Clinical Practice Guidelines

2011–2013

St John

first to care

CLINICAL PRACTICE GUIDELINES 2011 - 2013

Foreword

This is the comprehensive edition of the clinical practice guidelines, incorporating standing orders, developed for the ambulance sector of New Zealand.

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

These clinical practice guidelines expire at the end of 2013 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 clinical practice guidelines 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 or persons as a result of, or arising out of, the use of these clinical practice guidelines by persons other than authorised personnel.

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AUTHORITY TO PRACTICE AND PRACTICE LEVELS

Ambulance and Defence Force personnel cannot legally supply or administer prescription medicines to patients unless they have authority to practice or they are a Registered Health Practitioner with this ability described within their scope of practice by their registering authority. In addition, services restrict the use of some items of clinical equipment and some clinical interventions to specific personnel.

Authority to practice is the granting of authorisation to a specific person to supply or administer prescription medicines to patients or to use specific items of clinical equipment or to perform specific interventions, by and under the oversight of a doctor specifically tasked by the service. All clinical care provided to patients (beyond first aid) must comply with these clinical practice guidelines. Personnel may not use these clinical practice guidelines without individual authority to do so.

Authority to practice is granted at a specified practice level (listed below). Under each practice level is a delegated scope of practice. A delegated scope of practice defines the medicines and interventions personnel may administer or use when providing patient care. Ordinary interventions not formally described within any delegated scope of practice (for example, automated defibrillation) can be performed by all personnel.

Practice levels and delegated scopes of practice

Primary Care

Entonox, methoxyflurane.

Emergency Medical Technician (BLS)

All of the above, plus nasopharyngeal airway, nebulised salbutamol, nebulised ipratropium, GTN spray, IM glucagon, laryngeal mask airway, oral ondansetron, oral loratadine, nebulised adrenaline, PEEP valve, tourniquet.

Paramedic (BLS)

All of the above, plus manual defibrillation, synchronised cardioversion, IV cannulation, IV fluid administration, IV glucose, SC lignocaine for IV cannulation.

Paramedic (ILS)

All of the above, plus morphine, fentanyl, naloxone, IV or IM ondansetron, IM adrenaline, IV adrenaline for cardiac arrest, IV amiodarone for cardiac arrest, ceftriaxone, naloxone, IM and IN midazolam for seizures.

Intensive Care Paramedic (ALS)

All of the above, plus laryngoscopy, endotracheal intubation, capnography, cricothyrotomy, chest decompression, IO access, IO lignocaine, adrenaline, atropine, amiodarone, adenosine, midazolam, ketamine, pacing, vecuronium, suxamethonium (selected personnel only).

GENERAL PRINCIPLES OF TREATMENT

- Although not listed with each section, all patients require a primary and secondary survey, with appropriate intervention as required.
- Unless otherwise specified, all of the medicine doses and fluid volumes specified in these guidelines are for adults and children weighing ≥ 50 kg. See the paediatric pages for children weighing < 50 kg.
- All medicines have universal contraindications and as such they are not repeatedly listed with each medicine:

  a) Life threatening allergy to the medicine or its constituents is an absolute contraindication.

  b) Significant (but not life threatening) allergy is a relative contraindication and the medicine should not be administered unless there is a very strong indication to do so.

  c) Pregnancy (particularly in the first trimester) or breast feeding are relative contraindications and the medicine should not be administered unless there is a very strong indication to do so.

- Specific additional contraindications and cautions for medicine administration are listed in each section and further details are in the medicines section.

WHEN TREATMENT GIVEN DIFFERS FROM THAT DESCRIBED IN THESE GUIDELINES

There are some circumstances where it is permissible to provide treatment that differs from that described in these guidelines.

Providing a treatment not described in these guidelines and not within delegated scope of practice (e.g. administration of insulin).

This is permissible in the following three circumstances:

1. When in direct communication with, and asked to do so by, a St John Medical Advisor. The audit copy of the PRF must be sent to the Medical Advisor for audit. The person administering the treatment is responsible for ensuring this occurs.
2. When taking part in a clinical trial, feasibility trial or alternative care pathway that has been formally introduced by St John.
3. Some patients with specific needs have their own medicines for self-administration, or for administration by carers, in the event of an emergency. All personnel may administer such medicines provided:
    - There are clear written instructions **and**
    - They are capable of providing the treatment described.

If personnel are unsure they should seek urgent advice from a Medical Advisor or from the most senior doctor available within the Emergency Department the patient will be transported to.

Providing a treatment described in these guidelines but is not within delegated scope of practice (e.g. an emergency medical technician giving IM adrenaline for anaphylaxis).

This is permissible in the following three circumstances:

1. When in direct communication with, and asked to do so by, a St John Medical Advisor. The audit copy of the PRF must be sent to the Medical Advisor for audit. The person administering the treatment is responsible for ensuring this occurs.

2. When in direct communication with, and asked to do so by another doctor (other than a St John Medical Advisor) or by an intensive care paramedic on the clinical desk within the ambulance communications centre. Under these circumstances all of the following criteria must be met:
   - If the advice is coming from a doctor, they must either be present at the scene or be the most senior doctor available within the Emergency Department the patient will be transported to **and**
   - If the advice is coming from a doctor, their name and contact details must be documented on the PRF **and**
   - The treatments permissible are restricted to: nebulised salbutamol, nebulised ipratropium, sublingual GTN, IM glucagon, nebulised adrenaline or IM adrenaline **and**
   - The audit copy of the PRF must be sent (along with a note describing the circumstances) to a Medical Advisor for audit. The person administering the treatment is responsible for ensuring this occurs.

3. When treatment is provided by a student or trainee under the direct supervision of ambulance personnel. Under these circumstances all of the following criteria must be met:
   - The student or trainee is enrolled on a course that upon completion will make them eligible to seek authority to practice at a level that would include the treatment being provided **and**
   - The student or trainee has been taught how to provide that treatment **and**
   - The person providing the supervision has that treatment within their own delegated scope of practice and takes responsibility for the provision of that treatment **and**
   - The patient (if competent) is asked to consent to have treatment provided by a student or trainee.

Providing a treatment not described in these guidelines but is within delegated scope of practice (e.g. an emergency medical technician giving nebulised salbutamol for hyperkalaemia or an intensive care paramedic giving IV midazolam for pain relief).

This is permissible in the following two circumstances:

1. An intensive care paramedic may do so provided that the circumstances are exceptional and the audit copy of the PRF is sent (along with a note describing the circumstances) to a Medical Advisor for audit. The person administering the treatment is responsible for ensuring this occurs.

2. Personnel other than intensive care paramedics may only do so when in direct communication with, and asked to do so by, a doctor. A doctor may request personnel to provide treatment not described in these guidelines. Personnel may follow the request provided they believe it is consistent with good clinical practice and the treatment itself is within their delegated scope of practice. If personnel are asked to provide treatment they believe is inconsistent with good clinical practice they should decline the request. The name and contact details of the doctor must be recorded on the PRF, which must be sent (along with a note describing the circumstances) to a Medical Advisor for audit. The person administering the treatment is responsible for ensuring this occurs.

Providing a treatment within the scope of practice of a registered health professional (e.g. a registered nurse giving a treatment within their nursing scope of practice).

