.
- Administer 0.4 mg of GTN SL provided that:
  a) The systolic BP is greater than 100 mmHg and
  b) The heart rate is greater than 40/minute and less than 130/minute.
- Repeat GTN every 3-5 minutes provided it relieves symptoms.
- Use GTN with caution and increase the dosing frequency to 10 minutes if the patient:
  a) Has STEMI or
  b) Is small, frail, or physiologically unstable or
  c) Has poor perfusion or
  d) Has dysrhythmia or
  e) Has taken a drug for erectile dysfunction in the last 24 hours or
  f) Has known aortic or mitral stenosis.
- Gain IV access if the patient has:
  a) Significant pain or
  b) STEMI or
  c) Dysrhythmia or
  d) Poor perfusion or signs of shock.
- Administer an opiate if pain is significant. This should be morphine unless fentanyl is specifically indicated.

Referral

- All patients with suspected myocardial ischaemia must receive a firm recommendation to be transported to a medical facility by ambulance.
- Transport should usually be to an ED, but may be to a medical centre if this is specifically set up and equipped to investigate patients with myocardial ischaemia.

Additional information

The timing of 12 lead ECG acquisition

- Whenever feasible a 12 lead ECG should be acquired prior to providing treatment.
- Treatment may be provided prior to acquiring a 12 lead ECG if acquisition is going to be significantly delayed, but GTN must be administered with caution, because the patient may have STEMI.

Automated analysis and interpretation of the 12 lead ECG

- Most monitors provide automated analysis and interpretation of the 12 lead ECG. This utilises diagnostic software that has limitations.
- The information provided by automated analysis is useful but can also be misleading. Always independently analyse the ECG and take into account the clinical scenario before making a provisional diagnosis.
- If the automated analysis is not indicating the presence of STEMI, the likelihood that the patient is having a STEMI is very low and the patient should not be treated as having STEMI without seeking clinical advice.
- If the automated analysis is indicating STEMI, the likelihood that the patient has STEMI is only approximately 20% and personnel must take into account the clinical scenario in addition to considering the possibility of a STEMI mimic.

Atypical symptoms

- Some patients have atypical pain or discomfort, including any combination of face, jaw, neck, arm or upper abdominal discomfort.
- Use this section if you suspect atypical symptoms are due to myocardial ischaemia.

Silent myocardial ischaemia

- Some patients have silent myocardial ischaemia without pain or discomfort.
- Patients who are elderly or have diabetes are particularly at risk of this because they may have autonomic neuropathy.
- Symptoms may include shortness of breath, fatigue, weakness, non-specific malaise or light-headedness.
- To make a provisional diagnosis of silent myocardial ischemia there must be signs of myocardial ischaemia on the 12 lead ECG. These signs include ST depression, T wave inversion and T wave flattening.
- The predominant indication for GTN is the presence of chest pain or discomfort, but GTN may be administered if the patient has silent myocardial ischaemia. Only administer repeat doses of GTN if it is clearly associated with improvement of the signs of ischaemia on the 12 lead ECG.

Opiate administration

- Although morphine usually causes more vasodilation than fentanyl, morphine is the preferred opiate unless signs of low cardiac output are present.
- Registry data indicates an association between opiate administration and an increase in mortality rate in patients with an acute coronary syndrome. It is not clear why this association exists, but it is possible that it is due to reduced absorption of anti-platelet drugs as a result of reduced gastro-intestinal motility and/or an increased risk of vomiting. Opiates should not be withheld but have a low threshold for administering an anti-emetic.

Backup

- EMTs must seek clinical advice or call for backup if the patient has significant symptoms and the automated analysis of the ECG is indicating the presence of STEMI.
- Backup is not required if the patient has significant relief of symptoms following GTN and has near normal vital signs.
- Backup from a Paramedic or ICP should be requested if the patient has significant pain despite GTN, noting that most patients do not require an ICP.
- Backup from an ICP must be requested if the patient has:
  - Bradydysrhythmia or
  - Tachydysrhythmia or
  - Signs of shock.

3.3 ST elevation myocardial infarction (STEMI)

This section is for adults with STEMI.

- Be prepared to treat cardiac arrest but do not routinely attach defibrillation pads.
- Begin transport without delay, providing most treatments en route.
- Transmit the ECG to the STEMI Coordinator.
- Commence the process of arranging transport direct to a hospital with facilities for immediate primary percutaneous coronary intervention (primary PCI) if the diagnosis of STEMI is clear.
- Complete the fibrinolytic therapy/PCI checklist.
- Discuss the patient with the STEMI Coordinator and determine if the reperfusion pathway is primary PCI or fibrinolytic therapy. Ensure there is explicit discussion if there is 'yes' or 'unsure' to any of the checklist questions.
- Only administer oxygen if required to achieve an SpO_2 ≥94%.
- Administer 300 mg of aspirin PO.
- Gain IV access, preferably in the left arm.
- Administer GTN with caution and withhold GTN if signs of low cardiac output are present. GTN in 0.4 mg doses may be administered provided that:
  a) The systolic BP is greater than 100 mmHg and
  b) The heart rate is greater than 40/minute and less than 130/minute.
- Repeat GTN every 10 minutes only if it clearly relieves symptoms.
- Administer an opiate if pain is significant, using caution if GTN has been administered.
- Transport the patient direct to a hospital with the facilities for primary PCI provided the patient can clearly be transported there within 90 minutes of the diagnosis being made.
- Administer fibrinolytic therapy if the patient cannot be clearly transported to a hospital with the facilities to provide primary PCI within 90 minutes of the diagnosis being made.

Fibrinolytic therapy/PCI checklist

- Does the patient have any of the following absolute contraindications to fibrinolytic therapy?
  - Suspected aortic dissection.
  - Major surgery, major trauma or severe brain injury within the last six weeks.
  - Intracranial surgery within the last six months.
  - Ischaemic stroke within the last six months.
  - Previous intracerebral haemorrhage.
  - Known cerebral aneurysm, arterio-venous malformation or tumour.

- Does the patient have any of the following cautions to fibrinolytic therapy?
  - More than 10 minutes of CPR.
  - Non-compressible vascular puncture (including organ biopsy) within the last 24 hours.
  - Internal bleeding within the last six weeks.
  - Lumbar puncture or epidural insertion within the last six weeks.
  - TIA within the last three months.
  - Known bleeding disorder.
  - Taking warfarin or dabigatran. Note: if the patient is taking warfarin document their last known INR result if possible.
  - Systolic BP greater than 180 mmHg or diastolic BP greater than 110 mmHg.
  - Known to be pregnant or less than two weeks postpartum.
- Are any of the following present?
  - The time of onset of symptoms was greater than 12 hours ago.
  - The patient is dependent on others for their activities of daily living.
  - The patient has comorbidities that severely limit their functioning.
  - The patient has another disease, for example metastatic malignancy, that significantly shortens their life expectancy.
  - The patient is very frail.

Referral

- All patients with STEMI must receive a firm recommendation to be transported to hospital by ambulance.
- Transport direct to a hospital with the facilities for immediate PCI whenever this is feasible and safe.
- Transport to hospital may occur via a medical centre if fibrinolytic therapy is going to be provided by medical centre staff.

Additional information

General

- Patient outcomes are improved if the occluded coronary artery is reperfused (opened) as soon as possible.
- The STEMI Coordinator will determine the reperfusion pathway (primary PCI or fibrinolytic therapy) in discussion with ambulance personnel.
- Primary PCI will usually be the chosen reperfusion pathway, provided the patient can be clearly transported to a hospital with the facilities to provide immediate PCI within 90 minutes of the diagnosis being made.
- If primary PCI is not the chosen reperfusion pathway, fibrinolytic therapy should be initiated as soon as possible provided it is not contraindicated. The 90 minute transport time interval described above for primary PCI is such that in many areas of New Zealand the most appropriate reperfusion pathway will

be fibrinolytic therapy.

- Patients receiving fibrinolytic therapy will be immediately transported to a hospital with the facilities to provide immediate (or 'rescue') PCI, provided the patient is appropriate to receive 'rescue' PCI in the event of failure of reperfusion.
- IV access is preferably gained in the left arm because if the patient has primary PCI the cardiologist will usually gain access via the right radial artery.
- Silent STEMI is rare and if this is suspected clinical advice must be sought prior to treating the patient as having STEMI.

ECG transmission

- If the patient clearly meets criteria for having STEMI the 12 lead ECG must be transmitted to the STEMI Coordinator whenever possible.
- Following completion of the fibrinolytic therapy/PCI checklist, personnel must speak to the STEMI Coordinator. The role of the STEMI Coordinator is to determine the treatment pathway in discussion with personnel, determine which hospital the patient will be transported to and activate cardiac catheter room staff if required.
- Personnel should speak to the STEMI Coordinator if the 12 lead ECG cannot be transmitted. Additional options for transmission include texting a photograph of the 12 lead ECG.
- Personnel should transmit the 12 lead ECG to the Clinical Desk and seek clinical advice if there is uncertainty if STEMI is present.
- Personnel should seek clinical advice if they are unable to speak to the STEMI Coordinator.
- If neither transmission nor a phone call is possible, personnel should initiate treatment and speak to the STEMI Coordinator or seek clinical advice, as soon as possible. Treatment should include initiating fibrinolytic therapy provided it is clear the patient is having STEMI and no contraindications exist.

The fibrinolytic therapy/PCI checklist

- The items within the checklist all place the patient at increased risk of bleeding with both fibrinolytic therapy and primary PCI.
- Aortic dissection may involve the coronary arteries and cause STEMI. Aortic dissection usually presents with a sudden onset of severe pain that is maximal at the time of onset and often described as sharp, tearing or stabbing and may radiate to the back.
- Major surgery is any form of surgery where if subsequent bleeding developed, it could be life-threatening. Examples include surgery within a body cavity (for example the chest or abdomen), surgery involving the spine and any form of joint replacement.

- Major trauma is trauma severe enough to cause an injury where if subsequent bleeding developed, it could be life-threatening. Examples include multiple rib fractures, intra-abdominal injury and pelvic fractures.
- Severe brain injury is an injury that was severe enough to result in an injury visible on a CT scan.
- Intracranial surgery includes any operation or procedure involving the brain.
- Ischaemic stroke within the last six months includes thrombotic and embolic strokes. It is possible for an area of dead brain from a recent ischaemic stroke to be converted into a haemorrhagic stroke if fibrinolytic therapy is administered.
- Previous intracerebral haemorrhage includes all forms of previous bleeding within the brain.
- A cerebral aneurysm is a known weakness in the wall of a cerebral artery causing dilation of the vessel. If the patient has not heard the term 'cerebral or brain aneurysm' it is highly unlikely the patient has one.
- An arterio-venous (AV) malformation is an abnormal connection between an artery and a vein. The vein is exposed to arterial pressure because there is no capillary bed to reduce the pressure and the vein dilates and may rupture. If the patient has not heard of the term 'AV malformation' it is highly unlikely the patient has one.
- A cerebral tumour is any form of brain tumour (primary or metastatic).
- Non-compressible vascular puncture includes any invasive procedure involving a non-compressible organ (for example liver or kidney biopsy) or a blood vessel (for example a subclavian central line).
- Internal bleeding includes gastrointestinal bleeding, bleeding from the urinary tract and bleeding from the lung. 'Coffee-ground' vomit is very non-specific and is not a reliable clinical sign of gastrointestinal bleeding.
- A lumbar puncture is a procedure in which a needle is inserted between two lumbar vertebrae, most commonly to collect cerebrospinal fluid for diagnostic testing. An epidural insertion is a procedure in which a needle is inserted between two vertebrae, most commonly for the placement of a local anaesthetic agent. Following recent lumbar puncture or epidural insertion, the administration of fibrinolytic therapy may cause bleeding into the spine resulting in paraplegia.
- Hypertension significantly increases the risk of intracranial bleeding following fibrinolytic therapy. However, fibrinolytic therapy may be safely administered if the hypertension is controlled, for example using GTN and/or IV metoprolol.

Primary PCI pathway

- If it is clear that the patient can be transported to a hospital with the facilities for immediate PPCI within 90 minutes of the diagnosis of STEMI, personnel should begin transport toward that hospital while completing the fibrinolytic therapy/PCI checklist and contacting the STEMI Coordinator.

- The patient must be transported directly to the hospital with PCI facilities from the scene (this will often mean bypassing other hospitals) by the most expeditious means. A helicopter should be used if doing so will clearly save more than 15 minutes in total transport time, including transfer time from the helicopter pad to the hospital.
- Neither ticagrelor or clopidogrel are administered in the out-of-hospital setting if the patient is on the PCI pathway and a decision on administration will be made once the patient is in hospital.
- The STEMI Coordinator will activate cardiac catheter room staff.
- Personnel must notify receiving hospital staff prior to arrival that the patient is on the primary PCI pathway.
- The patient should usually be transferred directly to the cardiac catheter room on the ambulance stretcher, provided cardiac catheter room staff are ready.

Fibrinolytic therapy pathway

- If it is clear that the patient cannot be transported to a hospital with the facilities for immediate PCI within 90 minutes of the diagnosis of STEMI, personnel should complete the fibrinolytic therapy/PCI checklist and begin preparation for administering fibrinolytic therapy while contacting the STEMI Coordinator.

Fibrinolytic therapy being provided at a medical centre

- If fibrinolytic therapy is being provided at a medical centre en route to hospital:
  - The patient should remain in the ambulance if possible.
  - The patient should remain on the ambulance stretcher if taken into the medical centre, if possible.
  - Appropriate backup should be requested as soon as possible.

If cardiac arrest occurs

- Treat as per usual.
- Proceed with the chosen reperfusion pathway if ROSC occurs and the patient quickly regains consciousness, or has been intubated with an endotracheal tube.
- Transport the patient to the nearest appropriate hospital if ROSC occurs and the patient remains unconscious and has not been intubated with an endotracheal tube.
- Seek urgent clinical advice regarding the possibility of administering fibrinolytic therapy if ROSC does not occur within five minutes and fibrinolytic therapy has not yet been administered.
- Update the STEMI Coordinator when the patient's clinical course is clear and it is feasible to do so.

Backup

- Backup must be requested from a Paramedic or an ICP, noting that ICP backup is not always required.
- Backup from an ICP must be requested if the patient has:
  - Bradydysrhythmia or
  - Tachydysrhythmia or
  - Signs of shock.
- EMTs should call for immediate backup and begin the process of completing the fibrinolytic therapy/PCI checklist if they are confident the patient has STEMI.
- EMTs should seek clinical advice if they are uncertain of the diagnosis and the patient has significant symptoms and the automated analysis of the ECG is indicating the presence of STEMI.

3.4 Fibrinolytic therapy

This section is for adults receiving fibrinolytic therapy for STEMI. Provide the following treatment in addition to the treatment described within the 'STEMI' section.

- Prepare to treat cardiac arrest but do not routinely attach defibrillation pads.
- Gain IV access, preferably in both arms.
- Administer 1-2 mg metoprolol IV every 5-10 minutes for hypertension, only if instructed to do so by the STEMI Coordinator or the on call doctor.
- Determine the patient's known or estimated weight.
- Begin transport and provide treatment en route if feasible.

If the patient is aged less than 75 years

- Administer 300 mg of clopidogrel PO.
- Administer tenecteplase IV as per the dosing table below.
- Administer 5000 units of heparin IV approximately 15 minutes after tenecteplase.
- Administer enoxaparin SC as per the dosing table below.

Weight	Tenecteplase (dose IV)	Tenecteplase (volume IV)	Enoxaparin (dose SC)	Enoxaparin (volume SC)
<60 kg	30 units	6 ml	60 mg	0.6 ml
60-69 kg	35 units	7 ml	70 mg	0.7 ml
70-79 kg	40 units	8 ml	80 mg	0.8 ml
80-89 kg	45 units	9 ml	90 mg	0.9 ml
≥90 kg	50 units	10 ml	100 mg	1 ml

If the patient is aged 75 years or older

- Administer 75 mg of clopidogrel PO.
- Administer tenecteplase IV as per the dosing table below.
- Do not administer heparin IV.
- Administer enoxaparin SC as per the dosing table below.

Weight	Tenecteplase (dose IV)	Tenecteplase (volume IV)	Enoxaparin (dose SC)	Enoxaparin (volume SC)
<60 kg	15 units	3 ml	45 mg	0.45 ml
60-69 kg	17.5 units	3.5 ml	50 mg	0.5 ml
70-79 kg	20 units	4 ml	60 mg	0.6 ml
80-89 kg	22.5 units	4.5 ml	70 mg	0.7 ml
≥90 kg	25 units	5 ml	75 mg	0.75 ml

Post fibrinolytic therapy

- Transport the patient to the hospital determined by the STEMI Coordinator.
- Record the patient's blood pressure, heart rate and capillary refill time every 10 minutes.
- Monitor the patient closely for signs of bleeding.
- Acquire and transmit a 12 lead ECG to the STEMI Coordinator 60 minutes after administering the tenecteplase, or if there is any significant change in the patient's condition. Contact the STEMI Coordinator following transmission and provide an update on the patient's condition.

Additional information

General

- Bilateral IV access is preferred but do not delay commencing treatment to achieve this if IV access is difficult. Large bore IV access is not required and 18 or 20 gauge cannulae are sufficient.
- Fibrinolytic therapy may be administered via IO access if IV access cannot be obtained, but the IO access must be very secure.
- The patient will usually be transported to a hospital with the facilities to provide immediate percutaneous coronary intervention (PCI), without waiting to determine whether or not there are signs of reperfusion. This is so that if the patient requires 'rescue' PCI (urgent PCI for failure of reperfusion following fibrinolytic therapy) they are already in the most appropriate hospital.
- Approximately 35% of patients will require 'rescue' PCI.
- If it is not feasible (for example due to weather) to transport the patient directly to a hospital with the facilities to provide immediate PCI, transport the patient to the most appropriate hospital ensuring that the STEMI Coordinator is informed. The patient will then be subsequently referred to a cardiologist.
- The patient must be transported by a Paramedic or an ICP following fibrinolytic therapy.

Informed consent

- Written consent is not required for fibrinolytic therapy, but the patient needs to provide informed consent. For example:
  - Inform the patient they are having a 'heart attack' and that this is life-threatening. The heart attack is due to a clot blocking one of the blood vessels in the heart.
  - Their heart recording has been seen by a hospital doctor who has approved the administration of a clot busting drug.
  - The clot busting drug helps dissolve clots and this reduces the chances that they will die or be left with permanent heart damage. The earlier the clot

busting drug is administered, the more likely it is to work.
  - Rarely the clot busting drug can cause bleeding, for example from wounds or inside the body. Very rarely this bleeding can cause death.
  - There is good evidence that clot busting drugs are more likely to help the patient than to harm them.

Complications following fibrinolytic therapy

- Treat the patient using the appropriate section if complications from STEMI occur.
- Seek advice from the STEMI Coordinator if complications from fibrinolytic therapy occur. If the STEMI Coordinator cannot be contacted, seek urgent clinical advice.

3.5 Cardiogenic pulmonary oedema

This section is for adults. Seek clinical advice if the patient is a child. Do not use this section for the treatment of pulmonary oedema associated with drowning, aspiration or negative pressure pulmonary oedema.

- Acquire a 12 lead ECG.
- Administer 0.8 mg of GTN SL provided that:
  a) The systolic BP is greater than 100 mmHg and
  b) The heart rate is greater than 40/minute and less than 130/minute.
- Gain IV access if the patient has:
  a) Significant respiratory distress or
  b) Signs of poor perfusion.
- Continue to administer 0.8 mg of GTN every 3-5 minutes if the patient is not improving.
- Use GTN with caution and increase the dosing frequency to 10 minutes if the patient:
  a) Has STEMI or
  b) Is small, frail, or physiologically unstable or
  c) Has poor perfusion or
  d) Has dysrhythmia or
  e) Has taken a drug for erectile dysfunction in the last 24 hours or
  f) Has known aortic or mitral stenosis.
- Paramedics and ICPs may increase the dose and frequency of GTN administration if the patient is not improving, provided the systolic blood pressure is greater than 100 mmHg.
- Morphine in 1-2 mg doses IV may be administered for severe anxiety and/or respiratory distress.

CPAP

- Apply CPAP at 10 cmH_2O if the patient has:
  a) Severe respiratory distress despite treatment or
  b) An SpO_2 less than 92% despite treatment.
- Note that a lower SpO_2 threshold of less than 88% should be used if the patient also has CORD.
- Use CPAP with caution if the patient has an altered level of consciousness or signs of shock.

PEEP

- If CPAP is unavailable apply PEEP at 10 cmH_2O and increase this to 15 cmH_2O if the patient is not improving.
- Use PEEP with caution if the patient has signs of shock.

Referral

- All patients treated for cardiogenic pulmonary oedema must be given a firm recommendation to be transported to a medical facility by ambulance.
- The medical facility should usually be an ED, unless the patient is rapidly improving and can be taken to a GP that knows the patient well.

Additional information

General

- Cardiogenic pulmonary oedema is most commonly caused by myocardial ischaemia involving the left ventricle.
- The best treatment is GTN.
- Morphine is not a treatment for cardiogenic pulmonary oedema but may be used for symptom relief of severe anxiety and/or severe respiratory distress.
- Allow the patient to adopt the most comfortable position, placing their legs in a dependent position if this is feasible.

Differentiating cardiogenic pulmonary oedema from asthma

- Pulmonary oedema may produce a wheeze that sounds like asthma. If the patient has no history of asthma, the wheeze is unlikely to be due to asthma and the possibility of cardiogenic pulmonary oedema should be considered.
- Cardiogenic pulmonary oedema is the likely diagnosis when the patient has been supine (for example in bed), the onset has been gradual over hours to days and the wheeze is worse bilaterally in the lower zones. The patient is often hypertensive, clammy and peripherally vasoconstricted.
- Asthma is the likely diagnosis if the onset is relatively rapid, associated with cough and the wheeze is evenly heard through all lung fields. The patient is usually normotensive and not peripherally vasoconstricted.
- The patient may have a history of both asthma and pulmonary oedema. In this setting the patient may be able to tell you which condition is causing the shortness of breath.

Differentiating cardiogenic pulmonary oedema from chest infection

- Crackles that are unilateral, limited to one lobe/area only, or exist in the presence of a productive cough or elevated temperature, are most likely to be caused by a chest infection and not pulmonary oedema.

Medicines for erectile dysfunction

- A range of medicines is used for erectile dysfunction and some (particularly sildenafil) are also used in the treatment of pulmonary hypertension.
- GTN may interact with such medicines if they have been taken within the last

24 hours, causing severe and prolonged hypotension.

- GTN is not contraindicated in this setting, but there must be a strong indication, the dose should be reduced to 0.4 mg and the dosing interval increased to 10 minutes. If in doubt seek clinical advice.

Negative pressure pulmonary oedema

- During any form of asphyxiation, negative pressure can develop within the thoracic cavity as a result of inspiratory efforts occurring against a closed airway.
- This negative pressure can result in the rapid development of pulmonary oedema because the pressure gradient generated between lung capillaries and alveoli can result in fluid moving from capillaries into alveoli.
- The patient will have signs and symptoms of pulmonary oedema and will also usually have signs of hypovolaemia because the fluid that has entered the lungs has come from the circulation.
- Do not administer GTN but it is appropriate to administer CPAP or PEEP.
- The patient is usually hypovolaemic and 0.9% sodium chloride IV may be indicated.

The physiological effects of CPAP and PEEP

- CPAP and PEEP improve oxygenation, improve ventilation and reduce the workload of breathing, via the following physiological effects:
  - Fluid within the airways causes areas of lung to collapse and this causes shunting of blood because these areas have blood supply but do not contribute to gas exchange. CPAP reduces shunting because the inspiratory pressure assists areas of the lung that have collapsed to expand (also called recruitment).
  - Wet lungs become stiff and this increases the workload of breathing. CPAP reduces this workload because the inspiratory pressure assists inspiration.
  - The expiratory pressure assists small and medium sized airways to remain open during expiration, preventing lung collapse by splinting the airways open. Preventing areas of lung from collapsing is important because once collapsed, significant additional pressures are required to re-expand them.
  - The positive pressure in the thoracic cavity reduces the preload (filling) of the right ventricle by reducing venous return to the heart (this will be further compounded by administration of GTN).
  - The positive pressure in the thoracic cavity increases the afterload (the pressure the ventricle must contract against) of the right ventricle. In combination with reduced venous return to the heart, this reduces blood flow through lung vessels, reducing the amount of fluid entering the lungs.
  - The expiratory pressure increases the amount of air remaining in the lungs at the end of expiration (also called the functional residual capacity) and this causes the lungs to be more expanded. From this more expanded

resting position, less work is required to inspire as a result of the non-linear compliance of the lungs, particularly when the lungs are wet.

CPAP or PEEP being provided during transport

- During transport it is vital that the patient and personnel are safe and this requires all people to be adequately restrained.
- It is not always possible for the patient to be provided with CPAP or PEEP during transport with personnel restrained. The risk to personnel of being unrestrained during transport must be balanced against the risk to the patient of not receiving CPAP or PEEP.
- If the patient is rapidly improving, personnel should consider remaining on scene for an additional period of time, so that the patient does not require CPAP or PEEP during transport.
- The following principles must be applied if personnel are unrestrained during transport:
  - There must be an explicit decision that the balance of risk is such that it is appropriate to transport the patient with personnel unrestrained and
  - The vehicle must be travelling at normal road speed (even if under lights) and
  - The driver must ensure that the nature of their driving is modified to keep personnel as safe as possible during transport.

Backup

- Backup is not required if the patient has significant relief of symptoms following GTN and has near normal vital signs.
- Backup from a Paramedic or ICP should be requested if the patient has significant discomfort from myocardial ischaemia.
- Backup from an ICP must be requested if the patient has:
  - STEMI or
  - Bradydysrhythmia or
  - Tachydysrhythmia or
  - Signs of shock.

3.6 Determining the level of cardiovascular compromise

The treatment provided to a patient with a dysrhythmia is determined by the level of their cardiovascular compromise. There is a continuum of compromise that begins at completely normal and ends at extremely severe. Determining the level of compromise requires clinical judgement that divides this into four categories.

Not compromised

The patient is not compromised if their vital signs are normal (ignoring heart rate which is abnormal by definition) and there are no symptoms of myocardial ischaemia present.

The assessment of the level of cardiovascular compromise can be further validated by a visual assessment of the status code. If the patient 'looks status four' the patient is not compromised.

Mildly compromised

The patient is mildly compromised if their vital signs are near normal (ignoring the heart rate which is abnormal by definition) or mild symptoms of myocardial ischaemia are present. For example, the patient is mildly compromised when there is:

- Near normal blood pressure and near normal peripheral capillary refill time or
- Normal level of consciousness or
- Normal or near normal breathing or
- Mild symptoms of myocardial ischaemia.

The assessment of the level of cardiovascular compromise can be further validated by a visual assessment of the status code. If the patient 'looks status three' the patient is mildly compromised.

Moderately compromised

The patient is moderately compromised if their vital signs are abnormal (ignoring the heart rate which is abnormal by definition), or significant symptoms of myocardial ischaemia are present. For example, the patient is moderately compromised when there is:

- Hypotension or prolonged capillary refill time or
- An altered level of consciousness with an ability to obey commands or
- Moderate shortness of breath or
- Significant symptoms of myocardial ischaemia.

The assessment of the level of cardiovascular compromise can be further validated by a visual assessment of the status code. If the patient 'looks status two' the patient is moderately compromised.

Severely compromised

The patient is severely compromised if their vital signs are markedly abnormal (ignoring heart rate which is abnormal by definition) such that there is a high risk of cardiac arrest unless immediate interventions are carried out. For example, the patient is severely compromised when there is:

- Severe hypotension, an unrecordable blood pressure or absent radial pulses (noting that the absence of a palpable pulse does not equate to a specific blood pressure) or
- An inability to obey commands or
- Severe shortness of breath.

The assessment of the level of cardiovascular compromise can be further validated by a visual assessment of the status code. If the patient 'looks status one' the patient is severely compromised.

Summary table

Not compromised	Mildly compromised
• Normal vital signs. • No symptoms of myocardial ischaemia. • 'Looks status four'.	• Near normal vital signs e.g. near normal BP and CRT, normal LOC, normal or near normal breathing. • Mild symptoms of myocardial ischaemia. • 'Looks status three'.
Moderately compromised	**Severely compromised**
• Abnormal vital signs e.g. hypotension or prolonged CRT, altered LOC but can obey commands, moderate shortness of breath. • Significant symptoms of myocardial ischaemia. • 'Looks status two'.	• Markedly abnormal vital signs e.g. severe hypotension, inability to obey commands, severe shortness of breath. • High risk of cardiac arrest. • 'Looks status one'.

3.7 Ventricular tachycardia

This section is for adults with sustained ventricular tachycardia (VT), or an undifferentiated broad complex tachycardia with a ventricular rate greater than or equal to 150/minute, provided the patient is not in cardiac arrest. Seek clinical advice if the patient is a child or the VT is secondary to poisoning.

- Attach defibrillation pads.
- Acquire a 12 lead ECG.
- Do not administer GTN, even if the patient has cardiac chest pain.
- Determine the level of cardiovascular compromise.

If the patient is not severely compromised

- Gain IV access and administer 300 mg of amiodarone IV over 30 minutes, provided you are more than 15 minutes from hospital.
- Administer a further 150 mg of amiodarone IV over 30 minutes if the patient remains in VT, provided you are more than 15 minutes from hospital.
- Administer amiodarone with caution if the patient is poorly perfused and reduce the rate of administration if there is a significant fall in blood pressure or cardiac output.

If the patient is severely compromised

- If the patient cannot obey commands:
  a) Cardiovert using maximum joules in synchronised mode. Repeat this once if there is no response.
  b) Attach and use a defibrillator in automatic mode if you cannot use it in manual mode.
- If the patient can obey commands: gain IV access, administer ketamine for sedation and cardiovert as above.

Referral

- All patients that have been in VT must be given a firm recommendation to be transported to an ED by ambulance.

Additional information

General

- The rhythm is broad complex if the QRS duration is greater than 0.12 seconds.
- In VT the ventricular rate is usually greater than 150/minute.
- VT is usually associated with cardiovascular compromise.
- A broad complex tachycardia in a compromised patient should be assumed to be VT and treated accordingly.

The timing of 12 lead ECG acquisition

- Whenever feasible a 12 lead ECG should be acquired prior to providing treatment because this may help medical staff determine the diagnosis and ongoing treatment.
- If the patient is severely compromised and rapidly deteriorating, it is acceptable to provide treatment prior to acquiring a 12 lead ECG but print a short rhythm strip if possible. For all other patients treatment should only be provided after acquiring a 12 lead ECG, unless acquisition is going to be significantly delayed.

Differentiating VT from SVT with abnormal conduction

- Supraventricular tachycardia (SVT) with abnormal conduction (for example bundle branch block) can mimic VT.
- Differentiating VT from SVT with abnormal conduction can be difficult. Treat the rhythm as VT if you are uncertain.
- VT is most likely if the patient is older, has ischaemic heart disease or is compromised.
- SVT with abnormal conduction is most likely if the patient is younger, does not have ischaemic heart disease or is not compromised. Successful previous treatment with adenosine is indicative of a history of SVT with abnormal conduction.
- No ECG interpretation method is completely accurate in this situation but the following ECG characteristics may help determine whether a rhythm is most likely to be VT or SVT with abnormal conduction:
  - Precordial concordance (where the QRS complexes in leads V1-6 are all either negative or positive) is more likely with VT.
  - The longer the QRS duration, the more likely it is to be VT.
  - Regular frequency of QRS complexes is more likely with VT.
  - Right axis deviation is more likely with VT.
  - Capture beats (narrow QRS complexes occurring within a run of broad complex tachycardia) indicate atrio-ventricular dissociation and are more likely with VT.
  - Fusion beats (when a normal and a wide complex QRS join to form a hybrid QRS complex within a run of broad complex tachycardia) indicate atrio-ventricular dissociation and are more likely with VT.

GTN and VT

- GTN is not administered for chest pain associated with VT because the risks outweigh the benefits.
- During VT the atria and ventricles are contracting independently of each other (also called atrio-ventricular dissociation). This causes a reduction in ventricular preload (or filling) through loss of the 'atrial kick', which in combination with abnormal ventricular contraction may cause a substantial fall in cardiac output.

- GTN reduces venous return to the heart and may further reduce cardiac output with the risk of precipitating severe hypotension or cardiac arrest.

Amiodarone and VT

- 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 should be administered if there is recurrent VT, even if the runs of VT spontaneously revert.

Sedation before cardioversion

- Sedation is required prior to cardioversion unless the patient cannot obey commands.
- Routinely administer oxygen and task one person to continually monitor the patient's SpO_2, breathing and level of consciousness.
- Have a manual ventilation bag and mask immediately available.
- Administer ketamine IV to achieve a dissociated state immediately prior to cardioversion. Typically 0.5 mg/kg of ketamine will be required for most patients.
- Administer additional doses of ketamine if required.
- Paramedics should seek clinical advice if sedation is required for cardioversion and an ICP is not immediately available.

VT secondary to poisoning

- VT occasionally occurs secondary to poisoning, particularly poisoning associated with cyclic antidepressants. The cardiac toxicity may be reduced by a large bolus of sodium ions which is best accomplished using 0.9% sodium chloride:
  a) For an adult administer 2-3 litres of 0.9% sodium chloride IV.
  b) For a child administer 40-60 ml/kg of 0.9% sodium chloride IV.
  c) If 8.4% sodium bicarbonate is immediately available or can be delivered to the scene within 10 minutes, administer 100 ml IV to an adult or 20 ml/kg to a child, in addition to sodium chloride.
- Amiodarone should not be administered in this setting because it can be associated with severe worsening of shock without resolution of the rhythm.

Backup

- Backup from an ICP must be requested if the patient is in VT.
- If backup from an ICP is not immediately available personnel should seek urgent clinical advice.

3.8 Supraventricular tachycardia

This section is for adults with supraventricular tachycardia (SVT) with a ventricular rate greater than or equal to 150/minute. If the patient is a child, seek clinical advice.

- Acquire a 12 lead ECG.
- Gain IV access.
- Exclude the possibility that the rhythm is sinus tachycardia secondary to another clinical condition. Only use this section if the dysrhythmia appears to be the primary problem.
- Determine the level of cardiovascular compromise.

If the patient is not compromised or mildly compromised

- Try up to two 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.
- Adenosine is contraindicated if the patient has:
  a) Known sick sinus syndrome without an internal pacemaker or
  b) Previous 2nd or 3rd degree heart block without an internal pacemaker or
  c) Had a previous heart transplant without an internal pacemaker.
- Use adenosine with caution if the patient has:
  a) Asthma or
  b) CORD.
- To administer adenosine:
  a) Do not routinely attach defibrillation pads.
  b) The preferred site of injection is the antecubital fossa.
  c) Administer 6 mg adenosine IV as a rapid bolus followed immediately by a rapid flush of a minimum of 20 ml of 0.9% sodium chloride.
  d) If the rhythm does not revert, repeat as above administering 12 mg adenosine IV.

If the patient is moderately compromised

- Try up to two Valsalva manoeuvres.
- Administer adenosine as above if the rhythm fails to revert.

If the patient is severely compromised

- Reconsider the diagnosis as it is rare for SVT to cause severe compromise.
- If the patient cannot obey commands:
  a) Cardiovert using maximum joules in synchronised mode. Repeat this once if there is no response. Do not continue to cardiovert if the rhythm does not revert.

b) Attach and use a defibrillator in automatic mode if you cannot use it in manual mode.

- If the patient can obey commands, cardiovert as above, administering sedation using ketamine prior to cardioversion.

In addition

- If myocardial ischaemia and/or pulmonary oedema are present, provide additional treatment using the appropriate section, noting that the focus is on treating the dysrhythmia.

Referral

- A patient whose rhythm reverts to sinus rhythm following a Valsalva manoeuvre or adenosine administration should be given a recommendation to see their GP non-urgently provided:
  a) There are no ongoing symptoms or signs of myocardial ischaemia and
  b) The patient is given a copy of their 12 lead ECG and access to a copy of the PRF, for their GP.

Additional information

General

- A narrow complex tachycardia is characterised by a QRS duration of less than 0.12 seconds.
- Owing to the presence of an accessory pathway, there is the potential for faster heart rates (approaching 200/minute) with a narrow complex tachycardia, compared with a broad complex tachycardia.
- A narrow complex tachycardia is normally well tolerated provided there is no significant underlying heart disease.

The timing of 12 lead ECG acquisition

- Whenever feasible a 12 lead ECG should be acquired prior to providing treatment because this may help medical staff determine the diagnosis and ongoing treatment.
- If the patient is severely compromised and rapidly deteriorating, it is acceptable to provide treatment prior to acquiring a 12 lead ECG but print a short rhythm strip if possible. For all other patients treatment should only be provided after acquiring a 12 lead ECG, unless acquisition is going to be significantly delayed.

SVT and cardiovascular compromise

- It is very important to differentiate SVT causing cardiovascular compromise from sinus tachycardia secondary to another clinical condition, such as cardiogenic shock, hypovolaemia, or sepsis.
- If the primary problem is SVT causing cardiovascular compromise, the patient will usually have been well before suddenly developing palpitations. If not, the diagnosis should be reconsidered.
- SVT does not usually cause cardiovascular compromise unless the patient has ischaemic heart disease.
- Only rarely does SVT cause severe cardiovascular compromise and this usually requires the heart rate to be very high (for example greater than 200/minute). If the patient has severe cardiovascular compromise the diagnosis must be reconsidered, to exclude other possibilities such as septic shock before providing treatment for SVT.

Differentiating SVT from atrial fibrillation

- When atrial fibrillation is very fast (ventricular rates of 160-200/minute) the rhythm can appear regular, like SVT.
- When the rhythm is SVT the heart rate recorded on the monitor does not usually vary by more than one or two beats per minute. If the rhythm is very fast atrial fibrillation the heart rate recorded by the monitor will usually vary.
- Printing the rhythm strip at 50 mm/second (if this is possible within the monitor configuration) may help to determine whether the rhythm is regular (and thus probably SVT) or irregular (and thus probably atrial fibrillation).
- If the rhythm is possibly atrial fibrillation and an accessory pathway is present, adenosine may precipitate VF. If you are uncertain, treat the rhythm as atrial fibrillation and not SVT.

Differentiating SVT from atrial flutter

- When atrial flutter has 2:1 block, the rhythm may appear to be SVT with a rate of 150/minute and it may be very difficult to tell between the two.
- Printing the rhythm strip at 50 mm/second (if this is possible within the monitor configuration) may allow the atrial flutter waves to be seen.
- If there is uncertainty, treat the rhythm as atrial flutter and not SVT.

The Valsalva manoeuvre

- A Valsalva manoeuvre creates a sustained positive pressure in the thorax. This causes a reduction in venous return which causes sympathetic nervous system stimulation. When spontaneous breathing recommences, a sudden increase in arterial pressure results in vagal stimulation that may terminate SVT in approximately 40% of patients.
- Patients require coaching to produce a good Valsalva manoeuvre:
  a) Place the patient in a sitting position.
  b) Ask the patient to blow as hard as possible into a 10 or 20 ml syringe to try and move the plunger.
  c) Continue the manoeuvre for a minimum of 15-20 seconds.
  d) When the patient stops blowing, simultaneously lay the patient flat and raise their legs.
- If cardioversion occurs, it usually occurs after the end of the Valsalva manoeuvre.
- Do not perform carotid sinus massage because of the risk of causing a stroke.

Adenosine

- Do not administer adenosine if the patient is severely compromised and the rhythm does not revert with cardioversion. In this setting the rhythm is highly unlikely to be SVT and the risk of adenosine administration is very high.

Sedation before cardioversion

- Sedation is required prior to cardioversion unless the patient cannot obey commands.
- Administer oxygen and task one person to continually monitor the patient's SpO_2, breathing and level of consciousness.
- Have a manual ventilation bag and mask immediately available.
- Administer ketamine IV to achieve a dissociated state immediately prior to cardioversion. Typically 0.5 mg/kg will be required for most patients.
- Administer additional doses of ketamine if required.
- Paramedics should seek clinical advice if sedation is required for cardioversion and an ICP is not immediately available.

Backup

- Backup from an ICP must be requested if the patient is moderately or severely compromised and the rhythm does not revert following a Valsalva manoeuvre.

3.9 Atrial fibrillation or atrial flutter

This section is for adults with atrial fibrillation or atrial flutter who have cardiovascular compromise, particularly myocardial ischaemia. If the patient is a child seek clinical advice.

- Acquire a 12 lead ECG.
- Exclude the possibility that the dysrhythmia is secondary to another clinical condition. Only use this section if the dysrhythmia appears to be the primary problem.
- Gain IV access.
- Determine the level of cardiovascular compromise.

If the patient is not compromised or mildly compromised

- Do not provide specific treatment for the dysrhythmia.

If the patient is moderately compromised

- If the ventricular rate is persistently greater than 130/minute:
  a) Administer 300 mg of amiodarone IV over 30 minutes, provided the patient's systolic BP is greater than 100 mmHg and you are more than 15 minutes from hospital.
  b) Administer a further 150 mg of amiodarone IV over 30 minutes, using the same indications if the patient remains in atrial fibrillation or atrial flutter, provided you are more than 15 minutes from hospital.
  c) Use amiodarone with caution if the patient is poorly perfused and reduce the rate of administration if there is a significant fall in blood pressure.

If the patient is severely compromised

- Reconsider the diagnosis because it is very rare for atrial fibrillation or atrial flutter to cause severe compromise.
- If the patient cannot obey commands:
  a) Cardiovert using maximum joules in synchronised mode. Repeat this once if there is no response. Do not continue to cardiovert if the rhythm does not revert.
  b) If you cannot use a defibrillator in manual mode, use it in automatic mode and follow the instructions.
- If the patient can obey commands, cardiovert as above, administering ketamine prior to cardioversion.

In addition

- If myocardial ischaemia and/or pulmonary oedema are present, provide additional treatment using the appropriate section, noting that if fast atrial fibrillation or fast atrial flutter is present the focus is on treating the dysrhythmia.

Referral

- The patient should be given a firm recommendation to be transported to an ED by ambulance if:
  a) There is new onset atrial fibrillation or atrial flutter or
  b) Amiodarone is administered.
- The patient may be transported to a GP (preferably their own GP) if the atrial fibrillation is chronic, the ventricular rate is less than 130/minute and there are no symptoms of myocardial ischaemia.

Additional information

Atrial fibrillation

- It is uncommon for atrial fibrillation to be the primary cause of moderate cardiovascular compromise. When it does, a fast ventricular rate is usually causing myocardial ischaemia.
- It is rare for atrial fibrillation to be the primary cause of severe cardiovascular compromise. For this to occur it usually requires a combination of a very fast ventricular rate (160-200/minute) and ischaemic heart disease.
- If the patient is severely compromised, it is much more likely that there is another underlying condition such as septic shock and the diagnosis must be reconsidered prior to providing specific treatment for the dysrhythmia.

Atrial fibrillation and sepsis

- Atrial fibrillation is commonly associated with severe sepsis and/or high fever, particularly in the elderly.
- In this setting amiodarone is often associated with a dangerous fall in cardiac output and must be administered with caution.
- Amiodarone should only be administered in the setting of sepsis if the ventricular rate has failed to settle with 0.9% sodium chloride IV and cooling, and it is associated with significant symptomatic myocardial ischaemia.

Differentiating SVT from atrial fibrillation

- When atrial fibrillation is very fast (ventricular rates of 160-200/minute) the rhythm can appear regular, like SVT.
- When the rhythm is SVT the heart rate recorded on the monitor does not usually vary by more than one or two beats per minute. If the rhythm is very fast atrial fibrillation, the heart rate recorded by the monitor will usually vary.
- Printing the rhythm strip at 50 mm/second (if this is possible within the monitor configuration) may help to determine whether the rhythm is regular (and thus probably SVT) or irregular (and thus probably atrial fibrillation).
- If there is uncertainty, treat the rhythm as atrial fibrillation and not SVT.

Atrial flutter

- The atria contract at 300/minute and this usually appears like a 'saw tooth' pattern of P waves on the ECG.
- The ventricular rate is determined by the proportion of atrial contractions that are blocked. At 2:1 block the ventricular rate will be 150/minute, at 3:1 block the ventricular rate will be 100/minute etc. It is common for the block to vary over time and thus the ventricular rate may vary between relatively fixed rates of 60/minute, 75/minute, 100/minute, and 150/minute.
- It is uncommon for atrial flutter to be the primary cause of moderate cardiovascular compromise. When it does, a fast ventricular rate is usually causing myocardial ischaemia.
- It is rare for atrial flutter to be the primary cause of severe cardiovascular compromise. If a patient with atrial flutter is severely compromised, it is much more likely that there is another underlying condition such as cardiogenic shock or septic shock and the diagnosis must be reconsidered prior to providing specific treatment for the dysrhythmia.
- If the block is at 2:1, the rhythm may appear to be an SVT with a rate of 150/minute and in this setting it may be very difficult to decide between the two. Printing the rhythm strip at 50 mm/second (if this is possible within the monitor configuration) may allow the atrial flutter waves to be seen. If there is uncertainly, treat the rhythm as atrial flutter and not as SVT.

The timing of 12 lead ECG acquisition

- Whenever feasible a 12 lead ECG should be acquired prior to providing treatment because this may help medical staff determine the diagnosis and ongoing treatment.
- If the patient is severely compromised and rapidly deteriorating, it is acceptable to provide treatment prior to acquiring a 12 lead ECG but print a short rhythm strip if possible. For all other patients treatment should only be provided after acquiring a 12 lead ECG, unless acquisition is going to be significantly delayed.

Sedation before cardioversion

- Sedation is required unless the patient cannot obey commands.
- Administer oxygen and task one person to continually monitor the patient's SpO_2, breathing and level of consciousness.
- Have a manual ventilation bag and mask immediately available.
- Administer ketamine IV to achieve a dissociated state immediately prior to cardioversion. Typically 0.5 mg/kg will be required for most patients.
- Administer additional doses of ketamine if required.
- Paramedics should seek clinical advice if sedation is required for cardioversion and an ICP is not immediately available.

3.10 Cardioversion checklist

- Place pads in either the apex/sternum (recommended) or anterior/posterior position, in addition to ECG electrodes.
- Ensure the defibrillator is in manual mode.
- Select a lead with a visible R wave and ensure that artefact is minimised.
- Select synchronised mode.
- Confirm there is a detection symbol above every QRS complex.
- Ensure the patient has received adequate sedation if indicated.
- Select the joules, charge the defibrillator and confirm everyone is clear.
- Press and hold the shock button until the shock is delivered.
- Determine the rhythm and the level of cardiovascular compromise.
- If administering a second cardioversion, confirm the defibrillator is still in synchronised mode.

3.11 Bradycardia

This section is for adults with bradycardia. Bradycardia in children is usually due to hypoxia or hypovolaemia and treating the underlying cause takes priority over drug therapy.

- Acquire a 12 lead ECG and determine the rhythm.
- Gain IV access and provide appropriate treatment if there is a clear underlying cause.
- Initiate treatment if the heart rate is less than 50/minute and there is moderate or severe cardiovascular compromise.

If the rhythm is third degree heart block or an undifferentiated broad complex bradycardia:

a) Initiate transcutaneous pacing.
b) Stop pacing and administer adrenaline IV if the bradycardia is unresponsive to pacing.

- To administer adrenaline IV, place 1 mg adrenaline into a 1 litre bag of 0.9% sodium chloride:
  a) Administer as an IV infusion. Start at 2 drops per second and adjust the rate to the patient's condition or
  b) Administer 0.01 mg (10 ml) IV every 1-2 minutes.

If the rhythm is sinus bradycardia, nodal bradycardia, first degree heart block, second degree heart block or an undifferentiated narrow complex bradycardia:

a) Administer 0.6 mg atropine IV. Administer further doses (without a maximum dose) as required if the bradycardia is responsive to atropine.
b) Administer adrenaline IV if the bradycardia is unresponsive to atropine.
c) Stop adrenaline administration and initiate pacing if the bradycardia is unresponsive to adrenaline IV.

Transcutaneous pacing checklist

- Place the pads in either the anterior/posterior (recommended) or apex/sternum position in addition to ECG electrodes.
- Select a lead with a visible R wave and ensure artefact is minimised.
- Select pacing.
- Confirm there is a detection symbol above every QRS complex.
- Confirm pacing is in demand mode (not applicable to all models).
- Set the pacing rate to 70/minute.
- Select current and increase this until pacing capture occurs. Confirm there is a pacing spike before each QRS complex.

- Increase the current 10 mA above the capture threshold.
- Administer fentanyl and add low dose ketamine if required.
- Confirm there is mechanical capture with a palpable pulse, an improvement in the SpO_2 waveform or other signs of increased cardiac output.
- Increase the pacing rate to 80/minute if there is electrical capture, but no signs of increased cardiac output.
- Change to fixed or non-demand mode (not applicable to all models) if pacing is ineffective due to artefact.

Referral

- All patients treated for bradycardia must be given a firm recommendation to be transported to an ED by ambulance.

Additional information

General

- Bradycardia in adults is most commonly caused by:
  - Myocardial ischaemia, particularly when the sinoatrial node or atrioventricular node is ischaemic. Inferior myocardial ischaemia is much more likely to involve these nodes than anterior or antero-lateral myocardial ischaemia.
  - Structural heart disease involving the sinoatrial node, atrioventricular node or the conduction system. This is most common in elderly patients.
- Bradycardia caused by a problem high in the conduction system, for example at the level of the sinoatrial node or atrioventricular node, is most likely to be responsive to atropine or adrenaline. This is why in this setting pacing is reserved for failure of the bradycardia to respond to these medicines.
- Bradycardia caused by a problem low in the conduction system, for example below the atrioventricular node, is most likely to be responsive to pacing. This is why in this setting adrenaline is reserved for failure of the bradycardia to respond to pacing.

The timing of 12 lead ECG acquisition

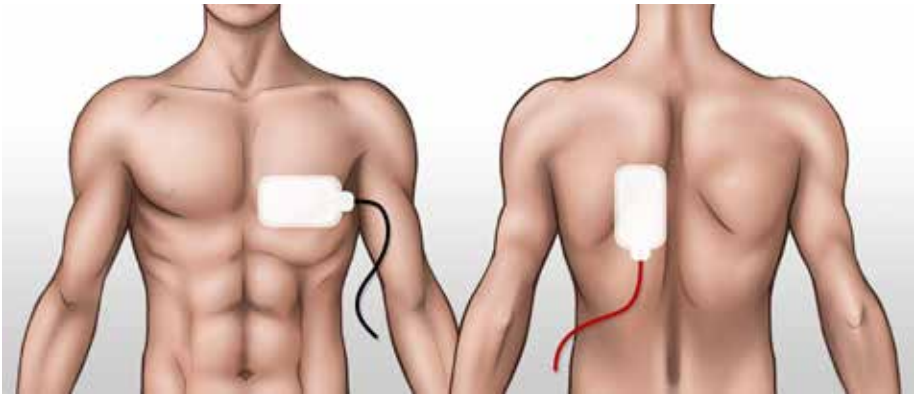
- Whenever feasible a 12 lead ECG should be acquired prior to providing treatment because this may help medical staff determine the diagnosis and ongoing treatment.
- If the patient is severely compromised and rapidly deteriorating, it is acceptable to provide treatment prior to acquiring a 12 lead ECG but print a short rhythm strip if possible. For all other patients treatment should only be provided after acquiring a 12 lead ECG, unless acquisition is going to be significantly delayed.

The pharmacological treatment of bradycardia

- Medicines that increase the heart rate will also increase myocardial oxygen demand. The decision to administer such medicines must take into account the potential advantage of an improvement in cardiac output versus the potential disadvantage of an increase in myocardial oxygen demand.
- Atropine may cause an initial worsening of bradycardia when given slowly. For this reason it must be given as an IV bolus.
- When administering IV adrenaline, an IV infusion is preferred over IV boluses because this reduces the adverse effects of adrenaline.
- If pacing is not indicated and the patient is severely compromised and rapidly deteriorating, it is appropriate to have a low threshold for administering adrenaline rather than atropine.

Transcutaneous pacing

- There is insufficient evidence to determine the optimum pad placement for pacing, but anterior/posterior placement may reduce pacing threshold and minimise discomfort for the patient.
  - Place the sternal pad between the left scapula and the spine.
  - Place the apical pad over the position where leads V3-4 would be for a 12 lead ECG.
- Most patients will require a current setting of 50-90 mA to achieve electrical capture. Patients that are obese or have CORD are likely to require a higher energy setting to achieve capture.
- Clinical judgement must be used when determining the maximum current level that is delivered, noting that it should be rare to exceed 150 mA.



Bradycardia secondary to poisoning with beta-blockers

- Bradycardia may be prominent in a patient who has taken a large dose of a beta-blocker, particularly if taken in combination with a calcium channel blocker.
- A patient who has taken large doses of these medicines may require high dose adrenaline by infusion.
- Glucagon is sometimes suggested as part of the treatment for bradycardia caused by beta-blockers because it stimulates cardiac cells via a mechanism that is independent of the beta receptor. However, glucagon has almost no role in the out-of-hospital setting because it rarely provides a sustained heart rate rise in addition to high dose adrenaline and the doses required exceed those carried by ambulance personnel.

Backup

- An ICP must be requested for all patients with bradycardia associated with moderate or severe cardiovascular compromise.
- An ICP should consider calling for assistance from a second ICP if the patient is receiving pacing.
- Personnel should seek clinical advice if backup from an ICP is requested but is unavailable.

3.12 Cardiogenic shock

This section is for adults. Seek clinical advice if the patient is a child.

- Acquire a 12 lead ECG.
- Gain IV access.
- Administer 0.9% sodium chloride IV if there are signs of poor perfusion, provided the patient is not short of breath, has no crackles in their chest and the primary problem is not dysrhythmia:
  a) Administer 250-500 ml of 0.9% sodium chloride IV.
  b) This may be repeated as required, up to a maximum of 1 litre.
  c) Stop the fluid if the patient becomes short of breath.
- Administer adrenaline IV if shock is severe and not improving. Place 1 mg of adrenaline into a 1 litre bag of 0.9% sodium chloride:
  a) Administer this as an IV infusion. Start at 2 drops per second and adjust the rate to the patient's condition or
  b) Administer 0.01 mg (10 ml) IV every 1-2 minutes.

In addition

- Treat as per the appropriate section if dysrhythmia, myocardial ischaemia, or pulmonary oedema is present, but do not administer GTN and use caution administering opiates, amiodarone, CPAP or PEEP.

Referral

- The patient must be given a firm recommendation to be transported to an ED by ambulance.
- Transport the patient to a hospital with a cardiac catheter room whenever it is feasible to do so.

Additional information

General

- This section should be read in conjunction with the sections on myocardial ischaemia and STEMI.
- Cardiogenic shock is caused by the heart being unable to pump adequately:
  - The most common cause is acute myocardial infarction.
  - Other causes include acute valve rupture, pulmonary embolism, dysrhythmia (particularly VT), cardiac tamponade and myocarditis.
  - Commonly the patient will be pale, cold and tachycardic with signs and symptoms of pulmonary oedema.

Cardiogenic shock secondary to poor left ventricular function

- The most common cause is an acute anterior, antero-septal or antero-lateral STEMI:
  - This is commonly associated with the development of pulmonary oedema.
  - Shock is unlikely to respond to 0.9% sodium chloride IV and must be administered with caution as it may make pulmonary oedema worse.

Cardiogenic shock secondary to poor right ventricular function

- Occasionally cardiogenic shock is caused by inadequate right ventricular function:
  - The most common cause is an acute inferior myocardial infarction involving the right ventricle.
  - Shock is likely to respond to 0.9% sodium chloride IV.

Improving outcomes from cardiogenic shock

- Cardiogenic shock has a high mortality rate unless the underlying problem is corrected in a timely manner. There are only two interventions in the out-of-hospital setting that significantly alter outcome:
  - Initiating fibrinolytic therapy for STEMI when indicated.
  - Transporting the patient to a hospital with a cardiac catheter room.