A registered health professional may choose to provide a treatment to a patient, even if this treatment is not within their delegated scope of practice, as defined within these guidelines. Under these circumstances all of the following criteria must be met:

- The treatment must be within their scope of practice, as defined by their registering authority **and**
- The treatment must be consistent with the emergency care principles contained within these guidelines **and**
- The audit copy of the PRF must be sent (along with a note describing the circumstances) to a Medical Advisor for audit. The person administering the treatment is responsible for ensuring this occurs.

Clinical trials

St John is 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 trial protocols and enter all eligible patients into clinical trials undertaken by St John.

PERSONAL NOTES

1.1 ASTHMA

- Give 5 mg salbutamol with 0.5 mg ipratropium by nebuliser. Repeat as required and give continuously if severe.
- Give 0.3-0.5 mg adrenaline IM if the patient is:
  a) Status one **or**
  b) Status two and not rapidly improving.
- Gain IV access if the patient is not rapidly improving.
- Give IV adrenaline if the patient is status one and not rapidly improving. Place 1 mg adrenaline in a 1 litre bag of 0.9% NaCl:
  a) Give as an IV infusion (preferred approach). Start at 2 drops per second and adjust the rate to the patient's condition **or**
  b) Give 10 ml (0.01 mg) every 1-2 minutes.
- IM adrenaline may be repeated every 10 minutes if IV access cannot be obtained.

NOTES

- Asthma is reversible bronchoconstriction. 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 to moderate asthma are short of breath but moving air and able to speak sentences. They usually don't have significant chest or neck indrawing.
- Patients with severe to life threatening asthma are very short of breath, not moving much air and unable to speak more than a few words per breath. They usually have marked indrawing (unless exhausted) and may not have wheeze, as they may not be moving enough air to create noise. These patients should be given adrenaline as a priority.
- Patients with a falling level of consciousness are at high risk and should be treated aggressively.
- Children aged less than 1 year who are short of breath and wheezy usually have bronchiolitis, not asthma. Children aged less than 1year have poorly developed bronchial smooth muscle and fewer beta 2 receptors than adults and bronchodilators are unlikely to provide benefit. Bronchodilators do not have a significant role in the treatment of bronchiolitis and should be rarely used in this setting. Instead, the focus of treatment should be on treating hypoxia.

- 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. In general, IV access should be obtained in all children who receive IM adrenaline.
- Many patients have a spacer through which they deliver their inhaled medications. Spacers are very effective for the majority of patients if their exacerbation is mild to moderate. If their asthma plan includes the administration of bronchodilators via MDI and spacer (commonly 1 puff, with 6 breaths to empty the spacer after each puff, repeated 6 to 12 times) allow them to continue to follow this plan rather than giving them nebulised bronchodilators. Spacers that are visibly very cloudy or very dirty on the inside are less effective and in this setting consideration should be given to using nebulised bronchodilators instead. Turbuhalers (e.g. bricanyl) must not be used with a spacer.
- Nebulised bronchodilators may be given if wheeze is present as a result of smoke or toxic gas inhalation.
- In general, a dose of 0.5 mg adrenaline IM is appropriate for the majority of adult patients. Reduce the dose if the patient is small, elderly or has ischaemic heart disease.
- The preferred site for IM adrenaline is the lateral thigh as this has the best absorption. If this site is not suitable use the lateral upper arm.
- Adrenaline administration can make a 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 giving more adrenaline.
- Heart failure may produce a wheeze that sounds like asthma. If the patient is over the age of 60 years, with no history of asthma, the wheeze is unlikely to be due to asthma and the possibility of cardiogenic pulmonary oedema should be considered:
    a) Cardiogenic pulmonary oedema is the likely diagnosis when the patient has been supine (e.g. 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.
    b) 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.
    c) Wheeze and/or crackles that are unilateral, limited to one lobe/area only, or exist in the presence of a productive cough or elevated temperature, are more likely to be due to a chest infection.

- Some patients may have a history of both asthma and heart failure. In this setting the patient may be able to tell you which condition is causing their shortness of breath.
- Dynamic hyperinflation 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 veinous return to the heart by increasing intra-thoracic pressure. The patients most at risk of life threatening dynamic hyperinflation are those receiving assisted ventilation. For this reason the ventilation rate must be kept at 6 breaths per minute in patients receiving assisted ventilation for life threatening asthma.
- Tension pneumothorax due to asthma is 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 and should only be undertaken if there are convincing clinical signs of tension pneumothorax.

1.2 CHRONIC OBSTRUCTIVE RESPIRATORY DISEASE

- Only give oxygen if required to maintain SpO_2 88-92%.
- Give 5 mg salbutamol with 0.5 mg ipratropium by nebuliser. Alternate 5 minutes with the nebuliser mask on and 5 minutes with the nebuliser mask off, if SpO_2 is > 92% during nebuliser delivery.
- Give 0.3-0.5 mg adrenaline IM if the patient is status one and not improving.
- Give IV adrenaline if the patient is status one and deteriorating despite IM adrenaline. Place 1 mg adrenaline in a 1 litre bag of 0.9% NaCl:
  a) Give as an IV infusion (preferred approach). Start at 2 drops per second and adjust the rate to the patient's condition **or**
  b) Give 10 ml (0.01 mg) every 1-2 minutes.

NOTES

- Chronic obstructive respiratory disease (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 life threatening CORD may not be wheezy because they may not be moving enough air to create wheeze.
- It is necessary to distinguish CORD from asthma because the treatments are different. Patients with asthma are usually less than 50 years of age and are symptom free between attacks. Patients with CORD are usually long term smokers, over 50 years of age and are not symptom free between attacks.
- For some patients their carbon dioxide clearance is dependent on hypoxia. Excess oxygen administration in these patients may cause hypercarbic respiratory failure and this is why we instruct that oxygen flow be titrated to an SpO_2 of 88-92%. The mechanisms by which excess oxygen administration causes hypercarbic respiratory failure are controversial and complex. They include:
  a) Reversal of hypoxic pulmonary vasoconstriction, causing high levels of CO_2 in poorly ventilated alveoli to diffuse back into the circulation.
  b) Decrease in ventilatory drive.
  c) Decreased CO_2 buffering capacity of haemoglobin.
  d) Absorption of CO_2 from alveoli beyond obstructed airways.

e) The higher density of oxygen compared with air causing increased work of breathing.

- Patients at risk of hypercarbic respiratory failure often have a card or letter describing specific instructions for oxygen therapy. These instructions should be followed.
- The reason we instruct personnel to alternate 5 minutes with the nebuliser mask on and 5 minutes with the nebuliser mask off is to limit oxygen exposure whilst delivering most of the nebulised drug. This alternating should not occur if the patient's SpO_2 remains less than or equal to 92% during nebuliser delivery.
- 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 stepped down to a lower flow (targeting an SpO_2 of 88-92%) and the patient reassessed.
- Consider assisting the patient's ventilation early (without added oxygen unless required to maintain SpO_2 88-92%), using a manual ventilation bag if:
  a) SpO_2 continues to fall below 80% despite treatments **or**
  b) The patient is becoming exhausted **or**
  c) The patient is suspected of developing hypercarbic respiratory failure despite lowering the oxygen flow.
- Adrenaline administration carries a risk of exacerbating myocardial ischaemia. This is why it is reserved for patients who are status one and failing to improve despite treatment.
- In general, a dose of 0.5 mg adrenaline IM is appropriate for the majority of adult patients. Reduce the dose if the patient is small, elderly or has ischaemic heart disease.
- The preferred site for IM adrenaline is the lateral thigh as this has the best absorption. If this site is not suitable use the lateral upper arm.
- Adrenaline administration can make a 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 giving more adrenaline.

- Heart failure may produce a wheeze that sounds like CORD. Differentiating cardiogenic pulmonary oedema from CORD is not always easy:
  a) Cardiogenic pulmonary oedema is the likely diagnosis when the patient has been supine (e.g. 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.
  b) 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.
  c) Wheeze and/or crackles that are unilateral, limited to one lobe/area only, or exist in the presence of a productive cough or elevated temperature, are more likely to be due to a chest infection.
- Some patients may have a history of both CORD and heart failure. In this setting the patient may be able to tell you which condition is causing their shortness of breath.

1.3 STRIDOR

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

- Give 5 mg nebulised adrenaline if there is resting stridor or moderate to severe respiratory distress.
- Repeat nebulised adrenaline as required every 10 minutes.

NOTES

- 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 too (biphasic stridor).
- Predominantly inspiratory stridor suggests obstruction above the vocal cords, whilst stridor with an expiratory component suggests obstruction at or below this level.
- 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.
- The differential diagnosis of stridor includes:
  a) Croup.
  b) Epiglottitis.
  c) Tracheitis.
  d) Foreign body.
  e) Pharyngeal abscess.
  f) Anaphylaxis.
  g) Angioedema.
- Croup is a viral infection of the upper airway. It is the most common cause of stridor in children, especially children aged 6 months to 2 years. The child usually has a slow onset 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 commonly in children aged 2 - 7 years but is now just as common in adults. The onset of illness is relatively quick (over hours), the patient often has a very sore throat, difficulty swallowing (which may cause drooling) and a high fever. Epiglottis is an emergency as 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 Staphylococcus aureus and is often a secondary infection, following a viral infection.
- Foreign body aspiration is most common in young children, the elderly and the intoxicated. A history of coughing and/or choking that precedes development of stridor may be present.
- Pharyngeal abscess formation is associated with a slow onset illness (over days), a very sore throat, difficulty swallowing and a high fever. It is usually a complication of:
  a) Bacterial pharyngitis in young children **or**
  b) Tonsillitis in young adults **or**
  c) Trauma from a foreign body.
- Anaphylaxis causing stridor is always associated with some other signs of systemic involvement from severe allergy (e.g. hypotension, bronchospasm or rash). If there are no signs of systemic involvement then anaphylaxis is highly unlikely.
- Angioedema is a condition that results in intermittent, unexpected and unpredictable swelling of the mouth and face, in the absence of systemic signs of anaphylaxis. This often occurs in patients taking aspirin or angiotensin converting enzyme inhibitors.

1.4 OXYGEN ADMINISTRATION

Few sections contain specific instructions on oxygen and clinical judgement is required. Oxygen does not necessarily provide benefit and should usually only be given if the patient has:

- An SpO_2 < 94% on air (exception – see CORD section) **or**
- Airway obstruction **or**
- Respiratory distress (exception – see CORD section) **or**
- Shock **or**
- Inability to obey commands from TBI **or**
- Smoke inhalation **or**
- Carbon monoxide poisoning.

Use the simplest device and lowest flow rates to achieve the desired SpO_2. If pulseoximetry is unreliable or unavailable, give oxygen as appropriate based on the above bullet points.

The oxygen flow rates to be used are:

- Nasal prongs 1-4 l/min.
- Simple mask 6-8 l/min.
- Nebulised medicines 8 l/min.
- Reservoir mask 10-15 l/min.
- Manual ventilation bag 10-15 l/min.

NOTES

- Oxygen is a treatment for hypoxia. Oxygen is not a 'general treatment' for patients who are unwell or injured.
- When oxygen levels within blood are higher than normal, it causes blood vessels (particularly small arteries) to vasoconstrict. This has the potential to lower blood flow to tissue and organs, particularly if blood flow is already low. This is why oxygen administration is restricted to those patients who have an indication to receive it.
- For most patients nasal prongs or a simple mask will be sufficient. Reservoir masks should be reserved for patients with severe hypoxia. Manual ventilation bags should be reserved for patients requiring assistance with their breathing or requiring the application of PEEP for cardiogenic pulmonary oedema.
- A pulse oximeter gives a reading of how much oxygen (as a percentage of maximum capacity) is within arterial blood. A pulse oximetry reading does not indicate how well a patient is breathing. This is determined by clinical examination.

- Pulse oximetry can be unreliable if the patient is 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. Always look at the patient rather than the pulse oximeter.
- Cyanosis is blue discolouration of skin or mucus 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 $SpO_2 < 80\%$. Cyanosis is much more difficult to detect in patients who are anaemic, have brown or black skin or have been exposed to carbon monoxide. Central cyanosis (of the mouth and lips) is usually due to severe hypoxia. Peripheral cyanosis (of the extremities) in the absence of central cyanosis is usually due to vasoconstriction.

PERSONAL NOTES

PERSONAL NOTES

2.0 ASSESSING NON-TRAUMATIC CHEST PAIN

Introduction

Non-traumatic chest pain must be considered to be myocardial ischaemia until proven otherwise. The distribution of 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 should have a very low threshold for recommending that a patient with non-traumatic chest pain is immediately transported to a medical facility.

Symptoms

Typically patients with myocardial ischaemia will describe central pain or discomfort that is dull, heavy or compressing in nature and radiating to their neck, jaw or arms (particularly the left arm). 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.
- Breathlessness without pain.
- Fatigue.
- Weakness.
- Light headedness.
- A feeling of impending doom.

Some patients have silent myocardial ischaemia without pain or discomfort. The elderly and diabetics are particularly at risk of this. They may present with shortness of breath, fatigue, weakness, non-specific unwellness or light headedness.

Investigations and examination

A 12 lead ECG should be obtained in all patients with typical or atypical symptoms, noting that a normal 12 lead ECG does not rule out myocardial ischaemia. Up to 50% of patients having a myocardial infarction initially have a normal 12 lead ECG.

Although patients with myocardial ischaemia may be pale and sweaty, in the majority of patients physical examination reveals no significant abnormality.

Risk factors

Risk factors, such as family history, smoking, obesity, hypertension, diabetes and hypercholesterolemia are important but many patients without any known risk factors develop 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. Máori and Polynesians are at increased risk.

Response to treatment

Do not assume that an apparently good response to antacid indicates the pain is attributable to gastritis or that an apparently good response to GTN indicates the pain is attributable to stable angina. The pain associated with myocardial infarction is frequently irregular and administration of medication may have a placebo effect.

2.1 MYOCARDIAL ISCHAEMIA

This section is for adults. If the patient is a child, consult a medical specialist.

- Only give oxygen if required to achieve $SpO_2 \geq 94\%$.
- Determine and record the cardiac rhythm.
- Acquire a 12-lead ECG, provided this does not significantly delay treatment or transport. Transmit this ECG if appropriate.
- Give 0.4-0.8 mg GTN provided systolic BP >100 mmHg and heart rate between 40 and 150/min. Use caution if:
  a) The patient has poor perfusion **or**
  b) Dysrhythmia is present **or**
  c) The patient has taken a drug for erectile dysfunction in the last 24 hours.
- Give 300 mg aspirin.
- Gain IV access.
- Initiate thrombolysis if indicated.
- Repeat GTN every 2-5 minutes if it relieves symptoms.
- Give opiate pain relief if pain is significant. This should be morphine unless fentanyl is specifically indicated.