Adrenaline administration

- Adrenaline administration is reserved for severe cardiogenic shock.
- The decision to administer adrenaline must weigh up the potential benefit of improving cardiac output against the potential risks of raising myocardial oxygen consumption and causing tachydysrhythmias. Adrenaline administration should be ceased if tachycardia or tachydysrhythmia occur without signs of improved cardiac output.
- Adrenaline administration (particularly IV bolus administration) can make the patient tachypnoeic and look or feel awful. It is important to differentiate this from a worsening of their shock and not to automatically respond by administering more adrenaline.
- An IV infusion is preferred over IV boluses because this reduces the adverse effects of adrenaline.

3.13 Cardiac arrest

- Perform continuous chest compressions whilst the defibrillator is being attached and charged.
- Defibrillate immediately if the cardiac rhythm is VF or VT using a single shock and immediately recommence chest compressions:
  a) Use the maximum joule setting for an adult.
  b) Use the joule settings from the paediatric drug dose tables for a child.
- Perform two-minute cycles of CPR between rhythm checks.
- Place an LMA and gain IV access, but chest compressions take priority.
- Defibrillate every two minutes using single shocks if the rhythm is VF or VT.
- Administer adrenaline IV every four minutes:
  a) 1 mg IV for an adult.
  b) See the paediatric drug dose tables for a child.
- Administer amiodarone if the rhythm is VF or VT at any time after the first dose of adrenaline:
  a) 300 mg IV for an adult.
  b) See the paediatric drug dose tables for a child.
- If the patient is in PEA correct reversible causes and administer:
  a) 2-3 litres of 0.9% sodium chloride IV for an adult.
  b) 40-60 ml/kg of 0.9% sodium chloride IV for a child.

Defibrillator failure checklist

Use this checklist if a defibrillator fails and there is not another defibrillator (including an AED) immediately available. At each defibrillator intervention, pause briefly to determine if the problem has been fixed.

- Task specific personnel to focus on resuscitating the patient.
- Task specific personnel to focus on troubleshooting the defibrillator.
- Call Control/Comms and ensure another vehicle is responding.
- Ensure the pads are attached and connected.
- Ensure the ECG leads are attached.
- Change the lead shown on the screen so that the rhythm is visible.
- Turn the defibrillator off for 30 seconds and turn it back on again.
- Remove and replace the batteries, utilising spare batteries if possible.
- Attach and connect a new set of pads.
- Switch to automatic mode if in manual mode.
- Turn the defibrillator off for 30 seconds and turn it back on again.

Log a reportable event if you reach the point of turning the defibrillator off for 30 seconds.

Additional information

Definitions

- A patient is in cardiac arrest when the patient is unconscious and has no signs of life. Agonal gasping is common during cardiac arrest, particularly in the presence of good CPR and is not considered a sign of life in this setting.
- A witnessed cardiac arrest is one where the patient is seen or heard to collapse, regardless of whether this is by a member of the public or by ambulance personnel.
- A primary cardiac arrest is one where the cardiac arrest is clearly caused by a cardiac problem, or there is no obvious cause.
- A secondary cardiac arrest is one where there is an obvious non-cardiac cause, for example asthma, drowning, trauma or poisoning.
- Return of spontaneous circulation (ROSC) is the presence of a palpable pulse, or clear signs of spontaneous circulation (such as non-agonal breathing, normal end tidal CO_2 or active movement) in the absence of CPR.
- Severe comorbidities are chronic diseases that substantially limit a patient's ability to lead a normal life. Examples include dementia, severe CORD, heart failure causing inability to exercise normally, a requirement for residential care and metastatic cancer with weight loss.

Deciding to start resuscitation

- Resuscitation should start unless there is a clear reason not to. Clear reasons for not starting resuscitation include:
  - Signs of rigor mortis or post-mortem lividity.
  - A clear advance directive not to receive resuscitation for cardiac arrest.
  - Scenarios where resuscitation is either futile or clearly not in the best interest of the patient. Examples include unwitnessed cardiac arrest with asystole as the initial rhythm, patients who are dying from cancer and patients with severe comorbidities.
- Family members do not have the right to either demand or decline resuscitation in the event of cardiac arrest, but their opinion of what the patient would want must be taken into consideration.
- Ambulance personnel must take into account all available information (including the patient's known wishes) and act in what they believe is the best interest of the patient.
- If there is doubt regarding the appropriateness of a resuscitation attempt, resuscitation should begin while further information is gained.
- There must be clear documentation regarding decisions made.

Deciding to stop resuscitation

- There is no absolute time at which it is possible to say that further resuscitation is futile if the patient has not developed ROSC. Stopping resuscitation requires clinical judgement on the likelihood of survival taking into account all of the following:
  - The cause of the cardiac arrest.
  - Whether or not the cardiac arrest was witnessed.
  - Whether or not there was bystander CPR.
  - The response time.
  - The initial rhythm.
  - The total estimated time in cardiac arrest.
  - The patient's comorbidities.

Deciding to stop resuscitation: EMTs

- Resuscitation must continue until a Paramedic or ICP arrives and makes a decision to stop, or advice is received via the Clinical Desk that it is appropriate to stop. If it is not possible for backup to arrive or to contact the Clinical Desk:
  - If the arrest was unwitnessed and no shock is advised, the prognosis is very poor and it is appropriate to stop resuscitation if there are no signs of ROSC 20 minutes after the onset of resuscitation by ambulance personnel.
  - For other circumstances it is appropriate to stop resuscitation if there are no signs of ROSC 40 minutes after the onset of resuscitation by ambulance personnel.

Deciding to stop resuscitation: Paramedics and ICPs

- It is appropriate to stop resuscitation 20 minutes after the onset of resuscitation by ambulance personnel in poor prognosis scenarios.
- It is appropriate to stop resuscitation 40 minutes after the onset of resuscitation by ambulance personnel in good prognosis scenarios.
- It is appropriate to stop resuscitation earlier than described above, if it becomes clear that it was inappropriate to have commenced resuscitation, or the rhythm has deteriorated into asystole and stayed in asystole despite resuscitation.

The prognosis of cardiac arrest

There is no one factor that can be used to determine the prognosis of an individual patient in cardiac arrest. Multiple factors must be taken into account, noting that in most patients there will be a mixture of prognostic factors.

Worse prognostic factors	Better prognostic factors
Secondary cardiac arrest	Primary cardiac arrest
Unwitnessed	Witnessed
No bystander CPR	Bystander CPR
Response time >8 minutes	Response time <8 minutes
Initial rhythm asystole or PEA	Initial rhythm VT or VF
Time in cardiac arrest >30 minutes	Time in cardiac arrest <30 minutes
$ETCO_2$ <15 mmHg or falling despite CPR	$ETCO_2$ >25 mmHg
Severe comorbidities present	No severe comorbidities present
Living in aged residential care	Living independently
Age >85 years	Age ≤85 years

- The reactivity of the patient's pupils during and immediately following cardiac arrest is not prognostic and there is no role for including pupil reactivity in decision making. The pupils may be dilated and unreactive and the patient may survive without brain damage, conversely the pupils may be reactive and the patient may subsequently die from brain damage.

The important aspects of CPR

- For an adult the CPR compression to ventilation ratio is 30:2 when ventilation is via a bag and mask. This ratio prioritises chest compressions on the basis that an adult is most likely to have had a primary cardiac arrest. If an adult has had a cardiac arrest secondary to asphyxiation or respiratory failure, alter the ratio to 15:2.
- For a child the CPR compression to ventilation ratio is 15:2 when ventilation is via a bag and mask (exception – the ratio is 3:1 for neonates). The 15:2 ratio reduces the priority of chest compressions on the basis that a child is most likely to have had a cardiac arrest secondary to respiratory failure. If a child has had a primary cardiac arrest, alter the ratio to 30:2.
- Perform continuous chest compressions if an LMA (or other supra-glottic airway) is present and this does not obviously impair ventilation via the LMA. If however, continuous chest compressions impair ventilation via the LMA, interrupt the chest compressions to provide ventilation. If there is uncertainty, the balance of risk is in favour of continuous chest compressions.
- Perform continuous chest compressions if the patient has been intubated with an ETT. Intubation with an ETT is not a high priority during the initial treatment

of cardiac arrest. If ROSC has not been achieved within 10 minutes, intubation with an ETT should occur provided this does not interrupt chest compressions.

- Perform chest compressions at 100-120/minute, ensure adequate depth and allow complete recoil, minimise pauses and perform uninterrupted compressions whenever possible.
- If a CPR feedback device is available it must be used.
- During continuous chest compressions ventilate adults and children with 10 breaths per minute. Ventilation rates higher than this must be avoided as they reduce the blood flow achieved during CPR, as a result of increased intra-thoracic pressure and reduced venous return.
- CPR is performed for two-minute cycles between rhythm checks. The person performing chest compressions should ideally change every two minutes, or earlier if tired.

The important aspects of using a defibrillator

- Attach and use a defibrillator as soon as possible. Defibrillation must not be delayed by performing other interventions.
- Personnel able to use defibrillators in manual mode must do so whenever possible. This reduces delays to defibrillation and pauses in chest compressions.
- In manual mode, defibrillators should be charged toward the end of the two-minute cycle, while chest compressions continue. This minimises the time delay between stopping chest compressions and delivering a shock. If a shock is not required the charge should be cancelled.
- Minimise the pre-shock pause. This is the time between stopping chest compressions and delivering a shock. Ideally pre-shock pauses should be less than three seconds.
- Minimise the post-shock pause by resuming chest compressions immediately following a shock, without checking for a pulse. Ideally post-shock pauses should be less than three seconds.
- Perform a brief pulse check at the end of a two-minute cycle, only if the rhythm looks capable of producing cardiac output, noting that this is highly unlikely if $ETCO_2$ is low. If there is any doubt that cardiac output is present, chest compressions should be immediately restarted.
- Each time there is a recognised change from one rhythm to another, move to the appropriate algorithm for the new rhythm.
- Defibrillators in advisory (automatic) mode must be used in children (including infants) if a defibrillator in manual mode is not immediately available.
- Deliver a pre-cordial thump if cardiac arrest occurs in the presence of personnel and a defibrillator is not attached, noting that pre-cordial thumps are rarely successful.

IV access and IV drugs

- Gaining IV access and administering IV drugs has a lower priority than performing good quality CPR.
- IV access is preferred over IO access. IO access should not be routinely gained, particularly in poor prognostic scenarios.
- All doses of IV drugs should be flushed with a running line of 0.9% sodium chloride or a minimum of 20 ml of 0.9% sodium chloride.

End tidal CO_2

- The level of end tidal CO_2 ($ETCO_2$) is a marker of the blood flow being achieved during CPR.
- $ETCO_2$ must be used to confirm ETT placement and must be continually measured if the patient has been intubated with an ETT.
- $ETCO_2$ may be measured if the patient is being ventilated via an LMA, noting that the $ETCO_2$ will be reduced if there is significant leak around the cuff. In this setting the trend of the $ETCO_2$ is more important than single measurements.
- $ETCO_2$ should not be measured if the patient is being ventilated via a face mask.
- A falling $ETCO_2$ despite CPR is a poor prognostic factor and must prompt a focus on ensuring good quality chest compressions and a ventilation rate at or below 10/minute.
- An $ETCO_2$ of less than 15 mmHg despite CPR is a very poor prognostic factor.
- A sudden increase in $ETCO_2$ is an indicator that ROSC may have occurred.

VF and VT

- Consider anterior/posterior placement of pads for small children, obese patients and patients in persistent VF or VT.
- Some patients with persistent VF will have an inherited abnormality of the ion channels within their heart. In this setting repeated doses of adrenaline may reduce the likelihood of successful defibrillation. If VF persists despite 15-20 minutes of resuscitation, consider administering a further 150 mg of amiodarone (adult dose) without further adrenaline administration.
- There are published case reports of patients with persistent VF achieving ROSC with simultaneous defibrillation from two defibrillators: this is called dual defibrillation or sequential defibrillation. This form of defibrillation must not occur without explicit clinical advice because it invalidates the warranty of the defibrillators and the evidence supporting it is not convincing.

Pulseless electrical activity (PEA)

- PEA is present when a patient in cardiac arrest has a rhythm that should be associated with cardiac output but is not. PEA is a clinical condition and not an abnormal rhythm.
- PEA is often secondary to a non-cardiac problem. The history immediately prior to cardiac arrest is very important in helping to determine what the cause may be.
- Potentially reversible causes of PEA include:
  - Hypoxia.
  - Hypothermia.
  - Hypovolaemia (including anaphylaxis).
  - Hyper/hypokalaemia (and other metabolic abnormalities).
  - Tension pneumothorax.
  - Tamponade (cardiac).
  - Toxins (poisoning).
  - Thrombosis (pulmonary and coronary).
- Some texts include hydrogen ions (acidosis) and hypoglycaemia in the list of causes of PEA. However, neither of these cause cardiac arrest in the absence of another clinical problem, even when severe. Hypoglycaemia should be ruled out following ROSC.
- Consideration should be given to transporting the patient to hospital with CPR in place if a potentially reversible cause is identified that cannot be treated at the scene. To be successful, such a decision must be made very early in the resuscitation attempt and time to hospital must be less than 10 minutes.
- It is common for PEA to degenerate into asystole with time. During this process it is common for slow (less than 30/minute) broad complexes to be present. This is treated as asystole and not PEA.
- Survival is rare if the rhythm deteriorates from PEA into asystole despite resuscitation and prolonged resuscitation attempts in this setting are usually inappropriate.
- In general, patients that survive cardiac arrest with an initial rhythm of PEA do so because the underlying problem is immediately identified and corrected.
- If the patient remains in PEA despite resuscitation attempts, consider the possibility that there is cardiac output that cannot be detected clinically. In this setting stop chest compressions and observe the $ETCO_2$ for one minute while ventilating at a rate of 10/minute:
  - If the $ETCO_2$ rapidly falls to below 10 mmHg the patient is in cardiac arrest.
  - If the $ETCO_2$ is maintained at or above 10 mmHg, the patient is not in cardiac arrest but has low cardiac output and should be treated accordingly.

Asystole

- Confirm the rhythm is asystole: check the cables, check the leads, check which lead is being shown on the screen and check the amplitude.
- Exclude bradycardia which can look like asystole at a glance, particularly in children.
- Survival from cardiac arrest with an initial rhythm of asystole is rare and prolonged resuscitation attempts in this setting are usually inappropriate.

Single responder resuscitation

- Attach and use a defibrillator immediately. It is acceptable to use the defibrillator in automatic mode until additional personnel arrive.
- Perform CPR with a focus on chest compressions, utilising bystanders to help.
- Interventions such as IV access or intubation are not a priority and should only occur after additional personnel arrive, or if bystanders are able to perform good CPR.

Transport to hospital with CPR en route

- Transport to hospital with CPR en route should be rare because:
  - There is no convincing evidence it improves patient outcomes.
  - The quality of the resuscitation attempt (particularly the quality of CPR) is usually compromised.
  - Unrestrained personnel are at risk in the back of a moving ambulance.
- However, a small number of patients may benefit from transport to hospital with CPR en route, particularly if there is a potentially reversible cause that ambulance personnel are unable to treat.
- The potential risks to the patient and personnel must be explicitly weighed up against the potential benefit to the patient.
- When transporting to hospital with CPR en route:
  - If a mechanical CPR device is available it must be used and
  - The vehicle must be travelling at normal road speed, even when under lights and
  - The driver must ensure the nature of their driving is modified to ensure that personnel are as safe as possible during transport.

Backup

- Backup from an ICP must always be requested.

Cardiac arrest in special situations

Cardiac arrest secondary to drowning

- Prioritise the ventilation aspect of CPR and use a CPR ratio of 15:2 unless an ETT is in place.
- Placing an ETT has a high priority if ROSC is not achieved in the first few minutes.
- IV drugs have a very low priority.
- See the 'drowning' section for additional information.

Cardiac arrest secondary to hanging

- Prioritise the ventilation aspect of CPR and consider a CPR ratio of 15:2.
- Cervical spine immobilisation is not routinely required. This is because clinically significant cervical spine injury following hanging is extremely rare unless the patient has fallen the height of their body.
- Survivors tend to come from the group that are in PEA and get ROSC within 5-10 minutes with good CPR alone.
- Prolonged resuscitation in the presence of asystole is inappropriate.
- IV drugs have a very low priority.

Cardiac arrest secondary to trauma

- A small number of patients have a primary cardiac arrest directly preceding their trauma. If this is suspected treat as a primary cardiac arrest.
- Cardiac arrest secondary to trauma has a poor prognosis and in most cases is caused by severe hypovolaemia. However, cardiac arrest in this setting is not futile and survival is possible provided the resuscitation attempt is focused on correcting reversible causes.
- Perform the following tasks simultaneously if possible, focusing on the most likely reversible causes:
  - Ventilate at 10 breaths per minute via an ETT or LMA. Attach $ETCO_2$ and use this as a measure of blood flow. Consider the possibility that the patient has cardiac output that cannot be detected clinically.
  - Do not perform chest compressions.
  - Perform bilateral finger thoracostomies if chest injury is possible.
  - Compress external bleeding and place a tourniquet if appropriate.
  - Begin transport as soon as possible.
  - Gain IV or IO access and administer 0.9% sodium chloride. Arrange for blood to be administered if this is available. If blood is unavailable administer 2-3 litres of 0.9% sodium chloride for an adult and 40-60 ml/kg of 0.9% sodium chloride for a child.
  - Splint the pelvis if pelvic injury is possible.
  - Align long bone fractures that are significantly displaced.

- IV adrenaline has a very low priority.
- Chest compressions are not performed in this setting because:
  - The heart is empty and chest compressions do not improve blood flow when the heart is empty.
  - The person performing chest compressions impairs access to the patient and impairs the resuscitation attempt.
  - The person performing chest compressions is best tasked to a higher priority intervention such as squeezing fluid.
- If the rhythm deteriorates into asystole for more than a few minutes, it is inappropriate to continue the resuscitation attempt.
- The resuscitation attempt should occur en route to hospital if possible.
- In some parts of New Zealand blood is available in the pre-hospital setting via medical staff. Only call for blood if there is an established protocol in the area for blood to be delivered to the scene.
- In the absence of an immediately reversible cause, it is usually inappropriate to commence resuscitation on a patient who is in cardiac arrest and trapped, unless the patient is able to be extricated in the next 1-2 minutes.

Cardiac arrest secondary to asthma

- Focus on using a ventilation rate of only 6/minute to avoid dynamic hyperinflation (gas trapping).
- IV adrenaline has a high priority.
- Exclude tension pneumothorax, noting this is rare. Needle chest decompression carries a significant risk of causing pneumothorax and finger thoracostomy is the preferred technique if chest decompression is required.
- Diagnosing tension pneumothorax is very difficult in the presence of cardiac arrest secondary to asthma because:
  - Breath sounds are likely to be reduced because of poor air movement and
  - The jugular veins are usually distended because of raised intra-thoracic pressure and
  - The percussion note is often hyper-resonant because of dynamic hyperinflation.
- In the setting of cardiac arrest secondary to asthma, the convincing signs of tension pneumothorax are most likely to be a clear difference in breath sounds and percussion note between the two sides.

Cardiac arrest secondary to anaphylaxis

- IV adrenaline has a very high priority.
- If the patient is in PEA and not immediately responding to resuscitation, escalate the adrenaline doses:
  a) For an adult escalate the second dose to 3 mg and the third dose to 5 mg.
  b) For a child escalate the doses following the same principle.

- 0.9% sodium chloride IV has a high priority:
  a) For an adult administer 2-3 litres of 0.9% sodium chloride IV.
  b) For a child administer 40-60 ml/kg of 0.9% sodium chloride IV.

Cardiac arrest secondary to cyclic antidepressant poisoning

- The cardiac toxicity of cyclic antidepressants is partly caused by blockade of sodium channels within the heart.
- This cardiac toxicity may be reduced by a large bolus of sodium ions which is best accomplished using 0.9% sodium chloride:
  a) For an adult administer 2-3 litres of 0.9% sodium chloride IV.
  b) For a child administer 40-60 ml/kg of 0.9% sodium chloride IV.
  c) If 8.4% sodium bicarbonate is immediately available or can be delivered to the scene within 10 minutes, administer 100 ml IV to an adult or 2 ml/kg to a child, in addition to 0.9% sodium chloride.

Cardiac arrest during pregnancy

- In the third trimester of pregnancy the uterus may impede venous return through the inferior vena cava in the supine position. Manually displace the uterus to the left or tilt the patient 30 degrees to their left to alleviate this.
- Consider transporting the patient with CPR en route (focusing on good chest compressions) if ROSC is not immediately achieved and time to a hospital with staff capable of performing an emergency caesarean section is less than 10 minutes. Provide as much pre-hospital warning as possible.

Cardiac arrest secondary to hypothermia

- In New Zealand it is rare for cardiac arrest to occur secondary to hypothermia. For hypothermia to be considered a potentially reversible cause of cardiac arrest, the patient must have been in (or under) ice or snow.
- At core temperatures below 30 degrees the patient is prone to VF and in this setting defibrillation and drugs may not be effective.
- Follow standard procedures but if ROSC is not achieved within 10 minutes, consider transporting the patient to hospital with CPR en route, provided the initial rhythm was not asystole. Where feasible this needs to be to a hospital with the facilities to place the patient on cardio-pulmonary bypass. Seek clinical advice whenever possible.
- If transporting to hospital while performing CPR, do not administer any further drugs and focus on providing good chest compressions.

Cardiac arrest and implanted defibrillators/pacemakers

- Implanted defibrillators and pacemakers are usually situated in the soft tissue under the left clavicle.
- Place defibrillation pads at least 8 cm from the implanted device if possible and consider utilising the anterior/posterior position.

Cardiac arrest occurring in infants during sleep

- Prioritise the ventilation aspect of CPR using a CPR ratio of 15:2.
- Beware of misdiagnosing severe bradycardia as asystole.
- Survivors tend to come from the group of patients that get ROSC within 5-10 minutes with good CPR alone.
- Prolonged resuscitation in the presence of asystole is inappropriate.
- IV drugs have a very low priority.
- Transport to hospital with CPR en route is usually inappropriate.

Movement during cardiac arrest

- The patient may move during cardiac arrest if cerebral blood flow is being maintained by very good CPR.
- This can cause personnel to believe that the patient is not in cardiac arrest and may lead to delayed defibrillation and/or inappropriate pauses in CPR.
- In this setting it is appropriate to briefly pause CPR to confirm the patient is in cardiac arrest.
- If the movement is significant enough to interfere with resuscitation:
  - Administer ketamine noting that the blood flow generated by CPR may be insufficient to deliver adequate levels of ketamine to the brain. For an adult administer 50 mg of ketamine IV once. For a child administer 0.5 mg/kg of ketamine IV once.
  - If significant movement continues, rocuronium may be administered provided an ETT has been placed and the position confirmed using $ETCO_2$. The blood flow generated by CPR may be insufficient to deliver adequate levels of rocuronium to skeletal muscle and neuromuscular blockade may not occur.
  - If rocuronium has been administered, neuromuscular blockade will occur if sustained ROSC is achieved and the patient will then require an adequate level of sedation.

3.14 Post cardiac arrest care

- Ensure the patient has an adequate airway and adequate breathing, but avoid hyperventilation.
  a) If the patient is ventilated, ventilate to an $ETCO_2$ of 35-45 mmHg.
  b) If the patient is ventilated via an ETT, provide sedation and neuromuscular blockade if required, using the 'post intubation' section.
  c) Titrate the oxygen flow rate to an SpO_2 of 94-97%, provided pulse oximetry is reliable.
- Gain IV access if not already achieved and ensure the patient has adequate circulation. See the 'cardiogenic shock' section if the patient has shock.
- Cover the patient with a single sheet without active warming, if the patient is unable to obey commands.
- Acquire a 12 lead ECG. See the 'STEMI' section if the patient has STEMI.

Referral

- Transport to a hospital with PCI facilities if the patient has STEMI whenever feasible. In all other instances transport to a major hospital whenever feasible.

Additional information

General

- Be prepared to treat further cardiac arrests.
- The most important aspects of post cardiac arrest care are to maintain an adequate airway, breathing and circulation.
- In the first few minutes following ROSC, the patient's physiological state is often quite unstable and it is important to monitor the patient closely and to intervene as required. It is appropriate to prepare for transport during this time, but do not immediately commence transport unless the patient has an unresolved time critical problem.

Targeted temperature management following ROSC

- Targeted temperature management (TTM) may also be described as therapeutic hypothermia.
- TTM appears to improve outcomes in patients remaining unconscious following a cardiac arrest.
- If TTM is being utilised by hospital personnel, a temperature of 35-36 degrees is usually targeted. Following ROSC, most patients covered with a single sheet will achieve a temperature of approximately 35 degrees provided active warming does not occur.

- It is useful to document the patient's tympanic temperature post ROSC, but this is not a priority.
- There is no role for active cooling (for example using ice packs or cold 0.9% sodium chloride IV) unless the patient has hyperthermia.

Oxygenation and ventilation post cardiac arrest

- There is some evidence that very high levels of oxygen at a tissue level post cardiac arrest may worsen outcomes by causing vasoconstriction (which lowers blood supply to the brain) and promoting inflammation within the brain.
- If pulse oximetry is reliable, the oxygen flow rate should be adjusted to achieve an SpO_2 of 94-97%, noting that this is not a priority in the first few minutes post ROSC.
  - If the SpO_2 is above 97%, lower the oxygen flow rate to 6 litres/minute and titrate the flow rate by further increments of 2 litres/minute as required.
  - In the absence of hypoxia do not adjust oxygen flow rates frequently, but make incremental adjustments every 5-10 minutes.
  - If pulse oximetry is unreliable, ventilate with an oxygen flow rate of 10-15 litres/minute.
- The target $ETCO_2$ for a patient ventilated via an endotracheal tube is 35-45 mmHg. This is intended to ensure that arterial CO_2 levels are at the upper end of normal, which maximises cerebral blood flow.

Backup

- Backup from an ICP must always be requested.
- Request backup for RSI if the patient has not been intubated and:
  - Backup can locate at least 15 minutes faster than transport can occur to hospital and
  - The patient has a poor airway or poor breathing and
  - The patient has a GCS less than or equal to 10.

4.1 Shock

Introduction

- Shock is a global reduction in blood flow (or perfusion) to the organs.
- Shock results in accumulation of the products of metabolism within tissues and this triggers an inflammatory response that causes cellular and organ dysfunction.
- Through sympathetic nervous system stimulation, the body attempts to increase cardiac output and shunt blood to essential organs such as the brain, heart, liver and kidneys.
- If sympathetic nervous system stimulation maintains a normal blood pressure, this is described as compensation. At the point when blood pressure begins to fall this is described as decompensation.

Signs of shock

- The combination of sympathetic nervous system stimulation and organ dysfunction produce the signs of shock:
  - Tachycardia.
  - Cold and clammy skin.
  - Prolonged capillary refill time.
  - Tachypnoea.
  - Narrowed pulse pressure.
  - Hypotension.
  - Altered level of consciousness.
- Tachypnoea, tachycardia and vasoconstriction are common presenting signs of shock in young children.
- An alteration in the level of consciousness usually occurs late in the shock process, particularly in children and young adults and is usually manifest as agitation with preservation of the ability to obey commands.

Blood pressure and shock

- Blood pressure is a poor guide to the severity of shock and must be considered as part of the overall clinical picture. Blood pressure may only begin to fall when shock is severe and blood pressure varies with age, gender, degree of fitness and medications.
- In order to have shock, the patient must have hypotension or signs of significantly impaired perfusion.
- In a young adult or child, the capacity for profound vasoconstriction may result in blood pressure being maintained despite a very low cardiac output.
- A patient with chronic hypertension may have a significant fall in their blood pressure as a result of shock and yet their blood pressure may be within the normal range.

Causes of shock

- **Hypovolaemic shock** is caused by inadequate intra-vascular volume. See the 'hypovolaemia from uncontrolled bleeding' and 'hypovolaemia from other causes' sections.
- **Anaphylactic shock** is caused by mediators released in response to a severe allergic reaction. See the 'anaphylaxis' section.
- **Septic shock** is caused by mediators released in response to severe infection. See the 'septic shock' section.
- **Cardiogenic shock** is caused by low cardiac output as a result of a heart problem. See the 'cardiogenic shock' section.
- **Spinal shock** is caused by loss of sympathetic nervous system outflow following spinal cord injury. See the 'hypovolaemia from other causes' section.
- **Obstructive shock** is caused by a clinical condition causing obstruction of blood flow into, or out of the heart.
  - Examples include pulmonary embolism (causing inadequate right ventricular function as result of increased afterload), tension pneumothorax (causing inadequate right ventricular filling as a result of raised intra-thoracic pressure) and cardiac tamponade (causing inadequate right ventricular and left ventricular filling).
  - Treat tension pneumothorax if present and see the 'hypovolaemia from other causes' section.
- **Hypoadrenal shock** (also called adrenal crisis) is caused by inadequate levels of circulating cortisol. See the 'hypovolaemia from other causes' section and note the following:
  - The adrenal glands produce additional cortisol during times of physiological stress and this is important for a normal cardiovascular response to occur, however some clinical conditions may result in abnormal adrenal function. Examples include: congenital adrenal hypoplasia, Addison's disease, previous pituitary surgery and those taking high daily doses of steroid.
  - A patient with inadequate adrenal function is at risk of hypoadrenal shock if they have illness or injury that is more than minor, particularly if they have been unable to increase their dose of oral steroid.
  - The patient may have their own hydrocortisone for injection in the event of illness or injury. Personnel should follow any instructions (including verbal) regarding IM or IV administration of hydrocortisone and should seek clinical advice if uncertain.
  - All patients at risk of inadequate adrenal function require urgent medical assessment if they have an illness or injury that is more than minor and all patients receiving hydrocortisone should be assessed in an ED.

- The term distributive shock is sometimes used to describe shock states associated with dilated and leaky blood vessels. This is particularly associated with anaphylactic shock and septic shock. In reality, there is often a combination of contributing factors to the shock state. For example:
  - In both anaphylactic and septic shock there is a combination of vasodilation, leaky blood vessels (with loss of intra-vascular volume) and impaired heart function.
  - In cardiogenic shock associated with right ventricular infarction, there is a combination of impaired right ventricular function and impaired left ventricular filling (reduced left ventricular pre-load).

4.2 Anaphylaxis

- Administer adrenaline if the patient is showing systemic signs of anaphylaxis:
  a) Administer 0.5 mg IM for an adult.
  b) See the paediatric drug dose tables for a child.
  c) All personnel may administer a patient's own adrenaline IM if the patient is showing systemic signs of anaphylaxis.
- If there is upper airway oedema or swelling, administer 5 mg of nebulised adrenaline in addition to other treatment. Repeat as required.
- Gain IV access and administer 0.9% sodium chloride IV if the patient has signs of poor perfusion:
  a) 1 litre for an adult.
  b) 20 ml/kg for a child.
  c) Administer further 0.9% sodium chloride as required.
- Repeat the adrenaline IM after 10 minutes if the patient is not improving.
- Administer adrenaline IV if the patient is deteriorating despite adrenaline IM. Place 1 mg of adrenaline into a 1 litre bag of 0.9% sodium chloride:

  For an adult:

  a) Administer this as an IV infusion. Start at 2 drops per second and adjust the rate to the patient's condition or
  b) Administer 0.01 mg (10 ml) IV every 1-2 minutes.

  For a child aged 5-14 years:

  a) Administer this as an IV infusion. Start at 1 drop per second and adjust the rate to the patient's condition or
  b) Administer IV boluses (see the paediatric drug dose tables) every 1-2 minutes.

  For a child aged less than five years:

  a) Administer IV boluses (see the paediatric drug dose tables) every 1-2 minutes.
  b) Do not administer adrenaline as an IV infusion.
- If bronchospasm is present, administer adrenaline nebulised, noting that this is not a substitute for further parenteral adrenaline if the patient is not improving.

Referral

- All patients receiving treatment for anaphylaxis must be given a firm recommendation to be transported to a medical facility by ambulance.
- Transport should usually be to an ED, unless the patient has rapidly improved with a single dose of adrenaline IM and is being taken to a GP that knows the patient well.

Additional information

General

- Anaphylaxis is a rapid onset, multiple-organ, generalised hypersensitivity (allergic) syndrome. It is usually characterised by skin features of systemic mediator release (urticaria, itch or flush, swollen lips and/or tongue) plus involvement of one or more of the following systems:
  - The respiratory system with any of the following: dyspnoea, chest or throat tightness, wheeze or stridor.
  - The cardiovascular system with any of the following: hypotension, poor perfusion, fainting, collapse or altered level of consciousness.
  - The gastrointestinal system with any of the following: severe nausea, vomiting, abdominal pain or diarrhoea.
- Exposure to an allergen results in the release of inflammatory mediators from mast cells and basophils which cause the signs and symptoms of anaphylaxis. While there are a number of mediators, histamine is the most widely recognised.
- Anaphylaxis can be triggered by almost anything, but most commonly it is caused by exposure to venom (particularly wasps and bees), food (particularly eggs, peanuts and shellfish) or medications.
- Patients with stings and only localised swelling, redness or pain do not have anaphylaxis.

Recognising anaphylaxis

- To have anaphylaxis patients must have signs of systemic involvement. Skin features alone are insufficient.
- A very small proportion of patients do not have obvious skin features initially, particularly if the onset is sudden and severe.
- Consider the possibility of anaphylaxis in all patients with unexplained bronchospasm, shock or respiratory distress.

Adrenaline administration

- The most important aspect of treatment is the early administration of adrenaline.
- The risk of death is raised in patients whose need for adrenaline (or repeat adrenaline) is under-recognised.
- Have a low threshold for administering adrenaline if anaphylaxis is suspected, even if it is not immediately life-threatening.
- Have a low threshold for repeat adrenaline if the patient is not rapidly improving.

- A dose of 0.5 mg adrenaline IM is appropriate for the majority of adults. ICPs may make a decision to reduce the dose, particularly if the patient is small, frail, or has ischaemic heart disease.
- When administering adrenaline IV to patients aged five years and over, an IV infusion is preferred over IV boluses because this reduces the adverse effects of adrenaline.

Angioedema

- Isolated oedema, particularly of the mouth and/or face in the absence of systemic signs of anaphylaxis is usually caused by angioedema and not anaphylaxis.
- Angioedema is a condition that results in intermittent, unpredictable and isolated swelling of the mouth and/or face. It often occurs in patients taking aspirin or an angiotensin enzyme converting inhibitor.
- Angioedema may respond to nebulised adrenaline.
- IM and IV adrenaline should not be administered because angioedema rarely responds to systemic adrenaline and the adverse effects of systemic adrenaline usually outweigh any possible benefit.

Additional treatment with anti-histamines and/or steroids

- Anti-histamines and steroids have no role in the acute treatment of anaphylaxis.
- The administration of promethazine (Phenergan) by other healthcare providers is strongly discouraged because it does not treat anaphylaxis and causes sedation and hypotension.
- Loratadine and prednisone may be administered following treatment for anaphylaxis if:
  - The patient has prominent itch and
  - All of the systemic signs of anaphylaxis have completely resolved.

Backup

- For personnel at First Responder level backup should be requested from the nearest personnel able to administer adrenaline IM. If this backup will take more than 10 minutes to locate, call the Clinical Desk for advice regarding adrenaline administration.
- Backup from an ICP should be requested if the patient is not rapidly improving after one dose of adrenaline IM.
- Backup from a Paramedic should be requested if backup from an ICP is not readily available.

4.3 Burns

- Administer oxygen if the patient has probable smoke inhalation.
- Cool the burn for at least 20 minutes:
  a) This should be at the scene unless there is an immediately life-threatening problem in the primary survey.
  b) Remove all clothing (leaving underwear on) and decontaminate the patient if the burns are due to chemical exposure.
- Irrigate chemical burns to the eye for at least 30 minutes.
- Estimate burn depth and size.
- Cover burns with cling film after cooling.
- Gain IV access.
- Administer 0.9% sodium chloride IV if the patient has signs of poor perfusion, or if the burn area is greater than 20%:
  a) 1 litre for an adult.
  b) 20 ml/kg for a child.
  c) Administer further 0.9% sodium chloride if transport time is greater than one hour, or if required for poor perfusion.
- Administer nebulised bronchodilators (using the 'asthma' section) if bronchospasm is prominent.
- Transport the patient direct to a designated major trauma hospital if the burn area is greater than 20%, whenever feasible.

Additional information

Airway burns

- Patients with suspected airway burns must be transported to a designated major trauma hospital without delay as airway swelling may require early intervention. Suspect airway burns if there is:
  - Burns around or involving the lips or
  - Loss of nasal hair or
  - Visible swelling or burns in the mouth or
  - A hoarse voice or
  - Stridor or
  - Black sputum.

Cooling, irrigating and dressing burns

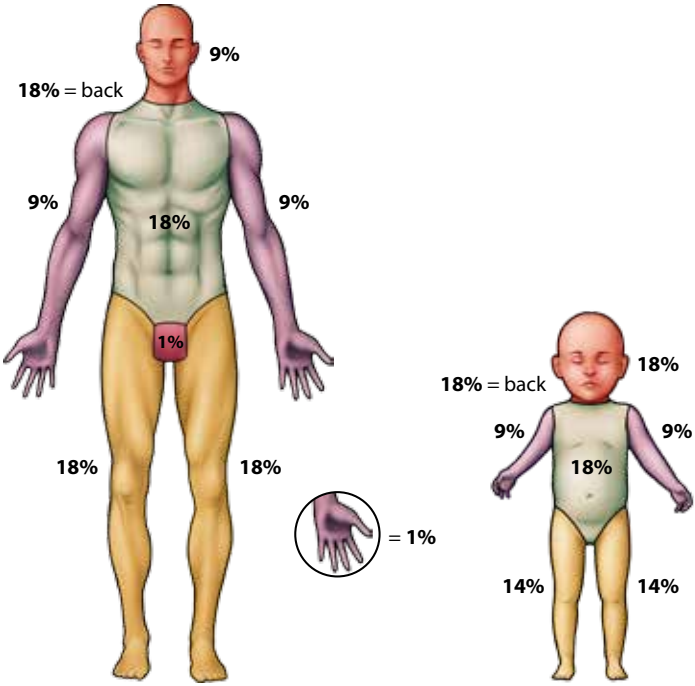
- Burns are preferably cooled using cool (not ice cold) running water:
  - Beware of hypothermia during cooling, particularly if the patient is a small child or the burn is large.
  - It is acceptable to shorten the duration of cooling for burns greater than 40%, if it risks causing clinically significant hypothermia.
  - Cool the burn but keep the patient warm.
- Chemical burns of the eye are potentially vision-threatening and irrigation must continue for at least 30 minutes. Chemical burns of the eye are not time critical in terms of transport to hospital and irrigation should occur at the scene whenever feasible. To irrigate the eyes:
  - Use a low pressure hose to run water continuously over the open eyes or
  - Use an IV line to run 0.9% sodium chloride continuously over the open eyes or
  - Place nasal cannulae over the top of the nose and run 0.9% sodium chloride continuously through these over the open eyes or
  - Fill a bowl or sink with water and get the patient to place their face into it while opening their eyes under water. Repeat this between breaths.
- Dressing burns is not a priority but may make burns less painful. Cling film should be applied after cooling and may provide some analgesia.
- Do not dress burns with creams or ointments.
- Burn gels provide analgesia but are not a substitute for 20 minutes of cool running water, provided this is available. If burn gels are used they should be applied after cooling is complete.

Decontamination

- The most appropriate form of decontamination for a patient with chemical burns is a shower of approximately three minutes duration, including a domestic shower. If heat has not been involved, the burn does not require cooling and in this setting the water should preferably be warm.
- Decontamination using a high pressure shower must be avoided if the patient has burns, as this may worsen the burn injury.
- Decontamination using a fire service hose (even on low pressure) should be avoided unless it is the only option, as this is likely to result in hypothermia.
- Decontamination using a fire service low pressure decontamination unit is acceptable, provided one is immediately available. However, decontamination should not be delayed waiting for one to arrive.

Estimating burn depth and size

- Estimate burn depth only after cooling is complete:
  - Superficial burns do not have blisters and are red and painful like sunburn.
  - Partial thickness burns have blisters, weep fluid and are painful.
  - Full thickness burns are charred, white, leathery and usually painless.
- Estimate burn size only after cooling is complete:
  - Do not include superficial burns in the estimate of burn size.
  - The preferred method of estimating burn size is to use a piece of paper the same size as the patient's hand (including their fingers). This represents 1% of body size.
  - It is very easy to overestimate burn size.



Electrical injury

- Patients with burns following electrical injury may have significant muscle and nerve damage along the pathway of the current.
- Continuous ECG monitoring is required because dysrhythmia may occur.

Fluid loss from burns

- Shock as a result of fluid loss following burns takes hours to develop.
- If a patient with burns has shock, look for an alternative cause other than burns.

4.4 Crush injury

Use this section for adults with a lower limb (or more) trapped under a weight for more than 60 minutes. If the patient is a child seek clinical advice.

- Request additional support at the scene from a medical specialist if this is available.
- Place a tourniquet on the limb/s if possible.
- Gain IV access (preferably in two sites) and administer a minimum of two litres of 0.9% sodium chloride. Administer further fluid as required.
- Monitor the cardiac rhythm continuously.
- Approximately 10 minutes prior to release of the weight:
  a) Administer continuous nebulised salbutamol and
  b) Administer 500 ml of 10% glucose IV as a bolus.
- As the weight is being released:
  a) Administer 50 ml of 8.4% sodium bicarbonate IV over one minute and
  b) Administer 6.8 mmol (1 g) of calcium chloride IV over one minute.
- Administer further doses of 8.4% sodium bicarbonate and calcium chloride if signs of hyperkalaemia occur.

Additional information

Crush injury

- Crush injury is also called traumatic rhabdomyolysis (muscle breakdown).
- Crush injury occurs when tissue is crushed underneath a heavy object with subsequent muscle damage.
- The degree of damage and the subsequent complications are directly related to the amount of tissue that is crushed, the weight of the object and the length of time that the weight is in place before it is released.
- Crush injury is rarely seen in isolation due to the mechanism of injury. Always look for other traumatic injuries and clinical problems (such as hypothermia) that are likely to coexist.
- Patients with severe crush injury are an important subgroup of patients with major trauma, because they may die from release syndrome at the time of extrication.

Release syndrome

- Release syndrome is a combination of severe shock, acidosis, hyperkalaemia (raised potassium levels) and dysrhythmia that occurs immediately following release of the weight, when severe crush injury has occurred.
- For release syndrome to occur a significant amount of tissue must be crushed

(equivalent to at least one leg) and the weight must be in place for at least one hour.

- Release syndrome is uncommon, but may be fatal in a small number of patients.

Crush syndrome

- Crush syndrome is a combination of organ failures (predominantly lung and kidney failure) that occur following severe crush injury.
- Crush syndrome is an evolving process that occurs over many hours to days, following severe crush injury.

Pathophysiology of crush injury and release syndrome

- Crush causes direct injury to muscles. Prolonged crush causes further damage by causing ischaemia. As muscle cells die, acid, cellular proteins (in particular myoglobin) and potassium leak out of cells.
- While under pressure the acid, myoglobin and potassium may be contained within the limb. On release of the pressure, reperfusion of the crushed area occurs and may result in:
  - Many litres of fluid rapidly moving into the crushed area, reducing circulating volume and causing hypovolaemia. This will be exacerbated if there is also uncontrolled bleeding.
  - A rapid release of acid, myoglobin and potassium into the circulation.
- Release of acid into the circulation interferes with normal cellular function, particularly in the heart.
- Release of potassium interferes with normal cardiac conduction and may cause severe dysrhythmia, including cardiac arrest.
- Release of inflammatory mediators causes an inflammatory response within the lungs that may cause severe pulmonary oedema and impaired oxygenation. If this occurs it usually develops over several hours following release.
- Release of myoglobin blocks the kidney's tubules and may cause renal failure.

Treatment

- Tourniquets help contain the toxic products within the crushed area and also help control bleeding, but in the absence of severe bleeding only have a role if applied prior to release of the weight. If a tourniquet has been applied, it should remain in place until the patient is in a clinical environment where life-threatening hyperkalemia (and/or bleeding) can be treated.
- Several litres of 0.9% sodium chloride should be administered, even if the patient does not appear to be hypovolaemic. This is termed pre-loading. Pre-loading offers protection in three ways:
  - Increased intravascular volume helps dilute the released products.

  - Sodium ions help protect the cardiac cell membranes from the effects of the potassium.
  - Increased urine flow through the kidneys helps prevent myoglobin blocking the tubules.
- Salbutamol stimulates beta-2 receptors and causes potassium to move into cells, lowering the potassium concentration in blood.
- Glucose stimulates endogenous insulin production and causes potassium to move into cells, lowering the potassium concentration in blood.
- Calcium provides protection to cardiac cell membranes from potassium.
- Sodium bicarbonate provides protection in three ways:
  - Sodium ions help protect cardiac cell membranes from the effects of potassium.
  - The bicarbonate raises blood pH, causing potassium to move into cells which lowers the potassium concentration in blood.
  - The bicarbonate raises urinary pH which reduces myoglobin deposition in kidney tubules.
- Always ensure an adequate flush between administering calcium and sodium bicarbonate because precipitation will occur if they are combined.
- A medical specialist will bring additional skills to the scene. They can provide anaesthesia and may also be able to bring blood to the scene.
- If calcium and sodium bicarbonate cannot be delivered to the scene, all of the other treatments should still be provided.
- Amputation is only rarely required. If amputation is being considered outside the setting of a major incident, this must be discussed with a medical specialist whenever feasible.

Should removal of the weight be deliberately delayed?

- Some texts advocate that removal of the weight should be delayed while specialist personnel are sent to the scene to prepare for release syndrome. As a general rule the weight must be removed as soon as possible, noting that clinical judgment is required. For example:
  - If there is significant weight on the head, neck, chest or abdomen, the weight must be released as soon as possible.
  - If there is a clinically significant risk of release syndrome, it is worth delaying release of the weight for 10-15 minutes (but no longer) while preparation for release syndrome occurs.

4.5 Hypovolaemia from other causes

This section is for hypovolaemia from:

a) Blunt trauma or
b) Peripheral blood loss that has been fully controlled or
c) Gastrointestinal bleeding or
d) Antepartum haemorrhage (see the 'obstetric related bleeding' section) or
e) Hyperthermia or
f) Fluid loss (for example from hyperglycaemia or diarrhoea) or
g) Hypovolaemia from a cause that does not fit into another section.

- Keep the patient warm.
- Gain IV access.
- Administer 0.9% sodium chloride IV if the patient has signs of hypovolaemia or poor perfusion:
  a) 1 litre for an adult.
  b) 20 ml/kg for a child.
  c) Administer further fluid as required.
- Arrange for blood to be administered if this is available and the patient has severe hypovolemic shock.
- Immobilise fractures. In particular firmly splint the pelvis and tie the knees together if shock is associated with a possible pelvic fracture.
- Transport a patient with trauma and hypovolaemic shock direct to a designated major trauma hospital whenever feasible.

Referral

- The patient must be given a firm recommendation to be transported to an ED by ambulance if 0.9% sodium chloride IV is administered.

Additional information

General

- Blood pressure alone is a poor guide to the severity of hypovolaemia and a poor guide to fluid therapy.
- Fluid therapy should be administered if there are signs of hypovolaemia even if the patient is not hypotensive.

- Fluid therapy should be titrated to signs of intravascular volume and perfusion. The trend of all of the following signs is an important guide to treatment:
  - Heart rate.
  - Pulse strength (noting that the absence of a palpable pulse does not equate to a specific blood pressure).
  - Capillary refill time.
  - Pulse pressure.
  - Blood pressure.
  - Level of consciousness.
- It is important to keep the patient warm because hypothermia worsens bleeding by contributing to coagulopathy:
  - Remove wet clothing and dry the patient as soon as possible.
  - Keep the patient covered with blankets whenever possible.
  - Keep the interior of the ambulance as hot as possible.
  - Ambient temperature IV fluid contributes to hypothermia, but do not warm IV fluid in microwaves because this can result in unreliable fluid temperatures and/or may damage the plastic bag.
  - Foil blankets are not useful for the majority of patients. Once in the ambulance, a hot environment is the most important factor and the presence of a foil blanket may be counter-productive by reducing the amount of heat absorbed by the patient.
- In some parts of New Zealand blood is available in the pre-hospital setting via medical staff. Only call for blood if there is an established protocol in the area for blood to be delivered to the scene. Blood should be requested early if shock is severe.
- Some patients may not become tachycardic despite significant hypovolaemia. Examples include:
  - Patients taking beta-blockers.
  - End stage hypovolaemic shock with a falling heart rate.
  - Ectopic pregnancy (dilatation of the fallopian tube may cause vagal stimulation).
  - Miscarriage (dilatation of the cervix may cause vagal stimulation).

IV fluid and hyperglycaemia

- Rapid boluses of IV fluid should be avoided if the cause of hypovolaemia is hyperglycaemia, unless the patient is severely shocked. This is because rapid boluses of IV fluid may contribute to cerebral oedema:
  - Rapid boluses of fluid may cause a rapid fall in glucose (by dilution) and this causes a rapid fall in osmolality. A rapid fall in osmolality causes water to shift into the brain and this may cause cerebral oedema.
  - Children and young adults are most at risk of cerebral oedema.
  - The IV fluid volume should be administered over approximately an hour, unless severe shock is present.

Shock following blunt trauma

- Shock following blunt trauma is usually caused by blood loss, but it is important to exclude tension pneumothorax.
- Occasionally shock following blunt trauma is caused by spinal cord injury, resulting in loss of sympathetic tone to peripheral blood vessels and/or the heart. Have a low threshold for administering an adrenaline infusion if the shock is not responding to 2 litres of 0.9% sodium chloride IV in an adult or 40 ml/kg in a child, provided it is clear that it is spinal shock and not hypovolaemic shock.
- When splinting a possibly fractured pelvis:
  - Do not spring the pelvis looking for instability.
  - It is difficult to determine that a pelvis is fractured by clinical examination. Assume that the pelvis is fractured if the patient has pain in the pelvic area, or is unable to report pain and has a suitable mechanism of injury.
  - Firmly splint the pelvis using a transfer/lifting belt, a Sagar cravat or a specifically supplied pelvic splint.
  - The splint should be centered over the pubic bone. Apply the splint firmly. It should feel like a firmly fitting belt.
  - Do not use a sheet to wrap the pelvis unless this is the only option because a sheet can rarely be applied firmly enough.
  - Prior to extrication from a vehicle, consider tying the patient's legs together and placing a pelvic splint on the stretcher so that the splint can be applied without delay.

Bleeding from wounds

- The best method of controlling external bleeding is firm, sustained and direct pressure over the bleeding point.
- If severe bleeding is present, the bleeding should be controlled by direct pressure before a dressing and bandage is applied.
- If clinically significant external bleeding continues despite direct pressure and the wound is unsuitable for tourniquet application, consider the use of topical adrenaline:
  - Dilute adrenaline to 10 times the volume (to 1:10,000) using 0.9% sodium chloride. For example: dilute 2 mg of adrenaline to a total of 20 ml, dilute 3 mg of adrenaline to a total of 30 ml or dilute 5 mg of adrenaline to a total of 50 ml.
  - Flood the wound with this solution and continue to provide direct pressure.
  - If there is a significant wound cavity, pack the cavity with gauze soaked in 1:10,000 adrenaline solution and provide direct pressure over the cavity.

Backup

  - Backup from an ICP must be requested if shock is severe.
  - EMTs must call for backup if topical adrenaline is administered.

4.6 Hypovolaemia from uncontrolled bleeding

This section is for hypovolaemia from:

a) Penetrating truncal trauma or
b) Leaking abdominal aortic aneurysm or
c) Peripheral penetrating trauma where blood loss has not been controlled or
d) Postpartum haemorrhage (see the 'obstetric related bleeding' section) or
e) Ectopic pregnancy.

- Compress any external bleeding.
- Apply a tourniquet if there is severe bleeding from a limb that is not controlled by direct pressure.
- Do not remove penetrating objects.
- Cover sucking chest wounds with a dressing.
- Begin transport without delay, providing most treatments en route.
- Keep the patient warm.
- Gain IV access.
- Administer IV fluid if the patient is severely shocked:
  a) Arrange for blood to be administered if this is available.
  b) If blood is unavailable, administer 500 ml of 0.9% sodium chloride for an adult or 10 ml/kg of 0.9% sodium chloride for a child.
  c) Administer further fluid if the patient remains severely shocked.
- Transport a patient with trauma and hypovolaemic shock direct to a designated major trauma hospital whenever feasible.

Additional information

General

- The most important aspects of pre-hospital care are to stop external bleeding and rapidly transport the patient to an appropriate major hospital, providing most treatments en route.
- Cover visible abdominal contents with cling film.
- It is important to keep the patient warm because hypothermia worsens bleeding by contributing to coagulopathy:
  - Remove wet clothing and dry the patient as soon as possible.
  - Keep the patient covered with blankets whenever possible.
  - Keep the interior of the ambulance as hot as possible.
  - Ambient temperature IV fluid contributes to hypothermia, but do not warm IV fluid in microwaves because this can result in unreliable fluid temperatures and/or may damage the plastic bag.

  - Foil blankets are not useful for the majority of patients. Once in the ambulance, a hot environment is the most important factor and the presence of a foil blanket may be counter-productive by reducing the amount of heat absorbed by the patient.
- There is no role for spinal immobilisation if the patient has penetrating trauma to the neck or torso.

IV fluid resuscitation for uncontrolled bleeding

- Mortality rates from shock associated with uncontrolled bleeding appear to be reduced if the patient is deliberately allowed to be relatively hypovolaemic prior to surgical control of the bleeding.
- The rationale for low volume resuscitation is that the bleeding is usually from an artery and bleeding may be reduced when blood pressure is relatively low. Fluid resuscitation may result in an increase in blood pressure and dilution of clotting factors, both of which reduce the chance of clot formation and may increase blood loss.
- The threshold for 0.9% sodium chloride in this section is higher than in the 'hypovolaemia from other causes' section, in that it is only administered when there are signs of severe shock.
- When administering 0.9% sodium chloride, clinical judgement is required that balances the risk of death from hypovolaemic shock against the risk of making bleeding worse.
- If the time to surgical intervention is going to be greater than one hour, it is appropriate to lower the threshold at which 0.9% sodium chloride is administered. In this setting, continue to follow the principle of deliberately allowing the patient to be relatively hypovolaemic, but administer more 0.9% sodium chloride than described.
- Bleeding from solid organs (for example lung, liver, spleen or kidney) following trauma has a pattern of bleeding that is usually relatively controlled. For this reason blood loss from such organs is not treated using this section, but is treated using the 'hypovolaemia from other causes' section.
- In some parts of New Zealand blood is available in the pre-hospital setting via medical staff. Only call for blood if there is an established protocol in the area for blood to be delivered to the scene. Blood should be requested early if shock is severe.

Defining severe shock

- Determining that the patient has severe shock requires clinical judgement because severe shock cannot be tightly defined. The overall clinical picture should be considered, taking into account the clinical scenario and the trend of the patient's heart rate, radial pulse strength, blood pressure, pulse pressure, peripheral capillary refill time and level of consciousness.

- Signs of severe shock include:
  - Increasing tachycardia.
  - Weak radial pulses (noting that the absence of a radial pulse does not equate to a specific blood pressure).
  - Prolonged capillary refill time.
  - A falling or un-recordable blood pressure.
  - Agitation, confusion or a falling level of consciousness (usually with preservation of the ability to obey commands).
  - A falling heart rate (a very late sign).
- It is not possible to define a blood pressure at which shock is severe. In young people blood pressure may only begin to fall when shock is already severe and blood pressure varies with age, gender, degree of fitness and medications.
- If a young patient's blood pressure is low or falling, it usually reflects a substantial loss of intravascular volume. In an elderly person with a reduced ability to compensate, a small loss of intravascular volume may result in a fall in blood pressure, even though shock is not severe.

Tourniquet application

- When applying a tourniquet:
  - Remove clothing from the limb if possible.
  - Apply as distally as possible.
  - Do not apply over a joint.
  - Tighten until bleeding stops. The tourniquet must be tight enough to stop arterial flow.
  - Leave the wound exposed so that it can be observed for bleeding.
  - Record the time of application.
  - Re-check the tourniquet following treatment. It may need to be further tightened if blood pressure improves.
  - Do not remove the tourniquet until someone capable of gaining surgical control of the bleeding is present.
- If the tourniquet is applied to a forearm or lower leg, the presence of two bones may limit the pressure that can be applied to vessels. If bleeding continues despite the tourniquet being tightened maximally, place the tourniquet on the upper arm or thigh.
- The tourniquet needs to be very tight if applied over a thigh, particularly if the thigh is large. Occasionally a second tourniquet may be required proximal to the first tourniquet.
- A tourniquet may be used to provide direct pressure over a dressing. In this setting the tourniquet needs to be tight enough to control bleeding and not necessarily tight enough to stop arterial flow.
- A conscious patient will usually require opiate analgesia and may require ketamine. If the patient is conscious and not in significant pain, it is likely that the tourniquet is not tight enough.

Sucking chest wounds

- Place a standard dressing on the wound.
- Do not cover a sucking chest wound with a sealed dressing because this risks the development of tension pneumothorax.
- Do not spend time trying to seal a dressing on three sides in order to form a valve, as this is rarely effective.
- Remove the dressing if the patient develops signs of a tension pneumothorax.

Bleeding from wounds

- The best method of controlling external bleeding is firm, sustained and direct pressure over the bleeding point.
- If severe bleeding is present, the bleeding should be controlled by direct pressure before a dressing and bandage is applied.
- If clinically significant external bleeding continues despite direct pressure and the wound is unsuitable for tourniquet application, consider the use of topical adrenaline:
  - Dilute adrenaline to 10 times the volume (to 1:10,000) using 0.9% sodium chloride. For example: dilute 2 mg of adrenaline to a total of 20 ml, dilute 3 mg of adrenaline to a total of 30 ml or dilute 5 mg of adrenaline to a total of 50 ml.
  - Flood the wound with this solution and continue to provide direct pressure.
  - If there is a significant wound cavity, pack the cavity with gauze soaked in 1:10,000 adrenaline solution and provide direct pressure over the cavity.

Backup

- Backup from an ICP must be requested if shock is severe.
- EMTs must call for backup if topical adrenaline is administered.

4.7 Minor traumatic brain injury

Use this section for patients who can obey commands and have a mechanism of injury consistent with traumatic brain injury (TBI).

- Assess the patient for symptoms or signs of concussion.
  a) Assess the patient's GCS.
  b) Assess for symptoms such as headache, nausea, amnesia, light headedness or feeling groggy or hazy.
  c) Assess for signs such as vomiting, disorientation, reduced attention or delay when answering questions.
  d) Assess memory by asking 2-3 questions.
  e) Assess coordination by observing the patient walk and performing the finger-nose test.
  f) Assess balance by performing Romberg's test.
- The patient has concussion if any abnormal symptoms or signs are present, or if there is any abnormality detected in memory, coordination or balance.

Referral and advice

- If any of the following are present the patient must be given a firm recommendation to be transported to an ED by ambulance:
  a) Loss of consciousness with the injury or
  b) Abnormal GCS or
  c) Seizure following the injury or
  d) Concussion is present and the patient is taking an anticoagulant or has a bleeding disorder or
  e) Severe signs or symptoms of concussion are present.
- Have a very low threshold for recommending transport to an ED if the patient is taking an anticoagulant or has a bleeding disorder, unless the injury is clearly minor and the patient is asymptomatic.
- If there are symptoms or signs of concussion, the patient must be given a firm recommendation to immediately stop activity (for example sport) that might result in further brain injury and see a doctor (preferably their own GP) for follow up.
- If there are no symptoms or signs of concussion, the patient may be given a recommendation to continue with activity. Clinical judgement is required that takes into consideration the nature of the injury, because the onset of symptoms or signs of concussion may sometimes be delayed.

- The patient (or their guardian) and any accompanying adults must be given the concussion information sheet, along with an explanation of the advice within it, if transport by ambulance to a medical facility does not occur and any of the following are present:
  a) There are symptoms or signs of concussion or
  b) The patient is thought to have had a significant injury or
  c) The patient is competent and refusing transport by ambulance or
  d) The patient is taking an anticoagulant or has a bleeding disorder.

Additional information

General

- If the patient has had loss of consciousness or has an abnormal GCS, transport to an ED by ambulance must occur because further assessment and observation is required in case subsequent intracranial bleeding develops.
- Clinical judgement is required when determining the patient has had loss of consciousness from the history given by bystanders. It is common for the patient to appear to be stunned for several seconds after a minor TBI and this is often reported by bystanders as being knocked out. This is not considered loss of consciousness unless there is a clear history of the patient being unconscious for a period of time that is in excess of a few seconds.
- The concussion assessment may be used for a child provided they are old enough to cooperate with having a history taken and being examined.
- The threshold for recommending transport to an ED must be lowered if the patient has alcohol and/or drug intoxication.

Concussion

- Concussion is a form of TBI where no detectable injury is present on CT brain imaging, but the patient has signs or symptoms of altered brain function.
- Concussion can occur with injury that does not result in loss of consciousness.
- Although the term minor TBI is used in conjunction with concussion, the associated symptoms are often significant and may impair brain function for many months.
- Concussion is most often thought of as being associated with contact sports, but also commonly occurs with assault, falls and minor road traffic crash.
- Repeated concussion can have long term effects and this is why a formal medical assessment is required prior to resuming activities that risk further concussion.

Patients taking an anticoagulant or with a bleeding disorder

- If the patient is taking an anticoagulant (such as warfarin or dabigatran) or has a bleeding disorder (such as haemophilia), there is an increased risk of intra-cranial bleeding following traumatic brain injury, even if there has been no loss of consciousness.
- Transport to ED does not necessarily need to be by ambulance, provided the patient has a GCS of 15, is asymptomatic, is accompanied by a competent adult and suitable private transport is immediately available.

Assessing memory

- To assess memory ask 2-3 questions. For example:
  - Where are we at the moment?
  - How did you get here today?
  - What were you doing before your injury?

Romberg's test

- Stand beside the patient and be prepared to assist if they stumble.
- Ask the patient to stand with their feet together, place their arms by their side, get their balance and then close their eyes.
- Observe how long the patient can maintain the stance. A patient with normal balance should be able to maintain the stance without stumbling for more than 15 seconds.

The finger-nose test

- Ask the patient to put the tip of their index finger on their nose.
- Hold your finger approximately 30 cm away and ask the patient to touch your finger.
- Slowly move your finger and ask them to alternately touch their nose, then your finger, then their nose etc.
- A patient with normal coordination will successfully do this. A patient with abnormal coordination will miss or overshoot.

4.8 Severe traumatic brain injury

Use this section for patients who cannot obey commands and have a mechanism of injury consistent with traumatic brain injury (TBI).

- Administer oxygen.
- Intubation must not be attempted without rapid sequence intubation (RSI), unless the patient has a GCS of 3 and ineffective breathing.
- Gain IV access.
- Administer 0.9% sodium chloride IV if the systolic blood pressure is less than 120 mmHg in an adult, or less than the normal predicted systolic blood pressure in a child:
  a) 1 litre for an adult.
  b) 20 ml/kg for a child.
  c) Administer further fluid as required.
- Transport the patient direct to a designated major trauma hospital whenever feasible.

Additional information

General

- The goal of treating a patient with severe TBI is to:
  - Recognise severe TBI and
  - Minimise or prevent secondary brain injury and
  - Treat other life-threatening injuries if present and
  - Transport the patient direct to a designated major trauma hospital whenever feasible.
- Secondary brain injury occurs when a further physiological insult occurs to the brain after the primary (initial) injury. Secondary brain injury increases mortality and worsens neurological recovery in survivors. Common causes of secondary brain injury include:
  - Hypoxia.
  - Hyperventilation.
  - Hypoventilation.
  - Hypotension.
- Oxygen is administered to a patient with severe TBI, even if their SpO_2 is greater than or equal to 94%. This is done to help prevent hypoxia. The choice of which administration device to use is a pragmatic one.
- The goal of fluid therapy is to minimise hypotension. Administer the minimum amount of fluid required to achieve a systolic BP of 120 mmHg in an adult, or a normal predicted systolic BP in a child.

- A patient with alcohol or drug intoxication who cannot obey commands following trauma should be presumed to have severe TBI until proven otherwise. This is the case even if it is highly suspected that alcohol or drug intoxication is the cause of the patient's altered level of consciousness.
- Hypoglycaemia can mimic severe TBI. A blood glucose concentration should always be measured.
- A brief seizure following severe TBI is relatively common, particularly in a child. These seizures do not usually require treatment with medicines, but repeated or prolonged seizures should be treated using the 'seizures' section.

Sedation, intubation and ventilation

- Sedation increases the risk of secondary brain injury and must be avoided unless the patient is so combative that treatment and/or transport cannot be provided safely.
- Intubation without RSI may worsen outcomes by increasing secondary brain injury and increasing intracranial pressure. This is why intubation without RSI is restricted to patients with a GCS of 3 and ineffective breathing.
- Capnography is compulsory for all intubated patients. The target end tidal CO_2 for patients ventilated via an endotracheal tube is 30-35 mmHg. This is intended to ensure that arterial CO_2 levels are at the lower end of normal.
- Do not hyperventilate a patient with TBI. Hyperventilation worsens the patient's outcome by causing cerebral vasoconstriction which decreases cerebral blood flow.

Backup

- Backup from an ICP must be requested if the patient has severe TBI.
- Backup from personnel skilled at RSI must be requested if the patient has any of the following, provided backup can locate with the patient significantly faster than the patient can be transported to hospital:
  - A poor airway or
  - Poor breathing or
  - A GCS less than 10.
- Backup from personnel skilled at RSI should be considered if the patient has severe agitation.

4.9 Joint dislocation and fracture realignment

- Fractures with significant displacement should be realigned as soon as possible and this should occur out-of-hospital whenever feasible.
- An attempt to relocate a dislocated finger should usually occur:
  a) Consider administering a ring block and/or inhaled analgesic.
  b) Apply longitudinal traction.
- An attempt to relocate a dislocated shoulder may occur provided:
  a) The patient has had previous dislocation of the same joint and
  b) The shoulder is dislocated anteriorly and
  c) There is no clear evidence of acromioclavicular joint dislocation and
  d) There is no clear evidence of a fracture involving the humerus and
  e) The dislocation is a result of malpositioning and/or a relatively minor force.
- To attempt relocation of a dislocated shoulder:
  a) Consider administering an inhaled analgesic.
  b) Gain IV access and administer fentanyl IV.
  c) Administer low dose midazolam IV if required, provided the patient can obey commands at all times.
  d) Use either the Stimson or modified Kocher's technique.
  e) A maximum of two attempts using one technique may be made.
- An attempt to relocate/realign a dislocated/severely deformed wrist, elbow, knee or ankle joint should usually occur, particularly when there is impaired sensation or perfusion distal to the injury, unless transport time to hospital is less than 15 minutes:
  a) Gain IV access and administer fentanyl IV.
  b) Administer ketamine IV to achieve dissociation.
  c) Provide sustained longitudinal traction of the limb with an assistant providing counter-traction above the injury site.
- An attempt to relocate a dislocated patella should usually occur.
  a) Consider administering an inhaled analgesic.
  b) Gain IV access and administer fentanyl IV if required.
  c) Grasp the patella with the hand and push it medially (inwards) while simultaneously straightening the knee.
- An attempt to relocate a dislocated hip must not occur without seeking clinical advice.

Additional information

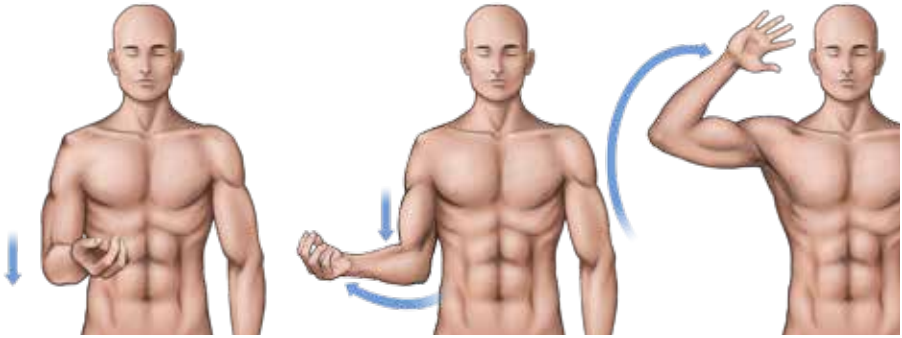
- A dislocated joint should be relocated/realigned as soon as possible because this will relieve pain and the longer the joint is dislocated the higher is the risk that damage will be done to nerves, blood vessels and ligaments.
- The same principle applies to significantly displaced fractures which should be realigned as soon as possible. 'Significant' cannot be tightly defined and requires clinical judgement.
- If there is compromised sensation or perfusion distal to a dislocated joint (including compromised perfusion of skin overlying the dislocation), relocation/realignment is urgent and should occur pre-hospital whenever feasible. Time to relocation/realignment is more important than time to hospital, because once in hospital the patient will require to be handed over and then seen by medical staff before relocation/realignment can occur.
- Dislocations associated with significant force have an increased likelihood of being associated with fractures. It is not possible to define 'significant' force and clinical judgement is required. However, the presence of associated fractures (including compound fractures) does not change the need to relocate/realign the joint if this is clinically indicated.
- Even in the absence of compromised perfusion or sensation, a dislocation/severe deformity of the wrist, elbow, ankle or knee should be relocated/realigned as soon as possible because of the high risk to nerves and blood vessels. This should usually occur pre-hospital unless time to hospital is less than 15 minutes.
- The general principles of relocating/realigning a dislocated joint are to:
  - Provide adequate analgesia and sedation if required.
  - Apply sustained traction in the longitudinal direction of the limb.
  - Have an assistant provide counter-traction above the injury site.
- Joint relocation has not been specifically described within the delegated scopes of practice:
  - EMTs are expected to relocate a dislocated patella.
  - For relocation of most other dislocations, the patient will usually require a minimum of opiate analgesia and may require sedation. This means that an ICP is usually required.
  - Occasionally a patient may require urgent relocation of a joint and backup is not available in a suitable time frame. In this setting personnel should seek clinical advice.
- The affected limb must always be assessed for perfusion, sensation and movement distal to the injury. This assessment must be repeated after any attempt to relocate/realign the joint.
- Additional instructions for relocating or realigning specific joints are contained within the following sections.

Shoulder dislocation

- An attempt to relocate a dislocated shoulder may occur provided:
  - The patient has had previous dislocation of the same joint and
  - The shoulder is dislocated anteriorly and
  - There is no clear evidence of acromioclavicular joint dislocation and
  - There is no clear evidence of a fracture involving the humerus and
  - The dislocation is a result of malpositioning and/or a relatively minor force.
- To relocate the shoulder:
  - Consider administering an inhaled analgesic.
  - Gain IV access in the unaffected arm and administer fentanyl.
  - Administer low dose midazolam if required, provided the patient can obey commands at all times.
  - Attempt one of two alternative techniques (see below).
  - A maximum of two attempts using one technique may be made.
  - Ensuring the patient is relaxed and taking adequate time to perform the procedure (5-10 minutes) are important factors in achieving relocation.
  - If the shoulder does not relocate, support the arm in the most comfortable position and transport to an ED.

The modified Kocher's technique

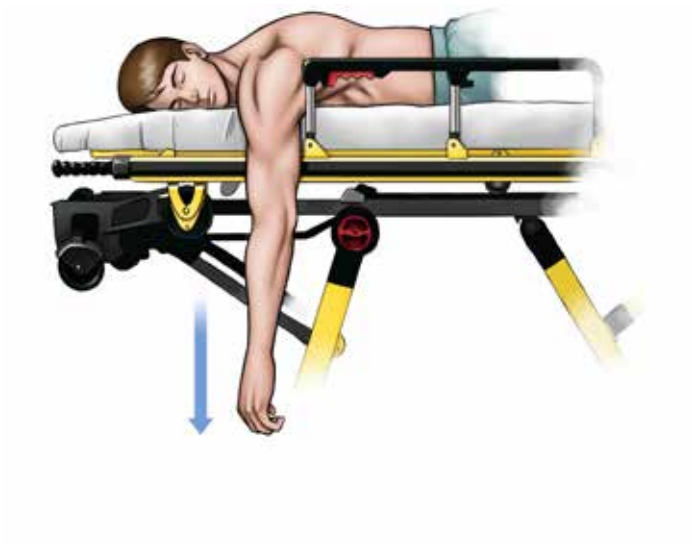
- Position the patient supine or sitting, with the arm by their side.
- Bend the elbow to 90 degrees.
- Apply traction to the humerus and slowly externally rotate the arm until resistance is felt (usually approximately 45 degrees).
- Slowly abduct the arm, as if to scratch the back of the head with the patient's hand.
- Massage the head of the humerus if the shoulder does not relocate.



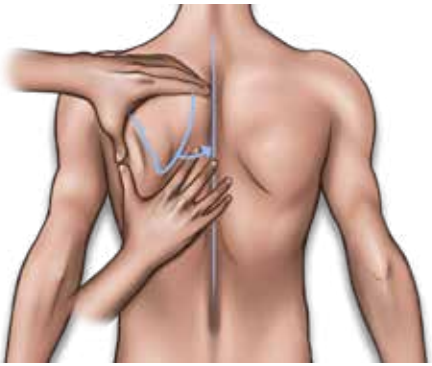
Step one Step two Step three

The Stimson technique

- Place the patient prone on the stretcher with their affected arm hanging down towards the ground. Ensure the stretcher height is such that their arm does not touch the ground. Apply continuous downward traction on the hand or wrist for several minutes.
- If the shoulder does not relocate after several minutes, maintain traction and gently rotate (supinate) the hand and wrist outwards. Maintain this position for several minutes.
- If this is unsuccessful, apply scapular rotation. Push the lower pole of the scapula (shoulder blade) towards the spine, whilst maintaining downward traction on the arm.



Scapular rotation

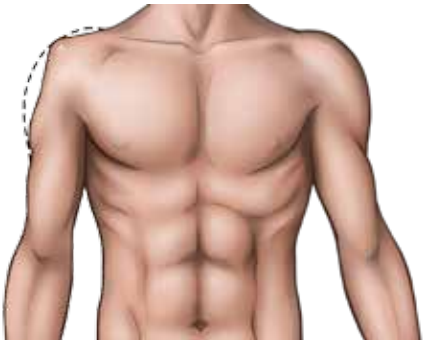


If the shoulder relocates

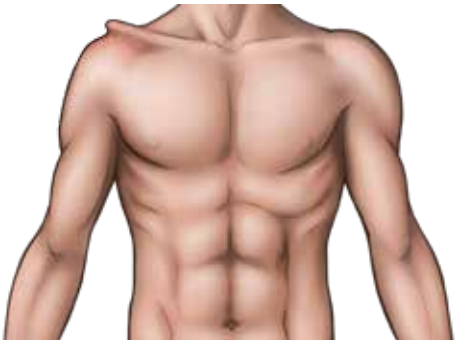
- This will usually be indicated by
  - A palpable or audible clunk.
  - Relief of pain.
  - Return of a normal shoulder shape.
  - Return of normal (or near normal) motion of the shoulder joint.
- Place the arm in a sling.
- Recommend the patient keeps their arm in a sling for 48 hours, avoids using the arm unnecessarily and sees their GP within 48 hours.
- A patient administered fentanyl and/or midazolam may be given a recommendation not to be transported to an ED by ambulance provided the patient:
  - Has a GCS of 15 and
  - Is in the care of a competent adult and
  - Is instructed not to drive a vehicle or operate machinery for at least 24 hours.
- Provide advice on taking analgesia. Regular paracetamol and/or an anti-inflammatory (following the package instructions) are usually appropriate.

Additional information on shoulder relocation

- The shoulder joint is rendered relatively unstable by a shallow cup (the glenoid fossa) with reliance on muscles, ligaments and tendons for stability.
- Approximately 95% of dislocations are anterior. This typically produces a squared shoulder appearance.
- The shoulder must be examined to ensure that the deformity relates to the shoulder joint and not the acromioclavicular joint situated at the outer end of the clavicle.



Squared shoulder appearance



Acromioclavicular joint dislocation

- Complications are mainly associated with relocation of first dislocations and dislocations that are associated with fractures or significant trauma.
  - It is not possible to define 'significant trauma' and clinical judgement is required.
  - The complications include displacing a fracture sustained at the time of injury or causing a fracture during relocation. This is the reason for only attempting relocation if the patient has an anterior dislocation of the shoulder in the setting of previous dislocation.
- Relaxation of muscles is one of the most important aspects of relocation. This requires reassurance, analgesia, sustained traction and patience.
- The shoulder should relocate with sustained traction and no force should be used during the manoeuvres described.
- Multiple techniques have been described for relocating a dislocated shoulder. Most of them rely on adequate muscle relaxation and sustained traction. If the patient has previously experienced successful relocation using a specific technique, it is acceptable to try this technique even if it is not one of the techniques described here.
- If the first technique is not successful, do not attempt an alternative technique.

Patella dislocation

- An attempt to relocate a dislocated patella should occur provided that only the patella is dislocated:
  - Administer inhaled analgesia.
  - Administer fentanyl IV if required.
  - Low dose midazolam may be administered provided the patient can obey commands at all times, but is rarely required.
- Bend the knee to approximately 45 degrees (it will usually already be in this position), grasp the patella with the hand and push it medially (inwards) while simultaneously straightening the knee.

If the patella relocates

- This will usually be indicated by
  - Relief of pain.
  - Return of a normal knee shape.
  - Return of an improved range of motion of the knee joint.
- If it is the first time that the patella has dislocated, the patient should be transported for medical review and an x-ray (this could be at an Accident and Medical Clinic and transport by ambulance may not be required).

- Transport for medical review is not required if:
  - The patella has dislocated before and
  - The patella relocates and
  - There is relief of pain and
  - The patient can actively bend their knee.
- A patient administered fentanyl and/or midazolam may be given a recommendation not to be transported to an ED by ambulance provided the patient:
  - Has a GCS of 15 and
  - Is in the care of a competent adult and
  - Is instructed not to drive a vehicle or operate machinery for at least 24 hours.
- Provide advice on taking analgesia. Regular paracetamol and/or an anti-inflammatory (following the package instructions) are usually appropriate.
- If the patient is not transported, provide advice to avoid unnecessary movement of the knee and see their GP within 48 hours.

Additional information on patella relocation

- Patella dislocation occurs most commonly in adolescents or young adults, following twisting on a bent knee. Occasionally a traumatic impact may have occurred.
- The patella dislocates to the lateral (outwards) aspect of the knee and this needs to be confirmed by palpating it. The patient may describe swelling on the inside of the knee, but this results from prominence of the underlying femur which is no longer covered by the patella.
- Complications are mainly associated with first dislocations. A piece of bone may be torn off the patella during dislocation or relocation. If pain is not immediately relieved by relocation an x-ray is required.
- A dislocated patella is not the same thing as a dislocated knee. A dislocated knee occurs when the tibia is dislocated from the femur.

Ankle dislocation

- The ankle should be relocated/realigned as soon as possible.
- If relocation/realignment is occurring out-of-hospital:
  - Gain IV access and administer fentanyl IV.
  - Administer ketamine IV to achieve dissociation.
  - Apply firm longitudinal traction to the forefoot, while an assistant generates counter-traction on the leg.
- Relocation will often correct with a 'clunk'. Dislocations with fractures may produce a grating sensation with no clear end-point. If this occurs continue

applying traction until the foot is aligned with the leg.

- If relocation occurs, splint the ankle and transport to an ED as an urgent x-ray is always required.
- If the ankle does not relocate, splint the ankle to reduce deformity as much as possible.

Additional information on ankle relocation

- Dislocation may involve the subtalar joint or the ankle joint itself. The clinical appearance is similar for both types.
- Ankle dislocation is frequently accompanied by fractures. The presence or absence of fractures (including compound fractures) does not alter the need to relocate/realign the ankle if clinically indicated and the technique is the same.

Knee dislocation

- A dislocated knee is an emergency because it may be associated with damage to the popliteal artery or peroneal nerve.
- The knee should be relocated/realigned urgently noting that relocation may be difficult because deep sedation is usually required.
- If relocation/realignment is occurring pre-hospital:
  - Gain IV access and administer fentanyl IV.
  - Administer ketamine IV to achieve dissociation.
  - Apply firm longitudinal traction to the lower leg, while an assistant generates counter-traction on the upper leg.
- If relocation is indicated because of distal ischaemia but is not achieved, applying longitudinal traction is the best method for restoring circulation, if this is achievable.

Hip dislocation

- A dislocated hip most commonly occurs in the setting of a prosthetic joint.
- A dislocated native (non-prosthetic) hip joint is time sensitive because there is a risk of ischaemia of the femoral head.
- Relocation usually requires deep sedation and for this reason should usually only occur in hospital.
- Occasionally a patient may suffer recurrent dislocations of a prosthetic hip joint and know that their hip is relatively easy to relocate. In this setting only attempt relocation following clinical advice from a medical specialist.

Finger dislocation

- An attempt to relocate a dislocated finger joint should occur.
- Examine and record the presence of sensation before administering a ring block and add inhaled analgesia if required.
- Apply longitudinal traction until the joint relocates. Do not persist if it does not relocate easily.
- If the finger relocates:
  - Splint the finger to the adjacent fingers.
  - An x-ray is always required as there is a high association with fracture. This is not urgent, and may occur within 24 hours provided there are no signs of compound fracture and the finger is aligned with normal distal perfusion.

Wrist dislocation

- Wrist deformity is normally caused by a fracture rather than dislocation alone, but the pre-hospital approach to both is the same.
- The wrist should be relocated/realigned urgently.
- If relocation/realignment is occurring pre-hospital:
  - Gain IV access and administer fentanyl IV.
  - Administer ketamine IV to achieve dissociation.
  - Apply firm longitudinal traction to the hand, while an assistant generates counter-traction on the elbow.
- If relocation/realignment is indicated because of distal ischaemia but is not achieved, applying longitudinal traction is the best method for restoring circulation, if this is achievable.

Elbow dislocation

- A dislocated elbow is an emergency because it may be associated with damage to the brachial artery or nerves.
- The elbow should be relocated/realigned urgently noting that relocation may be difficult because deep sedation is usually required.
- If relocation/realignment is occurring pre-hospital:
  - Gain IV access and administer IV fentanyl.
  - Administer IV ketamine to achieve dissociation.
  - Apply firm longitudinal traction to the forearm, while an assistant generates counter-traction on the upper arm.
- If relocation is indicated because of distal ischaemia but is not achieved, applying longitudinal traction is the best method for restoring circulation, if this is achievable.

Providing sedation

- It is vital to ensure that sedation is provided in a safe manner.
- Begin with an inhaled analgesic if appropriate.
- If an opiate is required fentanyl is the preferred opiate.
- If midazolam or ketamine is being administered:
  - Routinely administer oxygen and task one person to continually monitor the patient's SpO_2, breathing and level of consciousness.
  - Have a manual ventilation bag and mask immediately available.
  - During midazolam administration the patient must be able to obey commands at all times.
  - During ketamine administration the aim is to achieve a dissociated state. This usually requires approximately 0.5 mg/kg of ketamine.

4.10 Cervical spine immobilisation

- The possibility of cervical spine injury should always be considered if there is a mechanism of injury that could involve the cervical spine.
- If all of the following criteria are met, the patient's cervical spine can be cleared clinically:
  a) A normal level of alertness and
  b) No tenderness at the posterior midline of the cervical spine and
  c) No signs or symptoms of spinal cord injury and
  d) No pain or other factors that might distract the patient from the pain of a cervical spine injury.
- If the patient's cervical spine cannot be cleared clinically:
  a) Place a firm cervical collar or
  b) Place a lanyard around the patient's neck indicating the cervical spine has not been cleared clinically and consider using head blocks, rolled towels or manual stabilisation of the neck.

Additional information

Clearing the cervical spine clinically

- The criteria described above may be used in a child, provided the child is old enough to cooperate with having a history taken and being examined.
- Begin by taking a history, does the patient have:
  - Neck pain?
  - Numbness or tingling anywhere?
  - Pain elsewhere?
- Examine the patient:
  - Feel for midline tenderness by palpating the posterior cervical spine from the skull to the prominence of the first thoracic vertebrae. Lateral muscle tenderness is not a sign of cervical spine injury.
  - Look for normal sensation to light touch in the limbs.
  - Look for normal movement of the limbs.
  - Look for signs of decreased alertness.
- A patient has a decreased level of alertness if any of the following are present:
  - A GCS less than 15.
  - Short term memory loss.
  - Clinical signs of intoxication.
  - Delayed or inappropriate response to external stimuli.
- Signs and symptoms of possible spinal cord injury are present if there is altered sensation or altered motor power (strength) in the limbs.
- Deciding if the patient has pain that might cause distraction from the pain of a

cervical spine injury requires clinical judgement. To be considered distracting, the pain must be significant enough to prevent the patient from noticing that their neck is sore.

- Use additional caution when clearing the cervical spine clinically if the patient is not in apparent pain, but has an injury that would be expected to cause pain. Examples include long bone fractures and dislocations.
- If the cervical spine is cleared clinically, no form of cervical spine immobilisation is required.

Factors that increase risk

- The following factors increase the risk of cervical spine injury:
  - Road crash involving rollover or ejection.
  - Fall from a significant height. For example, more than one metre or more than five stairs in an adult, particularly if head first.
  - Diving head first into shallow water.
  - Injury involving axial loading of the spine. For example, a rugby scrum collapse.
  - Pre-existing cervical spine abnormalities. For example, rheumatoid arthritis and ankylosing spondylitis.

General principles of immobilisation and cervical collars

- Significant abnormalities within the primary survey always take priority over the cervical spine.
- The patient should always be positioned with their spine in neutral alignment. If the patient's spine is not aligned, for example there is significant angulation, the spine must be aligned immediately.
- For most adults in the supine position, achieving neutral alignment will require 3-4 cm of flat pillow or a folded towel behind the head, noting that if pre-existing kyphosis is present the patient may require more than this. Conversely, small children may require padding under the thoracic spine to avoid neck flexion from their relatively large head.
- A cervical collar should not be routinely placed if the patient's cervical spine cannot be cleared clinically. Deciding to place a cervical collar requires clinical judgement that balances the benefits and risks:
  - A cervical collar will limit movement of the cervical spine but there is no good evidence that this significantly reduces the risk of secondary spinal cord injury.
  - A cervical collar may worsen neck pain, promote the development of pressure areas, make airway management more difficult and raise intra-cranial pressure.
- Always place a lanyard (labelled "cervical spine not cleared") around the patient's neck if their cervical spine has not been cleared clinically and a cervical collar has not been placed.

When a cervical collar should be placed

- A cervical collar should be placed if the patient has severe posterior midline tenderness or signs/symptoms of spinal cord injury:
  - The cervical collar must be correctly sized and fitted.
  - The collar should be firm but not tight.
  - The patient may sit up to 15 degrees if they have difficulty breathing or for comfort.
  - Head blocks or rolled towels may be used to limit lateral movement of the head but are not routinely required.

If the patient is cooperative

- A cervical collar should not usually be placed if the patient is cooperative:
  - The patient should be advised to keep their head and neck still.
  - The patient may sit up to 15 degrees if they have difficulty breathing or for comfort.
  - Head blocks or rolled towels may be used to limit lateral movement of the head but are not routinely required.
- If the patient is being carried or driven over rough or winding terrain, there is an increased risk of head and neck movement. Consider placing a cervical collar and consider adding head blocks or rolled towels at the side of the head.

If the patient is uncooperative

- Clinical judgement is required if the patient is uncooperative as placing a cervical collar may result in an increase in movement and/or agitation.
- Have a low threshold for not placing a cervical collar and consider providing manual stabilisation.
- Often the only realistic option is to repeatedly instruct the patient to keep still.

If the patient is unconscious

- If the patient is unconscious and has not had an ETT or LMA placed:
  - Do not place a cervical collar.
  - Position the patient on their side.
  - Provide manual stabilisation of the head and neck.
- If the patient is unconscious and has had an ETT or LMA placed:
  - Do not place a cervical collar.
  - Position the patient supine.
  - Sit the patient to 15 degrees if TBI is present. This maximises cerebral venous drainage and minimises intra-cranial pressure.
  - Use head blocks or rolled towels to limit lateral movement of the head. Head blocks or rolled towels are routinely used in this setting to limit lateral movement of the head because this group of patients are at increased risk of cervical spine injury.

Additional notes on immobilisation

- Do not place tape across the patient's head and/or chin when the patient is on an ambulance stretcher because this has no useful role in immobilisation and risks creating a fulcrum effect that may worsen injury. It is acceptable to use tape for a brief period of time during extrication on a device such as a scoop stretcher or combi-carrier.
- Consider providing manual stabilisation during extrication from a vehicle, but this is not required if the patient is cooperative, is able to extricate themselves and is instructed to keep their head and neck still.
- Cervical spine immobilisation is not required if there is a penetrating injury to the neck.
- Cervical spine immobilisation is not routinely required following hanging. Clinically significant cervical spine injury following hanging is extremely rare and should only be considered a possibility if the patient has fallen a height that is greater than or equal to the height of their body.
- If it is not possible to place a cervical collar, for example if the patient has severe obesity, alternative options for stabilisation (including manual stabilisation) should be considered.
- If the patient has a pre-existing abnormality of the anatomy of their cervical spine (for example ankylosing spondylitis or rheumatoid arthritis), placing a cervical collar may be unsafe because this may cause the patient's normal anatomical position to be altered. Maintain the normal anatomical position of the patient's spine, noting this may require the patient to sit and be provided with additional pillows.
- Cervical collars are sometimes promoted in the absence of concerns regarding the cervical spine, as a means of limiting neck movement in small children who have been intubated with an endotracheal tube.
  - In this setting the cervical collar is being used to limit flexion of the neck which may dislodge the endotracheal tube.
  - Clinical judgement is required but the balance of risk is usually against this practice and the preferred approach is to provide manual stabilisation of the head and neck during patient movement.

Spine boards, scoop stretchers and combi-carriers

- Spine boards (and other rigid flat boards) are primarily sliding and extrication devices.
- Scoop stretchers and combi-carriers are primarily lifting and carrying devices.
- None of these devices have a role in providing immobilisation of the spine.
- All of these devices carry the risk of creating pressure injury if a patient is on one for longer than 30 minutes. If this is expected, the patient should be removed from the device prior to beginning transport whenever feasible.

- If the patient is transported on such a device, it must be removed as soon as possible after arrival at hospital.

The Kendrick extrication device (KED)

- The KED is primarily a lifting and extrication device and has no role in providing continuing immobilisation of the spine.
- The KED has the disadvantages of taking time to apply and restricting the patient's breathing.
- The preferred approach is to slide the patient out laterally or vertically, with their spine in alignment without using a KED. However, a KED may be used if there is significant clinical concern regarding the patient's spine and insufficient personnel or space to extricate the patient with their spine in alignment.
- If a KED is used it should be removed as soon as possible following extrication.

Cervical spinal cord neuropraxia

- Also sometimes called cervical cord concussion, this is temporary loss of motor and/or sensory function followed by recovery over a few minutes to a few hours.
- It is due to bruising and/or stretching of the cervical spinal cord and is often associated with hyper-flexion or hyper-extension of the neck.
- Most commonly the patient experiences immediate symptoms with any combination of the following: burning pain, numbness, tingling, weakness or paralysis. All four limbs are usually involved, but the patient may experience symptoms in only some limbs.
- Commonly the patient does not have a cervical fracture and may be completely symptom free following recovery from their symptoms.
- There is a high association between cervical cord neuropraxia and pre-existing cervical stenosis (narrowing of the cervical canal through which the spinal cord runs). If cervical stenosis is present this often requires urgent surgery.
- The symptoms of cervical neuropraxia may have resolved by the time ambulance personnel reach the scene:
  - The history must be recorded and passed on to medical staff, as this is likely to change the subsequent investigation of the patient.
  - The patient's cervical spine should not be cleared clinically, even though the patient may not have any symptoms.
  - The patient should be transported by ambulance to an ED.

Cervical collars placed by other personnel

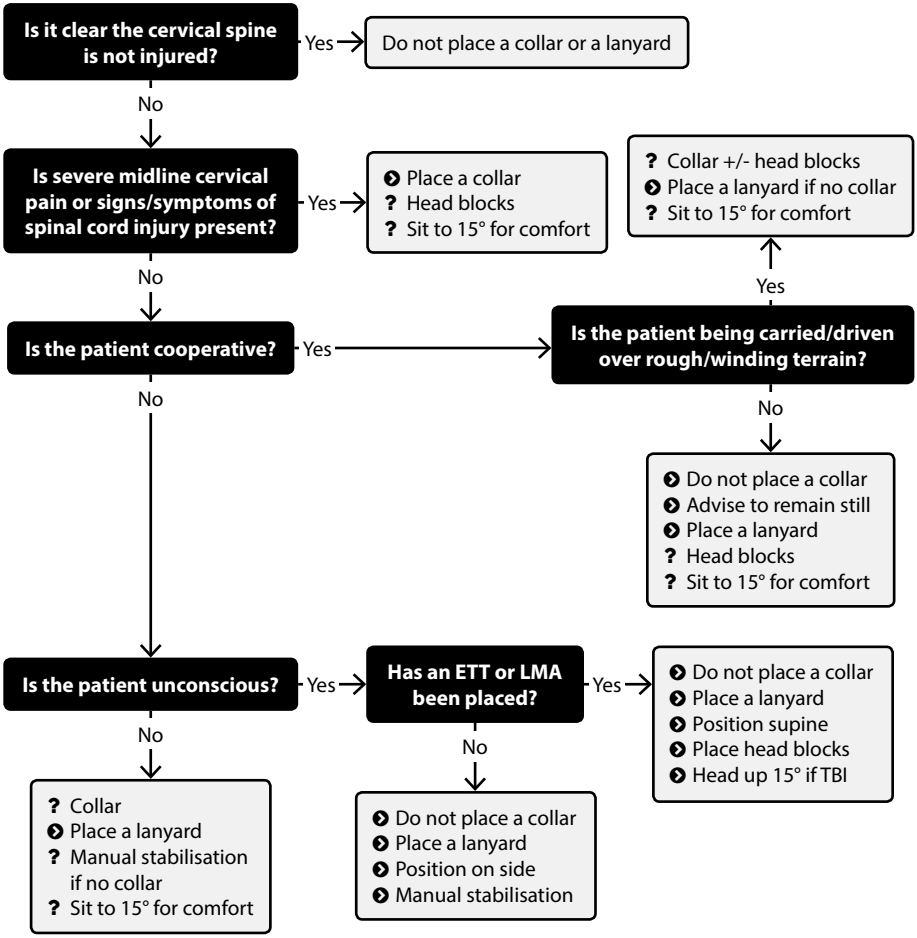
- Sometimes cervical collars (including soft cervical collars) have been placed by other healthcare providers prior to ambulance arrival.
- If a collar has been placed prior to ambulance arrival:
  - The collar should be removed if the patient's cervical spine can be cleared clinically.
  - The cervical spine immobilisation guidelines should be followed if the patient's cervical spine cannot be cleared clinically and this may involve removing or replacing the collar.
  - Removing or replacing the collar must be explained in a collegial manner to the other healthcare providers as a requirement under our CPGs.
  - The patient must receive an explanation that this is not a criticism of the clinical care they have already received.
  - If conflict occurs with the other healthcare providers, personnel should not persist with removing the collar and should begin transport from the scene. En route the ambulance should be stopped to enable the collar to be removed or replaced.

Prophylaxis of nausea and vomiting

- Prophylactic administration of ondansetron is not routinely required for a patient with an immobilised cervical spine.
- Consider administering ondansetron if:
  - The patient has nausea or
  - The nature of the patient's injuries or their position is such that vomiting would be particularly problematic.

See next page for flow chart

Cervical spine immobilisation summary



4.11 Spinal cord injury

This section is for patients with paraplegia or quadriplegia following traumatic injury.

- Transport the patient direct to a spinal cord impairment (SCI) centre whenever this is feasible and safe.
- The SCI centres have the following catchment areas:
  a) Middlemore Hospital: adults in the upper two-thirds of the North Island.
  b) Christchurch Hospital: adults in the lower third of the North Island and in the South Island.
  c) Starship Children's Hospital: children in the North Island.
  d) Christchurch Hospital: children in the South Island.
- Transport the patient to the most appropriate major trauma hospital if the patient has:
  a) Signs of other major trauma injury in addition to spinal cord injury or
  b) Inadequate breathing or
  c) Shock.
- Ensure the patient is appropriately immobilised, positioned, protected from pressure injury and kept warm.
- Have a low threshold for seeking clinical advice if there is uncertainty regarding the patient's condition, or transport to a SCI centre will involve a prolonged flight.
- Provide as much pre-hospital notification of arrival as possible, ensuring that ED staff are aware that the patient is being transported acutely under the spinal cord injury policy and not as an inter-hospital transfer.

Additional information

General

- A patient with SCI following trauma should be treated in a designated SCI centre as soon as possible after injury. This is because outcomes are optimised when surgery to decompress the spinal cord is performed urgently and this is only possible 24 hours a day, seven days a week in the SCI centres.
- The patient should be transported directly to a SCI centre unless there is a specific clinical reason, for example an immediately life-threatening problem, to transport the patient to a closer major trauma hospital. This is because secondary transfers incur delays that may impair outcomes.
- Patients with non-traumatic spinal cord impairment are not covered by this section. They should be transported to the most appropriate hospital and then transferred to a SCI centre.

Defining spinal cord injury in the out-of-hospital setting

- For the purposes of this section, signs of spinal cord injury require the patient to have paralysis with either paraplegia or quadriplegia.
- Altered sensation and/or weakness without paralysis are not sufficient. Patients may have these symptoms in the absence of spinal cord injury and transporting such patients to a SCI centre risks patients being transported long distances that do not require it.

Mechanism of injury

- The decision to transport a patient to a SCI centre is not directly affected by mechanism of injury.
- However, if the mechanism involves high velocity and another major trauma hospital is significantly closer to the scene than a SCI centre, it is vital to exclude other signs of major trauma prior to making a decision to transport the patient to a SCI centre.

Other signs of major trauma in addition to spinal cord injury

- The patient must be transported to the most appropriate major trauma hospital if there are other signs of major trauma in addition to that of spinal cord injury.
- Personnel must seek clinical advice if they are uncertain.

The adequacy of breathing

- Inadequate breathing is uncommon following spinal cord injury and usually only occurs with high cervical cord injury.
- Patients with diaphragmatic breathing should be transported directly to a SCI centre provided this is feasible, the patient has adequate oxygenation with supplemental oxygen and their breathing is not deteriorating.

Shock

- If shock is present the patient should usually be transported to the most appropriate major trauma hospital because the patient should be presumed to have hypovolaemic shock until proven otherwise.
- Loss of sympathetic outflow from the spinal cord following spinal cord injury can cause shock and in this setting the patient is usually vasodilated below the site of injury. It is appropriate to consider transporting the patient directly to a SCI centre provided personnel are confident the patient has spinal shock, particularly if the mechanism of injury involved low velocity and the patient clearly is not deteriorating. Personnel must have a low threshold for seeking clinical advice in this setting.

SCI centre catchment areas and transport destination

- The patient should be transported to the catchment area SCI centre provided this is feasible and safe. This means that some patients will be flown to a SCI centre that is not the closest SCI centre to the scene. This is preferable to flying to the closest SCI centre because it is important to balance patient numbers between centres and this reduces secondary inter-hospital transfers.
- It will not always be feasible to fly the patient to the catchment area SCI centre. For example, it is not always feasible to fly an adult from the lower third of the North Island to Christchurch Hospital.
- The following factors should be taken into account when determining which SCI centre the patient is transported to:
  - The catchment area boundaries and the location of the scene.
  - The location and availability of helicopters.
  - The weather.
  - Where the patient lives.
- Personnel should seek clinical advice if they are uncertain which SCI centre the patient should be transported to.

Transport

- If a helicopter flight will involve a significant flight time and/or involves overflying another major trauma hospital, it is essential that helicopter personnel re-evaluate the patient prior to flight, in order to ensure that there are no other signs of major trauma injury in addition to spinal cord injury.
- If a helicopter is required but is not available within a suitable time frame, or it is not feasible or safe (for example due to weather) to fly to a SCI centre, the patient should be transported to the most appropriate major trauma hospital. A suitable time frame cannot be tightly defined and requires clinical judgement.
- It is not usually feasible to transport a patient by fixed wing aircraft. In very unusual circumstances a fixed wing aircraft may be used, but personnel must seek clinical advice.
- The patient must be removed from extrication devices and transported directly on the stretcher, unless the total time on the extrication device is going to be less than 30 minutes.
- Urinary catheterisation is not required.

4.12 Major trauma triage

This section is for determining which patients have major trauma. Patients with major trauma should be transported to the most appropriate major trauma hospital, utilising the principles within regional major trauma destination policies.

Life-threatening problems requiring immediate medical intervention

- Transport the patient to the closest appropriate medical facility if the patient has a life-threatening problem requiring immediate medical intervention.
- Activate staging, preferably before leaving the scene, via Control/Comms if the medical facility is not a major trauma hospital.

Severe traumatic brain injury (TBI)

- Transport the patient to a major trauma hospital with neurosurgical facilities provided it is feasible and safe, if the patient has TBI and any of the following:
  a) Has been intubated and ventilated.
  b) Has lateralising neurological signs.
  c) Has a clinically obvious penetrating brain injury.

Complex multi-system trauma

- Transport the patient to a major trauma hospital that is also a tertiary hospital if the patient has complex multi-system trauma, provided this is feasible and safe.

Abnormal primary survey

- Transport the patient to the most appropriate major trauma hospital if the patient has any of the following features:
  a) Manageable airway obstruction.
  b) Respiratory distress.
  c) Shock.
  d) A motor score less than or equal to five.

Injury patterns

- Transport the patient to the most appropriate major trauma hospital if the patient has any of the following injury patterns:
  a) Penetrating trauma to the neck or torso.
  b) Crush injury to the neck or torso.
  c) Flail chest.
  d) Penetrating trauma to a limb with arterial injury.
  e) More than one long bone fracture.
  f) Crushed, amputated, mangled or pulseless limb.
  g) Clinically obvious pelvic fracture.
  h) Paraplegia or quadriplegia (see the 'spinal cord injury' section).

i) Burns involving the airway.
j) Burns greater than 20% of body surface area.

Additional risk factors

- Consider transporting the patient to a major trauma hospital even if the patient does not clearly have major trauma, if there are significant additional risk factors.
- Examples include:
  a) Additional signs or symptoms such as severe pain.
  b) High risk mechanism of injury such as ejection from a vehicle.
  c) Additional patient risk factors such as pregnancy.

Staging

- Consider staging the patient at another medical facility en route to a major trauma hospital if:
  a) Helicopter transport is indicated and
  b) The patient has immediate treatment needs that cannot be provided by personnel at the scene and
  c) The staging medical facility has appropriate personnel/facilities and
  d) The patient can be transported to the staging medical facility significantly faster than the helicopter can locate at the scene.

If no features of major trauma are present

- Transport the patient to the most appropriate hospital if they do not meet criteria for major trauma and no significant additional risk factors are present.
- The patient should be transported to a hospital with the facilities to meet the patient's expected healthcare needs. For example, if the patient has a compound fracture they should be transported to a hospital with orthopaedic surgical facilities.

Additional information

General

- The New Zealand National Major Trauma Network has determined the clinical criteria that define major trauma. This ensures all personnel in the out-of-hospital setting use the same clinical criteria when determining which patients have major trauma.
- Patients identified as having major trauma should be transported directly to a major trauma hospital whenever this is feasible and safe.
- Major trauma hospitals are those hospitals designated by the Regional Major Trauma Networks to receive patients with major trauma. Further details are described in the regional major trauma destination policies.

Life-threatening problems

- It should be rare for a patient with a life-threatening problem to be transported to a medical facility that is not a major trauma hospital, because delays to definitive care worsen outcomes.
- However, there are a small number of patients who have a life-threatening problem requiring immediate medical intervention, such that there is a high risk of death before reaching a major trauma hospital and the problem may be able to be rectified at a closer medical facility. Examples include:
  - Severe airway obstruction despite manual techniques and airway adjuncts.
  - Inadequate breathing.
  - Severe external bleeding that is not controlled.
- The closest appropriate medical facility will usually be a hospital, but sometimes will be a medical centre, particularly in remote areas.
- The decision to transport a patient with a life-threatening problem to a medical facility that is not a major trauma hospital requires clinical judgement and personnel must have a low threshold for seeking clinical advice. The decision should take into account the nature of the patient's injuries, the rate of deterioration, the relative proximity of the medical facilities and the personnel available at the medical facility.
- Personnel in the receiving medical facility must be notified as soon as possible, preferably before leaving the scene.
- Staging must be activated via Control/Comms, preferably before leaving the scene, if the medical facility is not a major trauma hospital.

Status codes

- Status codes cannot be used to automatically define the presence or absence of major trauma.
- The major trauma triage criteria must be used to determine whether or not the patient has major trauma.

Severe TBI

- Most patients with severe TBI do not require urgent neurosurgery.
- However, patients with any of the following clinical features have a high probability of requiring urgent neurosurgery and/or neuro-intensive care and should be transported to a major trauma hospital with neurosurgical facilities, provided this is feasible and safe:
  a) Has been intubated and ventilated. These patients usually require neuro-intensive care and/or neurosurgery.
  b) Has lateralising neurological signs, for example unilateral pupil dilatation or unilateral weakness. These patients usually require urgent neurosurgery for extradural or subdural bleeding.
  c) Has a clinically obvious penetrating brain injury.

Complex multi-system trauma

- Complex multi-system trauma cannot be tightly defined and clinical judgement is required, but includes patients with major trauma involving very severe injuries to more than one body region.
- Patients with complex multi-system trauma will usually benefit from transport to a major trauma hospital that is also a tertiary hospital, provided this is feasible and safe.

Airway obstruction

- Clinical judgement is required when determining that the patient has manageable airway obstruction rather than life-threatening airway obstruction requiring immediate medical intervention.
- For the majority of patients their airway obstruction is manageable and they can be adequately oxygenated using airway adjuncts and supplemental oxygen. If this is the case the patient should be transported to a major trauma hospital.

Motor score

- A motor score of less than or equal to five is a more useful predictor of clinically important TBI than the GCS, particularly across all ages.
- Consider transporting the patient to a major trauma hospital if they have a falling GCS or severe agitation, even if they are obeying commands.
- A patient with alcohol or drug intoxication who has a motor score of less than or equal to five following a mechanism of injury consistent with TBI, should be presumed to have severe TBI until proven otherwise, even if it is suspected that alcohol or drug intoxication is contributing to the altered level of consciousness.

Penetrating injury

- To meet the definition of penetrating injury to the neck or torso, there must be a strong clinical impression that the injury has penetrated:
  - The deep tissues when the injured region is the neck.
  - The thoracic cavity when the injured region is the chest.
  - The abdominal cavity when the injured region is the abdomen or pelvis.
- If the patient has a penetrating injury that appears to only involve skin or subcutaneous tissue and the patient's vital signs are normal, clinical judgement should be used and transport may occur to a hospital that is not a major trauma hospital.
- Arterial bleeding from penetrating injuries to the limbs is usually clear, particularly if it involves the brachial, femoral or popliteal artery. However, it is common for there to be some uncertainty as to whether or not bleeding from a limb is arterial. Provided the bleeding has been adequately controlled without a tourniquet and the limb has normal perfusion, clinical judgement

should be used and transport may occur to a hospital that is not a major trauma hospital, provided the hospital has the facilities to meet the patient's needs.

Crush injury

- Most patients with a clinically significant crush injury will have an abnormal primary survey and this will trigger the need for transport to a major trauma hospital.
- If the crush injury is not clinically significant and the patient has normal vital signs, clinical judgement should be used and transport may occur to a hospital that is not a major trauma hospital, provided the hospital has the facilities to meet the patient's needs.

Flail chest

- Flail chest is a clinical diagnosis. There must be clinical signs of paradoxical chest wall movement with breathing.
- The patient usually has severe pain, but pain alone is not a diagnostic sign of flail chest.

Fractures of long bones

- For the purposes of meeting criteria for major trauma, a fractured long bone requires the patient to have a clinically obvious fracture of the shaft of the femur, tibia or humerus.
- A fracture that is clinically isolated to the neck of the femur or to the ankle is not considered a long bone fracture.
- No distinction is made between closed and compound fractures for the purpose of meeting criteria for major trauma.

Clinically obvious pelvic fracture

- It is rare to make an out-of-hospital diagnosis of a clinically obvious pelvic fracture because this requires an obvious major deformity or clear evidence of a pelvic fracture visible through a wound.
- The most common symptom of a pelvic fracture is the presence of pelvic pain, but the presence of pain alone is not sufficient to diagnose a clinically obvious pelvic fracture.
- There is no role for examining the pelvis for signs of instability or crepitus because the pelvis may be severely unstable without these signs being present and the force required to elicit signs may cause harm.

Spinal cord injury

- If the patient has paraplegia or quadriplegia and no other signs of major trauma, the patient should be transported directly to a spinal cord impairment centre whenever it is feasible and safe to do so, even if this means bypassing other major trauma hospitals.
- If the patient has any other signs of major trauma in addition to their spinal cord injury, or it is not feasible and safe to transport the patient directly to a spinal cord impairment centre, the patient should be transported to the most appropriate major trauma hospital.
- See the 'spinal cord injury' section for additional information.

Burn injury

- Patients with burns greater than 20% of their body surface area should usually be transported to the nearest major trauma hospital and be subsequently referred to a Burn Centre. This is because some of the patients will be referred to Middlemore Hospital which is the National Burn Centre.
- However, it is preferable to transport the patient to a Regional Burn Centre (Middlemore Hospital, Waikato Hospital or Christchurch Hospital), provided the transport time is not significantly longer than the transport time to the closest major trauma hospital. 'Significantly longer' is not defined and requires clinical judgement.
- Note that in the Wellington area patients with burns greater than 20% of body surface area are transported to Wellington Hospital and not Hutt Hospital.
- Burns involving the face (without airway burns), hands or genitals may require treatment in a Burn Centre, but in the absence of major trauma such burns are not time critical and the patient should usually be transported to the most appropriate hospital and be subsequently transferred if required.

Additional risk factors: signs or symptoms

- Consider transporting the patient to a major trauma hospital if the patient has clinically significant additional signs or symptoms, but does not meet the criteria for having major trauma.
- Examples of additional signs or symptoms include, but are not limited to:
  - Severe soft tissue injury, particularly if it involves the face.
  - Severe abdominal pain.
  - Agitation.

Additional risk factors: mechanism of injury

- Consider transporting the patient to a major trauma hospital if the patient has a high risk mechanism of injury, but does not meet the criteria for having major trauma.

- Examples of high risk mechanisms of injury include, but are not limited to:
  - Vehicle versus pedestrian, motorcyclist or cyclist where the injured person has been run over or there is clinically significant impact.
  - Ejection from a vehicle.
  - Fall greater than twice the patient's height.
- Even in the presence of a high risk mechanism of injury, if the patient has apparently minor injuries and normal vital signs, clinical judgement should be used and transport should usually occur to the most appropriate hospital, rather than to a major trauma hospital.

Additional risk factors: patient risk factors

- Consider transporting the patient to a major trauma hospital if the patient has additional risk factors, but does not meet the criteria for having major trauma.
- Examples of additional patient risk factors include, but are not limited to:
  - Pregnancy.
  - Taking an oral anticoagulant.
  - Known bleeding disorder.
- Even in the presence of additional patient risk factors, if the patient has apparently minor injuries and normal vital signs, clinical judgement should be used and transport should usually occur to the most appropriate hospital, rather than to a major trauma hospital.

Determining the most appropriate major trauma hospital

- Few hospitals in New Zealand have the facilities required to treat all of the injuries a patient with major trauma may have and this includes many of the hospitals designated as a major trauma hospital. Clinical judgement must be used when determining which major trauma hospital the patient is transported to, taking into account:
  - The information within Regional Major Trauma Destination Policies.
  - The patient's expected treatment requirements.
  - The transport time to the relevant hospitals.
- In most cases, the most appropriate major trauma hospital will be the closest major trauma hospital. However, in some cases there will be a choice of major trauma hospitals that the patient could be transported to within similar times and the patient should be transported to the major trauma hospital with the most appropriate facilities to meet the expected treatment needs of the patient.
- Seek clinical advice if you are uncertain which major trauma hospital the patient should be transported to.