Use this section if you strongly suspect silent myocardial ischaemia. There should be objective evidence of myocardial ischaemia on the 12 lead ECG and no other obvious cause for their symptoms. In this circumstance only give repeated GTN if it is clearly associated with improvement.

NOTES

- Oxygen administration is now restricted to patients whose SpO_2 is below 94% on air. This is because supplemental oxygen may make myocardial ischaemia worse by causing vasoconstriction.
- Some patients have atypical pain or discomfort, including any combination of face, jaw, neck, arm or upper abdominal discomfort. Use this section if you strongly suspect this is due to myocardial ischaemia.
- Some patients have silent myocardial ischaemia without pain or discomfort. The elderly and diabetics are particularly at risk. They may present with shortness of breath, fatigue, weakness, non-specific unwellness or light headedness.
- Objective evidence of silent myocardial ischemia on a 12 lead ECG requires the presence of ST depression, or T wave inversion or T wave flattening.

Medicines for erectile dysfunction

- 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.
- GTN may interact with such medicines, causing severe and prolonged hypotension if they have been taken within the last 24 hours.
- GTN is not absolutely contraindicated in this setting but if used there must be a very strong indication and it must be used in 0.4 mg doses. If in doubt, seek medical advice.

2.2 CARDIOGENIC PULMONARY OEDEMA

This section is for adults. If the patient is a child, consult a medical specialist.

- Determine and record the cardiac rhythm.
- Acquire a 12-lead ECG, provided this does not significantly delay treatment or transport. Transmit this ECG if appropriate.
- Give 0.4-0.8 mg GTN provided systolic BP >100 mmHg and heart rate is between 40 and 150/min. Use caution if:
  a) The patient has poor perfusion **or**
  b) Dysrhythmia is present **or**
  c) The patient has taken a drug for erectile dysfunction in the last 24 hours.
- Gain IV access.
- Repeat GTN every 2-5 minutes if not improving, with the same precautions as above.
- If the patient has severe respiratory distress and is not improving:
  a) Apply PEEP set to 10. Focus on ensuring a tight seal with the mask. Do not assist the patient's breathing unless it is ineffective.
  b) Increase the PEEP to 15 if the patient does not improve
- IV morphine in 1 mg doses may be given for severe anxiety and/or respiratory distress.

NOTES

- Do not use this section for the treatment of pulmonary oedema associated with drowning or aspiration.
- Cardiogenic pulmonary oedema is most commonly caused by myocardial ischaemia or myocardial infarction. 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 respiratory distress.
- Allow the patient to adopt the position they feel most comfortable in. Where feasible, have the patient's legs in a dependent position.

Differentiating cardiogenic pulmonary oedema from asthma

- Heart failure may produce a wheeze that sounds like asthma. If the patient is over the age of 60 years, with no history of asthma, the wheeze is unlikely to be due to asthma and the patient should be evaluated for cardiogenic pulmonary oedema:

a) Cardiogenic pulmonary oedema is the likely diagnosis when the patient has been supine (e.g. 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.
b) 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.
c) Wheeze and/or crackles that are unilateral, limited to one lobe/area only, or exist in the presence of a productive cough or elevated temperature are more likely to be due to a chest infection.

- Some patients may have a history of both asthma and heart failure. In this setting the patient may be able to tell you which condition is causing their shortness of breath.

Medicines for erectile dysfunction

- 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.
- GTN may interact with such medicines, causing severe and prolonged hypotension if they have been taken within the last 24 hours.
- GTN is not absolutely contraindicated in this setting but if used there must be a very strong indication and it must be used in 0.4 mg doses. If in doubt, seek medical advice.

2.3 BRADYCARDIA

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

- Determine and record the cardiac rhythm.
- If the patient is unconscious with a heart rate less than 30/min, treat as cardiac arrest even if the pulse is palpable.
- Gain IV access and treat the underlying cause if obvious.
- Acquire a 12 lead ECG provided this does not significantly delay treatment or transport. Transmit this ECG if appropriate.
- If the heart rate is less than 50/min and the patient is significantly compromised:

If rhythm narrow complex: e.g. sinus or nodal bradycardia, 1st or 2nd degree block	**If rhythm broad complex: e.g. 3rd degree block**
1. Give 0.6 mg atropine IV. If atropine responsive repeat as required.	1. Initiate pacing.
2. If unresponsive to atropine give adrenaline.	2. If unresponsive to pacing give adrenaline.
3. If unresponsive to adrenaline initiate pacing.	

- Pacing: pace at a rate of 70/min. If the patient has significant pain from pacing, give IV fentanyl. Add low dose IV ketamine if required.
- To give IV adrenaline: place 1 mg adrenaline in a 1 litre bag of 0.9% NaCl.
  a) Give as an IV infusion (preferred approach). Start at 2 drops per second and adjust the rate to the patient's condition **or**
  b) Give 10 ml (0.01 mg) every 1-2 minutes.

NOTES

- Bradycardia in adults is most commonly caused by:
  a) 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.
  b) Structural heart disease involving the sinoatrial node, atrioventricular node or the conduction system. This is most common in elderly patients.
- Bradycardia may be prominent in patients who have taken large doses of a beta-blocker, particularly if taken in combination with a calcium-blocker. Patients who have taken large doses of these medicines in combination often require high dose adrenaline by infusion. Glucagon is sometimes recommended as part of the treatment for bradycardia caused by beta-blockers because it stimulates cells via a mechanism independent of the beta receptor. However, it rarely provides a sustained heart rate rise in addition to high dose adrenaline and it requires very high doses – much higher than we carry.
- 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 cause by a problem low in the conduction system, for example, below the atrioventricular node, is most likely to be responsive to pacing or adrenaline. In general, pacing is thought to have less cardiotoxicity than adrenaline which is why in this setting adrenaline is reserved for failure of the bradycardia to respond to pacing.
- Atropine may cause an initial worsening of bradycardia when given slowly. For this reason, it should be given as a fast IV push.

2.4 BROAD COMPLEX TACHYCARDIA

This section is for adults with ventricular tachycardia (VT) or an undifferentiated broad complex tachycardia with a rate greater than 150/min. Use this section even if the patient is not compromised. If the patient is a child, consult a medical specialist.

- Determine and record the cardiac rhythm.
- Gain IV access.
- Be prepared to treat cardiac arrest.
- Do not use GTN, even if the patient has cardiac chest pain.
- If the patient is significantly compromised go to step 1, if not, go to step 2.

1. If the patient is significantly compromised

- If the patient cannot obey commands:
  a) Cardiovert with 100J in synchronised mode. Repeat the cardioversion at 200J and then maximum joules 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 attach it in automatic mode and follow the instructions.
- If the patient can obey commands: cardiovert as above, giving low dose midazolam prior to each cardioversion.

2. If the patient is not significantly compromised

- Acquire a 12-lead ECG, provided this does not significantly delay treatment or transport. Transmit this ECG if appropriate.
- Give 300 mg amiodarone IV over 30 minutes provided you are more than 15 minutes from hospital.
- Use amiodarone with caution if the patient is poorly perfused and reduce the rate of administration if hypotension occurs.