Patients that rapidly improve without treatment

- A patient may initially meet criteria for major trauma but then rapidly improve without specific treatment.
- For example, a patient may have lost consciousness and then rapidly recovered, or had respiratory distress from an emotional cause that has rapidly improved.
- Provided the patient is very clearly improving and meets no other criteria for major trauma, clinical judgement should be used and transport should usually occur to the most appropriate hospital, rather than to a major trauma hospital.

Staging at a medical facility

- The majority of patients with major trauma should be transported directly to a major trauma hospital. However, it is occasionally appropriate for the patient to be transported to another medical facility (one that is not designated as a major trauma hospital) at the same time that a helicopter is dispatched to transport the patient to a major trauma hospital. This is termed staging and should only occur when all of the following apply:
  - The patient meets criteria to be transported by helicopter to a major trauma hospital.
  - Transport by road to the major trauma hospital is not appropriate because of distance.
  - The patient has immediate treatment needs that cannot be provided by personnel at the scene.
  - The staging medical facility has personnel and facilities to meet the patient's immediate treatment needs.
  - The patient can be transported to the staging medical facility significantly faster than the helicopter can locate at the scene. 'Significantly faster' cannot be tightly defined and requires clinical judgement.
- When a medical facility is being used as a staging point:
  - The aim of treatment at the staging medical facility is to provide immediate resuscitation/treatment and prepare the patient for helicopter transport.
  - Personnel must notify Control/Comms that the medical facility is being used as a staging point, prior to arrival at the staging medical facility.
  - Personnel must make it clear to medical facility staff that the medical facility is being used as a staging point.
  - An appropriate helicopter and crew will be dispatched as soon as possible and preferably before the patient arrives at the staging medical facility.

- When a helicopter is being dispatched to a medical facility that is being used as a staging point:
  - The helicopter mission will be dispatched as an out-of-hospital job and not as an inter-hospital transfer.
  - The clinical care of the patient during transfer will be provided by the helicopter crew.
  - If a doctor is available to be part of the usual helicopter crew they will be dispatched whenever this is feasible.
- If the patient is transported to a hospital and personnel are not using the hospital as a staging point and a decision is made by hospital staff to request a helicopter after the patient has arrived at that hospital, this mission will be dispatched as an inter-hospital transfer.

5.1 Agitated delirium

This section is for patients aged greater than or equal to 12 years. Seek clinical advice if the patient is aged less than 12 years.

- Assess the patient for a reversible cause such as hypoglycaemia, hypovolaemia or hypoxia. Move to the appropriate section if a clear cause is found.
- Determine the level of agitation.

Mild agitation

- Attempt verbal de-escalation.
- Consider calling for police assistance but this is not usually required.
- Administer olanzapine PO if verbal de-escalation is unsuccessful, provided the patient will take an oral medicine:
  a) 10 mg if the patient weighs greater than or equal to 80 kg.
  b) 5 mg if the patient weighs less than 80 kg.
  c) The dose may be repeated once after 20 minutes.
- If the cause is clearly a mental health problem, consider the possibility that the patient can be managed in the community with the support of mental health personnel.
- If the patient will not take an oral medicine, or their level of agitation is unsafe despite oral olanzapine, administer medicines as described under moderate agitation.

Moderate agitation

- Attempt verbal de-escalation.
- Consider calling for police assistance.
- Provide safe restraint as required.
- Begin by administering an opiate if the patient appears to be in pain and IV access can be obtained:
  a) 2-5 mg of morphine IV every 3-5 minutes or
  b) 20-50 mcg of fentanyl IV every 3-5 minutes.
- Administer midazolam if the patient does not appear to be in pain or opiate administration is unsuccessful:
  a) 2-5 mg of midazolam IV every 3-5 minutes. Reduce the dose to 1-2 mg if the patient is small, frail or physiologically unstable.
  b) 10 mg of midazolam IM. Reduce the dose to 5 mg if the patient is small, frail or physiologically unstable. The IM dose may be repeated every 10 minutes to a maximum of three doses.
- Once control has been obtained:
  a) Position the patient on their side.
  b) Provide safe restraint as required.

c) Administer oxygen and continually monitor the patient's airway, breathing and level of consciousness. Monitor heart rate, blood pressure and capillary refill time (particularly in restrained limbs) if possible.
d) Transport the patient to an ED.

Severe agitation

- Call for urgent police assistance.
- Consider leaving the scene and provide restraint only if it is safe to do so.
- Administer ketamine:
  a) 50-100 mg of ketamine IV every 3-5 minutes or
  b) 400 mg of ketamine IM if the patient weighs greater than or equal to 80 kg or
  c) 200 mg of ketamine IM if the patient weighs less than 80 kg
  d) The IM dose may be repeated once after 10 minutes.
- Once control has been obtained:
  a) Position the patient on their side.
  b) Provide safe restraint as required.
  c) Gain IV access.
  d) Administer midazolam IV using the doses described under moderate agitation.
  e) Administer oxygen and continually monitor the patient's airway, breathing and level of consciousness. Monitor heart rate, blood pressure and capillary refill time (particularly in restrained limbs) if possible.
  f) Request police escort during transport.
  g) Transport the patient to an ED.
- Seek clinical advice if the situation is not easily controlled.

Additional information

General

- Agitated delirium is also known as acute severe behavioural disturbance and excited delirium syndrome.
- Agitated delirium is a medical emergency. The combination of severe behavioural disturbance, agitation, hyperactivity and physiological excitation/stress may be life-threatening. In addition, the provision of treatment may involve the risk of harm to personnel.
- Agitated delirium may be caused by: drugs, traumatic brain injury, infection, metabolic disorders (such as hypoglycaemia and hyponatraemia), liver failure, psychiatric disorders, dementia and drug withdrawal (particularly alcohol). In New Zealand the most common cause appears to be recreational drug ingestion, particularly methamphetamines, cathinones and synthetic cannabinoids.

- Restraint and/or sedation must only be used if a patient is not competent to make decisions and their level of agitation is preventing safe assessment, treatment or transport.

Determining the level of agitation

- Signs and symptoms of mild agitation include: agitation and/or anxiety without physical aggression, mostly cooperative, restless but settles with de-escalation and reluctant to accept assistance but does so with repeated explanation.
- Signs and symptoms of moderate agitation include: agitation and/or anxiety with some physical aggression, uncooperative, very restless and/or has disorganised behaviour that fails to settle with de-escalation and failure to accept assistance.
- Signs and symptoms of severe agitation include: agitation with severe or dangerous physical aggression, wielding a weapon, destruction of physical surroundings and failure to acknowledge instructions or to interact.

Verbal de-escalation

- Verbal de-escalation is often under-utilised.
- Provided there is no immediate danger to people, verbal de-escalation must be attempted before providing sedation and/or restraint.
- Friends and/or family members may be helpful, but ask them to desist if they are making the situation worse.
- The key aspects to successful verbal de-escalation are:
  - Allow sufficient time. 15-20 minutes may be required.
  - Maintain a space of approximately two metres between you and the patient.
  - Have only one person verbally engage the patient.
  - Introduce yourself and state you are there to help. Provide reassurance.
  - Use a calm voice and adopt a non-threatening stance. Sit if possible.
  - Use short sentences and keep messages simple. Repetition is essential as the patient will usually have a short attention span.
  - Minimise the number of people in the immediate vicinity.
  - Limit unnecessary noise and distractions. For example limit radio noise.
  - Actively listen to the patient and try to gain an understanding of their concerns.
  - Try to establish rapport.
  - Offer choices if appropriate. For example, offer food, drink or a cigarette.
  - Avoid provocative statements. For example do not say "if you don't calm down we will have to sedate you".
  - Offer medicine if appropriate once rapport has been established. For example "I see you are very uncomfortable, would you like some medication to help?"

Providing restraint

- Restraint must only be provided when necessary as restraint often increases the level of agitation.
- Restraint carries risks that must be balanced against the risks of not appropriately assessing, treating or transporting the patient.
- Use the minimum amount of restraint required to ensure safety, using a tiered approach that matches the level of restraint to the level of agitation. For example:
  - For mild agitation the patient may only require guidance with a hand on their arm, shoulder or back.
  - For moderate agitation the patient may only require someone to hold their hands.
  - For severe agitation the patient is likely to require their limbs to be restrained.
- All forms of physical restraint must be recorded on the PRF.
- Never restrain the patient face down and never restrain the patient with weight on their neck, chest, back or abdomen, as these risk causing respiratory arrest.
- Clinical judgement is required, but police are not routinely required if restraint is provided. However, police should be requested if more than minimal restraint is required or there is significant risk of injury.
- There is a high risk of injury to the patient and/or personnel if the patient has severe agitation. In this setting it is vital that there is a planned and coordinated team approach to simultaneous provision of safe sedation and restraint.
- In rare circumstances where an immediate threat to life exists, it may be appropriate for a taser to be used by police to gain control, so that sedation and restraint can be safely provided. In this setting there must be an explicit discussion with police regarding the risks of using a taser, noting that these predominantly relate to the risk of injury associated with the fall following deployment of the taser.

Providing sedation

- Sedation is sometimes referred to as 'chemical restraint' but use of this term is discouraged.
- Sedation carries risks that must be balanced against the risks of not appropriately assessing, treating or transporting the patient.
- Use the minimum amount of sedation required to ensure safety, using a tiered approach that matches the dose and choice of sedation to the level of agitation.

- If the patient has moderate or severe agitation, the safest approach is usually to provide both sedation and restraint, because sedation minimises the amount of restraint required and vice versa.
- When administering an opiate:
  - There is no role for the IM or IN route because absorption is too unreliable.
  - Morphine is the preferred opiate unless the patient has clinically significant shock, because morphine will provide more sedation than fentanyl.
  - Administer sufficient opiate to be confident that further doses are providing no benefit.
- When administering midazolam:
  - The preferred route is IV, but this route is often not feasible initially.
  - No maximum IV dose has been described because the balance of risk is in favour of continuing to administer midazolam if the patient remains agitated.
- When administering ketamine:
  - The goal is to produce a state of dissociation so that the patient can be safely restrained and IV access obtained.
  - IV access should be obtained whenever possible and midazolam administered IV as the ketamine effect wears off.
  - If IV access cannot be obtained, midazolam should be administered IM in anticipation of the ketamine effect wearing off.
- Severe and/or uncontrolled agitation carries a risk of precipitating cardiac arrest. For this reason sedation must be administered if the patient is severely agitated, even if they have been successfully physically restrained.

5.2 Hyperglycaemia

Diabetic ketoacidosis (DKA)

- DKA is the most common condition causing clinically significant hyperglycaemia.
- DKA develops in patients with type one diabetes who have a relative lack of insulin.
- Patients with clinically significant DKA have:
  - Hyperglycaemia with a glucose that is usually greater than 20 mmol/litre.
  - Hypovolaemia from a combination of osmotic diuresis secondary to hyperglycaemia, reduced oral intake and vomiting.
  - Acidosis from metabolism of fatty acids to ketones. The most common sign of this is tachypnoea. The patient's breath may have a fruity smell from ketones.
- The patient may have non-specific abdominal pain.
- Do not administer rapid boluses of 0.9% sodium chloride IV unless the patient is severely shocked:
  - Rapid boluses may contribute to cerebral oedema by causing water to shift into the brain. This occurs because rapid dilution of glucose may cause a corresponding fall in osmolality.
  - Children and young adults are most at risk of cerebral oedema in this setting.
  - Administer the 0.9% sodium chloride IV over approximately one hour, unless severe shock is present.
- There is no role for transport to a GP unless it is for backup en route to hospital.
- There is no role for out-of-hospital administration of insulin because rapid falls in glucose risk causing cerebral oedema.

Hyperglycaemia without acidosis

- Patients with type two diabetes can develop clinically significant hyperglycaemia without acidosis, because there is sufficient insulin present to prevent cells shifting to predominantly metabolising fatty acids. This may be referred to as hyperosmolar non-ketosis (HONK), hyperosmolar hyperglycaemic non-ketotic state (HHNS) or hyperosmolar hyperglycaemic state (HHS).
- The patient may be very hypovolaemic from osmotic diuresis but will usually not have significant acidosis.
- The principles of pre-hospital treatment are the same as for a patient with DKA.

Patients with diabetes who are unwell

- Patients with diabetes often have significant comorbidities including ischaemic heart disease, peripheral vascular disease and renal impairment.
- They are at increased risk of developing infection, silent myocardial ischaemia and metabolic or electrolyte disorders. Have a lowered threshold for referring the patient to a doctor, even if there are no signs of clinically significant hyperglycaemia.

5.3 Hypoglycaemia

This section is for patients with a blood glucose concentration less than 3.5 mmol/litre. See the 'neonatal resuscitation' section if the patient is a newborn baby.

- Administer 10-20 g of glucose PO provided the patient is sufficiently conscious to be able to swallow.
- Gain IV access and administer glucose IV if the patient has a significantly altered level of consciousness or cannot swallow:
  a) 100 ml of 10% glucose IV for an adult.
  b) 2 ml/kg of 10% glucose IV for a child.
- Administer glucagon if unable to gain IV access:
  a) 1 mg of glucagon IM for a patient aged five years and over.
  b) 0.5 mg of glucagon IM for a child aged less than five years.
- Repeat the glucose measurement every 10 minutes until the glucose concentration is consistently greater than 3.5 mmol/litre. Administer further doses of glucose if required, but do not repeat glucagon IM.

Referral

- The patient may receive treatment for hypoglycaemia and be given a firm recommendation that transport by ambulance to a medical facility is not required, provided all of the following criteria are met:
  a) It is an isolated single episode and
  b) It is not due to overdose (including accidental) of insulin or oral hypoglycaemics and
  c) It is not complicated by seizure or clinically significant injury and
  d) The patient recovers fully and can mobilise normally and
  e) The blood glucose is >3.5 mmol/litre, 10 (or more) minutes after glucagon or the last glucose administration and
  f) An adult can stay with the patient for the next four hours and
  g) The patient eats a meal (preferably containing complex carbohydrate) and
  h) The patient is given the hypoglycaemia information sheet, which is explained to them and the accompanying adult.
- The patient must be given a firm recommendation to have their treatment reviewed (for example by their GP or diabetes service personnel). If the patient is aged less than or equal to 18 years or has been recently diagnosed with diabetes, this review must occur within the same day.

Additional information

Causes of hypoglycaemia

- Hypoglycaemia usually occurs in a patient taking insulin or an oral hypoglycaemic medicine.
- Less common causes of hypoglycaemia include septic shock (particularly in children), poisoning with agents that lower blood glucose and liver failure.
- Some oral hypoglycaemic medicines are excreted primarily by the kidneys. Suspect unrecognised deterioration in kidney function if a patient taking an oral hypoglycaemic medicine develops hypoglycaemia without an obvious cause.

Measuring blood glucose concentration

- Do not measure blood glucose concentration using the patient's glucose meter because the result may be inaccurate.
- Cleaning or swabbing skin with an alcohol swab is not routinely required, but should occur if the skin is visibly dirty.
- Use capillary blood to measure blood glucose concentration. Do not use blood from other sources because glucose meters are calibrated to use capillary blood.
- Check the history of the patient's glucose meter whenever possible. In particular rule out recurrent hypoglycaemia.

Treating hypoglycaemia

- Oral glucose is best administered as a simple carbohydrate that is rapidly absorbed.
  - Examples include 10% glucose (100 ml contains 10 g of glucose), glucose tablets or gel, sugar dissolved in water, 'non-diet' jam or similar glucose containing spreads and 'non-diet' soft drinks.
  - 10-20 g of glucose is approximately half a cup of 'non-diet' fruit juice or soft drink, one tablespoon of sugar, one tablespoon of honey or six squares of chocolate.
  - Most oral glucose gels contain 10-20 g of glucose per dose and can be administered to all patients, regardless of age.
  - Document oral glucose as the approximate number of grams of oral glucose administered, or a description of the food ingested.
- A brief period of hyperglycaemia may occur following treatment and the patient must be instructed not to treat this with insulin.
- Hypoglycaemia may occur several hours later as glucose is metabolised. This is why the instructions within the information sheet are important and why a meal must be eaten. The meal should preferably contain a complex carbohydrate such as brown rice, whole grain bread, porridge or beans.

Hypoglycaemia in children aged less than five years

- Hypoglycaemia in children aged less than five years is most commonly due to:
  - An illness in combination with no food intake and depleted glycogen stores or
  - Severe infection or
  - Poisoning with oral hypoglycaemic agents.
- Although metabolic disorders can cause hypoglycaemia in young children, this is rare. Do not delay treatment of hypoglycaemia in young children pending diagnostic tests, other than measuring a capillary glucose concentration. Although some texts advocate delaying treatment until a blood sample is taken for analysis of possible metabolic disorders, treatment always takes priority over blood tests in this setting.

5.4 Poisoning

- Measure the blood glucose concentration and treat accordingly.
- Administer naloxone if opiate poisoning is suspected and the patient has a significantly impaired level of consciousness, or significantly impaired breathing.
- For an adult administer:
  a) 0.1-0.4 mg of naloxone IV every 3-5 minutes or
  b) 0.8 mg of naloxone IM and repeat every 10 minutes if required.
- See the paediatric drug dose tables for naloxone dosage for a child.
- Administer 0.9% sodium chloride IV if cyclic antidepressant poisoning is suspected and the patient has tachycardia, QRS prolongation, signs of poor perfusion or an altered level of consciousness:
  a) 1-2 litres for an adult.
  b) 20-40 ml/kg for a child.

Referral

- The patient must be given a firm recommendation to be transported to an ED if the poisoning may be harmful.
- All patients that attempt suicide through deliberate poisoning require a psychiatric assessment. This may require transport to an ED but assessment could occur in the community provided the poisoning is clearly not harmful, an appointment can be made directly with a mental health team and the patient can be observed by a competent adult until assessment occurs.

Additional information

General

- An altered level of consciousness following poisoning is usually caused by one or more of the following: alcohol, benzodiazepines, anti-depressants, anti-psychotics, sedatives, recreational drugs, opiates or antihistamines.
- The treatment of poisoning is rarely poison specific and is focused on supporting airway, breathing and circulation.
- The New Zealand National Poisons Centre can be contacted on 0800 764766 for information if the name of the poison is known, but ambulance personnel do not know what the effects might be. However, use the Clinical Desk for advice regarding treatment or interventions and not the Poisons Centre.
- Do not induce vomiting for any poisons as this may cause oesophageal injury. This is particularly the case with alkaline products such as dishwashing powders. If the patient has ingested a known alkali or acid, encourage sips of water provided the patient's airway and swallow are normal and this does not

induce vomiting. Have a lowered threshold for administering ondansetron IV in this setting.

- IV access is not routinely required but should be obtained if the patient has an abnormal primary survey, or if there is significant concern that clinical deterioration may occur.
- There is no role for the transport of chemicals or vomit to hospital in order to help identify the poison.

Naloxone

- Naloxone is not indicated in the treatment of poisoning associated with an altered level of consciousness unless opiate poisoning is strongly suspected.
- Even when opiate poisoning is suspected, naloxone only has a role when there is clinically significant impairment of consciousness or breathing.
- There is no evidence to support the commonly held view that adequate oxygenation prior to naloxone administration reduces the severity of agitation following naloxone administration. However, treatment of severe hypoxia takes precedence over the administration of naloxone.

Alcohol poisoning

- The patient will usually have an altered level of consciousness and vomiting.
- Breathing will usually be adequately maintained provided the patient's airway is patent and not impaired by choking or aspiration.
- 0.9% sodium chloride IV does not speed recovery from alcohol poisoning and is not indicated for the treatment of alcohol poisoning, unless there are signs of hypovolaemia or dehydration.
- A patient that is obeying commands does not usually require transport to hospital.

Treatment of alcohol poisoning at events

- At large events, specific facilities and staff may be organised to manage and treat patients with alcohol poisoning.
- Patients have commonly co-ingested recreational drugs. In the absence of significant complications (such as seizures), these patients are usually suitable for treatment at such facilities.
- Patients with an altered level of consciousness may be adequately managed provided their airway and breathing are adequate and they are closely monitored.
- Clinical judgement is required when deciding if a patient should be transported to an ED. In general, transport to an ED should occur if the patient:
  - Has a history or signs consistent with TBI or
  - Has unequal pupils or
  - Has a GCS less than 8 or

  - Tolerates an oropharyngeal airway or
  - Has hypoglycaemia that does not respond to treatment or
  - Has very abnormal physiology (for example poor airway, poor breathing, signs of shock or a temperature less than 34 degrees).
- Some patients with GHB poisoning will have a GCS less than 8, tolerate an oropharyngeal airway for 20-30 minutes and then rapidly improve. In the absence of other reasons for transport, such patients may be suitable for treatment at the facility provided a doctor or ICP is present.
- Patients must be observed regularly. In general, half hourly observations of respiratory rate, heart rate and GCS are appropriate.
- Most patients will improve with time. There are no specific treatments for alcohol poisoning, but some treatments may be provided without transporting the patient to an ED:
  - 0.9% sodium chloride IV for signs of hypovolaemia.
  - Ondansetron for nausea and/or vomiting.
  - Glucose IV for hypoglycaemia. Alcohol impairs gluconeogenesis and may occasionally cause hypoglycaemia, particularly in children and adolescents. A patient may be treated for hypoglycaemia and not transported to ED provided only one dose of 10% glucose is required and the patient remains normoglycaemic.
- The patient may be discharged once they are obeying commands and able to mobilise safely. Prior to discharge they should receive advice (preferably written) on safe alcohol consumption.

Specific recreational drugs

- Recreational drugs are often taken in combination (particularly with alcohol) producing uncertain and compounding effects. Common recreational drugs include:
  - **Gamma hydroxybutyrate (GHB).** The patient may be deeply unconscious with a poor airway, poor breathing and intermittent apnoea. Commonly the patient requires assisted ventilation and improves rapidly after 20-30 minutes. The patient may take longer to improve if another sedative (for example alcohol) has also been ingested.
  - **Ecstasy** may cause an altered level of consciousness, seizures and hyperthermia.
  - **Ketamine** may cause hallucinations or an altered level of consciousness. If the latter occurs, airway and breathing are usually well maintained.
  - **Amphetamines and methamphetamines** may cause severe hypertension, tachycardia and disturbed behaviour. The latter may be severe and this may be associated with violence or attempted suicide.
  - **Cathinones** (for example mephedrone) are amphetamine-like. They may cause hypertension, tachycardia, hallucinations, paranoia, panic attacks and disturbed behaviour. The latter may be severe.

- **Cannabis and cannabinoids** may cause mental dissociation, anxiety, tachycardia, palpitations, chest pain, nausea and vomiting.
- **Herbal highs.** This is a broad term used to describe a wide range of drugs. These drugs may cause anxiety, tachycardia, palpitations, seizures, coma and intracranial haemorrhage.

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 an ED, even if asymptomatic and regardless of the apparent dose taken, because the described dose is often incorrect.

Cyclic antidepressant poisoning

- The new generation cyclic antidepressants are less toxic than many of the older generation tricyclic antidepressants, but the patient may develop an altered level of consciousness, seizures, tachycardia, tachydysrhythmias and shock.
- Part of the toxicity from cyclic antidepressants comes from the drug binding to sodium channels within the heart and this may be reduced by a large dose of sodium ions. This is the reason for an IV bolus of 0.9% sodium chloride.
- The total dose of sodium ions administered is more important than the nature of the IV fluid containing sodium. 100 ml of 8.4% sodium bicarbonate contains 100 mmol of sodium and 1 litre of 0.9% sodium chloride contains 150 mmol of sodium. 100 ml of sodium bicarbonate may be administered IV in addition to 0.9% sodium chloride provided it is immediately available, but there is usually no role for calling for bicarbonate to be delivered to the scene.

Serotonin syndrome

- Also known as serotonin toxicity, serotonin syndrome occurs as a result of raised serotonin levels within the brain.
- Although most commonly thought of as occurring following poisoning with selective serotonin reuptake inhibitors (SSRIs), serotonin syndrome may also occur when medicines or substances that increase serotonin levels are taken in combination. Examples include: SSRIs, ecstasy, amphetamines, anti-depressants and tramadol.
- Signs and symptoms include: tachycardia, tachypnoea, hypertension, sweating, hyperthermia, tremor, rigidity, confusion, agitation and seizures. If severe the patient will have coma and shock.
- Treatment is supportive. Uncover the patient and administer 0.9% sodium chloride IV if the temperature is greater than 39 degrees or there are signs of poor perfusion. Treat agitation with midazolam IV.

Organophosphate poisoning

- Organophosphate (OP) poisoning occurs most commonly with deliberate ingestion of insecticides containing an OP. It is possible for OP poisoning to occur following skin contact with chemicals containing an OP but this usually requires very significant exposure.
- Organophosphates inhibit the activity of the enzyme cholinesterase. This causes acetylcholine (ACh) to build up at neural junctions and at neuromuscular junctions within skeletal muscle. The build up of ACh causes:
  - Salivation.
  - Lacrimation (increased tears).
  - Defaecation and vomiting.
  - Urination.
  - Bradycardia.
  - Bronchoconstriction and bronchial secretions.
  - Muscle twitching and muscle weakness.
- Treatment is support of the patient's airway, breathing and circulation, in addition to treatment with atropine. Atropine will reverse most of the effects of the ACh:
  - An appropriate initial dose is 1.2 mg which should be repeated every five minutes until there are signs of adequate atropinisation.
  - Repeated and escalating doses may be required.
  - It is likely that additional atropine may need to be delivered to the treating crew.
- Adequate atropinisation will be indicated by:
  - Resolution of bradycardia.
  - Drying of secretions.
  - Resolution of wheeze.
- 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 OP.
- Decontamination prior to transport is not required if the patient has ingested an OP. The patient's vomit will contain OP and normal PPE should be worn to prevent contact with vomit.
- Decontamination prior to transport is required if there are OP chemicals on the patient's skin or clothing:
  - Clothing should be removed (leaving underwear on) and the patient decontaminated using water.
  - The most appropriate form of decontamination is a shower (including a domestic shower) of approximately three minutes duration.
  - Decontamination using a fire service decontamination unit is acceptable, provided one is immediately available. However, decontamination should not be delayed while waiting for one to arrive.
- Off gassing (where the patient exhales dangerous levels of OP) has never

been documented to occur. All cases of apparent off gassing were caused by OP on the patient's clothes and this is why clothing must be removed prior to transport.

Cyanide poisoning

- Cyanide impairs oxygen utilisation at a mitochondrial level. The oxygen levels within blood and tissues are normal, but oxygen cannot be used by cells.
- Cyanide is used in industry (particularly in mining) and by hunters. Cyanide may be present in high concentrations within smoke from house fires that involve synthetic furnishings.
- Most cyanide poisoning occurs when it is ingested, usually deliberately. Cyanide is poorly absorbed through skin but poisoning can occur from skin contact with high concentrations. Cyanide poisoning (including fatal poisoning) has been reported following smoke inhalation from house fires.
- Patients with cyanide poisoning have non-specific symptoms and signs:
  - Anxiety, nausea and headache.
  - Tachycardia.
  - Tachypnoea.
  - Falling level of consciousness (when severe).
  - Cardiac arrest (when very severe).
- PPE and decontamination:
  - No specific PPE (other than normal body fluid precautions) or decontamination is required if cyanide has been ingested.
  - In the unlikely event that cyanide is present on the patient's skin or clothing, decontamination should occur in the same way as described for organophosphates.
- Treatment:
  - The initial treatment is supportive.
  - There are case reports of patients surviving severe cyanide poisoning with supportive treatment alone.
  - Specific cyanide antidotes may be available at sites where cyanide is being used.
  - Personnel may administer the contents of cyanide antidote kits (following the instructions within them), if there is a history consistent with cyanide poisoning and the patient is symptomatic. Personnel should seek clinical advice if there is any doubt, but this should not delay treatment if the patient is showing signs of poisoning.
- Cyanide antidotes include:
  - Hydroxocobalamin: a form of Vitamin B12 that is contained within kits called Cyanokit. Hydroxocobalamin binds cyanide and is administered IV.
  - Amyl nitrite: usually comes in capsule form which is designed to be crushed into a tissue or hand. The gas released from the contents is inhaled. Amyl

nitrite causes the haemoglobin molecule to change to methaemoglobin and this binds cyanide. Amyl nitrite also causes skin flushing and hypotension.
  - Sodium thiosulfate: speeds metabolism of cyanide and is administered IV.
- Cyanide poisoning following exposure to smoke is clinically indistinguishable from carbon monoxide poisoning. Treatment is supportive. No specific PPE other than normal body fluid protection is required. If cyanide poisoning is suspected the patient should be transported to ED without trying to obtain specific cyanide antidotes.

Beta-blocker poisoning

- Bradycardia may be prominent with beta-blocker poisoning, particularly if taken in combination with a calcium channel blocker and an adrenaline infusion may be required.
- Glucagon is sometimes suggested as part of the treatment for bradycardia caused by beta-blockers because it stimulates cardiac cells via a mechanism that is independent of the beta receptor. However, glucagon has no role in the pre-hospital setting because it rarely provides a sustained heart rate rise in addition to adrenaline and requires much higher doses than carried by ambulance personnel.

Colchicine poisoning

- Colchicine is a medicine that is sometimes used in the treatment of gout.
- It is extremely poisonous with a high mortality rate. There are no effective treatments once it is absorbed.
- Patients with possible colchicine poisoning must be transported to an ED without delay, even if asymptomatic because specific gut decontamination techniques may be required urgently.

Paraquat poisoning

- Paraquat is a herbicide that is extremely poisonous, with a high mortality rate. As little as 20-40 ml may be fatal. There are no effective treatments once it is absorbed.
- Paraquat poisoning is rare because it is now used infrequently. However, it remains in sheds throughout rural New Zealand.
- Patients with possible paraquat poisoning must be transported to an ED without delay, even if asymptomatic because specific gut decontamination techniques may be required urgently.
- No specific PPE (other than normal body fluid precautions) or decontamination is required if paraquat has been ingested. In the unlikely event that paraquat is present on the patient's skin or clothing, decontamination should occur in the same way as described for organophosphates.

- Oxygen administration is controversial in patients with paraquat poisoning:
  - Part of the lung damage from paraquat is due to oxygen free radicals and the concentration of these is increased by exposure to high levels of oxygen.
  - In experimental models, animals with paraquat poisoning had worse outcomes when exposed to high levels of oxygen. On this basis many treatment guidelines recommend that supplemental oxygen be avoided.
  - However, there is no evidence to support this in humans and there are many case reports of patients with hypoxia associated with paraquat poisoning being treated with supplemental oxygen and surviving.
  - Oxygen should be administered if the SpO_2 is below 94% on air.

Foreign body ingestion

- This is most common in young children.
- The patient must be given a firm recommendation to be seen in an ED if the patient is symptomatic, for example: drooling, gagging, difficulty swallowing, a sensation of the foreign body, sore throat, cough or abdominal pain.
- The patient must be given a firm recommendation to be seen in an ED if the swallowed object is potentially dangerous, such as a battery, a magnet (especially if there is more than one) or a sharp object such as a pin:
  - This is the case even if the patient is asymptomatic.
  - Batteries and in particular button (or disc) batteries, can cause severe injury to the oesophagus or bowel and may need to be surgically removed. If a battery of the same size is available it should be taken to the ED with the patient.
  - A patient that has swallowed a button battery is time sensitive and should be assessed in an ED without significant delay, noting that transport by ambulance may not be required.
  - Button (or disc) batteries can be mistaken for coins. If the patient is thought to have swallowed a coin, but it is possible a button battery has been swallowed instead, the patient should be treated as if a battery has been swallowed.
- The patient may be given a firm recommendation to remain at home if the patient is asymptomatic and there is clear evidence that the swallowed object is not dangerous, for example a button or marble. In this setting the patient should be advised that the object will most likely pass through the bowel and that medical advice should be sought if symptoms develop.

5.5 Seizures

- Measure the blood glucose concentration and treat accordingly.
- Administer midazolam if the seizure is generalised and continues for longer than five minutes or the patient has status epilepticus.
- Administer up to two doses of midazolam IV every 3-5 minutes:
  a) 5 mg of midazolam IV for an adult. Reduce the dose to 2-3 mg if the adult is small, frail or physiologically unstable.
  b) See the paediatric drug dose tables for a child.
- Administer midazolam IM if IV access cannot be obtained. This may be repeated once after 10 minutes:
  a) 10 mg of midazolam IM for an adult. Reduce the dose to 5 mg if the adult is small, frail or physiologically unstable.
  b) See the paediatric drug dose tables for a child.
- Administer valproate IV over 10-15 minutes if the seizure continues or recurs after two doses of midazolam:
  a) 1200 mg of valproate for an adult.
  b) See the paediatric drug dose tables for a child.
- Some patients have pre-prescribed medicines to be administered via the rectal, nasal or buccal route. All personnel may administer such medicines, even if not within their delegated scope of practice, provided they have been prescribed for that patient and the seizure continues for longer than five minutes, or the patient has status epilepticus.

Referral

- A patient may be given a firm recommendation not to be transported to a medical facility by ambulance, even if midazolam has been administered, provided the patient:
  a) Has known epilepsy and
  b) Has not been injured and
  c) Has recovered to their usual postictal state and
  d) Can be left in the care of a competent adult and
  e) Has received a maximum of one dose of midazolam and
  f) Is instructed to see their GP for a review of their treatment.
- Transport (if required) should usually be to an ED, but could be to a GP if the patient is rapidly improving and is well known to the GP.

Additional information

Treating seizures with the patient's medication

- Most seizures will terminate spontaneously after 2-3 minutes.
- There is no immediate urgency to treat seizures with medication as long as the patient and their airway are protected by positioning.

Status epilepticus

- Status epilepticus is present if:
  - A single seizure lasts longer than 30 minutes despite treatment or
  - Multiple seizures are occurring and the patient remains unconscious between them.

Treating seizures with midazolam

- The preferred route is IV.
- Midazolam IV may take 2-3 minutes to stop the seizure.
- A brief period of apnoea is common following successful treatment with midazolam IV.
- The maximum number of doses of midazolam is two by any route. For example: two IV doses, one IM dose and one IV dose or two IM doses. This maximum of two doses may be administered in addition to any benzodiazepine that has already been administered via the nasal, buccal or rectal route prior to ambulance arrival.
- Wait 10 minutes before administering midazolam IV after IM administration. This is to allow adequate time for the IM dose to be absorbed.

Following the seizure

- Position the patient on their side.
- Maintain airway and breathing.
- Monitor pulse oximetry and administer oxygen if required.

The postictal state

- Following a seizure it is common for the patient to have an altered level of consciousness with drowsiness, confusion, agitation or amnesia. This is called the postictal state and usually lasts for 5-60 minutes.
- Sometimes the patient may appear to be in a postictal state, but is actually continuing to have seizures. Suspect this if the patient has rhythmic eye movements, dilated pupils, persistent tachycardia or failure to improve.
- During the postictal state the patient is usually not competent to make decisions. It is common for a patient in a postictal state to refuse assessment and clinical judgement is required in this setting.

Types of seizures

- Seizures may be classified as generalised (grand mal) or partial (focal or localised). Partial seizures may be simple (with no loss of consciousness) or complex (in which consciousness is lost).
- A patient having partial seizures may present without obvious convulsions and may be able to obey commands and interact during seizure activity. The patient may present with any combination of the following:
  - Habitual repetitive movements (automatisms).
  - Sensory symptoms including visual or auditory hallucinations.
  - Emotional outbursts or unusual feelings (such as feeling like they are outside their body).
  - Blank gaze.
- The most common cause of partial seizures is temporal lobe epilepsy.
- Partial seizures may respond to midazolam and/or valproate. If the seizure lasts longer than five minutes and is causing significant distress it is appropriate to administer midazolam and then to administer valproate if the seizure does not respond to two doses of midazolam.

Psychogenic non-epileptic seizures (pseudo-seizures)

- Non-epileptic seizures occur when there is motor activity that looks clinically like seizures, but there is no electroencephalography (EEG) evidence of seizure activity in the brain.
- In general, healthcare personnel cannot reliably distinguish between epileptic seizures (EEG positive) and non-epileptic seizures (EEG negative).
- It is very common for partial seizures from temporal lobe epilepsy to be initially misdiagnosed as non-epileptic seizures.
- The presence of tongue biting, or incontinence of urine or faeces lowers the likelihood of non-epileptic seizures.
- A patient with non-epileptic seizures may not have conscious control over their motor activity and in the absence of a previously confirmed diagnosis of non-epileptic seizures, personnel should assume that seizure activity is due to epilepsy until proven otherwise.
- The majority of patients with non-epileptic seizures will subsequently be diagnosed with a medical problem and a proportion have true epilepsy. A minority will be diagnosed as having a mental health problem such as conversion disorder or a personality disorder.

Febrile seizures

- Febrile seizures in children are associated with a rapid temperature rise, rather than any specific absolute temperature and usually occur in children aged less than six years.
- The most common cause of febrile seizures in children is a viral illness.

- Fever associated with infection usually confers some benefit to the patient and does not cause harm provided it is less than 40 degrees. For this reason rapid and/or aggressive cooling is not indicated unless the temperature is higher than 40 degrees. Unless this is the case, cool slowly by uncovering the child.

Backup

- Backup from an ICP must be requested when more than one dose of midazolam is administered or valproate is to be administered.
- Request backup for RSI in all patients with status epilepticus as this can cause brain injury via a combination of hypoxia and hyperthermia.

6.1 Infection

Infection

- Infection is present when a micro-organism (for example bacteria) invades part of the body producing a localised inflammatory response.
- Infection is usually isolated to a specific organ (for example the skin, urinary tract or lungs).
- For example, a patient with cellulitis, a surrounding red area with pain, no signs of a systemic inflammatory response and normal perfusion has an infection.

Systemic inflammatory response

- Systemic (or generalised) inflammatory response is present when the patient has signs of inflammation away from the infected site. Examples include:
  - Abnormal temperature, for example greater than 38 degrees or less than 36 degrees.
  - Tachycardia, for example a heart rate greater than 100/minute.
  - Tachypnoea, for example a respiratory rate greater than 20/minute in an adult.
- The presence or absence of a raised temperature is not always a useful sign:
  - Temperature can vary over time.
  - The measured temperature can differ between different sites at the same time (for example the temperature at the tympanic site may differ from the temperature at the axillary site).
  - A low temperature is a very important sign in that it is often associated with low cardiac output.
- Tachycardia may not be present if the patient is taking a beta-blocker.
- Tachypnoea may not be present if the patient has received opiates.
- Systemic inflammatory response can occur in the absence of infection. For example, a patient with pancreatitis may have a fever, tachycardia and tachypnoea without infection.

Sepsis

- Sepsis is present when a patient has clear signs of infection and signs of a systemic inflammatory response.
- For example, a patient with cellulitis, a surrounding red area with pain, a temperature of 38.5 degrees, a heart rate of 120/minute and normal perfusion has sepsis.

Septic shock

- Septic shock is present when a patient has clear signs of infection, signs of a systemic inflammatory response and clear signs of shock.
- For example, a patient with cellulitis, a surrounding red area with pain, a

temperature of 38.5 degrees, a heart rate of 120/minute, a blood pressure of 110 mmHg systolic and a peripheral capillary refill time of four seconds has septic shock.

- Septic shock occurs as a result of a widespread and severe inflammatory response secondary to the immune response to infection.
- In septic shock there is usually a combination of vasodilatation, capillary leak and impaired cardiac function causing the shock.
- In order to have shock, the patient must have hypotension or signs of significantly impaired perfusion.
- A patient with septic shock and pre-existing hypertension may have a significant fall in their blood pressure without developing hypotension, but will have signs of very poor perfusion.
- Additional signs and/or symptoms associated with septic shock include:
  - Decreased urine output.
  - Confusion.
  - Aching muscles and joints.
  - Rigors.

6.2 Septic shock

This section is for patients with a clinical diagnosis that is:

- Meningococcal septicaemia, regardless of the distance from hospital or
- Clearly septic shock provided the patient is more than 30 minutes from hospital.

- Determine the site of infection.
- Gain IV access and administer 0.9% sodium chloride IV:
  a) 1-2 litres for an adult.
  b) 20-40 ml/kg for a child.
  c) Administer further fluid as required.
- Administer antibiotics IV:
  a) Administer amoxicillin/clavulanic acid if the clinical diagnosis is meningococcal septicaemia.
  b) Consider calling for ceftriaxone if the patient has meningococcal septicaemia and a life-threatening allergy to penicillins, but not if the patient has septic shock from another source. Seek clinical advice regarding dosing.
  c) Administer amoxicillin/clavulanic acid if the patient has septic shock and the site of infection is the soft tissues, a joint or the chest.
  d) Administer amoxicillin/clavulanic acid followed by gentamicin if the patient has septic shock and the site of infection is the urinary tract, the abdomen or the site is unknown.
- If IV access cannot be obtained, administer amoxicillin/clavulanic acid IM only if the diagnosis is meningococcal septicaemia. Do not administer antibiotics IM if the patient has another source of septic shock.
- Amoxicillin/clavulanic acid dosing:
  a) 1.2 g IV for an adult.
  b) See the paediatric drug dose tables for a child.
- Gentamicin dosing and administration:
  a) 240 mg IV for an adult weighing less than 60 kg.
  b) 320 mg for an adult weighing 60-80 kg.
  c) 400 mg for an adult weighing greater than 80 kg.
  d) See the paediatric drug dose tables for a child.
  e) Administer gentamicin IV over 15-30 minutes.
- Administer adrenaline IV if shock is severe and not improving despite a minimum of two boluses of 0.9% sodium chloride. Place 1 mg of adrenaline into a 1 litre bag of 0.9% sodium chloride:

For an adult:

a) Administer this as an IV infusion. Start at 2 drops per second and adjust the rate to the patient's condition or
b) Administer 0.01 mg (10 ml) IV every 1-2 minutes.

For a child aged 5-14 years:

a) Administer this as an IV infusion. Start at 1 drop per second and adjust the rate to the patient's condition or
b) Administer IV boluses (see the paediatric drug dose tables) every 1-2 minutes.

For a child aged less than five years:

a) Administer IV boluses (see the paediatric drug dose tables) every 1-2 minutes.
b) Do not administer adrenaline as an IV infusion.

Additional information

Treating septic shock

- Blood cultures are not taken prior to commencing antibiotics because blood culture bottles have a very short shelf life and many DHB personnel refuse to process blood cultures taken by ambulance personnel.
- Administering antibiotics for septic shock without taking blood cultures is a balance of risk:
  - Not taking blood cultures increases the risk of not making a microbiological diagnosis and this alters the choice and duration of subsequent antibiotic treatment.
  - Delaying antibiotic administration increases the risk of deterioration and this increases morbidity and mortality, particularly if the transport time to hospital is prolonged.
  - For these reasons, antibiotics are only administered if the patient clearly has septic shock and the time to hospital is longer than 30 minutes.
- If the patient has septic shock the shock is significant enough for the patient to usually require approximately 40 ml/kg of 0.9% sodium chloride IV.

Antibiotic administration

- Consider gaining IV access in two sites.
- If both amoxicillin/clavulanic acid and gentamicin are being administered, the amoxicillin/clavulanic acid should be administered first. The gentamicin should then be diluted and administered over 15-30 minutes.

Meningococcal septicaemia

- Meningococcal septicaemia is infection within blood from the bacterium Neisseria meningitidis. It is relatively uncommon and has a high mortality rate.
- Meningococcal septicaemia is time critical in terms of commencing treatment and antibiotics should be administered pre-hospital whenever possible.
- Patients with meningococcal septicaemia in the early stages of infection commonly have non-specific influenza-like symptoms. Antibiotics are not indicated unless there are clear clinical signs of meningococcal septicaemia such as petechiae or purpura (see below).
- Meningococcal septicaemia commonly triggers disseminated intra-vascular coagulation (DIC).
  - This causes a combination of both bleeding and clotting within small blood vessels throughout the body.
  - It occurs in all organs but can be seen in the skin as small spots. The spots are not like a rash and will not blanch if a clear glass is pressed over them.
  - Petechiae are small spots about the size of the tip of a pen. They are due to bleeding from small capillaries in the skin. They can be seen anywhere and the patient should be examined fully to exclude them. They often develop over minutes and if the diagnosis is being considered, the patient's skin should be re-examined every 10-15 minutes looking for new petechiae.
  - Purpura are larger spots that look like small bruises. They result from a combination of bleeding and ischaemia of the skin. They are usually very obvious.
  - DIC is usually associated with signs of severe shock.
- As meningococcal bacteria die they release a substance called endotoxin. The body's immune response to endotoxin can cause profound worsening of shock following antibiotic administration. Be prepared to treat this with further 0.9% sodium chloride IV and adrenaline IV if required. It is rare for significant amounts of endotoxin to be released from other bacteria.

Meningitis

- Meningitis is a completely different disease to meningococcal septicaemia. It is relatively common and has a low mortality rate.
- Meningitis is inflammation of the meninges of the brain. The most common cause is infection.
- The infection is most commonly viral, but may be bacterial. Neisseria meningitidis is only one of the many bacteria that can cause bacterial meningitis.
- Meningitis is not usually time critical in terms of commencing treatment and antibiotics are rarely indicated pre-hospital.
- The patient will usually present with headache and signs of infection. They may have nausea, a stiff neck and photophobia.

- Antibiotics are not indicated pre-hospital for suspected meningitis in the absence of signs of meningococcal septicaemia or septic shock. Rarely, the patient may have an altered level of consciousness and if time to hospital is greater than 90 minutes, clinical advice should be sought regarding antibiotic administration.

6.3 Cellulitis

- Assess the patient, including an assessment of the features contained within the flag table:
  a) If any red flags are present the patient must be given a firm recommendation to be assessed in an ED, noting that transport by ambulance may not be required.
  b) If no red flags are present the patient should be given a firm recommendation to be seen by a doctor (preferably their own GP) within 12 hours.
- Follow a local pathway if one is in place.
- If the patient is not being referred or transported to an ED, consider administering a single dose of amoxicillin/clavulanic acid IV if it is possible there may be a delay in the patient seeing a doctor:
  a) 1.2 g IV for an adult.
  b) See the paediatric drug dose tables for a child.
  c) Wait a minimum of 20 minutes before leaving, to ensure there are no signs or symptoms of severe allergy.

Red flags

- Signs of shock.
- Severe pain, oedema or blistering.
- Skin necrosis.
- Inability to mobilise.
- Rigors.
- Neutropenia.
- Chemotherapy within the last four weeks.
- Temperature greater than 39 degrees.
- An associated abscess.
- Involves greater than 5% of body surface area.
- Rapidly spreading.
- Involves the face, hands or genitals.
- Diabetes on insulin.
- Significant lymphangitis.
- A prosthetic joint or heart valve.
- A hot or painful joint.
- Associated with a bite wound.
- Frail, elderly or significant comorbidities.

Additional information

- Cellulitis is most common in the lower leg.
- Mark the outer margins with a pen to provide a baseline for later clinical reference, noting that the cellulitis will usually extend outside the marked area for the first 1-2 days following the initiation of treatment.
- There are no orange or green flags for cellulitis because in the absence of red flags the patient still needs to be seen by a doctor.
- Have a lowered threshold for recommending transport to an ED if the patient is a child.
- Provide advice if the patient is not being transported to an ED:
  - Keep the limb elevated if possible.
  - Take paracetamol and/or ibuprofen for analgesia.
  - Call an ambulance if signs of severe systemic illness (for example very high fever or rigors) develop or the patient becomes unable to mobilise.
- Rigors indicate that bacteria may be in the blood.
- Neutropenia is a low neutrophil white blood cell count. Neutropenia usually occurs post chemotherapy and the patient will usually know if they are neutropenic.
- Chemotherapy includes any form of IV or oral chemotherapy for cancer treatment.
- 'Rapidly' spreading cannot be tightly defined and requires clinical judgement.
- Significant lymphangitis is present if there is red tracking or severe pain in the area of the lymph drainage/lymph nodes of the limb.
- A hot or painful joint indicates the possibility of septic arthritis (an infected joint) and this requires treatment in a hospital.
- If the patient is not being referred or transported to an ED and amoxicillin/clavulanic acid IV has been administered, remove the IV line prior to leaving the scene.
- Do not administer amoxicillin/clavulanic acid IM if IV access cannot be obtained.

6.4 Chest infection

- Assess the patient, including an assessment of the features contained within the flag table:
  a) If any red flags are present the patient must be given a firm recommendation to be assessed in an ED, noting that transport by ambulance will usually be required.
  b) If any orange flags are present (and no red flags) the patient should be given a firm recommendation to be seen by a doctor (preferably their own GP) within 24 hours.
  c) If green flags are present (and no orange or red flags) the patient is usually suitable to be given a recommendation to remain at home. Advise the patient to see their GP if their symptoms fail to improve.
- Follow a local pathway if one is place.

Red flags

- Signs of shock.
- Tachypnoea.
- Confusion.
- SpO_2 less than 94% on air (unless normal for the patient).
- Inability to mobilise normally.
- Severe pleuritic chest pain.
- Rigors.
- Neutropenia.
- Chemotherapy within the last four weeks.
- Temperature greater than 39 degrees.

Orange flags

- Temperature 37.5-39 degrees.
- Mild to moderate pleuritic chest pain.
- Age 65 years or older.
- CORD.
- Purulent sputum.
- Immunocompromised (for example taking steroids).

Green flags

- Temperature less than 37.5 degrees.
- Productive cough but sputum not purulent.
- Age 64 years or younger.
- Normal vital signs.
- Normal mobility.

Additional information

- If more than two orange flags are present, have a lowered threshold for recommending the patient is assessed in an ED.
- Purulent sputum is sputum that is clearly green or yellow/brown in colour.
- Rigors indicate that bacteria may be in the blood.
- Neutropenia is a low neutrophil white blood cell count. Neutropenia usually occurs post chemotherapy and the patient will usually know if they are neutropenic.
- Chemotherapy includes any form of IV or oral chemotherapy for cancer treatment.

6.5 Influenza

- Protect yourself from droplets.
- Have the patient wear a surgical mask if this is feasible.
- Assess the patient, including an assessment of the features contained within the flag table:
  a) If any red flags are present the patient must be given a firm recommendation to be assessed in an ED, noting that transport by ambulance will usually be required.
  b) If any orange flags are present (and no red flags) the patient should be given a firm recommendation to be seen by a doctor (preferably their own GP) within 24 hours.
  c) If green flags are present (and no orange or red flags) the patient is usually suitable to be given a recommendation to remain at home. Advise the patient to see their GP if their symptoms fail to improve.
- Include an assessment for signs of meningococcal septicaemia, which in the very early phase may be indistinguishable from influenza.

Red flags

- Tachypnoea.
- SpO_2 less than 94% on air (unless normal for the patient).
- Confusion.
- Inability to mobilise normally.
- Rigors.
- Neutropenia.
- Chemotherapy within the last four weeks.
- Temperature greater than 39 degrees.

Orange flags

- Aged over 65 years.
- Pregnant.
- Immunocompromised (for example taking steroids).
- Ischaemic heart disease.
- CORD.
- Diabetes requiring treatment.
- Severe obesity.

Green flags

- Normal vital signs.
- Normal mobility.

Additional information

- Consider an alternative diagnosis if the patient has any of the following:
  a) Absence of fever or
  b) Tachycardia that is inconsistent with influenza or
  c) Prolonged peripheral capillary refill time or
  d) Absence of respiratory or throat symptoms or
  e) Rigors or
  f) Inability to mobilise normally.
- Influenza is generally seasonal (usually winter months in New Zealand) and the prevalence in the community at any given time needs to be considered before making a provisional diagnosis of influenza.
- The patient will most commonly present with:
  - Non-specific symptoms (for example muscle aches, fatigue, malaise and headache) and
  - Respiratory symptoms (for example cough, sore throat and chest discomfort) and
  - Fever with a temperature greater than 38 degrees.
- If more than two orange flags are present, have a low threshold for recommending the patient is assessed in an ED.
- Rigors indicate that bacteria may be in the blood.
- Neutropenia is a low neutrophil white blood cell count. Neutropenia usually occurs post chemotherapy and the patient will usually know if they are neutropenic.
- Chemotherapy includes any form of IV or oral chemotherapy for cancer treatment.
- If the patient is not transported an influenza information sheet should be given to them and appropriate advice provided.

6.6 Lower UTI (cystitis)

- Assess the patient, including an assessment of the features contained within the flag table:
  a) If any red flags are present the patient must be given a firm recommendation to be assessed in an ED, noting that transport by ambulance may not be required.
  b) If any orange flags are present (and no red flags) the patient should be given a firm recommendation to be seen by a doctor (preferably their own GP) within 24 hours.
  c) If green flags are present (and no orange or red flags) the patient is usually suitable to be given a recommendation to remain at home. Advise the patient to see their GP if their symptoms fail to improve.
- Follow a local pathway if one is place.

Red flags

- Signs of shock.
- Flank/loin pain.
- Severe pain.
- Significant haematuria.
- Urinary retention.
- Inability to mobilise normally.
- Rigors.
- Neutropenia.
- Chemotherapy within the last four weeks.
- Temperature greater than 39 degrees.
- Confusion.

Orange flags

- Dysuria.
- Temperature 37.5-39 degrees.
- Moderate pain.
- Male.
- Aged less than 15 years or over 65 years.
- Pregnancy.
- Immunocompromised (for example taking steroids).

Green flags

- Normal vital signs.
- Normal mobility.
- Temperature below 37.5 degrees.
- Mild pain.

Additional information

- The classic presentation is usually a triad of:
  - Dysuria (pain on urination).
  - Frequency (frequent urination).
  - Lower abdominal discomfort.
- Urinary tract infections are a common cause of confusion in the elderly.
- If more than two orange flags are present, have a low threshold for recommending the patient is assessed in an ED.
- In women, lower urinary tract infections are usually self-limiting. Antibiotics may shorten the duration of the illness and reduce the incidence of recurrence, but are not required in all cases. If the patient is being given a recommendation for self-care, provide the following advice:
  - Take paracetamol and/or ibuprofen for analgesia.
  - Ensure adequate hydration.
  - See a pharmacist for advice.
  - See their GP if they are not improving.
- In men and children, lower urinary tract infections are uncommon and the patient should be given a firm recommendation to see their GP.
- Flank/loin pain indicates that pyelonephritis is possible.
- Significant haematuria requires frank blood to be clearly visible in the urine.
- Rigors indicate that bacteria may be in the blood.
- Neutropenia is a low neutrophil white blood cell count. Neutropenia usually occurs post chemotherapy and the patient will usually know if they are neutropenic.
- Chemotherapy includes any form of IV or oral chemotherapy for cancer treatment.

6.7 Sore throat

- Assess the patient, including an assessment of the features contained within the flag table:
  a) If any red flags are present the patient must be given a firm recommendation to be assessed in an ED, noting that transport by ambulance may not be required.
  b) If any orange flags are present (and no red flags) the patient should be given a firm recommendation to be seen by a doctor (preferably their own GP) within 24 hours.
  c) If green flags are present (and no orange or red flags) the patient is usually suitable to be given a recommendation to remain at home. Advise the patient to see their GP if their symptoms fail to improve.
- Follow a local pathway if one is place.

Red flags

- Signs of airway compromise.
- Signs of shock.
- Severe pain.
- Severe difficulty swallowing.
- Abnormal speech.
- Rigors.
- Neutropenia.
- Chemotherapy within the last four weeks.
- Temperature greater than 39 degrees.

Orange flags

- Onset over less than a day.
- Temperature 37.5-39 degrees.
- Moderate pain.
- Age less than 15 years.
- Age 16-45 years with any of the following features:
  a) Māori or Pacific People or
  b) Live in a low socioeconomic area of the North Island or
  c) Have a past history, or family history of rheumatic fever.

Green flags

- Mild pain.
- Temperature less than 37.5 degrees.