NOTES

- A broad complex tachycardia is any tachycardia with a QRS duration of greater than 0.12 seconds. The rate is usually 150/min or more.
- A broad complex tachycardia is usually associated with haemodynamic compromise. In a significantly compromised patient, the broad complex tachycardia should be assumed to be VT and treated accordingly.
- GTN is not to be used for chest pain associated with broad complex tachycardia because of the risk of precipitating cardiac arrest.

Defining compromise

- Significant compromise is defined as the patient being likely to have a cardiac arrest unless immediate interventions are carried out. These patients may have any combination of:
  a) Shock - pallor, sweating, cold and clammy extremities, impaired consciousness and hypotension.
  b) Syncope.
  c) Cardiogenic pulmonary oedema.
  d) Myocardial ischaemia – indicated by significant chest pain. Myocardial ischaemia is especially important if there is underlying coronary artery or structural heart disease, as this increases the risk of cardiac arrest.
- Patients who are not significantly compromised will display some adverse signs, such as mild chest discomfort, mild cardiogenic pulmonary oedema or compensated shock but they do not manifest signs of impending cardiac arrest. Be prepared to cardiovert if the patient deteriorates.

Differentiating VT from SVT with aberrancy

- Supraventricular tachycardia (SVT) with aberrant (abnormal) conduction (e.g. bundle branch block) can mimic VT. Differentiating VT from SVT with aberrancy can be very difficult. Use this section if you are uncertain.
- VT is most likely if the patient is older, has ischaemic heart disease or is compromised. SVT with aberrancy is most likely if the patent 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 aberrancy.

Continued on page 36.

- No ECG interpretation method is completely accurate in this situation but the following ECG characteristics may help with determining whether a rhythm is most likely to be VT or SVT with aberrancy:
  a) Precordial concordance (where the QRS complexes in leads V1-V6 are either all negative or positive) is more likely with VT.
  b) The longer the QRS duration, the more likely it is to be VT.
  c) Regular frequency of QRS complexes is more likely with VT.
  d) Right axis deviation is more likely with VT.
  e) Capture beats (a normal narrow QRS occurring within a run of broad complex tachycardia) indicate AV dissociation and are more likely with VT.
  f) Fusion beats (when a normal and a wide complex QRS join to form a hybrid within a run of broad complex tachycardia) indicate AV dissociation and are more likely with VT.

2.5 NARROW COMPLEX TACHYCARDIA

This section is for adults with atrial fibrillation, atrial flutter, or supraventricular tachycardia (SVT). It is mainly intended for patients with cardiovascular compromise – particularly myocardial ischaemia. Patients with these rhythms who are not compromised should usually be transported without specific treatment. If the patient is a child, consult a medical specialist.

- Determine and record the cardiac rhythm.
- Acquire a 12-lead ECG, provided this does not significantly delay treatment or transport. Transmit this ECG if appropriate.
- If the patient is significantly compromised go to step 1, if not, go to step 2.

1. If the patient is significantly compromised

- If the patient cannot obey commands:
  a) Cardiovert with 100J in synchronised mode. Repeat the cardioversion at 200J and then maximum joules 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 attach it in automatic mode and follow the instructions.
- If the patient can obey commands: cardiovert as above, giving low dose midazolam prior to each cardioversion.

2. If the patient is not significantly compromised

- If the rhythm is SVT go to step 3.
- If the rhythm is atrial fibrillation or atrial flutter go to step 4.

3. If the rhythm is SVT

- If the ventricular rate is greater than 150/min:
  a) Try one Valsalva manoeuvre.
  b) Give adenosine IV if the patient is compromised or if there is a history of recurrent SVT responsive to adenosine.
- Adenosine is contraindicated if the patient has:
  a) Known sick sinus syndrome without an internal pacemaker in place **or**
  b) Previous 2nd or 3rd degree heart block without an internal pacemaker in place.

- Adenosine is relatively contraindicated if the patient has:
  a) Asthma **or**
  b) CORD **or**
  c) Had a previous heart transplant.
- To give adenosine IV:
  a) The preferred site of injection is an antecubital fossa vein.
  b) Give 6 mg as a rapid bolus followed immediately by a rapid flush of 20 ml of 0.9% NaCl.
  c) If the rhythm does not revert, repeat as above using 12 mg.
- A patient who reverts to sinus rhythm following adenosine may receive a recommendation that they do not require transport to an Emergency Department, provided:
  a) They have a history of recurrent SVT responsive to adenosine **and**
  b) There are no ongoing symptoms or signs of myocardial ischaemia **and**
  c) They are instructed to see their GP for a review of their treatment.

4. If the rhythm is atrial fibrillation or atrial flutter

- If the ventricular rate is persistently >130/min and the patient is compromised:
  a) Give 300 mg amiodarone IV over 30 minutes, provided you are more than 15 minutes from hospital.
  b) Use amiodarone with caution if the patient is poorly perfused and reduce the rate of administration if hypotension occurs.

In addition

- If myocardial ischaemia and/or pulmonary oedema are present treat as per the appropriate section but use GTN and morphine with extreme caution.

NOTES

- Narrow complex tachycardias are characterised by a QRS duration of less than 0.12 seconds.
- Owing to the prevalence of accessory pathways, there is the potential for faster heart rates (approaching 200/min) compared with broad complex tachycardias.
- Narrow complex tachycardias are normally well tolerated by patients, provided they do not have significant underlying heart disease.

Defining compromise

- Significant compromise is defined as the patient being likely to have a cardiac arrest unless immediate interventions are carried out. These patients may have any combination of the following:
  a) Shock - pallor, sweating, cold and clammy extremities, impaired consciousness and hypotension.
  b) Syncope.
  c) Cardiogenic pulmonary oedema.
  d) Myocardial ischaemia – indicated by significant chest pain. Myocardial ischaemia is especially important if there is underlying coronary artery or structural heart disease, as this increases the risk of cardiac arrest.
- Patients who are not significantly compromised will display some adverse signs, such as mild chest discomfort, mild cardiogenic pulmonary oedema or compensated shock but they do not manifest signs of impending cardiac arrest. Be prepared to cardiovert if the patient deteriorates.

The Valsalva manoeuvre

- A Valsalva manoeuvre creates a sustained positive pressure in the thorax. This results in vagal stimulation that may terminate SVT in up to 25% of patients.
- A Valsalva manoeuvre is indicated if the patient has a narrow complex tachycardia other than atrial fibrillation or atrial flutter.
- Do not perform carotid sinus massage because of the risk of embolic stroke.
- Patients should:
  a) Be laid flat.
  b) Be asked to blow into a 20-50 ml syringe to try and move the plunger, starting with a normal sized breath.
  c) Continue the manoeuvre for a minimum of 15-20 seconds.
- When cardioversion occurs, it usually takes place after the patient stops blowing and takes a breath.