Additional information

- Sore throats are not usually a serious clinical problem. However, the immune response to untreated throat infections due to Group A Streptococcus may cause rheumatic fever, with subsequent heart and kidney disease. Rheumatic fever is particularly prominent within Māori and Pacific Island children and is a significant cause of preventable morbidity and mortality in New Zealand.
- Epiglottitis is a bacterial infection of the upper airway. It is now relatively rare as a result of immunisation. Historically it was most common in children aged 2-7 years but it is now quite common in adults. The patient usually has an onset of illness over a day or two, a very sore throat, difficulty swallowing (which may cause drooling) and a high fever. Epiglottitis is an emergency because the risk of airway occlusion is relatively high.
- Tracheitis is a bacterial infection of the trachea. It is relatively uncommon and mainly affects children. It is most commonly due to secondary bacterial infection following a viral infection.
- Pharyngeal abscess formation is usually associated with an onset of illness over days, a very sore throat, difficulty swallowing and a high fever. It is usually a complication of:
  - Bacterial pharyngitis in young children or
  - Tonsillitis in young adults or
  - Trauma from a foreign body.
- Rigors indicate that bacteria may be in the blood.
- Neutropenia is a low neutrophil white blood cell count. Neutropenia usually occurs post chemotherapy and the patient will usually know if they are neutropenic.
- Chemotherapy includes any form of IV or oral chemotherapy for cancer treatment.

6.8 Infectious disease precautions

Infectious disease	Level of PPE required	Level of vehicle cleaning required
Chicken pox	Droplet	Standard
Clostridium difficile diarrhoea	Contact	Standard
ESBL	Contact	Additional
Gastroenteritis, type not specified	Contact	Standard
Hepatitis A	Contact	Standard
Hepatitis B	Standard	Standard
Hepatitis C	Standard	Standard
HIV	Standard	Standard
Influenza	Droplet	Standard
Measles	Airborne	Standard
Meningitis, type not specified	Standard	Standard
Meningococcal disease	Droplet	Standard
MRSA	Contact	Additional
MRO, type not specified	Contact	Additional
Mumps	Droplet	Standard
Norovirus with vomiting	Airborne	Additional
Norovirus without vomiting	Contact	Additional
Pneumonia, type not specified	Standard	Standard
Rotavirus	Contact	Standard
Rubella	Airborne	Standard
Tuberculosis	Airborne	Standard
VRE	Contact	Additional
Whooping cough	Droplet	Standard

ESBL – extended spectrum beta-lactamase producing organism.

MRSA – methicillin resistant staphylococcus aureus.

MRO – multi-resistant organism.

VRE – vancomycin resistant enterococci.

PPE levels

Level of PPE	Level of PPE required
Standard	• Gloves for anticipated contact with body fluids. • Change contaminated gloves as soon as possible. • Eye protection for anticipated body fluid splash. • Consider overalls/gown and/or an apron for significant body fluid exposure. • Hand washing and drying or alcohol hand rub, before and after patient contact.
Contact	• Standard level PPE plus gloves and overalls/gown for direct contact with the patient or their immediate surroundings.
Droplet	• Standard level PPE plus a surgical mask for the patient and personnel. • Wear overalls/gown and/or an apron for direct contact if the patient has chicken pox. • Consider overalls/gown if within two metres of the patient if the patient is coughing significantly and unable to wear a mask. • N95 mask for personnel within two metres of the patient during procedures that may aerosolise droplets. For example when nebulising medicines.
Airborne	• Standard PPE plus an N95 mask for the patient and personnel. • Wear overalls/gown and/or an apron for direct contact if the patient has norovirus.

Vehicle cleaning and disinfection

Level of cleaning and disinfection	Minimum actions
Standard	• Open all vehicle doors for 10 minutes with nobody in the vehicle, if the infectious disease was airborne. • Wear gloves. • Decontaminate and disinfect surfaces contaminated with body fluid: a) Decontaminate using a cleaning solution, removing all visible soiling. b) Wipe with a disinfectant and allow to dry. • Remove used linen. • Wipe down the stretcher and all surfaces touched by the patient with disinfectant and allow to dry. • Wipe down all surfaces in the back of the vehicle touched by personnel (such as the monitor) with an approved disinfectant wipe and allow to dry. • Clean the floor if visibly dirty. • Replace linen. • Wash and dry hands. • Once disinfected surfaces are dry, the vehicle may be used for other patients.
Additional	• Standard level cleaning and disinfection plus: a) Wear gloves and overalls/gown and/or an apron. b) Wipe down all interior surfaces (including in the front of the vehicle) that the patient or personnel may have touched, with disinfectant and allow to dry. c) Clean the floor. • Once disinfected surfaces are dry, the vehicle may be used for other patients.

7.1 Special considerations in young children

Initial assessment

- A child's general appearance is an important consideration when determining how severe their illness or injury is, the need for treatment and the response to therapy.
- The paediatric assessment triangle (PAT) is a form of assessment that can be used to help determine the severity of illness or injury. The PAT involves an assessment of activity, breathing and circulation and is performed at the same time as the primary survey.

Activity
Movement, interaction, tone

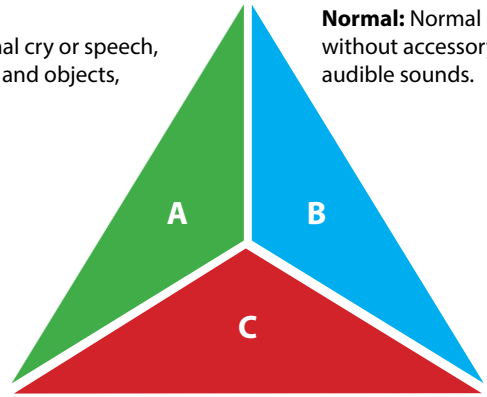
Abnormal: Inactive, lethargic, abnormal or absent cry or speech, failure to interact with people or objects, floppy.

Normal: Active, normal cry or speech, interacts with people and objects, good muscle tone.

Breathing
Respiratory rate, work of breathing

Abnormal: Tachypnoea, nasal flaring, indrawing, use of accessory muscles, grunting.

Normal: Normal regular breathing without accessory muscle use or audible sounds.



Circulation
Heart rate, perfusion

Abnormal: Tachycardia, mottled skin, pale, cold, slow capillary refill time.

Normal: Normal heart rate, normal skin colour, warm, fast capillary refill time.

- The more abnormal the PAT is, the more severe the illness or injury is:
  - If the PAT is normal, the child is unlikely to have severe illness or injury.
  - If one segment of the PAT is abnormal, the child is showing signs of an important illness or injury.
  - If two segments of the PAT are abnormal, the child is seriously ill or injured and is likely to be status two.
  - If three segments of the PAT are abnormal, the child is severely ill or injured and is likely to be status one.
- The aspects of the PAT that are most abnormal can help determine the underlying cause. For example:
  - If activity is abnormal, but breathing and circulation are near normal, the child is likely to have a condition primarily involving the brain.
  - If breathing is abnormal (particularly work of breathing), but activity and perfusion are near normal, the child is likely to have a condition primarily involving the lung.
  - If perfusion is abnormal, but activity and breathing (particularly work of breathing) are near normal, the child is likely to have a condition primarily involving the circulation.
- Document the aspects of the PAT on the PRF, but do not refer directly to the PAT as a title. This is because most hospital personnel are familiar with the individual aspects of the PAT, but not the actual title.

Communication

- The child is likely to be frightened. This will be contributed to by the injury or illness, the feelings and discomfort associated with it and the fact that ambulance personnel will be strangers.
- The child can only communicate up to their level of vocabulary. A calm and soothing tone is important.
- Communication is more difficult if the child is distressed or in pain.
- Parents, relatives and caregivers may be acting in a manner driven by feelings of helplessness and fear. It is important to acknowledge their anxiety and to keep a calm manner, without appearing to be overly relaxed or unconcerned.
- Whenever possible do not separate the child from parents or caregivers.

Interaction and activity

- A child will have reduced interaction and activity if very unwell or badly injured.
- Signs of reduced activity include:
  - Lethargy.
  - Abnormal cry.
  - Failure to interact with people or objects.
  - Reduced tone or floppiness.

The respiratory system

- Children rely heavily on the rate of breathing to compensate for respiratory difficulty. This is because they are unable to increase the depth of respiration due to the inability of the diaphragm to move farther downward against their abdominal organs.
- Tachypnoea is an early sign of respiratory distress.
- Children have narrower airways with higher resistance than adults.
- Children have a higher resting respiratory rate than adults and higher oxygen consumption.
- In children, the diaphragm is the dominant respiratory muscle. They do not move their chest wall significantly during normal breathing. Use of the diaphragm makes them more prone to fatigue.
- Children have lower functional residual capacity (FRC) than adults. This results in lower oxygen reserves and makes them more prone to hypoxia.
- Children have very compliant (elastic) ribs. This means that an increase in work of breathing will cause indrawing or retraction.
- Signs of respiratory distress include:
  - Tachypnoea.
  - Nasal flaring.
  - Grunting.
  - Weak cry.
  - Indrawing or retraction. Look for this in the supraclavicular, intercostal and substernal sites.
  - Accessory muscle use.
  - Stridor.
  - Abnormal positioning for example sitting forward, the sniffing position, the tripod position or refusing to lie down.
  - Head bobbing.
- Hypoxia in children causes tachycardia, agitation, drowsiness and pallor. Cyanosis is a late sign.
- If hypoxia is very severe the heart rate will begin to fall. This is a very late sign of imminent cardiac arrest.

The cardiovascular system

- Children have a higher blood volume (80-100 ml/kg) and cardiac output relative to size, a relatively fixed stroke volume and a higher resting heart rate than adults.
- Children have a significant capacity for vasoconstriction in the setting of falling cardiac output. This ability to vasoconstrict means that a fall in blood pressure is a very late sign of shock. However, the trend of blood pressure and pulse pressure over time are useful.

- The signs of shock in children are:
  - Tachycardia.
  - Tachypnoea.
  - Vasoconstriction with prolonged capillary refill time. This will also often produce mottled skin.
  - Reduced activity and interaction.
- Although children have a higher blood volume per kilogram, they have a lower total blood volume. This means that what may seem like a small amount of blood loss may represent a significant proportion of blood volume. For example, small children can become shocked from bleeding within their skull or from their scalp.

Traumatic brain injury (TBI)

- Children have large and heavy heads relative to their bodies and are more prone to TBI than adults.
- When unconscious, the upper airway tends to get obstructed by a relatively large, flaccid tongue, or kinked because of head flexion induced by the prominent occiput.
- GCS scoring is more difficult in small children. Focus on the motor score as it is the most important component.

Skeletal injury

- Children have more pliant and flexible bones than adults and are therefore subject to fewer fractures.
- Internal organ injuries in the absence of fractures of the overlying bones are more common than in adults. For example the rib cage is very compliant, so there may be internal injuries in the absence of superficial injuries, such as rib fractures.
- When a small child requires cervical spine immobilisation, to achieve neutral alignment they may require padding under the thoracic spine to avoid neck flexion from their relatively large head.

Temperature control

- Children have a less mature thermoregulatory (temperature control) mechanism and a higher surface area to mass ratio compared to adults. This makes heat loss and hypothermia more common.
- Children are at higher risk of hypothermia when exposed to cold weather, have burns, are cooled or are undressed during examination and treatment.

7.2 Paediatric equipment and drug doses

- For a child the doses of drugs, defibrillation energy and fluid therapy are based on weight when this is known.
- If the weight is not known it can be estimated from the child's age using formulae, noting that the formulae are a guide only and tend to under-estimate true weight.
- Many children will require a different sized LMA, ETT or length at lips than that predicted by the formulae.

Estimated weight (kg)	
Under 1 year old	5
1 - 10 years	(Age in years + 4) x 2
11 - 14 years	Age in years x 3
Cuffed endotracheal tube (ETT) size (mm)	
Newborn to 1 year	3 - 4
1 year and over	(Age in years ÷ 4) + 3.5
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
Defibrillation energy	
Initial and subsequent	5 J/kg

Paediatric drug doses

- The following pages contain tables of paediatric drug doses. They are based on rounding the child's weight off to the nearest of: 5, 10, 20, 30 or 40 kg. All children weighing 45 kg or more can be administered adult doses.
- The tables do not incorporate all administration information and should be read in conjunction with the drug information sheets within the comprehensive edition.
- The tables indicate the calculated dose of each drug for a given weight, the concentration of drug that should be drawn up and the volume that should be administered from that solution.
- Drug doses for rapid sequence intubation (RSI) are not contained within these tables but are contained within the RSI section.
- For drugs that have a dose range for adults (for example morphine), the paediatric dose has been calculated using the middle portion of the dose range. The dose should be reduced if the child is physiologically unstable and may need to be increased if the child is in severe pain.

- Some of the doses within the tables differ slightly from the recommended dose. This is to ensure a practical approach and to help reduce administration errors. For example, the usual recommended defibrillation energy for a child is 4 J/kg but this energy level is not available for the weight ranges within the following tables on most defibrillators used within the ambulance sector in New Zealand and for this reason 5 J/kg is used. Where there are differences between the dose in the tables and the recommended dose, these differences are not clinically significant.

Drug dilution

1	**Adrenaline IV 1:10,000 (0.1 mg/ml)** • Draw up 1 ml adrenaline from 1 mg/ml ampoule. • Make up to a total volume of 10 ml using 0.9% sodium chloride.
2	**Adrenaline IV 1:1,000,000 (0.001 mg/ml)** • Use a 1 litre bag of 0.9% sodium chloride. • Add 1 ml adrenaline from 1 mg/ml ampoule. • Shake well and label.
3	**Amoxicillin/clavulanic acid IV 120 mg/ml** • Add 4 ml 0.9% sodium chloride to 1.2 g powder amoxicillin/clavulanic acid ampoule, shake until dissolved. • Draw up the contents of the ampoule. • Make up to a total volume of 10 ml using 0.9% sodium chloride.
4	**Amoxicillin/clavulanic acid IM 500 mg/ml** • Add 2 ml 0.9% sodium chloride to 1.2 g powder amoxicillin/clavulanic acid ampoule, shake until dissolved. • The total volume will be 2.4 ml.
5	**Fentanyl IV 10 mcg/ml** • Draw up 2 ml fentanyl from 100 mcg/2 ml ampoule. • Make up to a total volume of 10 ml using 0.9% sodium chloride.
6	**Gentamicin IV** • Draw up the dose from the 80 mg/2 ml ampoule(s). • If administering in a 100 ml bag of 5% glucose: a) Not suitable for patients whose weight has been rounded to less than 20 kg. b) Administer over 15-30 minutes (1-2 drops/second). • If administering using a syringe: a) Dilute to a total of 10 ml using 0.9% sodium chloride. b) Administer 1 ml every 2-3 minutes.

7	**Ketamine IV 10 mg/ml** • Draw up 1 ml ketamine from a 200 mg/2 ml ampoule. • Make up to a total volume of 10 ml using 0.9% sodium chloride.
8	**Magnesium IV 10 mmol/ml** • Draw up 5 ml of magnesium from 10 mmol/5 ml ampoule. • Make up to a total volume of 10 ml using 0.9% sodium chloride.
9	**Midazolam IV 1 mg/ml** • Draw up 2 ml of midazolam from 15 mg/3 ml ampoule. • Make up to a total volume of 10 ml using 0.9% sodium chloride.
10	**Morphine IV 1 mg/ml** • Draw up 1 ml morphine from 10 mg/ml ampoule. • Make up to a total volume of 10 ml using 0.9% sodium chloride.
11	**Morphine (1 mg/ml) and midazolam (1 mg/ml) IV for post intubation sedation** • Draw up 2 ml of midazolam from 15 mg/3 ml ampoule and 1 ml of morphine from 10 mg/ml ampoule in the same syringe. • Make up to a total volume of 10 ml using 0.9% sodium chloride.
12	**Naloxone IV 0.1 mg/ml** • Draw up 1 ml naloxone from 0.4 mg/ml ampoule. • Make up to a total volume of 4 ml using 0.9% sodium chloride.
13	**Valproate IV** • Add 4 ml 0.9% sodium chloride to each 400 mg powder sodium valproate ampoule, shake until dissolved. This will give a 100 mg/ml solution. • If administering in a 100 ml bag of 5% glucose: a) Not suitable for patients whose weight has been rounded to less than 20 kg. b) Administer over 10-15 minutes (2-3 drops/second). • If administering using a syringe: a) Dilute to a total of 10 ml using 0.9% sodium chloride if the dose is less than or equal to 800 mg. b) If the dose is 1200 mg the volume will be approximately 12 ml. c) Administer over 10-15 minutes (1 ml every 1-2 minutes).

5 kg / 3 months

	Dose	Volume	💧
Cardiac arrest			
Adrenaline IV	0.05 mg	0.5 ml (1:10,000)	**1**
Amiodarone IV	25 mg	0.5 ml (undiluted)	
Manual defibrillation	25	Joules	
LMA	Size 1 (<5 kg)	Cuff inflation 4 ml	
ETT (cuffed)	Size 3	9 cm length at lips	
Other drugs			
Adrenaline IM	0.05 mg	0.5 ml (1:10,000)	**1**
Adrenaline IV (not cardiac arrest)	0.001 mg	1 ml (1:1,000,000)	**2**
Amoxicillin/clavulanic acid IV	150 mg	1.3 ml (120 mg/ml)	**3**
Amoxicillin/clavulanic acid IM	150 mg	0.3 ml (500 mg/ml)	**4**
Fentanyl IV	2.5 mcg	0.25 ml (10 mcg/ml)	**5**
Fentanyl IV (post intubation)	5 mcg	0.5 ml (10 mcg/ml)	**5**
Fentanyl IN (first dose)	10 mcg	0.2 ml (undiluted)	
Fentanyl IN (subsequent doses)	5 mcg	0.1 ml (undiluted)	
Gentamicin IV	30 mg	0.75 ml	**6**
Glucagon IM	0.5 mg	0.5 ml (undiluted)	
10% glucose IV	10 ml	10 ml	
Ibuprofen PO	-	-	
Ketamine IV	-	-	
Ketamine IV (post intubation)	5 mg	0.5 ml (10 mg/ml)	**7**
Ketamine IM/PO	-	-	
1% lignocaine IO	5 mg	0.5 ml (undiluted)	
1% lignocaine SC	1.5 ml (max)	1.5 ml (max)	
Loratadine PO	-	-	
Magnesium IV	-	-	
Midazolam IV (seizures)	0.5 mg	0.5 ml (1 mg/ml)	**9**
Midazolam IM (seizures)	1 mg	0.2 ml (undiluted)	
Morphine IV	0.25 mg	0.25 ml (1 mg/ml)	**10**
Morphine IM	1 mg	0.1 ml (undiluted)	

	Dose	Volume	
Morphine/Midazolam IV (post intubation)	0.2 mg of each	0.2 ml	**11**
Naloxone IV	0.05 mg	0.5 ml (0.1 mg/ml)	**12**
Naloxone IM	0.1 mg	0.25 ml (undiluted)	
Olanzapine PO	-	-	
Ondansetron PO	-	-	
Ondansetron IV/IM	-	-	
Paracetamol liquid PO	100 mg	2 ml (250 mg/5 ml)	
Paracetamol tablet PO	-	-	
Prednisone PO	-	-	
Rocuronium IV	5 mg	0.5 ml (undiluted)	
0.9% sodium chloride IV	100 ml	100 ml	
Tramadol PO	-	-	
Valproate IV	150 mg	1.5 ml	**13**

10 kg / 1 year

	Dose	Volume	💧
Cardiac arrest			
Adrenaline IV	0.1 mg	1 ml (1:10,000)	**1**
Amiodarone IV	50 mg	1 ml (undiluted)	
Manual defibrillation	50	Joules	
LMA	Size 2 (10-20 kg)	Cuff inflation 10 ml	
ETT (cuffed)	Size 3 or 4	12 cm length at lips	
Other drugs			
Adrenaline IM	0.1 mg	0.1 ml (undiluted)	
Adrenaline IV (not cardiac arrest)	0.002 mg	2 ml (1:1,000,000)	**2**
Amoxicillin/clavulanic acid IV	300 mg	2.5 ml (120 mg/ml)	**3**
Amoxicillin/clavulanic acid IM	300 mg	0.6 ml (500 mg/ml)	**4**
Fentanyl IV	5 mcg	0.5 ml (10 mcg/ml)	**5**
Fentanyl IV (post intubation)	10 mcg	1 ml (10 mcg/ml)	**5**
Fentanyl IN (first dose)	20 mcg	0.4 ml (undiluted)	
Fentanyl IN (subsequent doses)	10 mcg	0.2 ml (undiluted)	
Gentamicin IV	60 mg	1.5 ml	**6**
Glucagon IM	0.5 mg	0.5 ml (undiluted)	
10% glucose IV	20 ml	20 ml	
Ibuprofen PO	100 mg	½ tablet	
Ketamine IV	2.5 mg	0.25 ml (10 mg/ml)	**7**
Ketamine IV (post intubation)	10 mg	1 ml (10 mg/ml)	**7**
Ketamine IM/PO	10 mg	0.1 ml (undiluted)	
1% lignocaine IO	10 mg	1 ml (undiluted)	
1% lignocaine SC	3 ml (max)	3 ml (max)	
Loratadine PO	5 mg	½ tablet	
Magnesium IV	-	-	
Midazolam IV (seizures)	1 mg	1 ml (1 mg/ml)	**9**
Midazolam IM (seizures)	2 mg	0.4 ml (undiluted)	
Morphine IV	0.5 mg	0.5 ml (1 mg/ml)	**10**
Morphine IM	2 mg	0.2 ml (undiluted)	

	Dose	Volume	
Morphine/Midazolam IV (post intubation)	0.4 mg of each	0.4 ml	**11**
Naloxone IV	0.1 mg	1 ml (0.1 mg/ml)	**12**
Naloxone IM	0.2 mg	0.5 ml (undiluted)	
Olanzapine PO	-	-	
Ondansetron PO	2 mg	½ tablet	
Ondansetron IV/IM	1 mg	0.5 ml (undiluted)	
Paracetamol liquid PO	200 mg	4 ml (250 mg/5 ml)	
Paracetamol tablet PO	-	-	
Prednisone PO	-	-	
Rocuronium IV	10 mg	1 ml (undiluted)	
0.9% sodium chloride IV	200 ml	200 ml	
Tramadol PO	-	-	
Valproate IV	300 mg	3 ml	**13**

20 kg / 5 years

	Dose	Volume	💧
Cardiac arrest			
Adrenaline IV	0.2 mg	2 ml (1:10,000)	**1**
Amiodarone IV	100 mg	2 ml (undiluted)	
Manual defibrillation	100	Joules	
LMA	Size 2 (10-20 kg)	Cuff inflation 10 ml	
ETT (cuffed)	Size 4 or 5	15 cm length at lips	
Other drugs			
Adrenaline IM	0.2 mg	0.2 ml (undiluted)	
Adrenaline IV (not cardiac arrest)	0.004 mg	4 ml (1:1,000,000)	**2**
Amoxicillin/clavulanic acid IV	600 mg	5 ml (120 mg/ml)	**3**
Amoxicillin/clavulanic acid IM	600 mg	1.2 ml (500 mg/ml)	**4**
Fentanyl IV	10 mcg	1 ml (10 mcg/ml)	**5**
Fentanyl IV (post intubation)	20 mcg	2 ml (10 mcg/ml)	**5**
Fentanyl IN (first dose)	40 mcg	0.8 ml (undiluted)	
Fentanyl IN (subsequent doses)	20 mcg	0.4 ml (undiluted)	
Gentamicin IV	120 mg	3 ml	**6**
Glucagon IM	1 mg	1 ml (undiluted)	
10% glucose IV	40 ml	40 ml	
Ibuprofen PO	100 mg	½ tablet	
Ketamine IV	5 mg	0.5 ml (10 mg/ml)	**7**
Ketamine IV (post intubation)	20 mg	2 ml (10 mg/ml)	**7**
Ketamine IM/PO	20 mg	0.2 ml (undiluted)	
1% lignocaine IO	20 mg	2 ml (undiluted)	
1% lignocaine SC	6 ml (max)	6 ml (max)	
Loratadine PO	5 mg	½ tablet	
Magnesium IV	4 mmol	4 ml (1 mmol/ml)	**8**
Midazolam IV (seizures)	2 mg	2 ml (1 mg/ml)	**9**
Midazolam IM (seizures)	4 mg	0.8 ml (undiluted)	
Morphine IV	1 mg	1 ml (1 mg/ml)	**10**
Morphine IM	4 mg	0.4 ml (undiluted)	

	Dose	Volume	
Morphine/Midazolam IV (post intubation)	0.8 mg of each	0.8 ml	**11**
Naloxone IV	0.2 mg	2 ml (0.1 mg/ml)	**12**
Naloxone IM	0.4 mg	1 ml (undiluted)	
Olanzapine PO	-	-	
Ondansetron PO	4 mg	1 tablet	
Ondansetron IV/IM	2 mg	1 ml (undiluted)	
Paracetamol liquid PO	400 mg	8 ml (250 mg/5 ml)	
Paracetamol tablet PO	-	-	
Prednisone PO	20 mg	1 tablet	
Rocuronium IV	20 mg	2 ml (undiluted)	
0.9% sodium chloride IV	400 ml	400 ml	
Tramadol PO	-	-	
Valproate IV	600 mg	6 ml	**13**

30 kg / 10 years

	Dose	Volume	💧
Cardiac arrest			
Adrenaline IV	0.3 mg	3 ml (1:10,000)	**1**
Amiodarone IV	150 mg	3 ml (undiluted)	
Manual defibrillation	150	Joules	
LMA	Size 3 (30-50 kg)	Cuff inflation 20 ml	
ETT (cuffed)	Size 5 or 6	17 cm length at lips	
Other drugs			
Adrenaline IM	0.3 mg	0.3 ml (undiluted)	
Adrenaline IV (not cardiac arrest)	0.006 mg	6 ml (1:1,000,000)	**2**
Amoxicillin/clavulanic acid IV	900 mg	7.5 ml (120 mg/ml)	**3**
Amoxicillin/clavulanic acid IM	900 mg	1.8 ml (500 mg/ml)	**4**
Fentanyl IV	15 mcg	1.5 ml (10 mcg/ml)	**5**
Fentanyl IV (post intubation)	30 mcg	3 ml (10 mcg/ml)	**5**
Fentanyl IN (first dose)	60 mcg	1.2 ml (undiluted)	
Fentanyl IN (subsequent doses)	30 mcg	0.6 ml (undiluted)	
Gentamicin IV	160 mg	4 ml	**6**
Glucagon IM	1 mg	1 ml (undiluted)	
10% glucose IV	60 ml	60 ml	
Ibuprofen PO	200 mg	1 tablet	
Ketamine IV	7.5 mg	0.75 ml (10 mg/ml)	**7**
Ketamine IV (post intubation)	30 mg	3 ml (10 mg/ml)	**7**
Ketamine IM/PO	30 mg	0.3 ml (undiluted)	
1% lignocaine IO	30 mg	3 ml (undiluted)	
1% lignocaine SC	9 ml (max)	9 ml (max)	
Loratadine PO	5 mg	½ tablet	
Magnesium IV	6 mmol	6 ml (10 mmol/ml)	**8**
Midazolam IV (seizures)	3 mg	3 ml (1 mg/ml)	**9**
Midazolam IM (seizures)	6 mg	1.2 ml (undiluted)	
Morphine IV	1.5 mg	1.5 ml (1 mg/ml)	**10**
Morphine IM	6 mg	0.6 ml (undiluted)	

	Dose	Volume	
Morphine/Midazolam IV (post intubation)	1.2 mg of each	1.2 ml	**11**
Naloxone IV	0.3 mg	3 ml (0.1 mg/ml)	**12**
Naloxone IM	0.6 mg	1.5 ml (undiluted)	
Olanzapine PO	-	-	
Ondansetron PO	6 mg	1½ tablets	
Ondansetron IV/IM	3 mg	1.5 ml (undiluted)	
Paracetamol liquid PO	600 mg	12 ml (250 mg/5 ml)	
Paracetamol tablet PO	500 mg	1 tablet	
Prednisone PO	30 mg	1½ tablets	
Rocuronium IV	30 mg	3 ml (undiluted)	
0.9% sodium chloride IV	600 ml	600 ml	
Tramadol PO	-	-	
Valproate IV	800 mg	8 ml	**13**

40 kg / 13 years

	Dose	Volume	💧
Cardiac arrest			
Adrenaline IV	0.4 mg	4 ml (1:10,000)	**1**
Amiodarone IV	200 mg	4 ml (undiluted)	
Manual defibrillation	200	Joules	
LMA	Size 3 (30-50 kg)	Cuff inflation 20 ml	
ETT (cuffed)	Size 6 or 7	19 cm length at lips	
Other drugs			
Adrenaline IM	0.4 mg	0.4 ml (undiluted)	
Adrenaline IV (not cardiac arrest)	0.008 mg	8 ml (1:1,000,000)	**2**
Amoxicillin/clavulanic acid IV	1.2 g	10 ml (120 mg/ml)	**3**
Amoxicillin/clavulanic acid IM	1.2 g	2.4 ml (500 mg/ml)	**4**
Fentanyl IV	20 mcg	2 ml (10 mcg/ml)	**5**
Fentanyl IV (post intubation)	40 mcg	4 ml (10 mcg/ml)	**5**
Fentanyl IN (first dose)	80 mcg	1.6 ml (undiluted)	
Fentanyl IN (subsequent doses)	40 mcg	0.8 ml (undiluted)	
Gentamicin IV	240 mg	6 ml	**6**
Glucagon IM	1 mg	1 ml (undiluted)	
10% glucose IV	80 ml	80 ml	
Ibuprofen PO	300 mg	1 ½ tablets	
Ketamine IV	10 mg	1 ml (10 mg/ml)	**7**
Ketamine IV (post intubation)	40 mg	4 ml (10 mg/ml)	**7**
Ketamine IM/PO	40 mg	0.4 ml (undiluted)	
1% lignocaine IO	40 mg	4 ml (undiluted)	
1% lignocaine SC	12 ml (max)	12 ml (max)	
Loratadine PO	10 mg	1 tablet	
Magnesium IV	8 mmol	8 ml (1 mmol/ml)	**8**
Midazolam IV (seizures)	4 mg	4 ml (1 mg/ml)	**9**
Midazolam IM (seizures)	8 mg	1.6 ml (undiluted)	
Morphine IV	2 mg	2 ml (1 mg/ml)	**10**
Morphine IM	8 mg	0.8 ml (undiluted)	

	Dose	Volume	
Morphine/Midazolam IV (post intubation)	1.6 mg of each	1.6 ml	**11**
Naloxone IV	0.4 mg	4 ml (0.1 mg/ml)	**12**
Naloxone IM	0.8 mg	2 ml (undiluted)	
Olanzapine PO	5 mg	1 tablet	
Ondansetron PO	8 mg	2 tablets	
Ondansetron IV/IM	4 mg	2 ml (undiluted)	
Paracetamol liquid PO	800 mg	16 ml (250 mg/5 ml)	
Paracetamol tablet PO	750 mg	1 ½ tablets	
Prednisone PO	40 mg	2 tablets	
Rocuronium IV	40 mg	4 ml (undiluted)	
0.9% sodium chloride IV	800 ml	800 ml	
Tramadol PO	50 mg	1 tablet	
Valproate IV	1200 mg	12 ml	**13**

Paediatric vital signs

Age	Heart rate	Respiratory rate	Blood pressure (systolic)	Blood volume (ml/kg)
Newborn	120-180	30-60	60-90	85-90
1-12 months	100-160	30-50	90-105	75-80
1-4 years	80-110	24-40	95-105	75-80
5-12 years	65-100	18-30	100-110	70-75
>12 years	60-90	12-16	110-130	70-75

Paediatric Glasgow Coma Scale

Best eye response	
Spontaneously	4
To voice or touch	3
To pain or pressure	2
None	1
Best verbal response	
Smiles, babbles, coos	5
Cries normally	4
Cries only to pain or pressure	3
Moans or grunts	2
None	1
Best motor response	
Normal spontaneous movement	6
Localising	5
Normal flexion	4
Abnormal flexion	3
Extension	2
None	1

7.3 Neonatal resuscitation

- Always clarify who is in charge. If a lead maternity carer (LMC) is present, they are in charge of directing the treatment provided to the baby unless this responsibility is formally handed over to ambulance personnel.
- Assessment and interventions are based primarily on the baby's heart rate, breathing and SpO_2.

If breathing is inadequate or the heart rate is less than 100/minute

- Ventilate with a manual ventilation bag at a rate of 60/minute, using PEEP set to 5 cmH_2O and without added oxygen.
- Continually monitor the heart rate.

If the heart rate rises to greater than 100/minute

- Stop ventilation.
- Dry the baby and keep them warm.
- Administer oxygen if the SpO_2 is less than expected (see below).
- Continually monitor the heart rate, breathing and SpO_2.

If the heart rate is 60-100/minute

- Focus on providing ventilation.
- Ventilate with 10 litres/minute of oxygen if the heart rate fails to improve.

If the heart rate falls to less than 60/minute

- Start CPR at a ratio of 3:1.
- Continue to focus on ventilation with oxygen at 10 litres/minute.
- Place an LMA.
- Consider placing an ETT.
- Gain IV access.
- Administer adrenaline IV every four minutes:
  a) 0.01 mg (0.1 ml of 1:10,000) for gestation less than or equal to 26 weeks.
  b) 0.025 mg (0.25 ml of 1:10,000) for gestation 27-37 weeks.
  c) 0.05 mg (0.5 ml of 1:10,000) for gestation greater than or equal to 38 weeks.

In addition

- Measure the blood glucose concentration if the baby's activity is not normal, but this is not a priority if resuscitation is required. Administer glucose if the blood glucose concentration is less than 2.5 mmol/litre:
  a) Spread glucose gel on the gums, tongue and inside of the cheeks if the baby is conscious and repeat this every 5-10 minutes.
  b) Administer 10 ml of 10% glucose IV if the baby is unconscious or the blood

glucose concentration does not rise 20 minutes after oral glucose.

c) Repeat the glucose measurement every 10 minutes and administer further glucose if required until the glucose concentration is greater than or equal to 2.5 mmol/litre.

Expected SpO_2

- 60-70% at 1 minute.
- 65-85% at 2 minutes.
- 70-90% at 3 minutes.
- 75-90% at 4 minutes.
- 80-90% at 5 minutes.
- 85-90% at 10 minutes.
- 90-95% at more than 10 minutes.

Referral

- Transport to a hospital with neonatal facilities whenever feasible if the baby has required intervention or has abnormal vital signs.

Additional information

General

- Resuscitation of a neonate is focused primarily on supporting ventilation.
- A crying and/or active baby requires no specific intervention. Dry the baby and place skin to skin with the mother provided neither is requiring resuscitation. Place a hat on the baby if one is available, cover them both with a warm blanket and observe the baby's activity and breathing.
- It is normal for the peripheries of the baby to remain blue for several hours after birth.
- The heart rate is best monitored via pulse oximetry or ECG leads.
- Pulse oximetry should be monitored using the right hand whenever possible because a patent ductus arteriosus may produce falsely low measurements in the left hand and feet.
- Preventing heat loss is vital, particularly in a premature baby:
  - A premature baby requiring resuscitation should be immediately wrapped in plastic (leaving the face free) without being dried and placed under radiant heat as soon as possible.
  - A term baby should be dried and resuscitated in a warm environment if possible.
  - A hat should be placed on the baby if one is available.
  - The interior of the ambulance should be made as hot as possible.
- Mother and baby must be safely restrained during transport.

Hypoglycaemia

- Hypoglycaemia is uncommon in neonates in the first few hours.
- The normal blood glucose concentration is lower in a neonate than in older children and a neonate is not hypoglycaemic unless the glucose concentration is less than 2.5 mmol/litre.
- Glucose concentration should be measured via heel prick.
- If the baby is conscious, spreading glucose gel on the mucous membranes of the mouth is usually an effective treatment.

Oxygen administration, suctioning and ventilation

- Routine oxygen administration during neonatal resuscitation appears to make outcomes worse. This is why oxygen is reserved for deterioration despite initial ventilation.
- Suctioning the mouth and nose before the body is delivered is not required, even if meconium is present. If ventilation is required, this takes priority over suctioning meconium unless meconium is clearly occluding the airway.
- Ventilation via an LMA is preferred to ventilation via an ETT because intubation with an ETT has a high failure rate, unless the person performing the intubation is very experienced. However, if resuscitation is required for more than 10 minutes an ETT may be placed provided intubation is able to be easily performed.
- Ventilation via a face mask or LMA can result in distension of the stomach, but an attempt to decompress the stomach should not usually occur unless instructed to do so by an LMC.

Intravascular access, adrenaline and 0.9% sodium chloride

- Gaining IV access has a lower priority than providing good CPR with a focus on ventilation.
- If the baby is very small, IO access may be difficult to obtain because the paediatric IO needle may be too long and the softness of the bones may result in the IO needle being easily displaced.
- Administering adrenaline IV is not a priority, but may occur provided this does not compromise the focus on providing good ventilation and CPR.
- 0.9% sodium chloride IV does not have a significant role in resuscitation, but consider administering 10 ml/kg if there are signs that the baby has bled or the baby shows signs of shock.

Cutting the cord

- There is no urgency to clamp and cut the cord provided neither the baby nor the mother is requiring resuscitation.
- In the absence of urgency, clamp and cut the cord 2-3 minutes after birth.
- Clamp and cut the umbilical cord at least 5 cm from the baby as this facilitates access to the cord vessels for later cannulation if required.

Backup

- Request early backup and support from an ICP and/or LMC if resuscitation is required.
- There is no role for requesting a hospital neonatal team to attend a scene that is not a birthing unit.
- There may occasionally be a role for a hospital neonatal team to attend a birthing unit, noting that this decision will be made by a hospital neonatologist in consultation with the LMC and the team may take significant time to reach the scene.
- The decision to utilise a hospital neonatal team is usually a trade off between time and the availability of dedicated equipment during transfer:
  - If the baby is requiring ventilation or resuscitation, it will usually be faster to deliver the baby to hospital than to deliver a hospital team to the scene.
  - If the baby is not requiring ventilation or resuscitation and there is specific equipment at the scene that cannot be utilised during transfer, it may be preferable to wait at the scene for a hospital team with dedicated equipment.

Starting and stopping resuscitation

- A resuscitation attempt should always be started unless an LMC directs ambulance personnel not to.
- Resuscitation should usually occur at the scene because the quality of resuscitation is compromised during transport. However, resuscitation en route to hospital may be appropriate if transport time is less than 15 minutes and an ICP or LMC cannot reach the scene.
- If the LMC is not present to make the decision, resuscitation attempts should be stopped if the baby is in asystole for more than 10 minutes.
- If there is uncertainly personnel must seek clinical advice.

8.1 Obstetric related bleeding

General principles

- Always clarify who is in charge. If a lead maternity carer (LMC) is present, they are in charge of directing the treatment provided to the patient unless this responsibility is formally handed over to ambulance personnel.
- If the patient is status one or status two, transport should usually be to an ED, preferably within a hospital with an obstetric unit. However, the patient may be transported direct to an obstetric unit or delivery suite provided there has been pre-hospital notification of arrival and the patient is going direct to a resuscitation area.
- Good documentation is always important:
  a) Always document who was in charge of providing treatment if another healthcare provider was present.
  b) Separate PRFs are required for the mother and the baby.
- Good crew resource management and communication are always important, particularly when other healthcare personnel are involved in providing treatment.

Antepartum haemorrhage (APH)

- Commence transport as soon as possible, providing most treatments en route.
- Tilt the patient 30 degrees to their left to prevent supine hypotension.
- Seek help from an LMC if possible, provided this does not delay transport.
- Gain IV access and administer 0.9% sodium chloride IV utilising the principles within the controlled bleeding section:
  a) Rapidly administer 1 litre of 0.9% sodium chloride IV if the patient has signs of hypovolaemia or poor perfusion and immediately reassess.
  b) Administer further boluses of 0.9% sodium chloride IV as required.
  c) Arrange for blood to be administered if this is available and shock is severe.
- Transport the patient direct to a hospital with obstetric facilities whenever feasible, providing as much pre-hospital notification of arrival as possible.

Additional information on APH

General

- APH is any obstetric related bleeding occurring after 20 weeks gestation and prior to birth of the baby.
- APH usually presents with vaginal blood loss which must be considered to be APH until proven otherwise.

- There can be significant APH without visible vaginal blood loss, for example with placental abruption which is usually accompanied by abdominal pain.
- It is important to keep the patient warm. This is because hypothermia worsens bleeding by contributing to coagulopathy:
  - Keep the patient covered with blankets whenever possible.
  - Keep the interior of the ambulance as hot as is tolerable.
  - Ambient temperature IV fluid contributes to hypothermia, but do not warm IV fluid in microwaves because this can result in unreliable fluid temperatures and/or may damage the plastic bag.

IV fluid administration for APH

- Blood pressure alone is a poor guide to the severity of hypovolaemia and a poor guide to fluid therapy.
- 0.9% sodium chloride should be administered if there are signs of hypovolaemia or poor perfusion, even if the patient is not hypotensive.
- 0.9% sodium chloride should be titrated to signs of intravascular volume and perfusion. The trend of all of the following signs is an important guide to treatment:
  - Heart rate.
  - Pulse strength.
  - Capillary refill time.
  - Pulse pressure.
  - Blood pressure.
  - Level of consciousness.
- The threshold for IV fluid administration in APH is lower than in the postpartum haemorrhage section. This is because APH has a pattern of bleeding that is more likely to be relatively controlled in comparison and in APH shock carries an additional risk to the baby.
- In some parts of New Zealand blood is available in the pre-hospital setting via medical staff. Only call for blood if there is an established protocol in the area for blood to be delivered to the scene. Blood should be requested early if shock is severe.

Postpartum haemorrhage (PPH)

- Commence transport as soon as possible, providing most treatments en route.
- Place pressure on any compressible bleeding.
- Seek help from an LMC if possible, provided this does not delay transport.
- Administer 10 units of oxytocin IM into the mother's lateral thigh. If multiple babies are present administration must be delayed until after birth of the last baby.

- If the placenta has not delivered and an LMC is not available, seek urgent advice regarding controlled cord traction to help deliver the placenta.
- Gain IV access and administer IV fluid utilising the principles within the uncontrolled bleeding section:
  a) Arrange for blood to be administered if this is available.
  b) If blood is unavailable, rapidly administer 500 ml of 0.9% sodium chloride IV if there are signs of shock and immediately reassess.
  c) Administer further boluses of 0.9% sodium chloride IV if signs of shock remain.
- Feel for the uterus at approximately umbilical level and massage it firmly using a circular motion.
- If oxytocin is not available:
  a) Encourage the baby to begin suckling or
  b) Ask the patient or her partner to stimulate both nipples by gently rolling them back and forth between their fingers and thumbs for approximately 15 minutes.
- Perform bimanual compression of the uterus if bleeding is severe and the patient is deteriorating.
- Consider an adrenaline infusion if shock is very severe, appears disproportionate to the severity of blood loss and is unresponsive to 2-3 litres of 0.9% sodium chloride, or blood:
  a) Place 1 mg of adrenaline into a 1 litre bag of 0.9% sodium chloride.
  b) Administer this as an IV infusion. Start at 2 drops per second and adjust the rate to the patient's condition or
  c) Administer 0.01 mg (10 ml) IV every 1-2 minutes.
- Transport the patient to a hospital with obstetric facilities whenever feasible, providing as much pre-hospital notification of arrival as possible.

Additional information on PPH

General

- PPH is bleeding in excess of 500 ml that is ongoing following the birth of the baby.
- It is very difficult to estimate the volume of blood loss in PPH. This is because blood loss is usually spread over several locations (for example in the bed, on the floor or in the toilet), may be mixed with amniotic fluid and may be concealed (for example intra-uterine or intra-abdominal bleeding).
- The most important aspects of pre-hospital care are to rapidly transport to an appropriate hospital and stop compressible bleeding, providing most treatments en route.
- If oxytocin has already been administered as part of routine treatment after

birth of the baby, an additional 10 units of oxytocin should be administered in the setting of PPH and this will usually require meeting another vehicle.

- Secondary PPH is PPH occurring between 24 hours and six weeks after delivery. Oxytocin should be administered, even though the role for oxytocin in secondary PPH is unclear.
- It is important to keep the patient warm because hypothermia worsens bleeding by contributing to coagulopathy:
  - Keep the patient covered with blankets whenever possible.
  - Keep the interior of the ambulance as hot as is tolerable.
  - Ambient temperature IV fluid contributes to hypothermia, but do not warm IV fluid in microwaves because this can result in unreliable fluid temperatures and/or may damage the plastic bag.

IV fluid administration for PPH

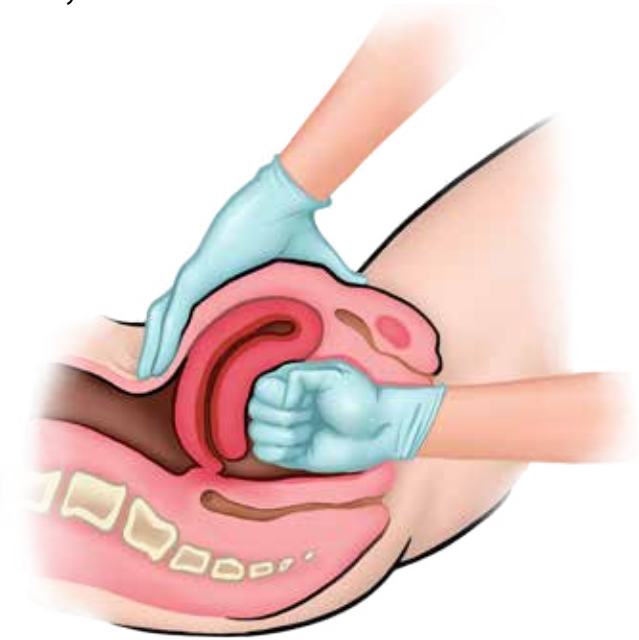
- The views of healthcare providers differ on the best approach to IV fluid resuscitation in the setting of PPH. Most LMCs will utilise the principles within the hypovolaemic shock section and this is acceptable if an LMC is present and in charge of directing the patient's treatment.
- The threshold for IV fluid administration in PPH is higher than in the APH section. This is because PPH has a pattern of bleeding that is more likely to be relatively uncontrolled in comparison and in APH severe shock carries an additional risk to the baby.
- Pregnant women have an expanded blood volume and can lose more than one litre of blood without showing signs of shock. If a pregnant (or recently pregnant) patient has signs of shock, it is by definition severe.
- A fall in blood pressure is a very late sign and will only occur if shock is very severe.
- The uterus has a high blood supply and bleeding associated with PPH can be massive and rapid. If blood loss appears substantial and/or the patient is very shocked, it is appropriate to commence rapid administration of several litres of 0.9% sodium chloride, in addition to requesting blood (if available) while simultaneously commencing transport.
- In some parts of New Zealand blood is available in the pre-hospital setting via medical staff. Only call for blood if there is an established protocol in the area for blood to be delivered to the scene. Blood should be requested early if shock is severe.

Nipple stimulation

- This is designed to release endogenous oxytocin to help the uterus contract, but should not delay commencing transport and treatment.
- It is not a priority if it is difficult to achieve.

Bimanual compression of the uterus

- To perform bimanual compression of the uterus:
  - Explain what you are going to do and why.
  - Place one hand in the vagina as far as you can and form a fist.
  - Push upward with this hand toward the umbilicus.
  - Place your other hand on the abdomen, feel for the uterus and push both hands firmly toward each other.



Amniotic fluid embolism

- Amniotic fluid embolism is rare.
- Amniotic fluid embolism occurs when amniotic fluid enters the maternal circulation, causing a severe inflammatory response that has a high mortality rate.
- Signs and symptoms include tachypnoea, hypoxia and shock.
- If shock is very severe, disproportionate to blood loss and unresponsive to 0.9% sodium chloride IV, amniotic fluid embolism should be considered a possibility.
- The treatment for amniotic fluid embolism is supportive and adrenaline IV by infusion may have a role.

8.2 Other obstetric conditions

General principles

- If a pregnant patient has a condition that is not primarily an obstetric condition, for example asthma or trauma, treat according to the appropriate section. In this situation:
  a) Ambulance personnel are in charge of providing treatment to the patient.
  b) The patient must be transported to an ED and not an obstetric unit or delivery suite.
- If the patient has a condition that is primarily an obstetric condition:
  a) Always clarify who is in charge. If a lead maternity carer (LMC) is present, the LMC is in charge of directing the treatment provided to the patient unless this responsibility is formally handed over to ambulance personnel.
  b) If the patient is status one or status two, transport should usually be to an ED, preferably within a hospital with an obstetric unit. However, the patient may be transported direct to an obstetric unit or delivery suite provided there has been pre-hospital notification of arrival and the patient is going direct to a resuscitation area.
- Good documentation is always important:
  a) Always document who was in charge of providing treatment if another healthcare provider was present.
  b) Separate PRFs are required for the mother and the baby.
- Good crew resource management and communication are always important, particularly when other healthcare personnel are involved in providing treatment.

Vaginal examination

- It is acceptable to view the vagina with the patient's permission, looking for signs of the baby's head or the umbilical cord.
- Do not examine the inside of the vagina except in the setting of severe PPH.

Miscarriage

- A patient with spontaneous miscarriage occurring during the first trimester does not require immediate referral or transport to hospital unless:
  a) Pain is severe or
  b) The nature or location of the pain is different to that of menstrual pain or
  c) Bleeding is clinically significant. For example more than a heavy period.
- Contact the LMC if possible.
- If miscarriage occurs after the first trimester the patient should be assessed in hospital, preferably one with obstetric facilities.
- If referral to hospital is not required and the LMC cannot be contacted, recommend the patient is reviewed by their LMC or GP within 24 hours.

Pregnancy and abdominal or pelvic trauma

- A pregnant patient with possible abdominal or pelvic trauma occurring during the second or third trimester must be given a firm recommendation to be assessed in hospital, preferably one with obstetric facilities, even if the trauma is minor.

Supine hypotension

- After 20 weeks gestation, hypotension may occur in the supine position because the uterus can impede venous return through the inferior vena cava.
- To prevent supine hypotension always tilt the patient 30 degrees (or more) to their left by placing a rolled towel or pillow under their right hip. If this cannot be achieved, manually displace the uterus to the left if feasible.

Pre-labour rupture of membranes

- This is rupture of the membranes prior to the onset of labour.
- Contact the LMC if possible.
- Exclude an obvious cord prolapse. If this is present, the patient requires immediate transport by ambulance.
- If the pregnancy is less than 37 weeks, firmly recommend that the patient is assessed in an obstetric unit.
- If the pregnancy is greater than or equal to 37 weeks, firmly recommend that the patient contacts their LMC.

Pre-term labour

- This is the onset of labour prior to 37 weeks of pregnancy.
- Contact the LMC if possible.
- Transport to a hospital with obstetric facilities immediately.
- Be prepared to provide neonatal resuscitation.
- Do not administer any medicines to slow down labour unless requested to do so by an LMC.

Birth

- Imminent birth following normal labour is not a valid reason to travel under lights.
- Pull to the side of the road if birth is imminent during transport.
- Support the patient to adopt the position she prefers.
- Support the baby's head and shoulders as they appear without applying traction.
- Dry the baby.
- Place the baby skin to skin with the mother provided neither requires resuscitation. Place a hat on the baby if one is available and cover mother and

baby with a warm blanket. Observe the baby's activity and breathing.

- Clamping and cutting the cord is not urgent unless the baby or mother is requiring resuscitation. In the absence of urgency, clamp and cut the cord 5 cm from the baby 2-3 minutes after birth.
- Administer 10 units of oxytocin IM into the mother's lateral thigh. If multiple babies are present administration must occur after birth of the last baby. Routine administration of oxytocin is controversial, but appears to reduce the incidence of postpartum haemorrhage.
- Allow the placenta to deliver spontaneously, without applying traction. This usually occurs within 60 minutes. Place the placenta in a plastic bag.
- Following delivery of the placenta, feel for the uterus at approximately umbilical level and rub it using a circular motion until it feels firm.

If the baby gets stuck

- If the baby's head appears, but the body does not birth after two contractions with pushing:
  a) Seek immediate help from an LMC if possible.
  b) Ask the patient to grab her knees, pull them to her chest and push as hard as she can with the next two contractions.
  c) If the above fails to deliver the baby, place the heel of your hand directly above the patient's pubic bone and push slowly but firmly straight back toward the patient's lower back. This is designed to reposition the baby's shoulder, which is usually what is preventing delivery.
  d) If the above fails, ask the patient to move on to her hands and knees and push as hard as she can with the next two contractions.
  e) If the above fails transport urgently.

If the cord is wrapped around the neck

- This is quite common and is not an emergency.
- If the cord is loose and is easy to slip over the baby's head, then do so. If you cannot easily slip it over the head, allow birth to continue.

Prolapsed umbilical cord

- This is when the umbilical cord appears in the vagina ahead of the baby.
- This risks the baby having poor blood supply from an obstructed cord and requires urgent delivery.
- Seek immediate help from an LMC if possible.
- Instruct the patient not to push and position her so that her hips are higher than her shoulders. This is designed to take the weight of the baby off the cord and delay delivery until an LMC is available. Either:
  a) Position the patient on her back with her hips on a pillow with the stretcher head down (this is the safest position during transport) or

b) Position the patient on her elbows and knees with her head down and with the stretcher head down.

- Encourage delivery to occur if the baby appears at the vaginal opening or the patient wants to push.

Breech delivery

- This is when the baby is coming out feet or buttocks first.
- This risks the baby having poor blood supply from an obstructed cord and requires urgent delivery.
- Seek immediate help from an LMC if possible.
- Instruct the patient not to push and position her so that her hips are higher than her shoulders. This is designed to take the weight of the baby off the cord and delay delivery until an LMC is available. Either:
  a) Position the patient on her back with her hips on a pillow with the stretcher head down (this is the safest position during transport) or
  b) Position the patient on her elbows and knees with her head down and with the stretcher head down.
- Encourage delivery to occur if the baby appears at the vaginal opening or the patient wants to push.

Retained placenta

- This is when the placenta has not been delivered within 60 minutes of the baby.
- Transport to hospital without unnecessary delay and seek help from an LMC if possible.
- Gain IV access and be prepared to treat postpartum haemorrhage.

9.1 The principles of intubation and ventilation

The risks

- The risks associated with intubation and ventilation include:
  a) Hypoxia and hypercarbia during laryngoscopy and
  b) Raised intra-cranial pressure during laryngoscopy and
  c) Unrecognised oesophageal intubation and
  d) Inadvertent hyperventilation post intubation and
  e) Reduced cardiac output as a result of raised intra-thoracic pressure reducing venous return to the heart and
  f) Interruption of chest compressions during cardiac arrest and
  g) Reduced blood flow during CPR (as a result of raised intra-thoracic pressure) if ventilation rates are greater than 10 breaths per minute. Note: this risk exists with supra-glottic airway devices too.

The benefits

The benefits associated with intubation and ventilation include:

a) Securing the airway and protecting the lungs from aspiration of vomit and
b) Controlling CO_2 levels by controlling ventilation and
c) Improving oxygenation by allowing the administration of PEEP via an ETT and
d) Allowing continuous chest compressions to occur (if CPR is in progress), without interruptions for ventilation.

The balance of risks and benefits

For the majority of unconscious patients being treated by ambulance personnel the risks of intubation without rapid sequence intubation (RSI) outweigh the benefits. For this reason intubation and ventilation without RSI must only occur if the patient has a GCS of 3 and ineffective breathing.

Intubation and ventilation during cardiac arrest

- For the majority of patients in cardiac arrest, chest compressions take priority over intubation and ventilation.
- Chest compressions should be continuous (without interruptions for ventilation) if an LMA is in place and ventilation appears clinically adequate. Replacing the LMA with an ETT is not a priority in the first 10 minutes, unless there is clinically significant vomiting or ventilation is clinically inadequate.
- If ROSC has not occurred within 10 minutes, consider replacing the LMA with an ETT.
- Ideally, intubation should occur with chest compressions in place or when chest compressions are being paused for a pulse check. Chest compressions should be paused for the minimum time necessary (and definitely no more than 15 seconds) to perform intubation.