2.6 CARDIOGENIC SHOCK

- Give oxygen via reservoir mask.
- Determine and record the cardiac rhythm.
- Gain IV access.
- Acquire a 12 lead ECG, provided this does not significantly delay treatment or transport. Transmit this ECG if appropriate.
- If dysrhythmia is present, treat as per the appropriate section but use amiodarone with extreme caution.
- If myocardial ischaemia and/or pulmonary oedema are present treat as per the appropriate section but use GTN and morphine with extreme caution.
- If there are signs of poor perfusion, give IV fluid, provided the patient is not short of breath, has no significant crackles in the chest and the primary problem is not dysrhythmia:
  a) Give 500 ml 0.9% NaCl IV.
  b) This may be repeated once.
  c) Stop the fluid if the patient becomes short of breath.
- If you have a choice of hospital destinations discuss these with a medical specialist, as the patient may benefit from going direct to a major hospital.

NOTES

- Cardiogenic shock is caused by the heart being unable to pump adequately.
  a) The most common cause is acute myocardial infarction.
  b) Other causes include acute valve rupture, pulmonary embolism, dysrhythmia (particularly VT), cardiac tamponade and myocarditis.
  c) Commonly the patient will be cold, pale and tachycardic, with signs and symptoms of pulmonary oedema.
- Most commonly cardiogenic shock is caused by inadequate left ventricular function.
  a) The most common cause is an anterior or anterolateral myocardial infarction.
  b) This is commonly associated with the development of pulmonary oedema.
  c) The patient is unlikely to respond to IV fluid. Give this with caution as it may make pulmonary oedema worse.

- Occasionally cardiogenic shock is caused by inadequate right ventricular function.
  a) Commonly this is caused by an inferior myocardial infarction.
  b) In this setting the right ventricle becomes a 'passive conduit' for blood flow and the left ventricle becomes relatively empty. The patient will not have signs or symptoms of pulmonary oedema and may have distended jugular veins.
  c) GTN and/or morphine must be used with caution as a significant fall in cardiac output and/or blood pressure may result. This is particularly the case in these patients because veinous dilation will further reduce the preload (filling) of the left ventricle.
  d) The patient is likely to respond to IV fluid.
- Cardiogenic shock has a very high mortality rate unless the underlying problem is corrected quickly. In general there are only two prehospital interventions that significantly alter outcome:
  a) Initiating thrombolysis for myocardial infarction when indicated.
  b) Transporting the patient direct (whenever feasible) to a hospital with the services required to correct the underlying problem.

2.7 CARDIAC ARREST

- Perform continuous chest compressions whilst the defibrillator is being attached and charged, if possible.
- Defibrillate immediately if the rhythm is VF or VT using a single shock at maximum joules and immediately recommence chest compressions.
- Perform 2 minute cycles of CPR between rhythm checks.
- Manage the airway and gain IV access but chest compressions take priority.
- Continue to defibrillate using a single shock every 2 minutes if the rhythm is VF or VT.
- Give 1 mg adrenaline IV every 4 minutes.
- If in VF or VT at any time after the first dose of adrenaline, give 300 mg amiodarone IV, once only as a bolus.
- If the patient has PEA:
  a) Correct reversible causes **and**
  b) Give 1-3 litres of 0.9% NaCl as a bolus.

NOTES

Definitions

- A patient is in cardiac arrest when they are unconscious and have no palpable pulses or no signs of life. However, if a patient is unconscious with a heart rate less than 30/min, treat as cardiac arrest even if their pulse is palpable.
- 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 arrest is either clearly due to a cardiac problem or there is no obvious cause.
- A secondary cardiac arrest is one where there is an obvious, non-cardiac cause (e.g. asthma, drowning, trauma, poisoning).
- Return of spontaneous circulation (ROSC) is the presence of a palpable pulse, in the absence of ongoing CPR, for longer than 60 seconds.

Deciding to commence resuscitation

- Resuscitation should begin unless there is a clear reason not to. Clear reasons not to include:
  a) Signs of rigor mortis or lividity.
  b) A clearly described advance directive (or living will) not to receive resuscitation for cardiac arrest.

c) Clinical scenarios where resuscitation is either futile or clearly not in the best interests of the patient. Examples include unwitnessed cardiac arrest with asystole as the initial rhythm, patients who are dying from cancer, and patients with severe end-stage comorbidities (e.g. end stage heart failure or end stage CORD).

- Competent patients have the right to decline treatment, including resuscitation in the event of cardiac arrest.
- 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 should take into account all of the available information, including advance directives made by the patient, and act in what they believe is the patient's best interest.
- If there is doubt regarding the appropriateness of a resuscitation attempt, then 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.
- Response time.
- The initial rhythm.
- The total estimated time in cardiac arrest.
- The patient's comorbidities.

For personnel at BLS paramedic level and below: resuscitation should usually continue until someone more senior takes over. This is not always possible:

- If the arrest was not witnessed and no shock is advised, then the prognosis is very poor and it is appropriate to stop resuscitation if there are no signs of life approximately 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 life approximately 40 minutes after the onset of resuscitation by ambulance personnel.

For personnel at ILS paramedic level and above: in general, it is appropriate to stop resuscitation approximately 20 minutes after the onset of resuscitation by ambulance personnel in poor prognosis scenarios and approximately 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 it was inappropriate to have commenced resuscitation.

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. In most patients there will be a mixture of worse and better 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
Total time in cardiac arrest > 30 minutes	Total time in cardiac arrest > 30 minutes
$ETCO_2$ < 10 mmHg for > 10 minutes	$ETCO_2$ > 10 mmHg for > 10 minutes
Significant comorbidities present	No significant comorbidities present

- End tidal CO_2 ($ETCO_2$) is a measure of blood flow during CPR. If $ETCO_2$ is less than 10 mmHg for longer than 10 minutes, this is a strong predictor of a very poor outcome.
- Significant comorbidities are chronic diseases that significantly limit a patient's ability to lead a normal life. Examples include: CORD, heart failure, kidney failure needing dialysis and metastatic cancer with weight loss.

General principles of CPR

- For adults the CPR compression to ventilation ratio is 30:2 for a patient who is receiving ventilation 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 clearly had a cardiac arrest secondary to asphyxiation or to respiratory failure, consider altering the ratio to 15:2.
- For children the CPR compression to ventilation ratio is 15:2 for a patient who is receiving ventilation via bag and mask (exception – the ratio is 3:1 for newborn babies). 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 clearly had a primary cardiac arrest, consider altering the ratio to 30:2.
- Perform continuous chest compressions if the patient has been intubated with an endotracheal tube.
- Consider performing continuous chest compressions if an LMA (or other supra-glottic airway) is present and this does not impair ventilation via the LMA. If however, continuous chest compressions appear to impair ventilation via the LMA, interrupt the chest compressions to provide ventilation. If you are unsure: the balance of risk is in favour of continuous chest compressions.
- During continuous chest compressions ventilate an adult with 8-10 breaths per minute and a child with 12-14 breaths per minute.
- Perform chest compressions at 100/min, ensure adequate depth, minimise pauses and perform uninterrupted compressions whenever possible.
- CPR is performed for 2 minute cycles between rhythm checks. The person performing chest compressions should ideally be changed every 2 minutes (or earlier if tired).

General principles of cardiac arrest resuscitation

- If you witness a cardiac arrest and a defibrillator is not attached, deliver a pre-cordial thump.
- Personnel able to use defibrillators in manual mode should do so whenever possible.
- In manual mode, the defibrillator should be charged toward the end of the 2 minute cycle of CPR, to minimise the time delay between stopping chest compressions and delivering a shock. If a shock is not required the charge should be dumped.

- Minimise the time between stopping chest compressions and delivering a shock, this is the pre-shock pause. Ideally pre-shock pauses should be less than 5 seconds.
- Resume CPR immediately following a shock, without checking for a pulse. Minimise the time between delivering a shock and restarting chest compressions, this is the post-shock pause. Ideally post-shock pauses should be less than 5 seconds.
- Perform a brief pulse check at the end of a 2 minute cycle, only if the rhythm looks capable of producing cardiac output. If there is any doubt that a pulse 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 should be used in children if a defibrillator in manual mode is not immediately available.
- All doses of IV drugs should be flushed, with a minimum of 40 ml 0.9% NaCl, which may be delivered by a running line.
- $ETCO_2$ must be continually measured if the patient has been intubated with an endotracheal tube. $ETCO_2$ should not be measured if the patient is being ventilated via a mask or LMA.
- If the patient does not gain ROSC, it is usually inappropriate to transport them to hospital with CPR in place.
- You must complete a cardiac arrest data form if you have attempted resuscitation.

VF and VT

- Consider anterior/posterior placement of pads for children, obese patients and patients in persistent VF or VT.

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 the cardiac arrest is very important in helping determine what the cause may be.

- Potentially reversible causes of PEA include:
  a) Hypoxia.
  b) Hypothermia.
  c) Hypovolaemia (including anaphylaxis).
  d) Hyper/hypokalaemia (and other metabolic abnormalities).
  e) Tension pneumothorax.
  f) Tamponade (cardiac).
  g) Toxins (poisoning).
  h) Thrombosis (pulmonary).
- Consideration should be given to transporting 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 should be made very early in the resuscitation attempt.
- It is common for PEA to degenerate into asystole. During this process you will often see slow, broad, bizarre complexes (<30/min). This is asystole and not PEA.
- Survival is rare if the rhythm deteriorates from PEA into asystole, despite resuscitation. Prolonged resuscitation attempts in this setting are usually inappropriate.
- In general, patients who survive cardiac arrest with an initial rhythm of PEA, do so because the underlying problem is immediately identified and corrected.

Asystole

- Confirm the rhythm is asystole: check the cables, the leads, which lead is showing on the screen and check the amplitude (gain control).
- 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. Prolonged resuscitation attempts in this setting are usually inappropriate.

CARDIAC ARREST IN SPECIAL SITUATIONS

Cardiac arrest secondary to asphyxiation

Examples include drowning, hanging or sudden unexpected death of an infant (SUDI). Prioritise and focus on the ventilation aspect of CPR and consider a CPR ratio of 15:2. If a patient has drowned, adequate ventilation is often only achieved via an endotracheal tube. Cervical spine injury following hanging is extremely rare unless the patient has fallen the height of their body.

Cardiac arrest secondary to trauma

A small number of patients have a primary cardiac arrest directly preceding their trauma. If you suspect this, then manage as a primary cardiac arrest.

Cardiac arrest secondary to trauma has an extremely poor outcome and in most cases is due to severe hypovolaemia. It is appropriate to initiate a resuscitation attempt while immediately reversible causes (especially tension pneumothorax and hypovolaemia) are being sought and corrected but unless quick ROSC occurs, it is usually inappropriate to continue. If the cardiac arrest is clearly secondary to trauma, chest compressions are a lower priority than identifying and correcting reversible causes, because the heart is usually empty.

Cardiac arrest secondary to asthma

Focus on using a ventilation rate of only 6/min to avoid dynamic hyperinflation. Adrenaline has a high priority. Exclude tension pneumothorax, noting this is quite rare in this setting. Do not decompress the chest unless the signs of tension pneumothorax are unequivocal. This is because chest decompression in this setting carries a significant risk of creating a tension pneumothorax.

Cardiac arrest secondary to anaphylaxis

IV adrenaline and IV fluid have a high priority.

Cardiac arrest secondary to cyclic antidepressant poisoning

Give adult patients 2-3 litres of 0.9% NaCl as a bolus, as the cardiac toxicity may be reduced with a large dose of sodium ions.

Cardiac arrest and pregnancy

In advanced pregnancy the uterus impedes veinous return through the inferior vena cava in the supine position. Tilt the patient to their left or manually displace the uterus to the left to alleviate this. If you do not achieve quick ROSC and you are within 10 minutes of a hospital capable of emergency caesarean section, consider transporting the mother with CPR en route (focusing on good chest compressions), providing as much pre-hospital warning as possible.

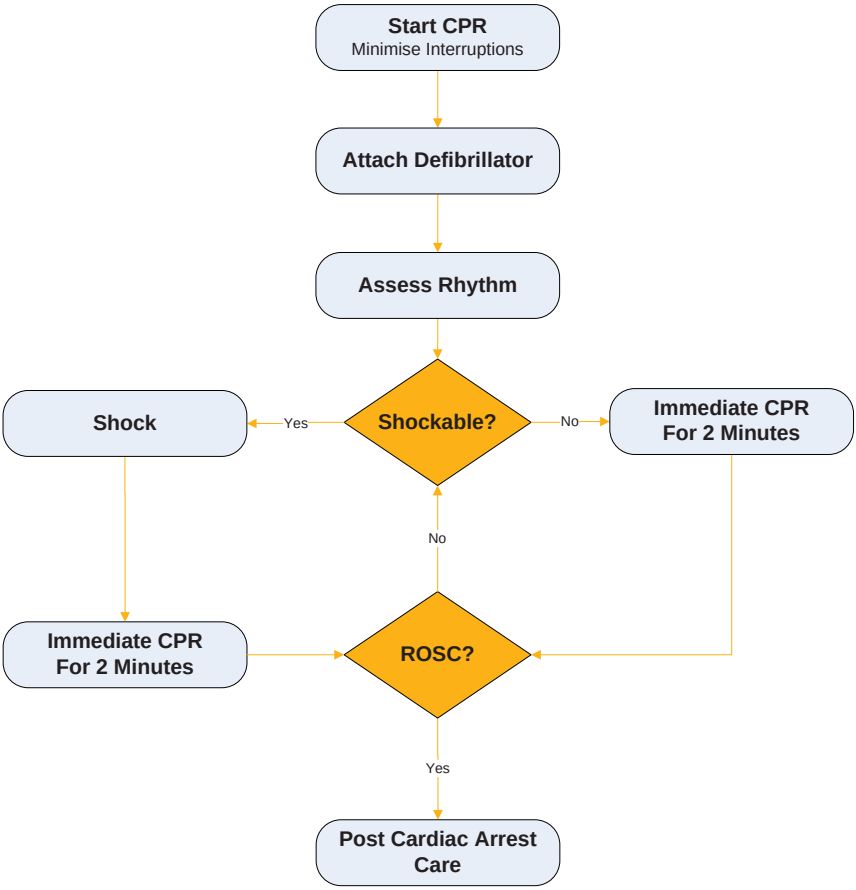
Cardiac arrest secondary to hypothermia

At very low core temperatures (<30 degrees) patients are prone to VF and defibrillation and drugs may not be effective. If you do not achieve ROSC within 3 shocks and you consider the arrest is secondary to hypothermia, consider transporting the patient to hospital with CPR en route. In this setting, stop defibrillating, do not give any further drugs, focus on good chest compressions and obtain early advice from a medical specialist.