Measurement of exhaled CO_2

- Intubation with an ETT must not be attempted unless measurement of exhaled CO_2 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 CO_2 ($ETCO_2$) via capnography is compulsory for all patients intubated with an ETT, including those in cardiac arrest.
- The ETT must be removed if the $ETCO_2$ is below 5 mmHg (including during cardiac arrest), even if it is thought that the low $ETCO_2$ is due to technical error. This is because the risk of unrecognised oesophageal intubation is too high, even when the ETT is thought clinically to be within the trachea.
- If the ETT is within the oesophagus and the stomach contains CO_2 (for example from drinks containing CO_2, or following mouth to mouth ventilation), CO_2 may be detectable for the first 2-4 breaths and then fall rapidly to a low level (for example an $ETCO_2$ below 5 mmHg).

9.2 Preparation for RSI checklist

This checklist is to be used by personnel to aid preparing a patient for RSI, when waiting for an appropriate ICP to arrive.

Checklist

- Attach nasal prongs without oxygen.
- Pre-oxygenate using a reservoir mask at 10 litres/minute, or a manual ventilation bag at 10-15 litres/minute with PEEP set at a minimum of 5 cmH_2O.
- Attach ECG, NIBP and SpO_2.
- Prepare capnography if this is available.
- Position the monitor so that it can be seen, leaving space to the right side of the patient's head for intubation equipment.
- Gain IV access, preferably in two sites.
- Prepare a running line of 0.9% sodium chloride.
- Position the patient for optimal airway control. For example, consider placing a folded towel under the head.
- Place an ETT holder with the strap undone under the patient's head.
- Ensure suction is working and turn it off.
- Prepare a manual ventilation bag with PEEP valve attached (if not already in use).
- Obtain a set of vital signs.
- If possible, update the responding ICP with the patient's condition and vital signs.
- Prepare the area:
  - If the patient is not in an ambulance, clear the area so that there is access to both sides of the patient if possible.
  - If the patient is in an ambulance, clear away as much unnecessary equipment as possible and consider travelling toward backup.

9.3 Rapid sequence intubation (RSI)

- RSI is indicated for a patient with:
  a) A GCS less than or equal to 10 and
  b) Clinically significant airway or ventilatory compromise.
- RSI is contraindicated if:
  a) Capnography is unavailable or
  b) A dedicated suitable assistant is unavailable.
- RSI with suxamethonium is contraindicated if:
  a) There is a history (or family history) of malignant hyperthermia or
  b) The patient has pre-existing paraplegia or quadriplegia or
  c) The patient has a muscle disorder with long term weakness or
  d) Hyperkalaemia is strongly suspected.
- Use caution performing RSI if:
  a) The intubation is predicted to be difficult or
  b) Transport time to hospital is less than 15 minutes or
  c) The underlying condition is likely to rapidly improve or
  d) The patient is aged less than five years or greater than 75 years or
  e) The patient has severe comorbidities.

RSI procedure

- Utilise the RSI checklist.
- Administer fentanyl IV over one minute, approximately two minutes prior to ketamine administration.
- Administer ketamine and then suxamethonium IV.
- Provide oxygen at 15 litres/minute via nasal prongs during laryngoscopy.
- Intubate and confirm ETT position with capnography.
- Utilise the post intubation checklist.
- Administer rocuronium provided ETT placement is confirmed by capnography and the $ETCO_2$ is greater than 5 mmHg.
- Adjust ventilation to the target $ETCO_2$ using the post intubation section.
- Administer sedation using the post intubation section.

Adult RSI Drug Doses

	50-80 kg	>80 kg
Fentanyl*	150 mcg	200 mcg
Ketamine	100 mg	150 mg
Suxamethonium	150 mg	200 mg
Rocuronium	50 mg	100 mg

* Halve the dose if there are signs of shock or the patient is frail.

Paediatric RSI Drug Doses

	10 kg	20 kg	30 kg	40 kg	50 kg
Fentanyl*	20 mcg	40 mcg	60 mcg	80 mcg	100 mcg
Ketamine	15 mg	30 mg	45 mg	60 mg	75 mg
Suxamethonium	20 mg	40 mg	60 mg	80 mg	100 mg
Rocuronium	10 mg	20 mg	30 mg	40 mg	50 mg

* Halve the dose if there are signs of shock.

Additional information

General

- The primary goal of performing RSI is to improve patient outcomes by securing the airway, treating hypoxia and controlling ventilation to prevent hypercarbia. This is particularly important in patients with severe TBI because secondary injury worsens long term outcomes.
- The decision to perform RSI must take into account all of the factors contributing to the balance of risk for each patient.
- Patient preparation and attention to detail are important factors to ensuring that the RSI is performed in a way that ensures the benefits outweigh the risks and this is why only selected ICPs are endorsed to perform RSI.
- Personnel calling for backup from an ICP endorsed to perform RSI must take into account how long it will take for backup to arrive. In order to be appropriately utilised, such backup must arrive at least 15 minutes faster than the patient can be transported to an appropriate hospital.
- Whenever feasible, a second ICP should be utilised as the dedicated assistant.
- Oxygen via nasal prongs at 15 litres/minute during laryngoscopy significantly prolongs the time to desaturation:
  - If two oxygen sources are available, oxygen should be administered via the manual ventilation bag/mask (with PEEP) in addition to oxygen via nasal prongs.
  - If only one oxygen source is available, consider shifting the oxygen tubing from the manual ventilation bag to the nasal prongs during laryngoscopy, noting that the oxygen tubing will need to be reconnected to the manual ventilation bag following intubation or following a failed intubation.
- The onset of adequate neuromuscular blockade may be delayed if cardiac output is very low. Consider increasing the dose of suxamethonium to approximately 3 mg/kg, up to a maximum of 200 mg.

- If RSI is strongly indicated but suxamethonium is contraindicated, consideration should be given to preforming RSI using rocuronium as the primary neuromuscular blocker. In this setting:
  - Personnel must seek clinical advice.
  - If it is not possible to seek clinical advice, RSI using rocuronium as the primary neuromuscular blocker may occur. Administer 1.5 mg/kg of rocuronium instead of suxamethonium, noting that it may take 1-2 minutes for adequate neuromuscular blockade to occur.

Cautions

- It usually takes approximately 15-20 minutes to prepare the patient, brief the team and safely perform RSI and this is why a transport time of less than 15 minutes is a caution. However, transport time is only one aspect of the total time it takes for a patient to reach hospital and time to intervention is more important than time to hospital.
- If the patient has a cause of coma that is likely to rapidly improve (examples include hypoglycaemia, a postictal state and poisoning with carbon monoxide, GHB or opiates), RSI is unlikely to improve their clinical outcome.
- Whenever feasible, clinical advice should be sought prior to RSI in patients with severe comorbidities that significantly restrict their daily functioning, because RSI is unlikely to improve their clinical outcome.

Delayed sequence intubation

- Delayed sequence intubation is a term used to describe the administration of sedation prior to RSI.
- Delayed sequence intubation is indicated if the patient meets criteria for RSI, but is agitated and/or combative to a level that is preventing safe preparation prior to RSI:
  - Administer sufficient sedation to gain control of the agitation. Ketamine (approximately 0.5 mg/kg IV) is the preferred medicine as this is less likely to impair breathing and circulation than midazolam, however midazolam in small doses (for example 1-3 mg IV) may be administered.
  - Once control is gained, ensure adequate pre-oxygenation and preparation.
  - Perform RSI and consider reducing the dose of ketamine, taking into account the dose of medicines already administered.

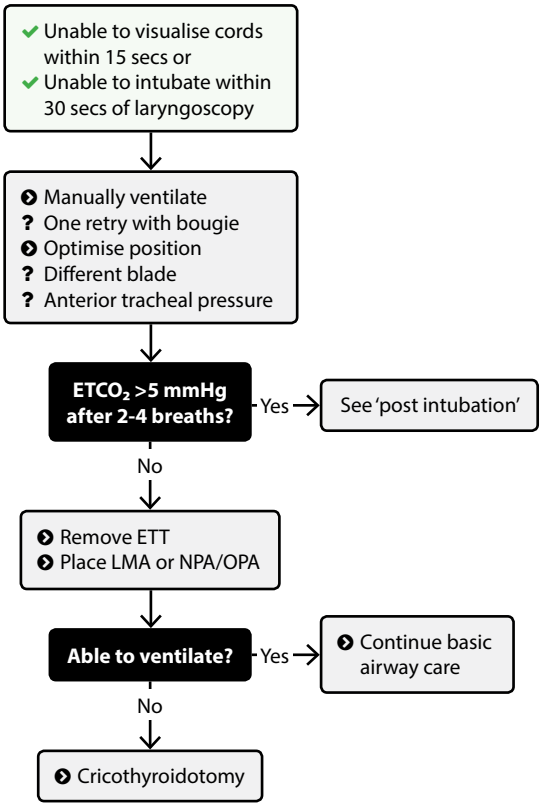
Truncated RSI

- Rarely, a patient may be deteriorating with airway obstruction so rapidly that there is a high risk of death prior to performing RSI and a truncated approach to RSI (also called crash intubation or crash RSI) should be considered:
  - Task one person to provide as much pre-oxygenation as possible.
  - Truncate the checklist to ensure that IV access is secure and the equipment to perform and confirm intubation is available and checked.
  - Administer suxamethonium alone if the patient has a GCS of 3.
  - Administer ketamine and suxamethonium if the patient has a GCS greater than 3.
  - Consider administering 3-5 large breaths prior to laryngoscopy.

9.4 RSI checklist

- Roles assigned and team briefed:
  a) Airway.
  b) Airway assistant.
  c) Drugs.
- Patient prepared:
  a) Pre-oxygenation. Nasal prongs in place.
  b) Position optimised.
  c) IV access patent. Running line attached.
  d) 0.9% sodium chloride IV bolus if indicated.
- Monitoring attached and visible:
  a) Baseline vital signs including ECG and NIBP.
  b) Pulse oximetry and capnography.
- Equipment checked and ready:
  a) Manual ventilation bag with PEEP valve set to minimum 5 cmH_2O.
  b) Oropharyngeal airway.
  c) Laryngoscope checked.
  d) ETT. Cuff checked. Syringe containing 5 ml of air.
  e) ETT holder in place.
  f) Suction checked and in position.
  g) Bougie.
  h) LMA and cricothyroidotomy equipment out.
- Drugs drawn up and doses confirmed:
  a) Atropine if the patient is bradycardic.
  b) Fentanyl.
  c) Ketamine.
  d) Suxamethonium.
  e) Morphine and midazolam.
  f) Rocuronium.
- Failed intubation plan communicated, including the SpO_2 level at which it will be implemented.

9.5 Failed intubation drill



9.6 Post intubation

- Use this section if:
  a) The patient has been intubated without RSI and
  b) ETT placement has been confirmed by capnography.
- If the patient has been intubated during cardiac arrest, this section should only be used if sustained ROSC occurs.
- Ventilate to a target $ETCO_2$ of:
  - 30-35 mmHg if the primary clinical problem is severe TBI.
  - 35-45 mmHg if the primary clinical problem is not severe TBI.
- Administer sedation in combination with neuromuscular blockade, if the patient shows clinically significant signs of movement. Avoid sedation and neuromuscular blockade in an adult with a very poor prognosis, whenever feasible.
- Administer morphine and midazolam if the patient does not have clinically significant shock:
  a) Draw up 10 mg of morphine in combination with 10 mg of midazolam in a 10 ml syringe. Dilute with 0.9% sodium chloride to a total of 10 ml.
  b) For an adult: administer 1-2 ml of this solution IV (1-2 mg of midazolam and 1-2 mg of morphine) every 5-15 minutes, titrating the doses and frequency to the clinical signs of the patient's level of sedation.
  c) For a child: administer morphine and midazolam IV every 5-15 minutes using doses from the paediatric drug dose tables, titrating the doses and frequency to the clinical signs of the patient's level of sedation.
- Administer fentanyl and ketamine if the patient has clinically significant shock:
  a) For an adult administer 50 mcg of fentanyl and 50 mg of ketamine IV every 15-30 minutes, titrating the frequency to the clinical signs of the patient's level of sedation.
  b) For a child administer fentanyl and ketamine IV every 15-30 minutes using doses from the paediatric drug dose tables, titrating the frequency to the clinical signs of the patient's level of sedation.
- Rocuronium IV dosage:
  a) 50 mg for an adult weighing 50-80 kg.
  b) 100 mg for an adult weighing greater than 80 kg.
  c) See the paediatric drug dose tables for a child.
  d) Repeat as required.

Post intubation checklist

- Confirm placement with capnography. Note the $ETCO_2$ level and waveform.
- Examine the chest for signs of bronchial intubation and adjust the ETT depth if required.
- Secure the ETT and note the length at lips.
- Replace the cervical collar (if appropriate).
- Measure vital signs.
- Consider administering sedation and neuromuscular blockade.
- Check the oxygen supply.
- Check the ETT cuff, ensuring the cuff contains only the minimum amount of air required to provide a seal.
- Ensure a manual ventilation bag is immediately available if a mechanical ventilator is being used.

Additional information

$ETCO_2$

- $ETCO_2$ is inversely proportional to ventilation when cardiac output is near normal.
- The target $ETCO_2$ ranges are:
  - 30-35 mmHg if the primary clinical problem is severe TBI. This will usually result in the arterial pCO_2 being at the lower end of the normal range.
  - 35-45 mmHg if the primary clinical problem is not severe TBI. This will usually result in the arterial pCO_2 being in, or just above the normal range.
- The $ETCO_2$ will usually be above the target range immediately following intubation. Aim to reach the target over 5-10 minutes because rapid reductions in $ETCO_2$ may cause cerebral vasoconstriction.
- A patient with life-threatening asthma or CORD who is intubated and ventilated will have a very high $ETCO_2$. In this setting targeting an $ETCO_2$ of 35-45 mmHg risks causing a reduced cardiac output from dynamic hyperinflation (or air trapping). Ventilate the patient with a respiratory rate of approximately six breaths per minute and allow the $ETCO_2$ to be high.
- $ETCO_2$ is proportional to blood flow when cardiac output is very low and the most common clinical setting is cardiac arrest. Typically $ETCO_2$ will be 15-25 mmHg during cardiac arrest with CPR in progress.
- In some patients (particularly those with clinically important aspiration) the $ETCO_2$ will remain high despite increasing ventilation. If the $ETCO_2$ remains high despite a ventilation rate of 20-30 breaths per minute, do not increase the ventilation any further and allow the $ETCO_2$ to remain high.

The decision to administer sedation and neuromuscular blockade

- Sedation and neuromuscular blockade are not required if the patient remains GCS 3 and does not show signs of clinically significant movement.
- Unnecessary sedation carries a risk of hypotension.
- Unnecessary sedation and neuromuscular blockade carries a risk of impairing clinical assessment of CNS function after arrival at hospital and this may have implications for clinical decisions regarding treatment.
- Conversely, patient movement incurs risk. This is particularly the case while the patient is being extricated from the scene and/or transported, often with limited numbers of personnel. Examples include:
  - Patient movement that may displace the ETT.
  - Coughing or gagging on the ETT which may raise ICP, particularly in patients with TBI.
  - Shivering. Shivering raises oxygen consumption as well as raising body temperature and is of particular concern if the patient is post cardiac arrest.
  - Spontaneous breathing that interferes with adequate oxygenation or ventilation. This is particularly a problem if the patient has severe impairment of oxygenation or very poor pulmonary compliance, for example from aspiration pneumonitis.
- The administration of sedation and neuromuscular blockade requires clinical judgement which balances the risks against the benefits. The decision must take into account the anticipated clinical course of the patient and whether or not the movement is clinically significant, noting that sedation and neuromuscular blockade should not be delayed until movement is so severe that the patient is at risk. For example:
  - A child should usually receive sedation and neuromuscular blockade.
  - An adult who has had a witnessed cardiac arrest with VF or VT as the first rhythm should usually receive sedation and neuromuscular blockade. Note that a patient who has been in cardiac arrest for a very short period of time may regain consciousness quickly and it may be safe to extubate them. Deciding whether to extubate or to administer sedation and neuromuscular blockade requires clinical judgement, noting that the balance of risk is usually in favour of administering sedation and neuromuscular blockade.
  - An adult with a very poor prognosis (for example: severe comorbidities, requiring long term care or cardiac arrest with a first rhythm of asystole) should usually have sedation and neuromuscular blockade withheld. This is because the patient is unlikely to benefit from admission to an intensive care unit and may be extubated in the ED.

Ensuring that adequate sedation is administered

- If neuromuscular blockade is administered, sedation must be administered to ensure that:
  - ICP is minimised (this is particularly the case if the primary clinical problem is severe TBI) and
  - The patient is not awake and aware that they are unable to move. This may occur if the patient recovers awareness after neuromuscular blockade is administered. Causes of coma that rapidly improve, such as carbon monoxide poisoning and GHB poisoning, place the patient at particular risk of this.
- When administering sedation:
  - Use doses of sedation at the lower end of the described dose range if the patient is small, frail, or cardiovascularly unstable.
  - Titrate the dose and frequency of administration to the clinical signs of the patient's level of sedation. Increase the dose and frequency of administration if the patient has hypertension and tachycardia, or shows signs of tears. Decrease the dose and frequency of administration if the patient has hypotension.

Ensuring a safe ETT cuff seal

- The cuff of the ETT is designed to ensure a seal within the trachea. This seal prevents air leaking out of the trachea during positive pressure ventilation and reduces the risk of aspiration of pharyngeal contents into the lungs.
- It is very easy to generate a high pressure within the ETT cuff and this may cause tracheal injury by impairing the blood supply to the tracheal mucosa. Tracheal injury may lead to tracheal stenosis and this may cause significant morbidity.
- Most adult patients only require 3-5 ml of air in the ETT cuff to ensure an adequate seal and using a 5 ml syringe to inflate the cuff reduces the risk of creating a high cuff pressure.
- As soon as feasible, the cuff should be checked to ensure that the minimum amount of air is present in order to provide a seal. Remove air from the cuff until a small leak is heard during positive pressure ventilation and then add 1-2 ml of air until the leak cannot be heard.
- The air within the cuff will expand at altitude:
  - This is not usually clinically significant if the flight is at usual helicopter altitude and is less than 30 minutes in duration.
  - If the flight is at high altitude or longer than 30 minutes in duration, consider removing small amounts of air to control cuff pressure and re-inflate the cuff as altitude decreases.

9.7 Mechanical ventilation

Introduction

- Mechanical ventilation is not described within delegated scopes of practice, but it may only be used by ICPs who have been trained and authorised to operate the ventilator being used.
- Mechanical ventilators are present in many of the air ambulances in New Zealand, noting there are multiple different types. This section provides generic instructions and does not replace training in the use of a mechanical ventilator.
- Sustained ventilation via a manual ventilation bag is a challenging task and this is compounded when the patient is being moved and/or when there are multiple clinical tasks. The advantages of mechanical ventilation include:
  a) Consistent ventilation at selected settings.
  b) Reduced risk of inadvertent hyperventilation, resulting in reduced risk of lowered cerebral blood flow.
  c) The logistic advantages of freeing personnel for other clinical tasks.

Ventilator modes

- There are multiple ventilation modes with multiple names and abbreviations used to describe them. However, the ventilation modes can be broadly categorised as:
  a) Volume controlled. In this mode the delivered tidal volume is set and the peak airway pressure is dependent on lung compliance.
  b) Pressure controlled. In this mode the delivered airway pressure is set and the tidal volume delivered is dependent on lung compliance.
  c) Synchronised. In this mode the patient is able to take spontaneous breaths between ventilator delivered breaths.
  d) Non-synchronised (this is often called controlled or mandatory). In this mode the patient is unable to take spontaneous breaths between ventilator delivered breaths.
- A volume controlled mode is recommended for most patients.

Common ventilator settings

- Tidal volume:
  a) A tidal volume of approximately 8 ml/kg of lean body weight is appropriate for most patients.
  b) From a practical perspective, the tidal volume should be proportional to the patient's height rather than weight, as height correlates best with lung volume. For example, a tall patient should have a higher tidal volume than a short patient with the same weight.

- Relief airway pressure:
  a) This is often referred to as the maximum pressure or P max and is the airway pressure that the ventilator will not exceed.
  b) If the peak airway pressure reaches the relief airway pressure, the ventilator will stop delivering positive pressure and alarm.
  c) The relief airway pressure is a safety setting. It helps prevent damage to the lungs from excessive pressure.
  d) The relief pressure should be set at 40 cmH_2O (or mbar) for adults and children.
  e) The pressure may need to be set higher in patients with obesity or stiff lungs (for example following aspiration) but should not exceed 45 cmH_2O without seeking clinical advice.
- Ventilation frequency:
  a) This should be set as close as possible to the normal respiratory rate for the patient's age.
  b) For an adult this will usually be 12-14/minute. Faster rates will be required in children.
  c) Beware using a mechanical ventilator if the patient has severe bronchospasm. Even with a low respiratory rate, the risk of dynamic hyperinflation (air trapping) is high and manual ventilation is usually the safest option.
- Inspiratory expiratory ratio:
  a) The proportion of time that each ventilation cycle spends in the inspiratory phase compared with the expiratory phase is called the inspiratory expiratory ratio (I:E ratio).
  b) An I:E ratio of 1:2 is appropriate for most patients. This means that one-third of the time will be in inspiration and two-thirds of the time in expiration.
  c) If bronchospasm is present, the I:E ratio can be increased to 1:4 or 1:5 to allow a longer expiratory time to reduce the risk of dynamic hyperinflation.
- Fraction of inspired oxygen:
  a) The fraction of inspired oxygen (FiO_2) is the percentage of inspired oxygen expressed as a fraction. For example, 60% oxygen is an FiO_2 of 0.6.
  b) Most ventilators allow the FiO_2 to be adjusted.
  c) It is appropriate to commence ventilation on an FiO_2 of 1.0, but provided pulse oximetry is reliable this should be reduced to minimise the FiO_2. This reduces the risk of harm from high oxygen concentrations at a tissue level and conserves the oxygen supply.

Commencing mechanical ventilation

- Ensure the patient is adequately sedated and neuromuscularly blocked if required. This is not routinely required, however the balance of risk is usually in favour of administering both.
- Connect an oxygen source to the ventilator and check the oxygen supply.

- Connect the ventilator to an electrical supply if required.
- Connect the ventilator circuit/tubing if not already in place.
- Test the ventilator and circuit/tubing.
- Select the ventilation mode.
- Set the initial tidal volume:
  a) 800 ml for an adult who is tall.
  b) 600 ml for an adult of average height.
  c) 8 ml/kg (rounded off to the nearest 10 kg) for a child.
- Set the initial ventilation rate:
  a) 12/minute for an adult.
  b) 16/minute for a child greater than or equal to 30 kg.
  c) 20/minute for a child under 30 kg.
- Set the maximum inspiratory pressure to 40 cmH_2O.
- Set the I:E ratio to 1:2.
- Set the FiO_2, commencing on 100% oxygen.
- Set the PEEP.
- Turn the ventilator on and connect the circuit/tubing to the patient.
- Check ventilation, oxygenation and vital signs.
- Ensure the tubing is secured.

Troubleshooting: general

- If at any time troubleshooting does not quickly resolve the problem, cease mechanical ventilation and commence manual ventilation.
- The **DOPES** mnemonic is an aid to one systematic approach to troubleshooting.
- **D is for displacement** of the ETT. Consider the possibility of inadvertent extubation, oesophageal placement or endo-bronchial intubation.
  a) Check the $ETCO_2$ level and waveform.
  b) Examine the chest.
  c) Adjust the ETT length at the lips if required.
- **O is for obstruction** of the ETT or circuit/tubing. Consider the possibility the ETT is obstructed (for example by secretions or kinking) or the circuit is obstructed.
  a) Check the ETT is not kinked.
  b) Check the patient is not biting the ETT.
  c) Check the circuit/tubing is not kinked.
  d) Pass a suction catheter or bougie down the ETT.
- **P is for pneumothorax.** Consider the possibility of pneumothorax.
  a) Examine the chest.
  b) Check for high peak inspiratory pressures.

c) Decompress the chest if tension pneumothorax is suspected, preferably by finger thoracostomy.
d) Consider other causes of abnormal lung function, for example pulmonary oedema, bronchospasm and aspiration.

- **E is for equipment.** Consider the possibility of an equipment problem.
  a) Check the ventilator and the settings.
  b) Check the circuit/tubing, ensuring all connections are secure.
  c) Check the oxygen supply.
- **S is for stacked breaths.** Consider the possibility of dynamic hyperinflation (air trapping). Disconnect the ventilator for 20-30 seconds to allow full expiration.

Troubleshooting: falling $ETCO_2$

- Reduce the ventilation rate.
- Continue to adjust the ventilation rate every 5-10 minutes.
- If $ETCO_2$ continues to fall, consider the possibility that this is due to falling cardiac output.

Troubleshooting: rising $ETCO_2$

- Increase the ventilation rate.
- Continue to adjust the ventilation rate every 5-10 minutes.
- In some patients (particularly those with clinically important aspiration) the $ETCO_2$ will remain high despite increasing ventilation. If the $ETCO_2$ remains high despite a ventilation rate of 20-30 breaths per minute, do not increase the ventilation any further and allow the $ETCO_2$ to remain high.

Troubleshooting: falling SpO_2

- Increase the FiO_2.
- Check the ventilator and circuit/tubing for leaks.
- Increase the PEEP.
- Examine for signs of endo-bronchial intubation.
- Examine for signs of pneumothorax.
- Consider the possibility of a monitoring error.

Troubleshooting: high airway pressures

- Ensure the patient is adequately sedated and neuromuscularly blocked.
- Examine for signs of endo-bronchial intubation.
- Examine for signs of bronchospasm.
- Check the ETT and circuit/tubing for signs of obstruction.
- Reduce the tidal volume.
- Increase the relief airway pressure to 45 cmH_2O.

10.1 Attempted or threatened suicide or self-harm

Use this section for patients who have attempted suicide, threatened suicide or who have self-harmed.

- Prevent imminent suicide if it is safe to do so.
- Assess the patient to determine if serious injury or serious poisoning is present that requires transport by ambulance to an ED.
- Arrange for a psychiatric assessment of the patient if:
  a) Suicide has been attempted or
  b) A threat to commit suicide appears significant or genuine.
- In all other circumstances have a low threshold for seeking psychiatric or clinical advice.
- Ensure appropriate follow up and support if the patient is not referred for a psychiatric assessment.

Additional information

Attempted suicide and arranging a psychiatric assessment

- All patients that have attempted suicide require a psychiatric assessment.
- The psychiatric assessment will occur in hospital if the patient requires transport to an ED. However, it is not always necessary to transport a patient to an ED to obtain a psychiatric assessment. All DHBs have mental health teams that provide this service in the community and these are often called Crisis Assessment and Treatment Teams or CAT teams. A local mental health team should be contacted whenever possible to discuss the best way to access a psychiatric assessment at that particular time.
- The contact numbers for DHB community mental health teams are on the Ministry of Health website and all personnel should know how to contact a DHB community mental health team in their area.
- Community mental health teams receive multiple requests for help, have to prioritise their responses and may not be able to respond immediately to a request for assessment. Provided the patient is not in imminent danger and a competent adult is with them, it is not necessary for ambulance personnel to remain with the patient until the mental health team arrives.

Threatened suicide

- Determining that a threat to commit suicide appears 'significant' requires clinical judgement. For the threat to be significant personnel must believe that the patient is at genuine risk of attempting to commit suicide.
- A patient may express brief threats of suicide, for example during an argument and these should not usually be considered significant unless other features of

concern are present, such as severe depression or a previous history of suicide attempts.

- Personnel must arrange for a psychiatric assessment to occur if the threat is considered significant and should seek clinical advice if uncertain.

Self-harm

- Self-harm occurs when a patient deliberately injures their body, but is not intending to die. Examples include, cutting skin, biting or burning skin.
- Self-harm is very common. It is important to differentiate between self-harm and attempting suicide and personnel should seek clinical advice if uncertain.
- Clinical judgement is required, but a patient who has self-harmed does not routinely require a psychiatric assessment, however personnel should have a low threshold for seeking advice from mental health personnel. If the patient is not referred to mental health personnel, ensure the patient has support from a competent adult, advise them to see their GP and provide them with a telephone support number such as Lifeline.

Calling for assistance from police

- Police are not required routinely to assist with the management of a patient that has attempted suicide or has self-harmed, including when the patient is receiving treatment and/or transport against their will.
- Police have limited powers when the patient is on private property and can only intervene if there is immediate danger to the patient or other people.
- Police should only be requested if:
  - There is an immediate risk of injury to the patient or other people or
  - More than minimal force is required in order to prevent suicide or
  - More than minimal force is required to treat or transport the patient.
- Minimal force cannot be tightly defined and requires clinical judgement. Examples of minimal force include:
  - Guiding a patient with a hand on their arm, shoulder or back.
  - Holding a patient's hand/s.
  - Guiding a patient on to a stretcher or into an ambulance.

The Mental Health (Compulsory Assessment and Treatment) Act 1992

- The Mental Health Act describes the process for the assessment and treatment, including compulsory treatment if necessary, of patients with mental health disorders.
- Registered medical practitioners, registered nurses and police have legal authority within the Mental Health Act to detain patients with mental health disorders, but ambulance personnel do not. However, ambulance personnel do have legal authority within the Crimes Act.

- A duly authorised officer (DAO) is a person with specific powers and responsibilities under the Mental Health Act. These powers include the ability to force a patient to undergo an assessment that may lead to a compulsory treatment order. DAOs are appointed and are usually mental health nurses.
- When asking for an assessment by a mental health team, personnel do not need to specifically request a DAO.

The Crimes Act 1961

- The Crimes Act describes the legal ability of anyone to use reasonable force (this is not defined in the act) in order to prevent suicide, or an act that is likely to cause immediate and serious injury to a person.
- Personnel can use reasonable force, including use of restraint and the administration of sedation if required, in order to treat and/or transport a patient they believe is at significant risk of immediate and serious injury.
- Personnel will not be judged on whether or not they complied with the wording in a specific act, but will be judged on whether or not they acted in the best interest of the patient and whether or not their actions were reasonable in the circumstances. If personnel are uncertain they should seek clinical advice.

10.2 Autonomic dysreflexia

This section is for patients with chronic spinal cord impairment and autonomic dysreflexia.

- Look for a cause of stimulation. For example:
  a) Look for signs of bladder distension and if a urinary catheter is present, ensure it is not blocked. If the urinary catheter is blocked and cannot be unblocked, it needs to be replaced urgently.
  b) Ask when the patient last passed a bowel motion as the patient may be constipated. If this is thought likely and the patient has a caregiver present, the caregiver may be able to administer an enema or disimpact the bowel.
  c) Look for an acute injury. If this is present administer an opiate IV, even though the patient cannot feel pain.
- If the patient remains symptomatic with a systolic blood pressure greater than 180 mmHg:
  a) Sit the patient up with their legs dependent if possible.
  b) Administer 0.4-0.8 mg of GTN SL every 3-5 minutes, provided the heart rate is not less than 40/minute or greater than 150/minute.
  c) Begin transport without delay.
  d) Seek clinical advice if the systolic blood pressure remains over 180 mmHg.

Additional information

General

- Autonomic dysreflexia (also known as autonomic hyper-reflexia) is a term used to describe abnormal stimulation of the autonomic nervous system in patients with chronic spinal cord impairment. Autonomic dysreflexia usually occurs in association with significant stimulation below the level of the cord injury.
- It is not entirely clear how and why autonomic dysreflexia occurs. The most common theory is that:
  - Significant stimulation below the level of the spinal cord injury results in an increase in pain-like impulses within sensory nerves going to the spinal cord. The sensory nerves are intact and capable of transmitting pain impulses, even though the patient cannot feel them.
  - The pain-like impulses cannot be transmitted to the brain because the spinal cord is damaged. This results in stimulation of the sympathetic nervous system below the level of the spinal cord injury.
  - Stimulation of the sympathetic nervous system causes vasoconstriction below the level of the spinal cord injury and this causes hypertension.
  - Hypertension triggers reflex parasympathetic stimulation within the brain, causing bradycardia and vasodilation above the level of the spinal cord injury.

Stimuli

- The most common forms of stimuli are:
  - Bladder distension, for example from a blocked urinary catheter.
  - Bowel distension, for example from severe constipation or bowel obstruction.
- Other forms of stimuli have been reported such as:
  - Fractures or burns.
  - Labour. This is well recognised and most pregnant women with chronic spinal cord impairment will be electively admitted to hospital for caesarian section under anaesthesia.

Signs and symptoms (not all need to be present)

- The patient will have chronic spinal cord impairment and:
  - Hypertension. This may be life-threatening. If hypertension is not present then the patient does not have autonomic dysreflexia.
  - Anxiety. This may be severe.
  - Headache. This occurs as a result of the hypertension.
  - Signs of vasoconstriction (such as mottling) below the level of the spinal cord injury. This may not always be clinically obvious.
  - Bradycardia. This occurs as a reflex cardiovascular response to hypertension.
  - Signs of vasodilation (such as flushing) above the level of the spinal cord injury. This may not always be clinically obvious.
  - Tachycardia. Rarely the patient can be tachycardic if there is significant stimulation of the sympathetic nervous system at a brain level.

10.3 Blocked urinary catheter

Use this section for blocked urinary catheters including suprapubic catheters, provided the patient has not had surgery on their renal tract or prostate in the last four weeks.

- Check that the:
  a) Drainage bag is not full and
  b) Drainage bag is below pubic height and
  c) Tubing is not kinked or blocked and
  d) Tubing does not contain a one way valve that has been incorrectly inserted facing the wrong way.
- Examine the patient for signs of sepsis. Recommend transport to a medical facility without further intervention if clinically significant signs of sepsis are present.
- Arrange for the catheter to be replaced within the next few hours if an appropriately trained person is available.
- Flush the catheter using a clean technique if it cannot be replaced within the next few hours:
  a) Draw up 50-100 ml of 0.9% sodium chloride or sterile water using a catheter tip syringe. Warm this under a tap if possible.
  b) Detach the drainage tubing from the catheter and attach the syringe.
  c) Flush the catheter firmly over 5-10 seconds. Some discomfort is expected but stop if there is severe pain.
  d) Remove (if possible) the fluid using the syringe.
  e) Re-attach the drainage tubing and ensure urine is flowing into the drainage bag.

Referral

- If the problem was resolved by flushing the catheter, arrange for the catheter to be replaced as soon as possible. The patient should be given a recommendation to remain at home and drink plenty of fluid to help maintain a good urine flow.
- If the problem was not resolved the patient should be given a firm recommendation to be transported to a medical facility to have the catheter replaced. Clinical judgement is required regarding the mode of transport and transport by private vehicle may be appropriate, provided this will not cause significant delay.

Additional information

- The preferred approach is to have the catheter replaced, provided this is feasible. This may be available via a local pathway such as a district nursing service.
- Even if the catheter is unblocked, the catheter should subsequently be replaced as soon as possible.
- Personnel may replace a urethral or suprapubic catheter, provided they have been formally trained and authorised to do so and have the appropriate equipment. Personnel who are uncertain if they are authorised must seek clinical advice.
- Flushing a urinary catheter requires a clean, but not sterile technique. Perform hand hygiene before putting on gloves. Minimise contact between gloved hands and non-sterile surfaces. Do not contaminate the end of the catheter syringe with non-sterile surfaces prior to connecting it to the catheter. The end of the catheter and the drainage tubing do not require cleaning with an alcohol swab.
- It is very common for sediment to be visible in the urine. This does not mean that a urinary tract infection is present.
- It is very common for the urine to appear slightly pink and contain small blood clots following a catheter flush and this does not require specific treatment or advice. If there are large blood clots or there is red urine, the patient should be given a firm recommendation to be transported to a medical facility by ambulance.
- If there are signs of clinically significant sepsis, flushing the catheter may precipitate severe sepsis and this is why transport should be recommended in this setting.
- It is common for the catheter to be flushed, but for the fluid not to return when the syringe is aspirated. This is not of concern if urine subsequently flows into the drainage bag. If urine does not flow the catheter is still blocked.

10.4 Drowning

If the patient is in cardiac arrest

- In addition to usual treatment:
  a) Prioritise the ventilation aspect of CPR and use a CPR ratio of 15:2 unless an ETT is in place.
  b) Placing an ETT has a high priority if ROSC is not achieved in the first few minutes.
  c) IV drugs have a very low priority.

If the patient is not in cardiac arrest

- Assess the patient for:
  a) Signs or symptoms of aspiration.
  b) Signs of injury.
  c) Hypothermia.

Referral

- Firmly recommend that the patient is transported to ED by ambulance if:
  a) There was any loss of consciousness associated with the drowning or
  b) There are any signs or symptoms of aspiration, for example tachypnoea, crackles in the lungs on auscultation, persistent coughing, shortness of breath or an SpO_2 less than 94% on air or
  c) There are any signs of clinically significant injury or
  d) The patient has a temperature less than 35 degrees.

Additional information

General

- Drowning occurs when a patient has impaired lung function as a result of aspiration following immersion or submersion in liquid (noting that most drowning occurs in water). Following drowning, the patient may or may not have a cardiac arrest and may or may not survive, but if the patient has abnormal lung function then the patient has drowned.
- The literature contains a number of imprecise and unhelpful terms. Do not use any of the following terms: near drowning, wet drowning, dry drowning, salt water drowning, fresh water drowning, silent drowning or secondary drowning.
- Always consider the possibility that a medical event (for example hypoglycaemia or a seizure) may have occurred prior to drowning.

Cardiac arrest

- The key to surviving cardiac arrest secondary to drowning is rapid rescue and early CPR, with a focus on ventilation. The rapidity of the rescue is more important than the means by which rescue occurs, noting that the safety of rescuers must be maintained.
- A resuscitation attempt should be commenced unless there are very clear signs that the patient is dead.
- There is no role for ventilation or for CPR while the patient is still in the water.
- It is common for significant amounts of frothy fluid to be coming from the mouth and/or nose. Do not interrupt ventilation to remove or suction fluid as this is usually ineffective (fluid will continue to be produced) and interruptions to ventilation are potentially harmful.
- Beware misdiagnosing severe bradycardia as asystole, especially in children.
- Adequate ventilation is often only achieved via an ETT because the lungs may contain significant amounts of water.
- Adequate ventilation may not be achieved via an LMA because of the high airway pressures required to achieve ventilation if the lungs contain significant amounts of water. If ventilation is not clearly achieved via an LMA, consider providing ventilation via a manual ventilation bag and mask using a two person technique.
- Survivors tend to come from the group of patients that get ROSC within 10-15 minutes, usually with good CPR (including good ventilation) alone.
- In most patients it will be appropriate to continue resuscitation attempts for approximately 40 minutes, but it may be appropriate to cease resuscitation attempts earlier than this if the rhythm has been asystole for more than 10 minutes despite resuscitation.
- Although there are case reports of patients surviving resuscitation attempts of several hours in duration, the patients were usually very small children that had drowned in water containing ice and the overall mortality rate was very high. Even in winter, water temperatures in New Zealand are not cold enough to provide significant cerebral protection and the duration of resuscitation should not be influenced by the temperature of the water the patient drowned in. Personnel should have a low threshold for seeking clinical advice if they are uncertain.

General treatment

- Liquid damages the endothelial lining of the lung and this may result in significant amounts of pulmonary oedema fluid.
  - Do not attempt to remove or suction fluid as this is usually ineffective (fluid will continue to be produced) and removing the oxygen mask increases the likelihood of hypoxia.
  - CPAP or PEEP is usually helpful.

  - The patient may be hypovolaemic (the pulmonary oedema fluid has come from the circulation) and may require 0.9% sodium chloride IV.
  - There is no role for treatment with GTN.
- Consider the possibility of cervical spine injury, but in the absence of trauma this is rare following drowning and is not an initial priority.
- The patient's stomach often contains significant amounts of water but there is usually no role for draining the stomach.
- There is no role for positioning the patient to try to achieve postural drainage of the lungs.
- Although there are significant electrolyte differences between salt water and fresh water, there are usually no clinically significant physiological differences between drowning in salt water and drowning in fresh water.

Referral

- Lung function may deteriorate several hours after aspiration. If there are any signs or symptoms of aspiration, even if at the time lung function appears normal, a recommendation must be made for transport to an ED.
- If the patient is not transported to an ED, recommend that the patient seeks medical advice at an ED if any abnormal respiratory symptoms develop within the next few days.

10.5 Epistaxis

Mild bleeding

- Firmly compress the fleshy part of the nose for 15 minutes.
- If the bleeding is not controlled administer intranasal adrenaline as below.

Moderate or severe bleeding

- Instruct the patient to blow their nose to clear all blood clots.
- Administer intranasal adrenaline into each bleeding nostril using a mucosal atomising device, and firmly compress the fleshy part of the nose for 15 minutes:
  a) Administer 0.2 mg adrenaline (2 ml of 1:10,000) for an adult.
  b) Seek clinical advice if the patient is a child.
- If the bleeding does not stop or recurs, a second dose of adrenaline may be administered after 15 minutes.

Severe bleeding that remains uncontrolled

- If bleeding is severe and uncontrolled despite intranasal adrenaline and pressure:
  a) Place a nasal tamponade device if one is available.
  b) If a nasal tamponade device is not available, place an ETT with the middle of the cuff approximately 3-4 cm into each bleeding nostril.
  c) Inflate the cuff with 2-3 ml of air.
  d) Remove the ETT if bleeding remains uncontrolled.

Referral

- If the bleeding is mild and:
  - **Stops completely,** no specific follow up is required. If the patient is taking an anticoagulant, their treatment should be reviewed by a doctor (preferably their GP) within 24 hours.
  - **Does not stop,** the patient should be seen by a doctor within a few hours. This could be their GP unless the patient is taking an anticoagulant in which case the patient should be seen in an ED.
- If the bleeding is moderate to severe and:
  - **Stops following adrenaline,** the patient must be seen by a doctor within a few hours. This is particularly important if the patient is taking an anticoagulant and transport to an ED by ambulance will usually be required.
  - **Does not stop,** the patient should be transported to ED by ambulance.
- If the patient is not transported by ambulance, provide advice to avoid hot showers, hot drinks or blowing their nose for as long as possible after the bleeding has been controlled.

Additional information

- Anticoagulants include warfarin and dabigatran, but not anti-platelet agents such as aspirin, clopidogrel or ticagrelor.
- Bleeding may be from the anterior part of the nose. In this setting bleeding is commonly:
  - Coming from capillaries.
  - Secondary to minor trauma or a dry mucosa.
  - Mild.
  - Controlled by anterior pressure.
- Bleeding may be from the posterior part of the nose. In this setting bleeding is more commonly:
  - Coming from a single artery or vein (resembling a varicose vein in the nose).
  - Seen in elderly patients, particularly those with hypertension or taking an anticoagulant.
  - Moderate or severe.
  - Not controlled by anterior pressure and may require cauterisation, tamponade or nasal packing.
- Bleeding is occasionally life-threatening and this occurs most commonly in elderly patients taking an anticoagulant. The patient may require 0.9% sodium chloride IV for hypovolaemia in addition to the above treatments.
- Clinical judgement is required when choosing the size of a cuffed ETT to use for severe uncontrolled bleeding. Most adults will require a size 5 or 6 ETT.

10.6 Minor allergy

This section is for minor allergic reactions (including bites and stings) that are confined to skin involvement.

- Administer loratadine if itch is prominent:
  a) 10 mg PO for an adult or child aged 12 years and over.
  b) 5 mg PO for a child aged 1-11 years.
- Administer prednisone in addition to loratadine, if itch is associated with a rash:
  a) 40 mg PO for an adult.
  b) See the paediatric drug dose tables for a child.

Referral

- A patient may be administered loratadine (with or without prednisone) and be given a firm recommendation that immediate referral to a medical facility is not required, provided:
  a) There are no signs of systemic involvement and
  b) There are no signs of spreading inflammation and
  c) There is no facial or intra-oral swelling and
  d) There are no signs of blistering or peeling and
  e) No adrenaline (including self-administration) has been administered.

10.7 Nausea and/or vomiting

- Administer ondansetron if nausea and/or vomiting is clinically significant:
  - Do not administer ondansetron to a child aged less than one year.
  - Administer ondansetron with caution, administering only one dose if the patient has a known prolonged QT syndrome.
- Ondansetron dosage:
  a) 4 mg IV or IM for a patient aged 12 years and over. This may be repeated once after 10 minutes.
  b) 8 mg PO for a patient aged 12 years and over.
  c) See the paediatric drug dose tables for a child.
  d) A maximum of two parenteral (IV or IM) doses may be administered in addition to one oral dose.

Referral

- A patient may be administered ondansetron and be given a firm recommendation that immediate referral to a medical facility is not required, provided the patient:
  - Appears to have a minor clinical problem and
  - Has no other significant symptoms and
  - Has normal vital signs.

Additional information

- The IV route is preferred.
- Prophylactic administration of ondansetron is not routinely required for a patient with an immobilised cervical spine. Consider administering ondansetron if:
  - The patient has nausea or
  - The nature of the patient's injuries and transport position are such that vomiting would be particularly problematic.
- Ondansetron should not be administered for vomiting associated with an altered level of consciousness because it is rarely effective in this setting.

10.8 Stroke

- Assess the patient using the FAST technique.
- Measure the blood glucose concentration and treat accordingly.
- If the patient is hypoglycaemic, or has received treatment for hypoglycaemia, do not treat the patient as having a stroke even if there are signs or symptoms consistent with stroke.
- If the patient has had a seizure, do not treat the patient as having a stroke even if there are signs or symptoms consistent with stroke.
- Transport to a designated stroke hospital immediately, if signs or symptoms of a stroke are present and the patient can reach that hospital within four hours of the time of symptom onset.
- Alert hospital staff early if the patient is status one or status two and provide the following information:
  a) FAST results and
  b) Time of symptom onset and
  c) NHI number (if known).

The FAST assessment

Face	Look for new onset of unilateral facial weakness. Ask the patient to smile and show all of their teeth/gums.
Arm	Look for new onset of unilateral arm weakness. Ask the patient to raise their arms to 90 degrees from the body, with their palms facing upward, close their eyes and keep their arms raised. Look for inability to raise one arm or for one arm that drifts downward.
Speech	Look for new onset of abnormal speech. Ask the patient to repeat a sentence and listen for slurring of words. Ask the patient to name several common objects shown to them and observe any difficulty or inability to name them.
Time	Note the time of symptom onset. This is defined as the time that the patient was last seen or known to be normal. If the patient has woken up with the signs or symptoms, then the time of symptom onset is the time that the patient was last seen or known to be awake and symptom free.

Additional information

General

- A patient is having a stroke until proven otherwise if there are new abnormalities as detected by the FAST assessment.
- Hypoglycaemia can cause signs and symptoms that mimic a stroke and these may persist for many hours following treatment. Treat the patient using the 'hypoglycaemia' section and not this section if the patient is hypoglycaemic, or has received treatment for hypoglycaemia.
- Seizures can cause signs and symptoms that mimic a stroke, particularly during the postictal phase and these may persist for many hours following the seizure. Treat the patient using the 'seizures' section and not this section if the patient has had a seizure.
- A patient with a stroke will have signs and symptoms that relate to the part of the brain that has lost blood supply. Most commonly these include any combination of:
  a) Unilateral face weakness.
  b) Unilateral arm weakness.
  c) Unilateral leg weakness.
  d) Speech disturbance.
  e) Visual disturbance.
- Examination for leg weakness is not part of the FAST assessment. However, observing the patient walking (if possible) will help detect leg weakness or poor coordination. Poor coordination may result from a stroke within the cerebellum.

Haemorrhagic stroke

- A patient with a haemorrhagic stroke will present very similarly to a patient with an ischaemic stroke, but in addition will usually have a sudden onset of headache.
- A patient with a haemorrhagic stroke is much more likely to have an altered level of consciousness than a patient with an ischaemic stroke.
- It is not possible to confidently distinguish between an ischaemic stroke and a haemorrhagic stroke without a CT scan.

Ischaemic stroke and time to fibrinolytic treatment

- A patient with an ischaemic stroke who can be transported to a designated stroke hospital within four hours of the time of symptom onset, is a potential candidate for fibrinolytic treatment, noting that fibrinolytic treatment is only suitable for approximately 15% of patients with acute stroke.
- The earlier fibrinolytic treatment is provided, the more likely the patient is to recover from their stroke. However, fibrinolytic treatment must be provided

within four and a half hours of the time of symptom onset. If the patient is arriving at a designated stroke hospital at four hours from the time of symptom onset, hospital personnel have only 30 minutes to perform a CT scan, make a diagnosis and initiate treatment.

- IV access should be obtained, noting that multiple attempts should not occur because of the subsequent risk of bleeding if fibrinolytic treatment is administered.
- Transport under lights is not routinely required, but should be considered if a clinically significant time saving will occur.
- There is no role for transport to a GP unless it is for backup for specific problems en route to hospital.
- A patient who cannot be transported to a designated stroke hospital within four hours of the time of symptom onset is usually not a candidate for fibrinolytic treatment. Transport should not be delayed, but the patient's condition is not time sensitive in terms of transport time to hospital.

Transport mode

- Transport to hospital should usually be by road, as only a small number of patients will benefit from transport by helicopter. However, the possibility of transport by helicopter should be considered if:
  - The patient is independent and without severe comorbidities and
  - The diagnosis is clear and
  - The patient has severe weakness and
  - The patient will clearly reach a designated stroke hospital within four hours of the onset of symptoms and
  - Helicopter transport will clearly save more than 30 minutes compared with road transport.
- Severe comorbidities are chronic diseases that substantially limit a patient's ability to lead a normal life. Examples include severe CORD, severe heart failure, metastatic cancer with weight loss and living in an aged care residential facility.

10.9 Transient Ischaemic attack (TIA)

- Assess the patient using the FAST technique.
- Treat using the 'stroke' section if the patient's signs or symptoms persist.
- Treat as a transient ischaemic attack (TIA) only if all signs and symptoms have completely resolved.

Referral

- The patient must be seen by a doctor as soon as possible and this should usually be in an ED. Transport by ambulance may not be required if the patient has access to private transport and this will not be unnecessarily delayed.
- The patient may be seen by their GP provided the GP is spoken to by ambulance personnel and an appointment is confirmed for the same day.

Additional information

- To have a TIA the patient must have signs or symptoms of a stroke that have completely resolved within 24 hours.
- A patient who has had a TIA is at increased risk of subsequently developing a stroke.
- The ABCD2 score is a means of assessing the risk of a patient subsequently developing a stroke following a TIA. The higher the score, the higher is their risk.
- A patient has had a TIA that is considered low risk if:
  a) Their ABCD2 score is less than or equal to three and
  b) They have not had another TIA in the last week and
  c) They are not in atrial fibrillation and
  d) They are not taking an anticoagulant.
- Anticoagulants include warfarin and dabigatran, but not aspirin or other anti-platelet drugs such as clopidogrel or ticagrelor.

See next page for the ABCD2 score table

The ABCD2 Score

	Score
Age: if equal to or greater than 60 years	1
Blood pressure: if SBP >140 mmHg and/or DBP >90 mmHg	1
Clinical features: (choose one):	
• Unilateral weakness	2
• Speech disturbance without weakness	1
Durations of symptoms:	
• >60 minutes	2
• 10-59 minutes	1
• <10 minutes	0
Diabetes on treatment: if present	1

10.10 SCUBA diving emergencies

- Position the patient flat.
- Administer oxygen via a reservoir mask.
- Gain IV access.
- Administer 0.9% sodium chloride IV using the 'hypovolaemia from other causes' section if the patient has signs of hypovolaemia or shock.
- Avoid transporting the patient higher than 300 metres above sea level provided this is feasible.

Referral

- Transport the patient to North Shore Hospital ED or Christchurch Hospital ED, provided the diagnosis is clear and it is feasible to do so. Seek clinical advice if there is uncertainty.
- Transport the patient to the nearest appropriate ED if the diagnosis is not clear, or it is not feasible to transport to North Shore Hospital ED or Christchurch Hospital ED.
- Do not transport direct to a recompression facility.
- Transport the patient's dive computer with them if this is available.

Additional information

General

- The most common SCUBA diving emergency is decompression sickness or 'the bends'. This occurs when gases (predominantly nitrogen) that are dissolved in body fluids expand to form bubbles.
- When a person has been SCUBA diving at depth, the increased ambient pressure results in an increase in the volume of gases dissolved in body fluids. As the diver ascends, these dissolved gases come out of body fluids and are exhaled via the lungs. If the volume of dissolved gases is high and/or the ascent is rapid, the gases leaving body fluids can form bubbles in the same way that occurs when a carbonated drink is opened.
- The patient should be positioned flat because this limits the number of bubbles that reach the brain.
- Entonox must not be administered to a patient with a SCUBA diving emergency because the nitrous oxide in Entonox expands gas filled spaces, including bubbles.

Signs and symptoms of decompression sickness

- The patient may have any combination of the following:
  - Joint pain, particularly in large joints.

  - Headache.
  - Visual disturbance.
  - Itching skin or a feeling of 'insects crawling on the skin'.
  - Altered peripheral sensation or motor power.
  - Confusion.
  - Reduced level of consciousness.
  - Seizures.
  - Chest pain.
  - Shortness of breath.
- Although symptoms usually develop within one hour of SCUBA diving, they may be delayed until up to 24 hours later and decompression sickness must be considered a possibility in any patient with unexplained symptoms occurring within 24 hours of SCUBA diving.

Arterial gas embolism

- Arterial gas embolism occurs when gas bubbles directly enter the arterial circulation.
- The arterial bubbles usually come from a lung that has been damaged by expansion of gas during ascent.
- A patient with arterial gas embolism will most commonly develop sudden loss of consciousness or stroke-like symptoms, during or immediately after ascent/surfacing.
- The treatment of a patient with arterial gas embolism is the same as the treatment of a patient with decompression sickness.

Transport and referral

- Decompression sickness and arterial gas embolism may be made worse by transport at altitude. This is because the decreased ambient pressure causes gas bubbles to enlarge.
- The patient must not be transported direct to a recompression facility because assessment in an ED is required prior to referral to a recompression facility.
- Recompression facilities are available in Devonport (Auckland) and in Christchurch. This is why transport via North Shore Hospital ED or Christchurch Hospital ED is preferred, provided the diagnosis is clear.

Signs of spinal cord impairment

- Decompression sickness may cause signs and symptoms of spinal cord impairment.
- Treat the patient using this section and not the 'spinal cord injury' section if the patient has signs or symptoms of spinal cord impairment following SCUBA diving and has not had a traumatic injury.

10.11 Obesity

General

- Obesity increases the risk of associated comorbidities.
- Patients with obesity have an increased risk of mortality and morbidity for the same level of illness or injury, in comparison to non-obese patients.
- Have a lowered threshold for recommending the patient is assessed in a medical facility if the patient is obese.
- Obesity is associated with psychological problems including poor self-esteem and depression.

Physiological effects of obesity

- Total lung capacity and functional residual capacity (FRC) are reduced.
- A reduction in FRC will cause the patient to desaturate faster than a non-obese patient.
- Work of breathing is raised due to the weight of the chest wall and abdominal contents. In particular, the work of breathing may be very high in the supine position.
- There is an increased risk of:
  a) Obstructive sleep apnoea.
  b) Hypertension.
  c) Ischaemic heart disease.
  d) Type two diabetes.
  e) Osteoarthritis.

Assessment

- Assessment is more difficult.
- It is more difficult to auscultate heart and breath sounds and to examine the abdomen.
- 12 lead ECG acquisition is more difficult due to difficulty locating anatomical landmarks for lead placement. Flattening or inversion of the T wave may be due to obesity, but should not be attributed to obesity alone.
- Pulse oximetry may be unreliable due to excessive tissue thickness. Consider placing the probe on a little finger, little toe or an earlobe.
- Blood pressure measurement may be inaccurate due to the blood pressure cuff not being the correct size. Use the correct sized cuff if available or use the patient's forearm to measure the BP, noting that this technique may result in higher readings than those taken on the upper arm.

Treatment

- Providing treatment is more difficult.
- Airway management is more difficult:
  a) Consider a two-person bag/mask ventilation technique.
  b) Intubation is more difficult.
  c) Consider 'ramping' the patient by elevating their upper body to 30° and aligning their ears to their sternal notch. This may make intubation and ventilation easier.
- IV cannulation is more difficult. Have a lowered threshold for gaining IO access.
- The patient is at higher risk of respiratory depression with opiate and/or oxygen administration.

Transport

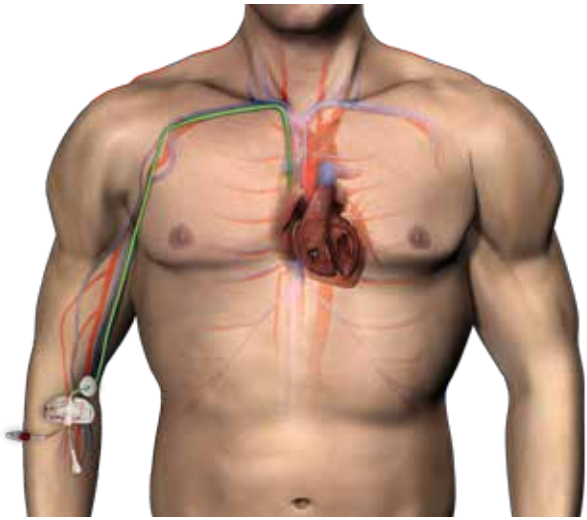
- Ensure the patient's weight does not exceed the stretcher capacity.
- Call for a specific bariatric vehicle and/or stretcher if this is available.
- Call for extra personnel if required.
- Transport the patient sitting up whenever possible.
- Restrain the patient as per normal. If the patient cannot wear a seatbelt, the driver must ensure that the nature of their driving is modified to keep the patient as safe as possible during transport.
- If the patient has a CPAP or BiPAP machine at home, ensure this is transported with the patient.
- Provide advanced warning of arrival at the medical facility.

10.12 Patients with existing vascular access

This section describes when existing vascular access may be used by personnel at Paramedic and ICP level.

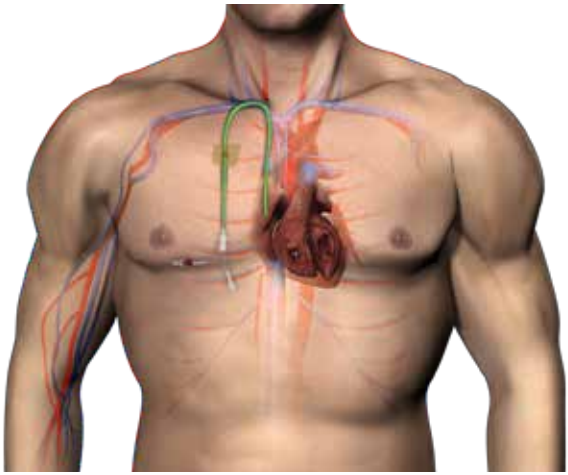
Peripherally inserted central catheters (PICC)

- These are often referred to as PICC lines.
- PICC lines are approximately 80 cm long and are placed via a vein in the antecubital fossa, with the distal tip sited in a central vein within the thorax.
- PICC lines usually have one or two lumens.
- PICC lines are usually used for medium term (weeks to months) vascular access for antibiotic or intravenous nutrition (IVN) administration in the community.
- If a patient has an existing PICC line, IV access should be obtained in another limb whenever feasible. If this is not feasible, IV cannulae must not be placed in the same antecubital fossa as a PICC line because this risks damage to the line.
- PICC lines may be used for medicine or fluid administration if immediate IV treatment is required and alternative IV access cannot be obtained:
  - Wear clean (but not sterile) gloves and maintain a technique that is as sterile as possible.
  - The luer plug may need to be changed if the existing one is not compatible with equipment carried by ambulance personnel.
  - Clean the luer plug with an alcohol swab.
  - Administer medicines or fluids as usual noting that a minimum of a 10 ml flush is required.
  - If an infusion is running do not disconnect this unless absolutely necessary.
  - If an infusion is disconnected do not reconnect it.



Tunnelled central lines

- These are often referred to as Hickman or Groshong lines.
- Tunnelled central lines are approximately 40 cm long and are placed via a vein (usually the internal or external jugular), with the distal tip sited in a central vein within the thorax and the proximal end tunnelled to emerge from the skin in the subclavian region.
- Tunnelled central lines usually have one or two lumens.
- Tunnelled central lines are usually used for long term (months to years) vascular access for administration of treatments such as chemotherapy, IVN or dialysis.
- Using a tunnelled line in the out-of-hospital setting increases the risk of infecting the line. The consequences of this are high and for this reason tunnelled lines may only be used for medicine or fluid administration if a patient has an immediately life-threatening condition and alternative IV access cannot be obtained.
- If the line is being used for dialysis:
  - It may contain a concentrated solution of anticoagulant to prevent blood clotting in the line. In this setting the line is usually labelled, but always assume that anticoagulant is present.
  - 5 ml of blood should be withdrawn and discarded to remove the anticoagulant before using the line.
  - If blood cannot be withdrawn, try another lumen.
  - If blood still cannot be withdrawn, consider using the lumen noting that it is possible the patient may get a bolus of anticoagulant. The anticoagulant dose will be small and is unlikely to be detrimental.
- The rest of the principles of using a tunnelled central line are the same as those for using a PICC line.

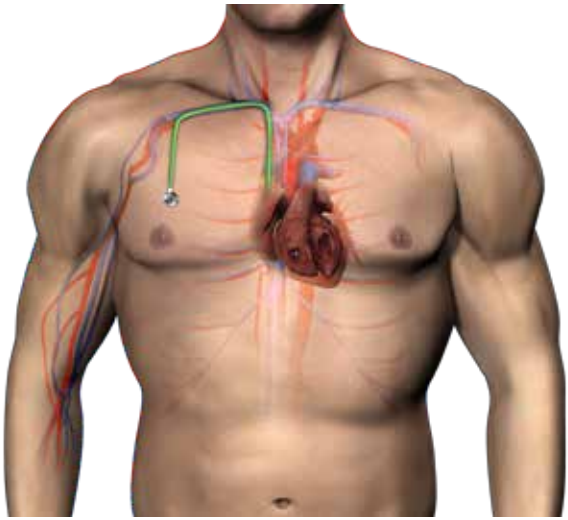


Central lines

- All lines that have their tip in a central vein are central lines, however the term is usually used to describe standard central lines. These are approximately 15 cm long and are usually placed via an internal jugular or subclavian vein, with the distal tip sited in a central vein within the thorax. The skin insertion site is situated immediately over the entry site to the vein.
- Very occasionally central lines may be placed via a femoral vein.
- Central lines usually have one to three lumens.
- It is unusual for a patient in the community to have a central line, but when present it is most likely a form of dialysis access.
- The principles of using a central line are the same as those for using a tunnelled line.

Portacath lines

- These are lines that are placed via a vein (usually a jugular or subclavian vein) with the tip sited in a central vein within the thorax and the end placed surgically under closed skin. On the end is a port which is accessed using a specifically designed needle inserted through the overlying skin. The port is usually located in the subclavian area or upper arm.
- Portacath lines are usually used for long term vascular access for chemotherapy.
- The principles of using a portacath line are the same as those for using a tunnelled central line, noting that:
  - The specifically designed needle must be available.
  - The port must only be accessed by people trained to do so.
  - An anticoagulant may be present.



Dialysis fistulae

- These are surgically created connections between an artery and a vein.
- Dialysis fistulae are used for vascular access for dialysis and have a high flow of blood through them.
- Dialysis fistulae are usually situated in the arm but are occasionally in the leg.
- Do not gain IV access in the same limb as a fistula, unless IV access cannot be obtained elsewhere and medicine or fluid administration is required for an immediately life-threatening condition. In this setting, gain IV access as far from the fistula as possible, noting that if the IV access is proximal to the fistula there may be arterial flow within the vein.
- Do not measure blood pressure in the same limb as a fistula because the result will be altered.
- Do not attempt to establish vascular access in a fistula, even in a life-threatening emergency because the risk of intra-arterial injection and/or permanent damage is very high.

11.1 Abdominal pain

Use this section to help determine which patients with abdominal pain require referral to a medical facility and if so, to which type of facility.

- Assess the patient, including an assessment of the features contained within the flag table:
  a) If any red flags are present the patient must be given a firm recommendation to be transported to an ED by ambulance.
  b) If any orange flags are present (and no red flags) the patient should be given a firm recommendation to be seen by a doctor (preferably their GP) within 12 hours.
  c) If green flags are present (and no orange or red flags) the patient is usually suitable to be given a recommendation to remain at home. Advise the patient to see their GP if their symptoms fail to improve.
- Follow a local pathway if one is in place.

Red flags

- Severe pain.
- Abnormal vital signs.
- Pain radiating to the back.
- Loin or flank pain.
- Temperature greater than 38 degrees.
- Rigors.
- Female aged 14-50 years and last menstrual period more than four weeks ago.
- Pregnant.
- Abdominal tenderness on palpation.
- Pain made worse by movement.
- Indigestion or epigastric pain.
- Persistent or recurrent vomiting.
- Age over 65 years or less than five years.
- Immunocompromised (for example taking steroids).

Orange flags

- Dysuria.
- Frequency or urgency of urination.
- Recent unplanned weight loss.
- Haematuria.
- Temperature 37-38 degrees but other vital signs normal.
- New onset of constipation in the elderly.

Green flags

- ✔ Diarrhoea and vomiting with normal vital signs.
- ✔ Pain associated with menstruation.
- ✔ Recurrent constipation.

Additional information

General

- A patient with abdominal pain who calls an ambulance should usually be assessed in an ED, unless there is an obvious benign cause such as urinary tract infection, menstruation or recurrent constipation.
- There are multiple conditions that can cause abdominal pain. The distribution of nerve supply to abdominal organs is such that pain from them may be non-specific, difficult to localise and may mimic the pain from other causes in terms of location, sensation and radiation.

Red flags

- Abdominal pain radiating to the spine or flank may result from conditions such as pancreatitis, peptic ulceration, cholecystitis, pyelonephritis or a leaking abdominal aortic aneurysm.
- An abdominal aortic aneurysm is usually asymptomatic prior to leaking. Although many texts describe a pulsating mass, this may not be palpable. A leaking abdominal aortic aneurysm usually presents with abdominal pain that radiates to the back and signs of shock.
- A temperature greater than 38 degrees suggests infection is present.
- Rigors suggest bacteraemia is present.
- A female aged 14-50 years whose last menstrual period was more than four weeks ago may have an ectopic pregnancy.
- Perforated bowel (for example from cancer, diverticular disease or ulceration) usually presents with non-specific abdominal pain for 1-2 days followed by signs of peritonitis (abdominal tenderness with pain made worse by movement).
- All patients with upper abdominal (epigastric) pain should have a 12 lead ECG acquired, noting that a normal ECG does not rule out myocardial ischaemia.

11.2 Falls

Use this section to help determine which patients following a fall require referral to a medical facility and if so, to which type of facility. Use the 'syncope' section if the patient appears to have had a fall as a result of loss of consciousness.

- Assess the patient, including an assessment of the features contained within the flag table:
  a) If any red flags are present the patient must be given a firm recommendation to be transported to an ED by ambulance.
  b) If any orange flags are present (and no red flags) the patient should be given a firm recommendation to be seen by a doctor (preferably their GP) within 24 hours.
  c) If green flags are present (and no orange or red flags) the patient is usually suitable to be given a recommendation to remain at home. Advise the patient to see their GP if their symptoms fail to improve.
- In addition, perform a falls risk assessment if the patient is aged 65 years or over, is living independently and is not being transported to an ED by ambulance. Gain consent and refer the patient via a falls referral pathway if any abnormalities are found. Alternatively, refer the patient to their GP if a falls referral pathway is not available.
- Follow a local pathway if one is in place.

Red flags

- Clinically significant injury.
- Clinically significant pain.
- Abnormal vital signs.
- Signs of stroke.
- Seizure without history of epilepsy.
- Headache.
- New onset of visual disturbance.
- Unable to mobilise.
- Unstable medical condition contributing to the fall.

Orange flags

- More than one fall in the last week.
- Postural hypotension.
- Seizure with history of epilepsy.
- Recent change in medication.
- Minor injury requiring non-urgent treatment.
- New reduction in mobility but able to weight bear.

Green flags

- Minor soft tissue injury not requiring medical treatment.
- Able to mobilise in a manner that is normal for the patient.

Additional information

General

- A patient that has fallen without a clear mechanical cause, for example a trip or slip, requires a thorough history and clinical examination to rule out a cause for collapse.
- Have a raised index for suspicion of injury if the patient:
  - Has fallen a significant height, for example greater than one metre or five steps in an adult or
  - Is taking an anticoagulant or has a known bleeding disorder.
- Always take into account the patient's comorbidities and social circumstances.
- Examples of unstable medical conditions contributing to the fall include diabetes with poor glucose control and poorly controlled Parkinson's disease. Clinical judgement is required when determining that a medical condition requires review in an ED or review by the patient's GP.
- Clinical judgement must be used to determine when a patient with orange flags should be seen by a doctor. The 24 hour timeframe is a maximum and many patients should be seen sooner than this, for example if soft tissue injury is present.
- Postural hypotension is present if there is a fall of greater than 20 mmHg in the systolic BP or greater than 10 mmHg in the diastolic BP when standing.

Falls risk assessment

- Falls are a common cause of injury and loss of independence in older patients.
- Ambulance personnel have an important role in referring older patients at risk of a fall to a falls referral pathway, as this reduces the risk of further falls and injury.
- Referral to a falls referral pathway is not required if the patient is living in an aged care residential facility because the facility personnel are required to manage this.
- Ask the patient the following questions:
  - Have you slipped, tripped or fallen in the last year?
  - Do you need to use your hands to get out of a chair?
  - Are there any activities you've stopped doing because you are afraid of falling?
  - Do you worry about falling?

- Perform Romberg's test.
- Perform a timed up and go test.
- Refer the patient to a falls referral pathway if:
  - The patient answered 'yes' to any of the questions or
  - Romberg's test is abnormal or
  - The timed up and go test is abnormal.
- Examine the environment for hazards which may contribute to the risk of falling. Examples include rugs, mats, cords and poor footwear. Eliminate these hazards with the patient's permission if feasible.

Romberg's test

- Stand beside the patient and be prepared to assist if they stumble.
- Ask the patient to stand with their feet together, place their arms by their side, get their balance and then close their eyes.
- Observe how long the patient can maintain the stance. A patient with normal balance should be able to maintain the stance without stumbling for more than 15 seconds.

Timed up and go test

- Seat the patient in a chair and mark a location three metres away. The patient should wear their regular footwear and use any regular walking aids.
- Give the patient the following instructions. "When I say go I want you to stand up, walk to the line, turn around, walk back and sit down again".
- Begin timing on the word go and stop when the patient sits back down.
- The timed up and go test is abnormal if the time is longer than 12 seconds.
- During the timed up and go test observe the patient's posture, gait and balance. Record any obvious abnormalities.

11.3 Fever in patients aged under five years

Use this section to help determine which children under five years of age with fever require referral to a medical facility and if so, to which type of medical facility.

- All children aged less than three months with a fever should be transported to an ED by ambulance.
- For children aged three months and older: assess the child and utilise the paediatric assessment triangle. Include an assessment of features contained within the flag table:
  a) If any red flags are present, the parents or guardians must be given a firm recommendation that the child is transported to an ED by ambulance.
  b) If any orange flags are present (and no red flags), the parents or guardians should be given a firm recommendation that the child is seen by a doctor (preferably a GP) within six hours.
  c) Strongly consider recommending transport to an ED by ambulance if there are orange flags in more than one section (for example an orange flag within the activity section and also within the respiratory section).
- If green flags (and no red or orange flags) are present, the child is usually suitable to remain at home. Advise the parents or guardians to see their GP if the child fails to improve. The patient may be administered paracetamol and/or ibuprofen if indicated.
- Follow a local pathway if one is in place.

Red flags

- **Colour:**
  - Pale or ashen.
  - Mottled.
  - Blue.
- **Activity:**
  - No response to social cues.
  - Difficult to rouse or does not stay awake when roused.
  - Weak cry.
  - Exhaustion.
- **Respiratory:**
  - Grunting.
  - Respiratory rate greater than 60/minute aged 3-12 months.
  - Respiratory rate greater than 50/minute aged over 12 months.
  - Moderate or severe chest indrawing.
  - SpO_2 less than 94% on air.

Red flags

- **Circulation and hydration:**
  - Reduced skin turgor.
  - Severe tachycardia.
  - Peripheral capillary refill time greater than three seconds.
  - Bradycardia (an extremely late sign).
- **Other:**
  - Temperature greater than 39 degrees.
  - Neutropenia.
  - Chemotherapy within the last four weeks.
  - Pain in a single joint or a single muscle area.
  - Rigors.
  - Petechiae or purpura.
  - Neck stiffness.
  - Focal neurological signs.
  - Significant concern regarding neglect or non-accidental injury.

Orange flags

- **Colour:** pallor reported by caregiver (but not seen by personnel).
- **Activity:**
  - Not responding to social cues normally.
  - No smile.
  - Wakes only after physical stimulation.
  - Decreased activity.
  - Poor feeding.
- **Respiratory:**
  - Nasal flaring.
  - Respiratory rate 50-60/minute aged 3-12 months.
  - Respiratory rate 40-50/minute aged over 12 months.
  - Mild indrawing.
  - Crackles audible on auscultation.
  - SpO_2 94-95% on air.
- **Circulation and hydration:**
  - Dry mucous membranes.
  - Tachycardia.
  - Peripheral capillary refill time 2-3 seconds.
  - Reduced urinary output or frequency.
- **Other:**
  - Illness for longer than five days.
  - Non-weight bearing or not mobilising appropriately.
  - Immunocompromised (for example taking steroids).
  - Help from a healthcare provider has been sought more than once within 24 hours.

Green flags

- **Colour:** normal colour of skin, lips and tongue.
- **Activity:**
  - Responds to normal social cues.
  - Smiles.
  - Wakes easily and stays awake.
  - Strong/normal cry or not crying.
- **Respiratory:**
  - Normal respiratory rate.
  - No signs of indrawing.
  - SpO_2 greater than or equal to 96% on air.
- **Circulation and hydration:**
  - Normal skin and eyes.
  - Moist mucous membranes.
  - Normal heart rate.
  - Peripheral capillary refill less than two seconds.

Additional information

- Children can be challenging to assess and treat. The combination of parental anxiety and uncertainty from personnel with regard to their clinical decisions can complicate simple clinical conditions. Objectively utilising the flags will help overcome some of these issues.
- Fever in children is most commonly caused by a viral infection.
- Infection in children is common with most having 8-10 episodes in their first 24 months and most are benign and self-limiting.
- The threshold for transport to an ED must be lowered in children with coexisting chronic diseases such as renal disease, congenital heart disease, or respiratory disease.
- The threshold for transport to an ED must be lowered if help from a healthcare provider has been sought more than once within 24 hours.
- Rigors suggest bacteraemia.
- Neutropenia is a low neutrophil white blood cell count. Neutropenia usually occurs post chemotherapy and the parents will usually know their child is neutropenic.
- Chemotherapy includes any form of IV or oral chemotherapy for cancer treatment.
- Septic arthritis may present with pain in a single joint.
- Myositis and fasciitis may present with tenderness in a single muscle area.
- Meningitis may present with drowsiness, headache and/or neck stiffness.

- Severe muscle tenderness may occur with meningococcal septicaemia, myositis or fasciitis.
- Petechiae or purpura commonly occur with meningococcal septicaemia.
- Parents are often very concerned and may wish for their child to be transported by ambulance, despite a recommendation to the contrary. In this setting transport by ambulance should occur if no other reasonable transport option is available.
- An apparent improvement following the administration of anti-pyretics (such as paracetamol and/or ibuprofen) may be due to masking of symptoms and does not rule out a serious infection.

11.4 Fever in patients aged five years and over

Use this section to help determine which patients aged five years and over with fever require referral to a medical facility and if so, to which type of facility.

- Assess the patient, including an assessment of the features contained within the flag table:
  a) If any red flags are present the patient must be given a firm recommendation to be transported to an ED by ambulance.
  b) If any orange flags are present (and no red flags) the patient should be given a firm recommendation to be seen by a doctor (preferably their GP) within 12 hours.
  c) If green flags are present (and no orange or red flags) the patient is usually suitable to be given a recommendation to remain at home. Advise the patient to see their GP if their symptoms fail to improve. The patient may be administered paracetamol and/or ibuprofen if indicated.
  d) Follow a local pathway if one is in place.

Red flags

- Significantly abnormal vital signs.
- Pain or tenderness in the flank or back.
- Rigors.
- Neutropenia.
- Chemotherapy within four weeks.
- Abdominal pain with tenderness on palpation.
- Pain in a single joint or a single muscle area.
- Severe muscle tenderness.
- Temperature greater than 39 degrees.
- Drowsiness.
- Severe or worsening headache.
- Neck stiffness.
- Petechiae or purpura.

Orange flags

- Cellulitis.
- Immunocompromised (for example taking steroids)
- Frequency or urgency of urination.
- Sore throat.
- Cough productive of purulent sputum.
- Pleuritic chest pain.
- Help from a healthcare provider has been sought more than once within 24 hours.

Green flags

- Influenza with normal vital signs and normal mobility.

Additional information

General

- The threshold for transport to an ED must be lowered if the patient has coexisting chronic disease such as renal disease, cardiac disease or diabetes.
- The threshold for transport to an ED must be lowered if help from a healthcare provider has been sought more than once within 24 hours.

Red flags

- Fever usually causes an increase in the heart rate and respiratory rate and clinical judgement must be used when determining that the patient's vital signs are significantly abnormal.
- Pyelonephritis may present with pain or tenderness in the flank or back.
- Rigors suggest bacteraemia.
- Neutropenia is a low neutrophil white blood cell count. Neutropenia usually occurs post chemotherapy and the patient will usually know they are neutropenic.
- Chemotherapy includes any form of IV or oral chemotherapy for cancer treatment.
- A patient with abdominal pain and tenderness on palpation requires a surgical review.
- Septic arthritis may present with pain in a single joint.
- Myositis and fasciitis may present with tenderness in a single muscle area.
- Meningitis may present with drowsiness, headache and/or neck stiffness.
- Severe muscle tenderness may occur with meningococcal septicaemia, myositis or fasciitis.
- Petechiae or purpura commonly occur with meningococcal septicaemia.

11.5 Headache

Use this section to help determine which patients with headache require referral to a medical facility and if so, to which type of facility.

- Assess the patient, including an assessment of the features contained within the flag table:
  a) If any red flags are present the patient must be given a firm recommendation to be transported to an ED by ambulance.
  b) If any orange flags are present (and no red flags) the patient should be given a firm recommendation to be seen by a doctor (preferably their GP) within 12 hours.
  c) If green flags are present (and no orange or red flags) the patient is usually suitable to be given a recommendation to remain at home. Advise the patient to see their GP if their symptoms fail to improve.
- A patient with green flags (and no orange or red flags) may remain at home and be administered a single dose of any combination of paracetamol, ibuprofen, tramadol or ondansetron. In addition, a patient with known migraines and typical symptoms may also be administered 0.9% sodium chloride IV (up to a maximum of 1 litre for an adult and 20 ml/kg for a child).
- Follow a local pathway if one is in place.

Red flags

- Headache or neck pain following neck manipulation.
- Neck pain or neck stiffness.
- Sudden onset of severe headache.
- Temperature greater than 37.5 degrees (in the absence of influenza symptoms).
- Persistent vomiting.
- Focal neurological signs.
- Altered level of consciousness, including a history of altered level of consciousness with the onset of the headache.
- Worsening headache following recent trauma to the head.
- Taking an anticoagulant or has a known bleeding disorder.
- Signs of temporal arteritis.
- Hypertension during pregnancy.
- Previous history of intracranial bleeding.
- Family history of cerebral vascular abnormalities.
- Onset during sexual activity.

Orange flags

- Symptoms associated with sinusitis.
- Migraine with symptoms different to usual.

Green flags

- Symptoms associated with influenza.
- Known migraine with usual symptoms.
- Normal vital signs, normal assessment using the FAST technique and able to walk normally.

Additional information

General

- It is unusual for a patient with headache to call for an ambulance and the patient should usually be assessed in an ED, unless there is an obvious benign cause such as a migraine, influenza, sinusitis, caffeine withdrawal, nicotine withdrawal or a hangover.

Migraines

- Migraines are recurrent severe headaches. They usually come on over an hour or two and last for several hours.
- Migraines may be preceded by transient neurological symptoms (an aura) such as visual changes (for example altered vision, spots or flickers) and/or sensory changes such as pins and needles.
- The pain is usually unilateral (but may be bilateral), throbbing, made worse by activity, associated with nausea and vomiting and may be associated with sensitivity to light and noise.
- Some patients with migraines call for an ambulance and request opiate pain relief. Opiates are strongly discouraged in this setting.

Red flags

- Subarachnoid haemorrhage may present with sudden onset of severe headache (thunderclap headache) and/or headache associated with neck stiffness.
- Vertebral artery dissection may present with sudden onset of neck pain and/or headache which may follow injury or neck manipulation.
- Meningitis may present with headache, fever, neck stiffness, photophobia, nausea and vomiting. The symptoms of meningitis are similar to those of migraine, except that the pain from migraine:
  - Usually comes on over an hour or two, whereas the pain from meningitis usually comes on more slowly.
  - Is usually throbbing, whereas the pain from meningitis is usually more constant.
  - Usually lasts only for a few hours, whereas the pain from meningitis persists.

- Intracerebral haemorrhage usually presents with sudden onset of severe headache and focal neurological signs. The patient will also have a falling level of consciousness if the intracerebral haemorrhage is severe.
- Anticoagulants include warfarin and dabigatran, but not anti-platelet agents such as aspirin, clopidogrel or ticagrelor.
- Temporal arteritis is an inflammatory condition affecting the blood vessels supplying the temporal area of the head. It is also sometimes called giant cell arteritis. It is an emergency because untreated it can lead to blindness. It most commonly occurs in patients over the age of 60 years and may present with any combination of:
  - Headache.
  - Fever.
  - Jaw pain (which may get worse with chewing).
  - Altered vision.
  - Scalp sensitivity.
  - Stiff aching joints.
- Hypertension during pregnancy is a potential sign of pre-eclampsia. In general, to be considered hypertensive, a pregnant patient needs to have a systolic BP greater than 140 mmHg or a diastolic BP greater than 90 mmHg. However, it is possible for a pregnant patient to have pre-eclampsia with blood pressures below those described. Personnel should have a low threshold for recommending transport to an ED if a pregnant patient has headache and a blood pressure that is higher than their normal blood pressure.
- Onset of severe headache during sexual activity may be associated with subarachnoid haemorrhage.

Pain relief

- Opiate pain relief is discouraged for a patient with headache, but is not contraindicated if the headache is severe or due to subarachnoid haemorrhage.

11.6 Non-traumatic lumbar back pain

This section is for adults with non-traumatic lumbar back pain. Use this section to help determine which patients require referral to a medical facility and if so, to which type of facility.

- Assess the patient, including an assessment of the features contained within the flag table:
  a) If any red flags are present the patient must be given a firm recommendation to be transported to an ED by ambulance.
  b) If any orange flags are present (and no red flags) the patient should be given a firm recommendation to be seen by a doctor (preferably their GP) within 12 hours.
  c) If green flags are present (and no orange or red flags) the patient is usually suitable to be given a recommendation to remain at home. Advise the patient to see their GP if their symptoms fail to improve.
- If the patient remains at home:
  a) A single dose of any combination of paracetamol, ibuprofen and tramadol may be administered.
  b) Provide advice on taking regular pain relief and remaining mobile.
  c) Provide them with the back pain information sheet.
- Follow a local pathway if one is in place.

Red flags

- Loss of bladder or bowel control.
- Temperature greater than 38 degrees.
- Rigors.
- Abnormal vital signs.
- Pain in the thoracic spine or chest.
- Abdominal pain or tenderness.
- Altered sensation in the saddle area.
- Altered sensation and/or power in both legs.
- Unable to walk.
- Signs or symptoms of generalised illness.
- Pain radiating down both legs.

Orange flags

- A history of cancer (other than skin cancer).
- Immunocompromised (for example taking steroids).
- Worsening pain, especially when lying down or at night.
- Recent unplanned weight loss.
- Pain radiating down or altered sensation/power in one leg.
- Osteoporosis.
- IV drug use.

Green flags

- Pain and/or muscle spasm isolated to the lumbar area.
- Able to walk.

Additional information

General

- Non-traumatic back pain is usually precipitated by lifting or twisting, aggravated by movement and is often associated with muscle spasm.
- A prolapsed disc may compress a nerve root causing altered sensation and/or motor power in one leg. Pain that radiates into one or both legs is usually a sign of sciatic nerve involvement. If the altered sensation and/or power are only in one leg, the patient does not need immediate transport to ED provided no red flags are present.
- Always examine the back for signs of tenderness. This will help localise the pain and may help distinguish back pain from tenderness over the kidney or lower ribs.
- Always observe the patient walking. A patient with severe lumbar back pain will usually find it difficult to move from a supine to a standing position and walking may be painful. However, provided the patient is able to walk, immediate transport to ED is not required provided no red flags are present.

Red flags

- Loss of bladder or bowel control, loss of sensation over the saddle area, loss of sensation and/or power in both legs or inability to walk are all signs of compression of the spinal cord. The saddle area covers the perineum, buttocks and upper posterior thighs.
- Fever is a sign of possible epidural abscess.
- Always take a history with regard to abdominal pain and examine the abdomen for signs of tenderness. Abdominal pain radiating to the lumbar spine or flank may result from conditions such as pancreatitis, peptic ulceration, cholecystitis, pyelonephritis or a leaking abdominal aortic aneurysm.

11.7 Syncope

Use this section to help determine which patients with syncope require referral to a medical facility and if so, to which type of facility.

- Assess the patient, including an assessment of the features contained within the flag table:
  a) If any red flags are present the patient must be given a firm recommendation to be transported to an ED by ambulance.
  b) If any orange flags are present (and no red flags) the patient should be given a firm recommendation to be seen by a doctor (preferably their GP) within 24 hours.
  c) If green flags are present (and no orange or red flags) the patient is usually suitable to be given a recommendation to remain at home. Advise the patient to see their GP if syncope occurs again.
- Follow a local pathway if one is in place.

Red flags

- Abnormal vital signs.
- Failure to recover to normal.
- Abnormal 12 lead ECG.
- New or unexplained shortness of breath.
- Clinically significant injury.
- Occurred during exertion.
- Pregnancy.
- Headache.
- Known valvular or congenital heart disease.

Orange flags

- Age less than 16 years.
- Postural hypotension.
- Family history of sudden death.
- History of heart failure.

Green flags

- Clearly benign. Factors associated with benign syncope include:
  - Posture, for example prolonged standing.
  - Provoking factors, for example pain or a procedure.
  - Prodromal symptoms, for example sweating or feeling hot.

Additional information

- Syncope, also known as fainting or transient loss of consciousness is common and may occur in up to half of the population at some time in their lives. However, syncope can also be associated with clinically important disease, particularly heart disease.
- The most common cause of syncope is a brief, but significant fall in cardiac output. The patient should then regain a normal level of consciousness within a few minutes.
- Take and record a history from a witness if possible:
  - **What was the patient's posture before the syncope?** Sometimes there will be a prolonged period of standing prior to benign syncope.
  - **Were there any obvious provoking factors?** Sometimes pain or a procedure (particularly injection) will provoke benign syncope.
  - **Were there any obvious prodromal symptoms?** Commonly the patient will complain of feeling sweaty or feeling hot prior to benign syncope.
  - **What was the appearance and colour of the patient during the syncope?** Most commonly the patient will be very pale as a result of low cardiac output.
  - **Were there any abnormal movements during the syncope?** It is common for a patient to have some abnormal movement during syncope, but rhythmic jerking movements suggest a seizure has occurred.
  - **How long was the patient unconscious for?** Most patients should recover to a normal level of consciousness within a few minutes. Failure to quickly regain a normal level of consciousness suggests a neurological cause.
  - **Was the patient confused when they woke?** A very brief period of disorientation may occur, but confusion that persists beyond a few minutes suggests a neurological cause.
- Examine the patient:
  - Look for signs of injury.
  - Look for signs of tongue biting. This suggests a seizure has occurred.
  - Always perform a 12 lead ECG. Any abnormality warrants medical follow up.
  - Measure a full set of vital signs, including a BP standing and sitting/lying. Postural hypotension is present if there is a fall of greater than 20 mmHg in the systolic or greater than 10 mmHg in the diastolic BP when standing.

11.8 Vertigo

Use this section to help determine which patients with vertigo require referral to a medical facility and if so, to which type of facility.

- Assess the patient, including an assessment of the features contained within the flag table:
  a) If any red flags are present the patient must be given a firm recommendation to be transported to an ED by ambulance.
  b) If any orange flags are present (and no red flags) the patient should be given a firm recommendation to be seen by a doctor (preferably their GP) within 24 hours.
  c) If green flags are present (and no orange or red flags) the patient is usually suitable to be given a recommendation to remain at home. Advise the patient to see their GP if their symptoms fail to improve.
- A patient with green flags (and no orange or red flags) may remain at home and be administered ondansetron using the 'nausea and vomiting' section.
- Follow a local pathway if one is in place.

Red flags

- Signs of stroke.
- Headache.
- Unable to walk unaided.
- Neck pain.
- Visual disturbance.
- Abnormal coordination during the finger-nose test.
- Nystagmus that persists for more than 10 seconds with the head still.
- Altered level of consciousness.
- Abnormal vital signs.
- History of recent trauma, especially head or neck injury.
- Symptoms that do not improve when the head is still.

Orange flags

- First episode of vertigo.
- Symptoms worsened by changes in head position.
- Symptoms improve, but do not completely settle when the head is kept still.
- Tinnitus or loss of hearing.

Green flags

- Symptoms totally resolve within 60 seconds when the head is kept still.

Additional information

- Vertigo is a symptom and not a diagnosis.
- Vertigo is the false sensation that the body or its surroundings are moving or spinning and is usually accompanied by nausea and loss of balance. It is important to differentiate this from a feeling of light headedness.
- The three main causes of vertigo are: cerebellar stroke, benign paroxysmal positional vertigo (BPPV) and vestibular neuritis. Cerebellar stroke is less common but much more serious and can easily be missed. BPPV and vestibular neuritis are both common and benign.

Cerebellar Stroke

- Cerebellar stroke is usually ischaemic and occurs most commonly in patients aged over 50 years.
- The symptoms of cerebellar stroke usually come on suddenly (over a few minutes) and are associated with:
  - Vertigo that is not altered by head position.
  - Nausea and vomiting.
  - Loss of coordination with an abnormal finger-nose test.
  - Inability to walk unaided.
- Hearing is not affected and tinnitus is not a feature.
- Cerebellar stroke may be associated with vertebral artery dissection and this may be associated with neck pain and/or recent head or neck injury.

Benign Paroxysmal Positional Vertigo (BPPV)

- BPPV is caused by calcium particles (called otoliths) which become dislodged and float to abnormal positions in the inner ear.
- The symptoms of BPPV usually come on slowly over 12-24 hours and are associated with:
  - Brief but very intense periods of vertigo that occur with changes in head position, for example sitting up or rolling over. Vertigo usually resolves over 30-60 seconds when the head is kept still.
  - Nausea is common but vomiting is rare.
  - Symptoms may be worse in the morning and may be worse when the head is tilted to a particular side.
- Hearing is not affected and tinnitus is not a feature.
- Mildly abnormal coordination may be present when walking, but the finger-nose test is normal.

Vestibular Neuritis

- Vestibular neuritis is caused by an inflammation of the vestibular nerve.
- The most common cause of vestibular neuritis is a viral infection.
- The symptoms of vestibular neuritis usually come on over 12-24 hours and are associated with:
  - Vertigo that is altered by position, but not as dramatically as BPPV.
  - Nausea and vomiting.
  - Reduced hearing (especially on one side) and/or tinnitus (buzzing noise).
- Mildly abnormal coordination may be present when walking, but the finger-nose test is normal.

Nystagmus

- Nystagmus is involuntary, rapid and repeated small movements of the eyes.
- To look for nystagmus, ask the patient to keep their head still and watch your finger while you move it from one side of their field of vision to the other. Pause your finger for 10 seconds and observe the patient's eyes.
- Nystagmus that stops within 10 seconds of the patient focusing on your finger is usually due to a peripheral benign cause such as BPPV or vestibular neuritis.
- Nystagmus that persists for longer than 10 seconds when the patient is focusing on your finger is usually due to a central cause such as cerebellar stroke.

The finger-nose test

- Ask the patient to put the tip of their index finger on their nose.
- Hold your finger approximately 30 cm away and ask the patient to touch your finger.
- Slowly move your finger and ask them to alternately touch their nose, then your finger, then their nose etc.
- Test both sides.
- A patient with normal coordination will successfully do this. A patient with abnormal coordination will miss or overshoot.

12.1 Medicines

Introduction

- This section contains additional information on medicines, but does not incorporate all required knowledge.
- The information is limited to that which is particularly relevant. For example, only cautions and adverse effects relevant to medicine administration in the out-of-hospital setting are listed.

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 (IO) route.
- All medicines administered via the IV route require an IV flush of 0.9% sodium chloride between medicines.
- Unless specifically described within these CPGs, medicines must not be combined within the same syringe.
- For each medicine, a standardised approach to drawing up, diluting and administering the medicine has been described. Taking a standardised approach reduces medication errors.
- The person administering the medicine is responsible for ensuring the 'five rights':
  a) The right medicine is being administered.
  b) The right dose is being administered.
  c) The right patient is receiving the medicine. In particular, the contraindications and cautions have been considered.
  d) The right route is being used.
  e) The medicine is being administered at the right time. In particular, the dosing interval is correct.
- All personnel are responsible for ensuring good practice:
  a) If a second clinical person is present they must be shown the ampoule and asked to name it.
  b) The specified dilutions must be used.
  c) The syringe must be labelled with name of the medicine unless the medicine is being drawn up and administered in one uninterrupted manoeuvre. The concentration must be included on the label if the medicine has been diluted and the label must not obscure the volume markings on the syringe.
  d) If a second clinical person is present they should be asked to check the calculation of a diluted solution.
  e) The person administering the medicine should be the person who draws it up.

f) The person administering the medicine must ensure it is not expired.
g) If a medicine has a maximum dose and more than this has been drawn up, the excess dose should be discarded before beginning to administer the medicine.
h) The person administering the medicine should say the medicine name, dose and route as it is being administered.

Administering medicines with caution

- The words "use caution" or "administer with caution" are used in a number of places with the CPGs.
- This indicates that personnel must consider the benefits and risks before administering the medicine, including the possibility of withholding the medicine, reducing the dose or extending the time between doses.

Reporting medicine errors

- Medicine errors must be appropriately reported so that trends can be captured and preventable factors identified. This enables changes to be made to training and systems that improve patient safety.

12.2 Adenosine

Mechanism of action

- Adenosine is an antidysrhythmic used for the treatment of paroxysmal supraventricular tachycardia (SVT).
- 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.

Delegated scope of practice

- ICPs.

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. Adenosine may cause severe bradycardia if the patient has sick sinus syndrome.

✖ Previous 2nd or 3rd degree heart block without an internal pacemaker in place. Adenosine 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.

⊖ CORD. 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 CORD.

⊖ 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.

Use in pregnancy or when breastfeeding

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

Dosage

- 6 mg in an adult.
- A second dose of 12 mg may be administered if the rhythm does not revert.

Administration

- Administer undiluted as a rapid IV bolus, followed by a rapid flush of 20 ml of 0.9% sodium chloride, preferably via an antecubital fossa vein.

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.

Usual onset of effect

- 5-10 seconds.

Usual duration of effect

- 10-20 seconds.

Pharmacokinetics

- Adenosine is rapidly taken up and metabolised within seconds by red blood cells and vascular endothelial cells.

Usual preparation

- Ampoule containing 6 mg in 2 ml.

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.

Additional information

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

12.3 Adrenaline

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.

Delegated scopes of practice

- EMTs: nebulised, intranasal and topical adrenaline.
- Paramedics: all of the above and IV adrenaline for cardiac arrest.
- ICPs: all indications and all routes.

Indications

- ✔ Cardiac arrest.
- ✔ Anaphylaxis.
- ✔ Severe asthma.
- ✔ Imminent respiratory arrest from CORD.
- ✔ Severe bradycardia.
- ✔ Septic shock, cardiogenic shock and neurogenic shock unresponsive to 0.9% sodium chloride IV.
- ✔ Moderate to severe stridor.
- ✔ Intranasal for clinically significant bleeding from the nose.
- ✔ Topical for clinically significant bleeding from a wound.

Contraindications

- ✖ None.

Cautions

- ⊖ Myocardial ischaemia. Adrenaline will increase myocardial oxygen consumption.
- ⊖ Tachydysrhythmias. Adrenaline will usually make tachydysrhythmias worse.

Use in pregnancy or when breastfeeding

- Safe and should be administered when indicated.

Dosage

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

Administration

- Topical: dilute each mg of adrenaline to a total of 10 ml using 0.9% sodium chloride. This solution contains 0.1 mg per ml. Apply topically in addition to direct pressure.
- Intranasal: dilute each mg of adrenaline to a total of 10 ml using 0.9% sodium chloride. This solution contains 0.1 mg per 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:
  a) Adults and children whose weight has been rounded to 50 kg or more: administer undiluted as an IV bolus.
  b) Children under 45 kg: dilute 1 mg of adrenaline to a total of 10 ml using 0.9% sodium chloride. 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 into a 1 litre bag of 0.9% sodium chloride. Shake well and label. This solution contains 0.001 mg per ml.
  a) For an adult: administer as an IV infusion starting at 2 drops per second. Adjust the rate to the patient's condition.
  b) For a 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 1 mg of adrenaline into a 1 litre bag of 0.9% sodium chloride, Shake well and label. This solution contains 0.001 mg per ml. Draw up the dose from this solution and administer as an IV bolus.

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

- The cardiovascular effects last 5-15 minutes.
- The mast cell membrane effects may last for several hours.

Usual preparation.

- Ampoule containing 1 mg in 1 ml.

Pharmacokinetics

- Adrenaline is metabolised by the liver and taken up by sympathetic nerve endings.
- There are no significant effects from liver impairment on acute administration.

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.

Additional information

- When administering an IV infusion of adrenaline using 1 mg of adrenaline in a 1 litre bag of 0.9% sodium chloride:
  a) 2 drops per second via a standard IV administration set will administer approximately 0.4 mg/hour of adrenaline.
  b) Record an estimate of the total dose of adrenaline administered on the PRF.

12.4 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 (for example ectopy), a reduction in electrical conduction, a reduction in heart rate and a stabilization 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).

Delegated scopes of practice

- Paramedics: cardiac arrest.
- ICPs: all indications.

Indications

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

Contraindications

- ✖ Known severe allergy.
- ✖ Known severe allergy to 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.
- ⊖ Hypotension. 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.
- 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 when 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.

Dosage

- Cardiac arrest:
  a) 300 mg for an adult.
  b) If VF or VT persists, a second dose of 150 mg may be administered.
  c) See the paediatric drug dose tables for a child.
- Tachydysrhythmia in an adult:
  a) 300 mg IV over 30 minutes.
  b) A further 150 mg IV over 30 minutes may be administered if the tachydysrhythmia persists.

Administration

- Cardiac arrest: administer IV undiluted as a bolus.
- Tachydysrhythmia:
  a) Place 300 mg amiodarone in 100 ml of 5% glucose and label. 1 drop per second via a standard IV administration set will deliver 100 ml over approximately 30 minutes. Slow the rate of infusion if hypotension occurs.
  b) The administration set will need to be flushed with 0.9% sodium chloride to ensure that all of the amiodarone has been administered.
  c) 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 5% glucose or 0.9% sodium chloride. Administer this IV over 30 minutes and slow the rate of infusion if hypotension occurs.

Common adverse effects

- Hypotension.
- Nausea, vomiting, flushing and sweating.
- 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.

Usual preparation

- Ampoule containing 150 mg in 3 ml.

Pharmacokinetics

- Amiodarone is metabolised in the liver.
- There are no significant effects from liver impairment on acute administration.

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 (for example diltiazem).

Additional information

- 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.
- When diluting amiodarone with 0.9% sodium chloride the solution will go slightly cloudy. This does not adversely affect the amiodarone.

12.5 Amoxicillin/clavulanic acid

Mechanism of action

- Amoxicillin/clavulanic acid is a beta-lactam antibiotic with broad activity against gram negative and gram positive bacteria. It also has some activity against anaerobic bacteria, particularly those from the mouth.
- Amoxicillin is the active ingredient and is part of the penicillin class of antibiotics. Amoxicillin inhibits production of the bacterial cell wall, causing bacteria to die.
- Many bacteria are resistant to amoxicillin due to their ability to produce beta-lactamase (an enzyme) which destroys the active part of beta-lactam antibiotics. Clavulanic acid inhibits the beta-lactamase enzyme and has no direct antibacterial action.

Delegated scopes of practice

- Paramedics and ICPs.

Indications

- ✔ A clinical diagnosis of meningococcal septicaemia regardless of distance from hospital.
- ✔ Septic shock if the patient is more than 30 minutes from hospital.
- ✔ Cellulitis. In this setting a single IV dose may be administered if the patient is being referred to primary care and there may be a delay in the patient seeing a doctor.

Contraindications

- ✖ Known severe allergy.
- ✖ Known severe allergy to penicillins. Up to 10% of the population claim to have a penicillin allergy, but only approximately 1% will have a clinically significant allergy. Unless the allergy is clearly severe, amoxicillin/clavulanic acid should be administered.
- ✖ Anaphylaxis to any beta-lactam antibiotic, for example penicillins or cephalosporins.

Cautions

- ⊖ None.

Use in pregnancy or when breastfeeding

- Safe and should be administered if indicated.

Dosage

- 1.2 g for an adult.
- See the paediatric drug dose tables for a child.

Administration

- IV administration:
  a) Dissolve 1.2 g using approximately 5 ml of 0.9% sodium chloride and dilute to a total of 10 ml.
  b) If the patient is a child, discard unrequired drug before administration.
  c) Administer into a running IV line over 1-2 minutes.
- IM administration:
  a) Dissolve 1.2 g using 2 ml of 0.9% sodium chloride. Approximately 30 seconds of shaking will be required. The final volume will be 2.4 ml.
  b) If the patient is a child, discard unrequired drug before administration.
  c) Personnel may choose to administer half of the dose into each lateral thigh, but this is not routinely required.

Common adverse effects

- None.

Usual onset of effect

- 30-60 minutes.

Usual duration of effect

- 6-8 hours.

Usual preparation

- Ampoule containing 1 g of amoxicillin and 200 mg of clavulanic acid as a powder for reconstitution.

Pharmacokinetics

- Amoxicillin/clavulanic acid 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

- None.

Additional information

- Rash is common with penicillin antibiotics and is not a contraindication.
- Diarrhoea and/or vaginal candidiasis (thrush) is common following a course of amoxicillin/clavulanic acid and is due to an antibiotic effect on the bacterial flora within the bowel and vagina. This is not an allergy.

- The ampoule has a warning that amoxicillin/clavulanic acid should not be administered IM. However, if the patient has meningococcal septicaemia and IV access cannot be obtained, the balance of risk is in favour of administering amoxicillin/clavulanic acid IM.
- Administering half the IM dose into each thigh may reduce the pain associated with IM injection. This is not routinely required and clinical judgement is required taking into account the volume being administered, the size of the patient's thigh and the patient's level of consciousness.
- Do not dissolve amoxicillin/clavulanic acid with 1% lignocaine.

12.6 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.

Delegated scopes of practice

- EMTs, Paramedics and ICPs.

Indications

✔ Myocardial ischaemia.

Contraindications

✖ Known severe allergy.

✖ Third trimester of pregnancy.

Cautions

⊖ 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 CORD 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.

Use in pregnancy or when 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. Advise the patient to stop breastfeeding and seek further advice from their lead maternity carer.

Dosage

- 300 mg.

Administration

- Administer PO. Dispersible tablets may be chewed or dissolved in water.

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.

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.

Usual preparation

- 300 mg dispersible tablets.

Pharmacokinetics

- 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.

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.

Additional information

- 111 Call Handlers will give instructions for patients to take aspirin if they are suspected of having myocardial ischaemia. This means that some patients that do not have myocardial ischaemia will be advised to take aspirin. The risk for these patients is extremely low and there is potential benefit for those patients who are experiencing myocardial ischaemia.
- The contraindications to aspirin in the call handling protocols are different to those within these CPGs and these differences are not clinically significant.
- Many patients have enteric coated aspirin and not dispersible aspirin and they will be given instructions to chew and swallow their enteric coated aspirin.

- Enteric coated aspirin is not destroyed when it is chewed and will be absorbed. It is however, quite unpleasant to chew and swallow.
  a) If the patient still has the tablets in their mouth, ask them to spit the tablets out and administer an additional 300 mg of dispersible aspirin.
  b) If the patient has chewed and swallowed 300 mg of aspirin (including enteric coated aspirin), do not administer additional aspirin.
  c) If the patient has swallowed (without chewing) 300 mg of enteric coated aspirin, administer an additional 300 mg of dispersible aspirin. This is because absorption of the enteric coated aspirin will be delayed.
  d) If it is unclear what the patient has taken, administer an additional 300 mg of dispersible aspirin.
- Urea also impairs platelet function, but aspirin is not contraindicated in the setting of renal failure.

12.7 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:
  a) An increase in heart rate.
  b) Drying of salivary and bronchial secretions.
  c) Bronchodilation.
  d) Reduced gastrointestinal motility.

Delegated scopes of practice

- ICPs.

Indications

✔ Narrow complex bradycardia causing clinically significant cardiovascular compromise.

✔ Organophosphate poisoning.

Contraindications

✖ Known severe allergy.

Cautions

⊖ Myocardial ischaemia. Atropine will increase myocardial oxygen consumption.

Use in pregnancy or when breastfeeding

- Safe and should be administered when 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

- 0.6 mg for an adult. Repeat as required without a maximum dose, if the bradycardia is responsive to atropine.
- Escalating doses are likely to be required for organophosphate poisoning.

Administration

- Administer undiluted as an IV bolus.
- Slow administration may result in transient bradycardia.

Common adverse effects

- Tachycardia.
- Confusion. Particularly in the elderly or those with intellectual impairment.
- Dry mouth.
- Blurred vision.

Usual onset of effect

- 5-10 seconds.

Usual duration of effect

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

Usual preparation

- Ampoule containing 0.6 mg in 1 ml.

Pharmacokinetics

- 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.

Common interactions

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

12.8 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.

Delegated scopes of practice

- ICPs.

Indications

✔ Crush injury in adults.

Contraindications

✖ None.

Cautions

⊖ None.

Use in pregnancy or when breastfeeding

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

Dosage

- 6.8 mmol (1 g of calcium) IV over 1 minute for an adult.
- Repeat the dose if signs of hyperkalaemia persist or recur.
- Seek clinical advice for a child.

Administration

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

Pharmacokinetics

- 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.

Additional information

- Document the dose administered in mmol.
- Calcium gluconate is an alternative formulation of calcium, usually containing 2.2 mmol per 10 ml. Administer two ampoules at a time if only calcium gluconate is available.

12.9 Clopidogrel

Mechanism of action

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

Delegated scopes of practice

- Paramedics and ICPs.

Indications

✔ STEMI in conjunction with fibrinolytic therapy.

Contraindications

✖ Known severe allergy.

Cautions

⊖ Clinically significant bleeding. Clopidogrel will increase bleeding.

⊖ At risk of bleeding. If the answer to any of the fibrinolytic/PCI checklist questions is 'yes' or 'unsure', personnel must discuss this with the STEMI Coordinator or seek clinical advice prior to administration.

⊖ Pregnancy.

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 discuss this with the STEMI Coordinator or 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

- 300 mg if the patient is aged less than 75 years.
- 75 mg if the patient is aged greater than or equal to 75 years.

Administration

- Administer PO.

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.

Usual preparation

- 75 mg tablets.

Pharmacokinetics

- Clopidogrel is a pro-drug 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, for example warfarin or dabigatran.

12.10 Enoxaparin

Mechanism of action

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

Delegated scopes of practice

- Paramedics and ICPs.

Indications

✔ STEMI in conjunction with fibrinolytic therapy.

Contraindications

✖ Known severe allergy.

Cautions

⊖ Clinically significant bleeding. Enoxaparin will increase bleeding.

⊖ At risk of bleeding. If the answer to any of the fibrinolytic/PCI checklist questions is 'yes' or 'unsure', personnel must discuss this with the STEMI Coordinator or seek clinical advice prior to administration.

⊖ Pregnancy.

Use in pregnancy or when breastfeeding

- Safety has not been demonstrated. The likelihood of STEMI occurring in a woman who is pregnant is so low that personnel must discuss this with the STEMI Coordinator or 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

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

	Age less than 75 years		Age 75 years or older	
Weight	**Enoxaparin (dose SC)**	**Enoxaparin (volume SC)**	**Enoxaparin (dose SC)**	**Enoxaparin (volume SC)**
<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

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 drug 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 drug 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

- Pre-filled syringe containing 100 mg in 1 ml.

Pharmacokinetics

- 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, for example warfarin or dabigatran.

12.11 Entonox

Mechanism of action

- Nitrous oxide is the active ingredient in Entonox.
- Nitrous oxide is an analgesic. The mechanism of action is poorly understood but includes:
  a) Suppression of CNS impulses.
  b) Blockade of N-methyl-d-aspartate (NMDA) receptors.
  c) Stimulation of gamma amino-butyric acid (GABA) receptors.

Delegated scopes of practice

- EMTs, Paramedics and ICPs.

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 last 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 when breastfeeding

- Safe and may be administered if indicated.

Dosage

- 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 four degrees), the nitrous oxide and oxygen may separate out and the cylinder should be inverted 3-5 times prior to administration to remix them.
- An ambulance is not considered a confined space. Maximising ventilation (for example 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.

Pharmacokinetics

- 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, for example opiates, benzodiazepines or alcohol.

Additional information

- 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.
- A lead maternity carer may ask to provide their own Entonox during transfer. This is acceptable provided the Entonox cylinder is no larger than an A size and is appropriately restrained.

12.12 Fentanyl

Mechanism of action

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

Delegated scopes of practice

- Paramedics and ICPs.

Indications

✔ Moderate to severe pain when the patient:

a) Requires intense analgesia for a short period of time only (for example for joint relocation) or
b) Has clinically significant shock or
c) Does not have IV access.

Contraindications

✖ Known severe allergy.

✖ Unable to obey commands (exceptions: administration for RSI, agitated delirium and post intubation).

✖ Current respiratory depression.

Cautions

⊖ Age less than one year. Children under the age of one year are at increased risk of respiratory depression following opiate administration.

⊖ At high risk of respiratory depression, for example: severe CORD, morbid obesity or on home BiPAP. Such patients may develop respiratory depression following opiate administration.

⊖ Labour. Opiates 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 when breastfeeding

- Safety has not been demonstrated in pregnancy, but fentanyl 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

- IV for analgesia:
  a) 10-50 mcg every 3-5 minutes for an adult. Use a dose at the lower end of the range if the patient is small, frail or cardiovascularly unstable.
  b) See the paediatric drug dose tables for a child.
- Intranasal for analgesia:
  a) 100 mcg IN for an adult weighing 80 kg or less. Further doses of 50 mcg may be administered every 10 minutes without a maximum dose. Halve these doses if the patient is frail or cardiovascularly unstable.
  b) 200 mcg IN for an adult weighing greater than 80 kg. Further doses of 100 mcg may be administered every 10 minutes without a maximum dose. Halve these doses if the patient is frail or cardiovascularly unstable.
  c) See the paediatric drug dose tables for a child.
- IV for RSI: see the 'RSI' section.

Administration

- The preferred route for adminstration is IV.
- IV administration: dilute 100 mcg to a total of 10 ml. This final solution contains 10 mcg/ml.
- Intranasal administration in children:
  a) Draw up fentanyl undiluted, placing half of the total dose into two separate 1 ml syringes. When drawing up the first syringe, draw up an additional 0.1 ml of fentanyl over and the above the planned volume and expel this slowly through the mucosal atomiser, in order to fill the dead space of the mucosal atomiser with fentanyl. This does not need to be done with subsequent doses as the dead space will contain fentanyl.
  b) Administer fentanyl IN by rapidly injecting one syringe (half of the total dose) into each nostril. Rapid injection is required in order to achieve a fine mist, which maximises absorption.
- Intranasal administration in adults:
  a) Draw up fentanyl undiluted using 1 ml syringes. Administer a maximum of 1 ml at a time per nostril. The dead space of the mucosal atomiser is very small in relation to the overall volume administered and does not need to be taken into account.
  b) Administer fentanyl IN by rapidly injecting one syringe (half of the total dose) into each nostril. Rapid injection is required in order to achieve a fine mist, which maximises absorption.
  c) If the dose is 200 mcg, administer 1 ml into each nostril, wait five minutes and then administer a further 1 ml into each nostril. This maximises absorption.

Common adverse effects

- Respiratory depression.
- Bradycardia.
- Hypotension (though less than morphine).
- Sedation.
- Nausea and vomiting.
- Itch (though less than morphine).
- Euphoria.

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 containing 100 mcg in 2 ml.

Pharmacokinetics

- Fentanyl is more lipophilic (fat soluble) than morphine and this is why fentanyl is well absorbed through the nasal mucosa.
- In comparison to morphine, the increased lipophilicity results in a slightly more rapid penetration into the brain (though this is not usually clinically significant) and a more intense pain relief which dissipates relatively quickly as fentanyl is distributed to (and taken up by) fatty tissues.
- Fentanyl causes less histamine release than morphine. This usually results in less of a fall in blood pressure than an equivalent dose of morphine and is why fentanyl is the preferred opiate if the patient has clinically significant shock. However, fentanyl administration will usually cause a fall in blood pressure.
- 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 opiates and sedatives, for example benzodiazepines or alcohol.

Additional information

- Morphine is the preferred opiate unless fentanyl is specifically indicated.

12.13 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.

Delegated scopes of practice

- Paramedics and ICPs.

Indications

✔ Septic shock (in addition to amoxicillin/clavulanic acid) if the patient is more than 30 minutes from hospital and the site of infection is the urinary tract, the abdomen or is unknown.

Contraindications

✖ Known severe allergy.

✖ Pregnancy.

Cautions

⊖ None.

Use in pregnancy or when 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.

Dosage

- Adults:
  a) 240mg if weighs less than 60 kg.
  b) 320mg if weighs 60-80 kg.
  c) 400mg if weighs greater than 80 kg.
- See the paediatric drug dose tables for a child.

Administration

- Administer amoxicillin/clavulanic acid first.
- Gentamicin may be administered in a 1 litre bag of 0.9% sodium chloride (adults only), a bag of 5% glucose (patients whose weight has been rounded to greater than or equal to 20 kg only) or in a syringe via a running IV line.
- If administering gentamicin in a 1 litre bag of 0.9% sodium chloride:
  a) Shake well and label.
  b) Administer IV over 15-30 minutes.

- If administering gentamicin using 5% glucose:
  a) Do not use in a child if their weight has been rounded to less than 20 kg. This is because of the risk of hyponatraemia.
  b) Dilute the gentamicin in a 100 ml bag of 5% glucose. Shake well and label.
  c) 1-2 drops per second via a standard IV administration set will deliver 100 ml over 15-30 minutes.
- If administering gentamicin using a syringe:
  a) Dilute to a total of 10 ml using 0.9% sodium chloride.
  b) Administer 1 ml every 2-3 minutes into a running IV line.
- If an administration set has been used, it will need to be flushed with 0.9% sodium chloride to ensure that all of the gentamicin has been administered.
- Do not administer as an IV bolus as this increases the risk of adverse effects.

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 or prolonged dosing.

Usual onset of effect

- 30-60 minutes.

Usual duration of effect

- 24 hours.

Usual preparation

- Ampoule containing 80 mg of gentamicin in 2 ml.

Pharmacokinetics

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

Common interactions

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

Additional information

- Gentamicin is not contraindicated if the patient has renal failure.

12.14 Glucagon

Mechanism of action

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

Delegated scopes of practice

- EMTs, Paramedics and ICPs.

Indications

✔ Hypoglycaemia when the patient cannot swallow glucose/food and IV access cannot be obtained.

Contraindications

✖ Known severe allergy.

Cautions

⊖ None.

Use in pregnancy or when breastfeeding

- Safe and should be administered if indicated

Dosage

- 1 mg IM for an adult or child aged five years and over.
- 0.5 mg IM for a child aged less than five years.
- Do not repeat the IM dose.

Administration

- Dissolve the powder using the syringe within the kit and administer IM.
- 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

- None.

Usual onset of effect

- 5-10 minutes (depending on absorption).

Usual duration of effect

- 15-60 minutes.

Usual preparation

- Ampoule containing 1mg as powder.

Pharmacokinetics

- Glucagon is predominantly excreted unchanged into bile and urine.
- There are no significant effects from liver or kidney impairment on acute administration.

Common interactions

- None.

Additional information

- Glucagon relies on stored glycogen being available to exert its effect and if glycogen stores are not available, glucagon may be ineffective. Examples include if the patient:
  a) Has undergone strenuous exercise.
  b) Has not eaten food for more than 12 hours.
  c) Is suffering from adrenal insufficiency.
  d) Is suffering from chronic hypoglycaemia.
  e) 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 as described in the 'hypoglycaemia' section.
- Glucagon also reduces the tone and motility of the smooth muscle in the gastrointestinal tract, but is not recommended in the setting of oesophageal obstruction.
- Glucagon is sometimes suggested as part of the treatment for bradycardia caused by beta-blockers because it stimulates cardiac cells via a mechanism that is independent of the beta receptor. However, glucagon has almost no role in the out-of-hospital setting because it rarely provides a sustained heart rate rise in addition to adrenaline and requires much higher doses than that carried by ambulance personnel.

12.15 Glucose gel

Mechanism of action

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

Delegated scopes of practice

- All personnel. ATP is not required to administer glucose gel.

Indications

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

Contraindications

✖ None.

Cautions

⊖ None.

Use in pregnancy or when breastfeeding

- Safe.

Dosage

- 10-20 g for all ages.
- Administer one sachet and repeat every 10 minutes if hypoglycaemia persists or recurs.

Administration

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

Common adverse effects

- None.

Usual onset of effect

- 5-10 minutes.

Usual duration of effect

- 30-60 minutes.

Usual preparation

- There are multiple different brands.
- Most are a sachet containing 10-20 g of glucose.

Pharmacokinetics

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

Common interactions

- None.

Additional information

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

12.16 Glyceryl trinitrate (GTN)

Mechanism of action

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

Delegated scopes of practice

- EMTS, Paramedics and ICPs.

Indications

✔ Myocardial ischaemia.

✔ Cardiogenic pulmonary oedema.

✔ Hypertension associated with autonomic dysreflexia.

Contraindications

✖ Systolic BP less than 100 mmHg.

✖ Heart rate less than 40/minute.

✖ Heart rate greater than 130/minute if the primary clinical problem is myocardial ischaemia, STEMI or cardiogenic pulmonary oedema.

✖ Heart rate greater than 150/minute if the primary clinical problem is autonomic dysreflexia.

✖ Ventricular tachycardia.

Cautions

⊖ STEMI, particularly STEMI 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.

⊖ Poor perfusion. Poor perfusion is a sign of reduced cardiac output which may fall further with GTN administration.

⊖ Dysrhythmia. Dysrhythmia may cause a reduced cardiac output which may fall further with GTN administration.

- A drug for erectile dysfunction has been taken within the last 24 hours. See common interactions.
- Known aortic or mitral stenosis. With aortic or mitral stenosis, cardiac output may be reduced as a result of the narrowed valve and a fall in preload may cause a further fall in cardiac output.

Use in pregnancy or when 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.

Dosage

- Myocardial ischaemia: 0.4 mg every 3-5 minutes. Increase the dosing interval to 10 minutes if caution is required.
- Cardiogenic pulmonary oedema: 0.8 mg every 3-5 minutes. Increase the dosing interval to 10 minutes if caution is required. Paramedics and ICPs may increase the dose and frequency if the patient is not improving, provided hypotension is not present.
- Autonomic dysreflexia: 0.4-0.8 mg every 3-5 minutes.

Administration

- Spray under the tongue. If this cannot be achieved it is acceptable to spray into the mouth.
- If GTN is administered in the presence of a caution:
  a) The patient should be lying flat.
  b) IV access should have been obtained whenever possible.
  c) The dosing interval should be increased to 10 minutes.
  d) Personnel should be ready to administer 0.9% sodium chloride IV if there is a significant fall in cardiac output or blood pressure.

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

- Metered dose bottle delivering 0.4 mg doses.

Pharmacokinetics

- 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.

Common interactions

- The effects may be increased if the patient is taking an anti-hypertensive medicine.
- Severe and/or prolonged hypotension may occur if a medicine for erectile dysfunction has been taken within the last 24 hours:
  a) There is a range of medicines with different names used for erectile dysfunction and some of them (particularly sildenafil) are also used in the treatment of pulmonary hypertension.
  b) All of these medicines are long acting vasodilators and the administration of GTN may cause further vasodilation.

Additional information

- GTN must be used with caution in the presence of STEMI because the risks may outweigh the benefits:
  a) GTN may cause a significant fall in cardiac output.
  b) GTN has a role in treating symptomatic myocardial ischaemia, but does not usually have a significant role in treating STEMI.
- Particular caution must be used in the presence of STEMI involving the right ventricle and personnel must have a low threshold for withholding GTN:
  a) STEMI involving the right ventricle can result in a significant reduction in right ventricular contractility.
  b) When the right ventricle is significantly impaired, it may provide little in the way of contribution to cardiac output and blood may be passively flowing down a pressure gradient between the inferior vena cava (IVC), the superior vena cava (SVC) and the left atrium.
  c) This may result in the preload (filling) of the left side of the heart being dependent on the venous pressures within the IVC and SVC.
  d) GTN can result in a significant fall in venous pressure (and thus a fall in preload) which may cause a significant fall in cardiac output.

12.17 Heparin

Mechanism of action

- Heparin is an anticoagulant. It potentiates the activity of anti-thrombin lll (a naturally occurring anticoagulant) causing inhibition of multiple coagulation factors.

Delegated scopes of practice

- Paramedics and ICPs.

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.

⊖ At risk of bleeding. If the answer to any of the fibrinolytic/PCI checklist questions is 'yes' or 'unsure', personnel must discuss this with the STEMI Coordinator or seek clinical advice prior to administration.

⊖ Pregnancy.

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 discuss this with the STEMI Coordinator or 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

- 5000 units.

Administration

- Dilute to a total volume of 5-10 ml using 0.9% sodium chloride.
- Administer IV as a bolus approximately 15 minutes after the fibrinolytic therapy.

Common adverse effects

- Increased bleeding.

Usual onset of effect

- 5-15 minutes.

Usual duration of effect

- 2-4 hours.

Usual preparation

- Ampoule containing 5000 units in 0.2 ml.

Pharmacokinetics

- It is unclear how heparin is cleared.

Common interactions

- The risk of bleeding will be increased if the patient is taking an anticoagulant, for example warfarin or dabigatran.

12.18 Ibuprofen

Mechanism of action

- Ibuprofen is a non-steroidal anti-inflammatory drug (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.

Delegated scopes of practice

- EMTs, Paramedics and ICPs.

Indications

✔ Mild to moderate pain (usually in combination with paracetamol), particularly soft tissue pain, musculoskeletal pain or headache.

✔ May be administered in addition to other measures for severe pain, particularly when the transport time is long.

Contraindications

✖ Known severe allergy.

✖ Third trimester of pregnancy.

Cautions

⊖ The patient has taken ibuprofen within the last four hours. Ibuprofen is contained in many products such as cold and flu tablets/drinks, combination analgesics and migraine tablets. Additional ibuprofen may be administered provided it is clear that the total dose taken within a four 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 judgement 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 CORD have known worsening of bronchospasm with NSAIDs. If there is a clear history of significant bronchospasm with NSAIDs, ibuprofen should be withheld.
- Taking warfarin. Ibuprofen displaces warfarin from binding sites and increases the activity of warfarin. This effect is usually only clinically important with chronic administration, however ibuprofen should be withheld if a patient taking warfarin has signs of bleeding or a clinical condition that may involve bleeding. Examples include trauma or a likely need for surgery.
- Pregnancy.

Use in pregnancy or when 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.
- May be administered if the patient is breastfeeding. Advise the patient to stop breastfeeding and seek further advice from their lead maternity carer.

Dosage

- 600 mg for an adult weighing greater than 80 kg.
- 400 mg for an adult weighing 80 kg or less.
- See the paediatric drug dose tables for a child.

Administration

- Administer PO.
- Children unable to swallow tablets may be administered ibuprofen tablets that have been crushed and placed in a soft food such as jam or honey.

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

- 200 mg tablets.

Pharmacokinetics

- 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.

Additional information

- Ibuprofen is not indicated for pain associated with myocardial ischaemia.
- All personnel (including those without ATP) may give ibuprofen to a patient for self-administration, provided the package instructions are followed.

12.19 Ipratropium

Mechanism of action

- Ipratropium is a bronchodilator.
- Ipratropium is an anticholinergic agent with predominantly antimuscarinic activity. It antagonises (blocks) acetylcholine receptors, causing vagal inhibition resulting in bronchodilation.

Delegated scopes of practice

- EMTs, Paramedics and ICPs.

Indications

✔ Bronchospasm secondary to asthma or CORD.

✔ Prominent bronchospasm secondary to airway burns or smoke inhalation.

Contraindications

✖ Known severe allergy.

Cautions

⊖ None.

Use in pregnancy or when breastfeeding

- Safety has not been demonstrated during pregnancy, but ipratropium 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

- 0.5 mg once only.

Administration

- Administer nebulised undiluted, in combination with 5 mg of salbutamol.

Common adverse effects

- Tachycardia.
- Dry mouth.
- Blurred vision.

Usual onset of effect

- 2-5 minutes.

Usual duration of effect

- 6 hours.

Usual preparation

- Ampoule containing 0.5 mg in 2 ml.

Pharmacokinetics

- Only a small amount of the nebulised dose is absorbed, with most of the dose being nebulised to the atmosphere. The inhaled ipratropium 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.

Common interactions

- None.

Additional information

- Ipratropium does not have a significant role in the treatment of bronchospasm as a result of smoke, toxic gas inhalation or chest infection. However, it may be administered if bronchospasm is prominent.
- Ipratropium has been reported to cause worsening of glaucoma, but only with frequent doses of nebulised ipratropium (with the nebulised drug contacting the eyes) in the setting of poorly controlled glaucoma. Glaucoma is not a caution when administering a single dose.

12.20 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.

Delegated scopes of practice

- ICPs.

Indications

- ✔ Severe pain (in addition to other medicines), particularly musculoskeletal or burn pain that has not been adequately controlled with an opiate.
- ✔ Inducing dissociation, for example for 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.
- ✖ Age less than one 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, for example haemorrhagic stroke.

Use in pregnancy or when 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.

Dosage

- For analgesia:
  a) 10-50 mg IV every 3-5 minutes. Most adult patients will need 20-30 mg.
  b) Use a dose at the lower end of the range if the patient is small or frail.
  c) Doses at the upper end of the range should be reserved for when dissociation is required.
  d) 1 mg/kg (rounded off to nearest 10 kg) IM or PO, up to a maximum of 100 mg, if IV access cannot be obtained. This may be repeated once after 10 minutes.
  e) See the paediatric drug dose tables for a child.
- For dissociation: titrate to effect. Most patients will need approximately 0.5 mg/kg.
- For severe agitated delirium:
  a) 50-100 mg of ketamine IV every 3-5 minutes.
  b) 200-400 mg of ketamine IM which may be repeated once after 10 minutes.
- For RSI see the RSI section.
- For significant movement during CPR that is interfering with resuscitation:
  a) For an adult administer 50 mg of ketamine IV once.
  b) For a child administer 0.5 mg/kg IV once.

Administration

- For analgesia ketamine should usually be administered in combination with an opiate. The patient should receive sufficient opiate until further doses are not providing additional analgesia. Most adults will need at least 10 mg of morphine or at least 100 mcg of fentanyl before ketamine is administered.
- The preferred route of administration is IV:
  a) For an adult dilute 200 mg to a total of 20 ml or 100 mg to a total of 10 ml. This final solution contains 10 mg/ml.
  b) For a child dilute 100 mg to a total of 10 ml. This final solution contains 10 mg/ml.
- The IM route is preferred over the PO route as IM absorption is more reliable. Administer IM ketamine undiluted. The preferred IM site is the lateral thigh, if this site is not suitable use the lateral upper arm.
- The PO route should be reserved for the very unusual circumstance in which IM injection is contraindicated. Administer ketamine PO undiluted in a liquid, for example paracetamol syrup or water.

Common adverse effects

- Transient hypertension.
- Tachycardia.
- Apnoea.
- Nausea and vomiting.
- Sedation.
- Hallucinations.

Usual onset of effect

- IV: 1-2 minutes.
- IM: 5-10 minutes.
- PO: 10-20 minutes.

Usual duration of effect

- 10-60 minutes.

Usual preparation

- Ampoule containing 200 mg in 2 ml.

Pharmacokinetics

- Ketamine is predominantly 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 analgesic medicines or sedatives, for example opiates, benzodiazepines or alcohol.

Additional information

- Warn the patient it is possible to feel strange following ketamine administration.
- Some patients may experience hallucinations or awful experiences and these appear more common if sub-therapeutic doses of ketamine are administered.
- Do not treat hallucinations routinely with midazolam because the combination of midazolam and ketamine is commonly associated with a reduced level of consciousness, particularly if an opiate has also been administered. Most hallucinations will settle with a combination of further administration of ketamine, explanation and time. However, midazolam in 1-2 mg doses IV may be administered if the hallucinations are severe provided the patient is physiologically stable.

12.21 1% lignocaine

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.

Delegated scopes of practice

- Paramedics and ICPs.

Indications

✔ 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.

Contraindications

✖ Known severe allergy.

Cautions

⊖ Local infection in the area of injection.

Use in pregnancy or when breastfeeding

- Safe. May be administered if indicated.

Dosage

- Subcutaneous:
  a) The maximum subcutaneous dose for an adult is 20 ml.
  b) See the paediatric drug dose tables for the maximum dose for a child.
  c) The subcutaneous dose may be repeated once after an hour.
- Intraosseous:
  a) 5 ml for an adult.
  b) See the paediatric drug dose tables for a child.
  c) The intraosseous dose may be repeated once after 15 minutes.

Administration

- Subcutaneous for IV insertion: administer into the subcutaneous tissue at the site of cannulation. Raise a bleb and wait approximately one minute before insertion.
- 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 one further minute before infusing fluid. This is intended to limit the amount of lignocaine flushed into the circulation.

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

- Ampoule containing 50 mg in 5 ml.

Pharmacokinetics

- Lignocaine is metabolised in the liver.
- There are no significant effects from liver impairment on acute administration.

Common interactions

- None.

Additional information

- Do not apply lignocaine topically to the eye because the solution contains a preservative that may cause harm.
- Warming lignocaine, for example 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.

12.22 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.

Delegated scopes of practice

- EMTs, Paramedics and ICPs.

Indications

✔ Minor allergic reactions confined to skin involvement.

✔ Prominent itch associated with anaphylaxis, provided all systemic signs of anaphylaxis have resolved.

Contraindications

✖ Known severe allergy to loratadine.

✖ Age less than one year.

Cautions

⊖ Pregnancy.

Use in pregnancy or when 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

- 10 mg for an adult or child aged over 12 years.
- 5 mg for a child aged 1-11 years.

Administration

- Administer PO.
- Always ask a parent (or guardian) if a young child can swallow tablets. Loratadine may be crushed and placed in a soft food such as jam or honey.

Common adverse effects

- None.

Usual onset of effect

- 30-60 minutes.

Usual duration of effect

- 12-24 hours.

Usual preparation

- 10 mg tablets.

Pharmacokinetics

- Loratadine is predominantly metabolised by the liver.
- There are no significant effects from liver impairment on acute administration.

Common interactions

- None.
- Increases in plasma concentrations of loratadine have been reported after concurrent administration of ketoconazole, erythromycin and roxithromycin. In a small number of patients this was associated with a prolonged QT interval, but this only occurred with prolonged administration.

Additional information

- All personnel (including those without ATP) may give loratadine to a patient for self-administration, provided the package instructions are followed.

12.23 Magnesium sulphate

Mechanism of action

- Magnesium is the active ingredient in magnesium sulphate.
- Magnesium reduces bronchial smooth muscle contraction resulting in bronchodilation.

Delegated scope of practice

- ICPs.

Indications

✔ Bronchospasm secondary to severe or life-threatening asthma.

Contraindications

✖ Known severe allergy.

Cautions

⊖ Hypotension. Magnesium is a vasodilator and may make hypotension worse.

Use in pregnancy or when breastfeeding

- Safe and should be administered when indicated.
- Muscle weakness may occur in the baby if administered within two hours of birth and this may cause respiratory depression.

Dosage

- 10 mmol (2.47 g) IV for an adult.
- See the paediatric drug dose tables for a child.
- A second dose may be administered if transport time is longer than 30 minutes and the patient is not improving.

Administration

- Administer IV over 10-15 minutes.
- Dilute to a total of 10 ml using 0.9% sodium chloride and administer 1 ml every 1-2 minutes into a running IV line. Alternatively add to a bag of 5% glucose, shake well and label.
- If administering magnesium using a bag of 5% glucose:
  a) Do not use in a child if their weight has been rounded to less than 20 kg. This is because of the risk of hyponatraemia.
  b) 2-3 drops per second via a standard IV administration set will deliver 100 ml over 10-15 minutes.
  c) The administration set will need to be flushed with 0.9% sodium chloride to ensure that all of the magnesium has been administered.

Common adverse effects

- Flushing. Particularly if administered rapidly.
- Hypotension. Particularly if administered rapidly.
- Muscle weakness. This is usually only seen with doses exceeding 20 mmol.

Usual onset of effect

- 5-10 minutes.

Usual duration of effect

- 30-60 minutes.

Pharmacokinetics

- 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.

Additional information

- Do not administer magnesium into an IV line that has an adrenaline 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.

12.24 Methoxyflurane

Mechanism of action

- Methoxyflurane is an inhalational analgesic.
- The mechanism of action is not clear.

Delegated scopes of practice

- EMTs, Paramedics and ICPs.

Indications

✔ Moderate to severe pain.

Contraindications

✖ Known severe allergy.

✖ Personal or family history of malignant hyperthermia.

✖ Unable to obey commands.

✖ Known renal impairment.

✖ Has received methoxyflurane within the last week. Frequent administration increases the risk of renal impairment.

Cautions

⊖ 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 methoxyflurane may worsen renal impairment.

⊖ Pre-eclampsia. In this setting renal impairment is likely and methoxyflurane may worsen renal impairment.

⊖ Administration within a confined space.

Use in pregnancy or when breastfeeding

- Safety has not been formally demonstrated in pregnancy, but methoxyflurane may be administered. Methoxyflurane has been extensively used during labour in Australia for many years without adverse effects.
- Methoxyflurane may cause temporary drowsiness in the baby and administration should be discussed with the lead maternity carer if there are known signs of foetal distress.
- May be administered if the patient is breastfeeding. Advise the patient to stop breastfeeding and seek further advice from their lead maternity carer.

Dosage

- Maximum of 6 ml (two doses) for a patient aged greater than or equal to 12 years.
- Maximum of 3 ml (one dose) for a child aged less than 12 years.

Administration

- Whenever possible have the patient self-administer methoxyflurane.
- Administer 3 ml (one dose) at a time and always use the charcoal filter. Using a charcoal filter maximizes the amount of exhaled methoxyflurane that is absorbed, limiting exposure to personnel.
- Instruct the patient to breathe out through the inhaler.
- 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.
- An ambulance is not considered a confined space. Maximising ventilation (for example having ventilation fans on) reduces occupational exposure. Consider not administering methoxyflurane in an ambulance if the patient cannot cooperate with breathing out through the inhaler.

Common adverse effects

- Sedation.
- Light headedness.
- Nausea.
- Dislike of the taste/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.

Pharmacokinetics

- 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, for example opiates, benzodiazepines or alcohol.

Additional information

- Malignant hyperthermia (MH) is a rare, inherited disorder of muscle metabolism affecting approximately 20 families in New Zealand, many of whom are in the Manawatu area. When exposed to some anaesthetic agents (including methoxyflurane) the patient may develop a life-threatening hyper-metabolic state with severe hyperthermia. Patients with MH (or a family history of MH) usually know about it.
- 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.
- Some lead maternity carers may ask that methoxyflurane is not administered during labour and may ask to provide their own Entonox during transfer. This is acceptable provided the Entonox cylinder is no larger than an A size and is appropriately restrained.

12.25 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.

Delegated scopes of practice

- Paramedics and ICPs.
- May only be administered in discussion with the STEMI Coordinator or with the on call doctor via the Clinical Desk.

Indications

✔ Control of hypertension prior to fibrinolytic therapy for STEMI.

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 CORD. Metoprolol may cause bronchospasm and should usually be withheld if the patient regularly takes bronchodilators.

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 discuss this with the STEMI Coordinator or 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

- 1-2 mg every 5-10 minutes. The dose and frequency of administration must be discussed with the STEMI Coordinator or the on call doctor via the Clinical Desk.

Administration

- Administer IV undiluted as a bolus.

Common adverse effects

- Hypotension.
- Bradycardia.
- Bronchospasm.

Usual onset of effect

- 2-3 minutes.

Usual duration of effect

- 1-2 hours.

Usual preparation

- Ampoule containing 5 mg in 5 ml.

Pharmacokinetics

- Metoprolol is metabolised in the liver.
- There are no significant effects from liver impairment on acute administration.

Common interactions

- The blood pressure effects will be potentiated by other medicines that lower blood pressure. For example, GTN, 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.

12.26 Midazolam

Mechanism of action

- Midazolam is a benzodiazepine.
- Midazolam enhances the activity of gamma-aminobutyric acid (GABA) at GABA receptors within the central nervous system, resulting in anticonvulsant activity, sedation, amnesia, anxiolysis and muscle relaxation.

Delegated scopes of practice

- Paramedics: IM and IV for seizures. IM for agitated delirium.
- ICPs: all routes and all indications.

Indications

✔ Prolonged seizures.
✔ Moderate agitated delirium.
✔ Pain associated with severe muscle spasm.
✔ Sedation, for example for joint relocation.
✔ Sedation post intubation.
✔ Severe anxiety associated with CORD.

Contraindications

✖ Known severe allergy.

Cautions

⊖ Concurrent administration of opiates or ketamine. This will increase the effects of midazolam.
⊖ Intoxication. This will increase the effects of midazolam.
⊖ Elderly. Older age will increase and prolong the effects of midazolam.

Use in pregnancy or when 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.

Dosage

- The dose of midazolam is dependent on the indication and the route. See the individual sections.

Administration

- IV administration:
  a) Dilute 2 ml from a 15 mg/3 ml ampoule to a total of 10 ml using 0.9% sodium chloride. This solution contains 1 mg/ml.
  b) Administer IV as a bolus.
- IM administration:
  a) Draw up the dose from a 15 mg/3 ml ampoule. Do not dilute.
  b) The preferred site is the lateral thigh as this has the best absorption. If this site is not suitable use the lateral upper arm.
- For sedation post intubation: combine 10 mg of midazolam with 10 mg of morphine and dilute to a total of 10 ml using 0.9% sodium chloride.

Common adverse effects

- Sedation.
- Respiratory depression.
- Hypotension.
- Amnesia.

Usual onset of effect

- IV: 2-3 minutes.
- IM: 3-5 minutes, dependent on absorption.

Usual duration of effect

- 30-60 minutes. The sedative effect may be longer, particularly in the elderly.

Usual preparation

- Ampoule containing 15 mg in 3 ml.

Pharmacokinetics

- Midazolam is predominantly metabolised by 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 sedatives or pain relieving medicines (for example other benzodiazepines, opiates, ketamine and alcohol).

Additional information

- When providing sedation the patient must be able to obey commands at all times.

12.27 Morphine

Mechanism of action

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

Delegated scopes of practice

- Paramedics and ICPs.

Indications

✔ Moderate to severe pain.

✔ Cardiogenic pulmonary oedema with severe anxiety and/or respiratory distress.

✔ Sedation post intubation.

Contraindications

✖ Known severe allergy.

✖ Unable to obey commands (exceptions: agitated delirium and post intubation).

✖ Current respiratory depression.

Cautions

⊖ Age less than one year. Children under the age of one year are at increased risk of respiratory depression following opiate administration.

⊖ At high risk of respiratory depression, for example: severe CORD, morbid obesity or on home BiPAP. Such patients may develop respiratory depression following opiate administration.

⊖ Labour. Opiates 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 when 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

- IV for analgesia:
  a) 1-5 mg every 3-5 minutes for an adult. Use a dose at the lower at end of the

range if the patient is small, frail or physiologically unstable.
   b) See the paediatric drug dose tables for a child.
- IM for analgesia:
   a) 5-10 mg repeated once after 10 minutes for an adult. Use a dose at the lower end of the range if the patient is small, frail or physiologically unstable.
   b) See the paediatric drug dose tables for a child.
- Cardiogenic pulmonary oedema: 1-2 mg IV sparingly.
- Sedation post intubation: 1-2 mg IV in combination with 1-2 mg of midazolam IV for an adult, every 10-15 minutes.

Administration

- The preferred route for administration is IV.
- IV administration:
   a) Dilute 10 mg to a total of 10 ml. This solution contains 1 mg/ml.
   b) Administer IV as a bolus.
- IM administration:
   a) Do not use the IM route if the patient is shocked.
   b) Morphine IM is often relatively ineffective and should be reserved for when IV access cannot be obtained and fentanyl IN is not able to be administered, or is ineffective.
   c) Administer undiluted.
   d) The preferred site is the lateral thigh as this has the best absorption, but if this site is not suitable use the lateral upper arm.
   e) Two IM doses of morphine may be administered in addition to fentanyl IN, noting that the cumulative effects of multiple doses of opiate may not become apparent for 30-60 minutes, particularly if the patient is elderly.
   f) Morphine IV may be administered if IV access is obtained following administration of morphine IM, but take into account that morphine may still be being absorbed.
   g) Morphine IM is only repeated once because it takes 10-20 minutes to be absorbed and if more than two doses are required the patient needs an alternative form of pain relief.
- For sedation post intubation: combine 10 mg of morphine with 10 mg of midazolam and dilute to a total of 10 ml.

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 containing 10 mg in 1 ml.

Pharmacokinetics

- Morphine is less lipophilic (fat soluble) than fentanyl.
- In comparison to fentanyl the reduced lipophilicity results in a slightly less rapid penetration into the brain, though this is not usually clinically significant.
- Morphine causes more histamine release than fentanyl. This usually results in a greater fall in blood pressure than an equivalent dose of fentanyl and is why fentanyl is the preferred opiate if the patient has clinically significant shock.
- Morphine 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 opiates and sedatives, for example benzodiazepines or alcohol.

Additional information

- Morphine is the preferred opiate unless fentanyl is specifically indicated.
- Histamine release and/or itch are common. This is not 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.
- It should be rare to administer both morphine and fentanyl to the same patient. However, this may be appropriate if the patient has ongoing pain after needing intense pain relief for a short period of time, for example following straightening of an angulated fracture. In this setting all of the fentanyl ampoule should be administered before administering morphine.
- Morphine is not contraindicated in a patient with abdominal pain.
- Morphine has been reported to cause spasm of the sphincter of Oddi, but it is not contraindicated in a patient with cholecystitis or biliary colic.

12.28 Naloxone

Mechanism of action

- Naloxone is an opiate receptor antagonist (blocker). By blocking opiate receptors naloxone reverses the effects of opiates, particularly respiratory depression and sedation.

Delegated scopes of practice

- Paramedics and ICPs.

Indications

✔ Opiate poisoning is suspected and the patient has a significantly impaired level of consciousness or significantly impaired breathing.

✔ Excess adverse effects from administration of opiates.

Contraindications

✖ Known severe allergy.

Cautions

⊖ Chronic opiate use. If the patient is taking an opiate chronically, there is a risk of adverse physiological effects associated with opiate withdrawal.

Use in pregnancy or when 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

- 0.1-0.4 mg IV every 3-5 minutes for an adult.
- 0.8 mg IM for an adult. This may be repeated every 10 minutes.
- See the paediatric drug dose tables for a child.

Administration

- The preferred route for administration is IV.
- IV: dilute 0.4 mg to a total of 4 ml. This final solution contains 0.1 mg/ml.
- Administer the minimum dose required to produce improvement. Rapid reversal of opiates may be associated with seizures, hypertension, pulmonary oedema or severe agitation, particularly if the patient takes opiates regularly.
- IM: administer 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.
- IM naloxone should only be repeated if there are clinical signs it is effective.

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 opiate it is being used to antagonise and naloxone may need to be repeated.

Usual preparation

- Ampoule containing 0.4 mg in 1 ml.

Pharmacokinetics

- Naloxone is predominantly metabolised by the liver.
- There are no significant effects from liver impairment on acute administration.

Common interactions

None.

Additional information

- There is no role for naloxone in the treatment of cardiac arrest associated with opiate 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 ROSC occurs, naloxone should still not be administered because it may be associated with seizures, hypertension, pulmonary oedema or severe agitation.

12.29 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.

Delegated scopes of practice

- Paramedics and ICPs.

Indications

✔ Mild agitation.

Contraindications

✖ Known severe allergy.

✖ Age less than 12 years.

Cautions

⊖ Pregnancy.

⊖ The elderly. Olanzapine has increased and prolonged effects.

Use in pregnancy or when 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

- 10 mg if the patient weighs greater than or equal to 80 kg.
- 5 mg if the patient weighs less than 80 kg.
- The dose may be repeated once after 20 minutes.

Administration

- Administer PO. 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 water, tea or coffee.

Common adverse effects

- Sedation.

Usual onset of effect

- 10-20 minutes.

Usual duration of effect

- 12-24 hours.

Usual preparation

- 5 mg dispersible tablets (or wafers).

Pharmacokinetics

- Olanzapine is predominantly metabolised by the liver.
- There are no significant effects from liver impairment on acute administration.

Common interactions

- Intoxication. Olanzapine will have increased effects if the patient is intoxicated with alcohol or has taken recreational drugs.
- Sedative drugs. Concurrent administration with other sedative drugs (such as midazolam) will result in an increased effect.

12.30 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.

Delegated scopes of practice

- EMTs: PO.
- Paramedics and ICPs: IV and IM.

Indications

✔ Clinically significant nausea and/or vomiting.

Contraindications

✖ Known severe allergy.

✖ Age less than one 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.

Use in pregnancy or when 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

- 8 mg PO for a patient aged 12 years and over.
- 4 mg IV or IM for a patient aged 12 years and over. This may be repeated once after 10 minutes.
- See the paediatric drug dose tables for a child.
- A maximum of two parenteral (IV or IM) doses may be administered in addition to one PO dose.

Administration

- The preferred route of administration is IV.
- 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).
- PO: 10-20 minutes.

Usual duration of effect

- 4-8 hours.

Usual preparation

- 4 mg dispersible tablets (or wafers).
- Ampoule containing 4 mg in 2 ml.

Pharmacokinetics

- Ondansetron is predominantly metabolised by the liver.
- There are no significant effects from liver impairment on acute administration.

Common interactions

- None.

Additional information

- Prophylactic administration of ondansetron is not required for a patient with an immobilised cervical spine. Consider administering ondansetron if:
  a) The patient has nausea or
  b) The nature of the patient's injuries and transport position are such that vomiting would be particularly problematic.
- Ondansetron should not be administered for vomiting associated with an altered level of consciousness because it is rarely effective in this setting.

12.31 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.

Delegated scopes of practice

- Paramedics and ICPs.

Indications

✔ Following normal birth.

✔ Postpartum haemorrhage.

Contraindications

✖ Known severe allergy.

Cautions

⊖ None.

Use in pregnancy or when breastfeeding

- Safe and should be administered if indicated.

Dosage

- 10 units.

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 postpartum haemorrhage develops. This may require meeting another vehicle.

Common adverse effects

- Abdominal cramping.
- Tachycardia.
- Flushing.

Usual onset of effect

- 5-10 minutes.

Usual duration of effect

- 30-60 minutes.

Usual preparation

- Ampoule containing 10 units in 1 ml.

Pharmacokinetics

- Oxytocin is metabolised in the liver and kidneys.
- There are no significant effects from liver or kidney impairment on acute administration.

Common interactions

- None.

Additional information

- Routine administration of oxytocin following normal birth is controversial, but appears to reduce the incidence of postpartum haemorrhage.
- Oxytocin has been reported to cause prolongation of the QT interval if the patient is taking other medicines that also prolong the QT interval. However, this is usually associated with prolonged IV infusions and is not a clinically significant consideration when administering one or two IM doses.
- Oxytocin must not be administered IV unless instructed to do so by a lead maternity carer or a doctor via the Clinical Desk. Oxytocin IV must be given by infusion because IV boluses carry a high risk of causing hypotension. The dose and method of administration must be discussed with the lead maternity carer or doctor, but commonly 10-40 units of oxytocin will be placed into a 1 litre bag of 0.9% sodium chloride and administered over 1-4 hours.

12.32 Paracetamol

Mechanism of action

- Paracetamol inhibits the production of prostaglandins resulting in a reduction in pain and fever.

Delegated scopes of practice

- EMTs, Paramedics and ICPs.

Indications

- ✔ Mild or moderate pain, usually in combination with other medicines.
- ✔ May be administered in addition to other medicines for severe pain, particularly if the transport time is long.

Contraindications

- ✖ Known severe allergy.
- ✖ Current paracetamol poisoning.

Cautions

- ⊖ The patient has taken paracetamol within the last four hours. Paracetamol is contained in many products such as cold and flu tablets/drinks, cough mixtures, combination pain relievers and migraine tablets. Additional paracetamol may be administered provided it is clear that the total dose taken within a four hour period does not exceed the dose described within the CPGs. Withhold paracetamol if there is any doubt.
- ⊖ Abdominal pain, particularly if the patient is very unwell or vomiting. Clinical judgement 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.
- ⊖ Known severe liver disease. Liver disease must be severely impaired before paracetamol clearance is altered, but the balance of risk is such that paracetamol should usually be withheld in this setting.

Use in pregnancy or when breastfeeding

- Safe and may be administered if indicated.

Dosage

- 1.5 g PO for an adult weighing greater than 80 kg.
- 1 g PO for an adult weighing 80 kg or less.
- See the paediatric drug dose tables for a child. Always ask a parent (or guardian) of a young child if the child can swallow tablets and consider administering syrup.

- The doses described are slightly higher than those commonly used in healthcare and in the community. However, these doses are safe and effective provided they are not continued for a prolonged period of time.

Administration

- Administer PO.

Common adverse effects

- None.

Usual onset of effect

- 30-60 minutes.

Usual duration of effect

- 4-6 hours.

Usual preparation

- 500 mg tablets.
- Syrup containing 50 mg/ml.

Pharmacokinetics

- Paracetamol is metabolised in the liver.
- If liver impairment is severe, paracetamol clearance will be significantly delayed.

Common interactions

- None.

Additional information

- Paracetamol is not indicated for the treatment of fever because fever may confer some benefit if the patient has an infection. However, paracetamol may be administered if the patient has a temperature greater than 39 degrees and the fever is causing discomfort.
- Paracetamol is not indicated for pain associated with myocardial ischaemia.
- All personnel (including those without ATP) may give paracetamol to a patient for self-administration, provided the package instructions are followed.

12.33 Prednisone

Mechanism of action

- Prednisone 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.

Delegated scopes of practice

- EMTs, Paramedics and ICPs.

Indications

✔ Bronchospasm associated with asthma or CORD.

✔ Prominent rash associated with anaphylaxis, provided all systemic signs of anaphylaxis have resolved.

✔ Minor allergy associated with rash.

Contraindications

✖ Known severe allergy.

✖ Age less than one year.

Cautions

⊖ Age less than five years with asthma. Prednisone does not usually have a role in children aged less than five years because it does not generally alter the course of their asthma exacerbation. However, prednisone is indicated if the child has a clear history of asthma and has previously received oral steroids.

Use in pregnancy or when breastfeeding

- Safety has not been demonstrated during pregnancy. However, there is significant clinical experience with prednisone and it appears to be safe. Prednisone should be administered if there is bronchospasm, but should be withheld if the clinical problem is minor, for example rash or itch.
- May be administered if the patient is breastfeeding. Advise the patient to stop breastfeeding and seek further advice from their lead maternity carer.

Dosage

- 40 mg for an adult.
- See the paediatric drug dose tables for a child. Always ask a parent (or guardian) of a young child if the child can swallow tablets.
- If the patient is already taking prednisone:
  a) Administer an additional full dose if the patient is taking a dose that is lower than that described in these CPGs. If the patient is not transported

by ambulance to a medical facility, advise the patient to discontinue their usual prednisone, take the prednisone supplied by ambulance personnel and have their treatment reviewed by a doctor (preferably their own GP) within two days.

b) Do not administer an additional dose if the patient is taking a dose equal to or higher than that described in these CPGs. If the patient is not transported by ambulance to a medical facility, advise the patient to continue taking their usual prednisone and have their treatment reviewed by a doctor (preferably their own GP) within two days.

Administration

- Administer PO.
- Prednisone tablets are very bitter. Do not crush prednisone tablets because this may cause vomiting and ensure the tablets are swallowed as quickly as possible once in the patient's mouth.

Common adverse effects

- Bitter taste.
- Fatigue.
- Sodium and water retention. This may worsen hypertension and heart failure, but is usually only of clinical significance with prolonged dosing.
- Gastrointestinal reflux.

Usual onset of effect

- 30-60 minutes.

Usual duration of effect

- 24 hours.

Usual preparation

- 20 mg tablets.
- The tablets may be divided. The tablet does not always break evenly and this is not of clinical importance. The larger piece of the divided tablet should be chosen for administration.

Pharmacokinetics

- Prednisone is predominantly metabolised by the liver.
- There are no significant effects from liver impairment on acute administration.

Common interactions

- None.

Prednisone packs

- If the patient is aged 10 years or older and is not transported, a prednisone pack should be provided unless the patient already has an asthma or CORD action plan for administering their own prednisone.
- Also provide an information sheet, ensuring the information is explained to the patient and to any carers.
- The pack contains four days' supply of prednisone and this is usually sufficient for a complete course of prednisone. However, it is important to advise the patient to be seen by a GP (preferably their own) for a review of their treatment within two days.

12.34 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.

Delegated scopes of practice

- ICPs.

Indications

✔ Neuromuscular blockade is required following endotracheal intubation:

a) Rocuronium is routinely administered following rapid sequence intubation (RSI).

b) Rocuronium is administered if the patient shows clinically significant signs of moving following intubation without RSI.

✔ Patient movement during cardiac arrest that is significant enough to interfere with resuscitation, despite ketamine administration.

Contraindications

✖ Endotracheal placement has not been confirmed by capnography.

✖ Known severe allergy.

Cautions

⊖ Chronic muscle weakness. Examples include myasthenia gravis, motor neuron disease and muscular dystrophy. Rocuronium may cause prolonged muscle weakness and should be withheld if possible. If rocuronium is administered the dose should be halved.

⊖ An adult with a very poor prognosis. Examples include severe comorbidities requiring long term care, unwitnessed cardiac arrest and cardiac arrest with a first rhythm of asystole. Rocuronium should be withheld if possible because the patient is unlikely to benefit from admission to an intensive care unit and may be extubated in the ED.

Use in pregnancy or when breastfeeding

- Safe and should be administered when indicated.

Dosage

- 50 mg IV for an adult weighing 50-80 kg.
- 100 mg IV for an adult weighing greater than 80 kg.
- See the paediatric drug dose tables for a child.
- Repeat as required.

Administration

- Administer IV as a bolus.

Common adverse effects

- None.

Usual onset of effect

- 1-2 minutes.

Usual duration of effect

- 30-60 minutes.

Usual preparation

- Ampoule containing 50 mg in 5 ml.

Pharmacokinetics

- Rocuronium is metabolised in the liver and excreted in urine.
- Significant hepatic or renal impairment will delay clearance and prolong the duration of effect.

Common interactions

- None.

Additional information

- Rocuronium is a non-depolarising neuromuscular blocker. This means that the acetylcholine receptor at the neuromuscular junction is not stimulated prior to being blocked and no fasciculations will occur. This is in contrast to suxamethonium which is a depolarising neuromuscular blocker. Suxamethonium binds to the acetylcholine receptor at the neuromuscular junction and stimulates the receptor before blocking it, resulting in brief muscle contractions which are seen as fasciculations.
- During cardiac arrest the blood flow generated by CPR may be insufficient to deliver adequate levels of rocuronium to skeletal muscle and neuromuscular blockade may not occur. If sustained ROSC is achieved, neuromuscular blockade will occur and the patient will require an adequate level of sedation.
- Adequate sedation must always be administered to a patient if rocuronium is administered. See the 'post intubation' section.

12.35 Salbutamol

Mechanism of action

- Salbutamol is a bronchodilator. It is an agonist (stimulator) of beta-2 receptors.

Delegated scopes of practice

- EMTs, Paramedics and ICPs.

Indications

✔ Bronchospasm secondary to asthma or CORD.

✔ Prominent bronchospasm secondary to airway burns or smoke inhalation.

Contraindications

✖ Known severe allergy.

Cautions

⊖ None.

Use in pregnancy or when breastfeeding

- Safe and may be administered if indicated.

Dosage

- 5 mg. The initial dose is combined with 0.5 mg of ipratropium, but subsequent doses are not.

Administration

- Administer nebulised undiluted.

Common adverse effects

- Tremor.
- Tachycardia.

Usual onset of effect

- 2-5 minutes.

Usual duration of effect

- 1-2 hours.

Usual preparation

- Ampoule containing 5 mg in 2.5 ml.
- Ampoule containing 2.5 mg in 2.5 ml.

Pharmacokinetics

- Only a small amount of the nebulised dose is absorbed, with most of the dose being nebulised to the atmosphere. The inhaled salbutamol is absorbed through the lungs and some is swallowed.
- Salbutamol is metabolised in the liver and excreted in urine.
- Liver and kidney impairment do not significantly alter acute administration.

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.

Additional information

- Salbutamol does not have a significant role in the treatment of bronchospasm as a result of smoke, toxic gas inhalation or chest infection. However, it may be administered if bronchospasm is prominent.

12.36 8.4% 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.
- Following crush injury 8.4% sodium bicarbonate may have a role because:
  a) Sodium ions help protect cardiac cell membranes from the effects of hyperkalaemia.
  b) A rise in pH results in potassium moving into the cells, which lowers the potassium concentration in blood.
  c) A rise in urinary pH reduces myoglobin deposition in the kidneys.

Delegated scopes of practice

- ICPs.

Indications

✔ 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.

✔ ECG signs of hyperkalemia following crush injury.

Contraindications

✖ None.

Cautions

⊖ IV access via a small vein. 8.4% sodium bicarbonate is hyperosmolar and will cause venous irritation if administered via a small vein.

Use in pregnancy or when breastfeeding

- Safety has not been demonstrated, but 8.4% sodium bicarbonate should be administered if indicated.

Dosage

- 50 mmol (50 ml) for an adult.
- Repeat the dose if the ECG signs of hyperkalaemia persist or recur.
- Seek clinical advice for a child.

Administration

- Administer IV over one 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 0.9% sodium chloride between medicines.

Common adverse effects

- None.

Usual onset of effect

- 1-2 minutes.

Usual duration of effect

- 1-2 hours.

Usual preparation

- Ampoule containing 1 mmol/ml of sodium bicarbonate.
- Ampoules may be 10 ml, 50 ml or 100 ml.

Pharmacokinetics

- 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.

Common interactions

- None.

Additional information

- Document the dose administered as mmol.
- 8.4% sodium bicarbonate may have a role in cyclic antidepressant poisoning if there are signs of severe cardiovascular compromise.
  a) Part of the toxicity from cyclic antidepressants comes from the drug binding to sodium channels within the heart and this may be reduced by a large dose of sodium ions.
  b) The total dose of sodium ions administered is more important than the nature of the IV fluid containing sodium. 100 ml of 8.4% sodium bicarbonate contains 100 mmol of sodium and 1 litre of 0.9% sodium chloride contains 150 mmol of sodium. 100 ml of 8.4% sodium bicarbonate may be administered IV in addition to 0.9% sodium chloride, provided 8.4% sodium bicarbonate is immediately available, but there is usually no role for calling for 8.4% sodium bicarbonate to be delivered to the scene.
- 8.4% sodium bicarbonate will cause a rise in carbon dioxide concentration within blood because bicarbonate combines with hydrogen ions and dissociates into water and carbon dioxide. However, the rise in carbon dioxide concentration is not usually clinically significant unless the patient has inadequate breathing.

12.37 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 central nervous system.

Delegated scopes of practice

- Paramedics and ICPs.

Indications

✔ Status epilepticus that has not responded to two doses of midazolam.

Contraindications

✖ Known severe allergy.

Cautions

⊖ None.

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

- 1200 mg for an adult.
- See the paediatric drug dose tables for a child.

Administration

- Administer IV over 10-15 minutes, preferably into a running IV line.
- The ampoules are usually supplied with a 4 ml ampoule of water for reconstitution. The water ampoule may be discarded and 0.9% sodium chloride used for reconstitution.
- Dissolve each ampoule using 4 ml of 0.9% sodium chloride. Draw up the ampoules into one syringe and dilute further to a total of 10 ml if the volume is less than this. Administer 1 ml IV every 1-2 minutes.

- Valproate may be added to a 100 ml bag of 5% glucose. Shake well and label.
  a) Do not use in a child if their weight has been rounded to less than 20 kg. This is because of the risk of hyponatraemia.
  b) 2-3 drops per second via a standard IV administration set will deliver 100 ml over 10-15 minutes.
  c) The administration set will need to be flushed with 0.9% sodium chloride to ensure that all of the valproate has been administered.
- 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.

Pharmacokinetics

- Valproate is predominantly metabolised in the liver.
- There are no significant effects from liver impairment on acute administration.

Common interactions

- None.

Additional information

- Sodium valproate may be documented as valproate.
- Paramedics must call for backup from an ICP if valproate is to be administered.

12.38 Suxamethonium

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.

Delegated scopes of practice

- ICPs.

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). In susceptible patients suxamethonium will trigger life-threatening 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. Examples include muscular dystrophy and motor neurone disease. Long term muscle weakness causes proliferation of acetylcholine receptors on skeletal muscle and suxamethonium may cause life-threatening hyperkalaemia.

✖ Hyperkalaemia is strongly suspected. Suxamethonium will cause a brief rise in the potassium concentration within blood of 0.5-1 mmol/litre. In the presence of hyperkalemia this rise may be significant.

Cautions

⊖ None.

Use in pregnancy or when breastfeeding

- Safe and should be administered if indicated.

Dosage

- 200 mg for an adult weighing greater than 80 kg.
- 150 mg for an adult weighing less than or equal to 80 kg.
- See the paediatric drug dose tables for a child.
- The onset of adequate neuromuscular blockade may be delayed if cardiac output is very low. Consider increasing the dose of suxamethonium to approximately 3 mg/kg, up to a maximum of 200 mg.

Administration

- Administer undiluted for an adult or a large child.
- Dilute 100 mg to a total volume of 10 ml for a small child. This solution contains 10 mg/ml.
- Administer IV as a bolus.

Common adverse effects

- Bradycardia. This is due to stimulation of acetylcholine receptors in the parasympathetic nervous system and is usually only clinically significant in small children.

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 containing 100 mg in 2 ml.

Pharmacokinetics

- Suxamethonium is metabolised by the enzyme pseudocholinesterase. Metabolism is rapid and in most patients suxamethonium is cleared within 4-8 minutes.
- The neuromuscular blocking effects of suxamethonium can be increased to 4-12 hours if the patient has pseudocholinesterase deficiency.
- Pseudocholinesterase deficiency is rare.

Common interactions

- None.

Additional information

- Without refrigeration suxamethonium loses approximately 5-10% of activity per month. Suxamethonium may be safely stored in kits provided it is discarded after three months. Suxamethonium in stores and on station should remain refrigerated.
- Suxamethonium is a depolarising neuromuscular blocker. This means that the acetylcholine receptor at the neuromuscular junction is stimulated prior to being blocked and muscle fasciculations occur prior to the onset of neuromuscular blockade.
- Malignant hyperthermia (MH) is a rare, inherited disorder of muscle metabolism affecting approximately 20 families in New Zealand, many of

whom are in the Manawatu area. When exposed to some anaesthetic agents (including suxamethonium) the patient may develop a life-threatening hypermetabolic state with severe hyperthermia. Patients with MH (or a family history of MH) usually know about it.

- 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.

12.39 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.

Delegated scope of practice

- Paramedics and ICPs.

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 last six weeks.
✖ Intracranial surgery within the last six months.
✖ Ischaemic stroke within the last six months.
✖ Previous intracerebral haemorrhage.
✖ Known cerebral aneurysm, arterio-venous malformation or tumour.

Cautions

⊖ 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 six weeks.
⊖ TIA within the last three months.
⊖ Known bleeding disorder.
⊖ Taking warfarin or dabigatran. If the patient is taking warfarin document their last known INR result if possible.
⊖ Systolic BP greater than 180 mmHg or diastolic BP greater than 110 mmHg.
⊖ Known to be pregnant or less than two weeks postpartum.

Additional comment

- All of the contraindications and cautions relate to the risk of bleeding following the administration of a fibrinolytic agent.

Use in pregnancy or when breastfeeding

- Administration during pregnancy or within two weeks of birth carries a significant risk of bleeding. The likelihood of STEMI occurring in a woman who is pregnant or within two weeks of birth is very low and personnel must discuss this with the STEMI Coordinator or 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

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

	Age less than 75 years		Age 75 years or older	
Weight	**Tenecteplase (dose IV)**	**Tenecteplase (volume IV)**	**Tenecteplase (dose IV)**	**Tenecteplase (volume IV)**
<60 kg	30 units	6 ml	15 units	3 ml
60-69 kg	35 units	7 ml	17.5 units	3.5 ml
70-79 kg	40 units	8 ml	20 units	4 ml
80-89 kg	45 units	9 ml	22.5 units	4.5 ml
≥90 kg	50 units	10 ml	25 units	5 ml

Administration

- Dissolve the powder using the syringe within the kit.
- Discard unwanted drug from the syringe before administration.
- If an error is made in discarding unwanted drug and the dose remaining in the syringe is less than planned, contact the STEMI Coordinator for advice.
- 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 in the usual manner.

Usual onset of effect

- 5-10 minutes.

Usual duration of effect

- 2-6 hours.

Pharmacokinetics

- Tenecteplase is metabolised by the liver.
- There are no significant effects from liver dysfunction on acute administration.

Usual preparation

- Glass ampoule containing 50 mg of tenecteplase, in powder form with a pre-filled syringe containing 10 ml of sterile water.

Common interactions

- None.

Additional information

- 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. If intracerebral bleeding occurs the patient will usually have sudden onset of headache, a falling level of consciousness and focal neurological signs.

12.40 Tramadol

Mechanism of action

- Tramadol is an analgesic. It has multiple actions within the central nervous system, including opiate receptor stimulation and inhibition of the re-uptake of noradrenaline and serotonin.

Delegated scopes of practice

- EMTs, Paramedics and ICPs.

Indications

✔ Moderate pain, usually in combination with paracetamol and ibuprofen.

✔ Tramadol may be administered for severe pain if no suitable personnel are available to administer an opiate. However, do not administer tramadol if an opiate 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 last four hours. Additional tramadol may be administered provided it is clear that the total dose taken within a four hour period does not exceed the dose described within the CPGs. Withhold tramadol if there is any doubt.

⊖ Abdominal pain, particularly if the patient is very unwell or vomiting. Clinical judgement 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 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. Tramadol has anti-cholinergic activity and this may worsen confusion.

⊖ Pregnancy.

Use in pregnancy or when 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

- 50 mg for a patient aged 12 years or older.

Administration

- Administer PO.

Common adverse effects

- Nausea and/or vomiting.
- Lightheadedness or feeling unusual.
- Sedation.
- Dry mouth.

Usual onset of effect

- 30-60 minutes.

Usual duration of effect

- 4-8 hours.

Usual preparation

- 50 mg tablets.

Pharmacokinetics

- 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 has been reported to cause serotonin syndrome in patients taking other medicines or recreational drugs 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.

Additional information

- 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 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.

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