Cardiac arrest and implanted defibrillators/pacemakers

Implanted defibrillators and pacemakers are usually in the soft tissue under the left clavicle. Standard procedures should be followed with the defibrillation pads placed as far away from the implanted defibrillator or pacemaker as possible.

Cardiac Arrest Summary



Cardiac Arrest Summary

During CPR

Airway adjuncts (LMA/ETT)
Oxygen
IV/IO access
Plan actions before interrupting compressions
Drugs:

- Give 1mg adrenaline IV every 4 minutes.
- If in VF or VT at any time after the first dose of adrenaline, give 300 mg amiodarone IV, once only as a bolus.

Consider and correct:

- Hypoxia.
- Hypovolaemia.
- Hyper/hypokalaemia.
- Hypothermia.
- Tension pneumothorax.
- Toxins.
- Thrombosis.

Post Cardiac Arrest Care

Re-evaluate ABCDE
Treat precipitating causes
Consider 12 lead ECG
Ensure adequate oxygenation
Ensure adequate ventilation (do not hyperventilate)
Consider passive cooling

2.8 POST CARDIAC ARREST CARE

- Avoid hyperventilation while ensuring the patient has an adequate airway and adequate breathing.
- Call for RSI backup provided they can locate with you at least 15 minutes faster than you could transport to an appropriate hospital if:
  a) The patient has a poor airway or poor breathing **and**
  b) The patient has a GCS ≤ 10.
- Gain IV access if not already done.
- Uncover the patient and allow passive cooling if their motor score is less than 5 and the patient is:
  a) An adult with an initial rhythm of VF or VT **or**
  b) A child regardless of the initial rhythm.
- Acquire a 12 lead ECG, provided this does not significantly delay treatment or transport. Transmit this ECG if appropriate.

NOTES

- Be prepared to treat further cardiac arrest.
- The most important aspects of post cardiac arrest care are to maintain an adequate airway, breathing and circulation.
- Hyperventilation must be avoided because it lowers blood flow to the brain.
- Hypothermia has been shown to improve outcomes in adult patients who remain unconscious following VF or VT cardiac arrest. Most hospital staff will initiate cooling in such patients and this is why we are initiating passive cooling post ROSC in this group.
- It is not clear if hypothermia improves outcomes in adults with initial rhythms of PEA or asystole. Most hospital staff will not initiate cooling in such patients and this is why we are not initiating passive cooling post ROSC in this group.
- It is not clear if hypothermia improves outcomes in children following cardiac arrest. However, most hospital staff will initiate cooling in children regardless of their initial rhythm and this is why we are initiating passive cooling post ROSC in this group.

2.9 POST THROMBOLYSIS CARE

This section is for patients who are being transported after thrombolysis for myocardial infarction.

- Only give oxygen if required to achieve SpO2 ≥ 94%.
- Monitor the cardiac rhythm continuously and be prepared to treat cardiac arrest.
- Give opiate pain relief if pain is significant. This should be morphine unless fentanyl is specifically indicated.
- Record blood pressure, pulse and capillary refill time every 10 minutes.
- Monitor closely for signs of bleeding.
- Acquire a 12 lead ECG after 60 minutes or if there is any significant change in the patient's condition. Do not transmit this ECG unless specifically asked to do so.

NOTES

- These patients must be transported in double-crewed ambulances.
- These patients are at increased risk of cardiac arrest. In this setting the initial rhythm is usually VF.
- These patients have received a medicine that accelerates the breakdown of blood clots and are likely to have received heparin. For these reasons, they are at increased risk of bleeding.
- Do not place additional IV lines unless necessary.
- Compress any external bleeding. Bleeding may be internal, which is why we ask for frequent recordings of blood pressure, pulse and capillary refill time.
- The most common life threatening bleeding post thrombolysis is spontaneous intra-cranial bleeding. If this happens, the patient will usually have: sudden onset of headache, a falling level of consciousness and focal neurological signs. If this occurs it is usually fatal.
- Use the appropriate section if the patient has complications of their myocardial infarction.
- Seek urgent advice from a medical specialist if the patient has complications of thrombolysis.

PERSONAL NOTES

PERSONAL NOTES

3.0 SHOCK

Shock is a global reduction in blood flow (perfusion) to the tissues and organs of the body. Shock results in accumulation of the products of metabolism (including acids) in the tissues and organs and this causes cellular and organ dysfunction.

Through sympathetic nervous system stimulation, the body attempts to increase cardiac output to maintain perfusion to organs and to shunt blood to the central blood vessels that supply essential organs, such as the brain, heart, liver and kidneys. If sympathetic nervous system stimulation maintains a normal blood pressure it is described as compensation. At the point at which blood pressure begins to fall significantly, decompensation is occurring.

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.
- Tachypnoea.
- Narrowed pulse pressure.
- Hypotension.
- Confusion or falling level of consciousness.

Hypotension does not need to be present for the patient to be shocked. Some patients (in particular young patients) have the capacity for profound vasoconstriction and this may maintain a normal blood pressure, despite very low cardiac output. To have shock, the patient must either have hypotension or signs of significantly impaired perfusion.

Tachypnoea, tachycardia and vasoconstriction are common signs of shock in very young children.

Causes of shock

Shock can be broadly classified according to the underlying cause:

- **Hypovolaemic shock** is due to inadequate intra-vascular volume. Use the sections titled hypovolaemic shock from uncontrolled bleeding and hypovolaemia from other causes.
- **Anaphylactic shock** is due to mediators released in response to an allergic reaction. Use the section titled anaphylaxis.

- **Septic shock** is due to a systemic inflammatory state in response to an infection. Use the section titled septic shock.
- **Cardiogenic shock** is due to inadequate cardiac output as a result of a heart problem. Use the section titled cardiogenic shock.
- **Spinal shock** is due to loss of sympathetic nervous system outflow following spinal cord injury. Use the section titled hypovolaemia from other causes.
- **Obstructive shock** is due to pulmonary embolism causing inadequate right ventricular function or tension pneumothorax causing inadequate right ventricular filling. Use the section titled hypovolaemia from other causes.
- **Hypoadrenal shock** is due to inadequate levels of circulating cortisol. Patients with congenital adrenal hypoplasia are at risk of this, particularly if they have moderate trauma or illness. Use the section titled hypovolaemia from other causes and follow any written instructions regarding administration of the patient's own hydrocortisone.

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 multiple contributing factors. For example:

- In both anaphylactic and septic shock there is usually a combination of vasodilatation, leaky blood vessels (with loss of intra-vascular volume) and impaired heart function.
- In cardiogenic shock associated with right ventricular myocardial infarction, there is impaired right ventricular function and reduced left ventricular preload (filling).

3.1 HYPOVOLAEMIC SHOCK FROM UNCONTROLLED BLEEDING

This section is for hypovolaemic shock 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 **or**
e) Ectopic pregnancy.

- Compress any external bleeding. Apply a tourniquet if there is life threatening bleeding from a limb that is not controlled by conventional measures.
- Do not remove penetrating objects.
- Cover sucking chest wounds with a sealed dressing.
- Load and treat en route.
- Gain large bore IV access.
- Give IV fluid only if severely shocked, e.g. no radial pulse, a falling level of consciousness or unrecordable blood pressure:
  a) Give adults 1 litre of 0.9% NaCl.
  b) Give children 20 ml/kg of 0.9% NaCl.
  c) Give further small boluses only if the patient remains severely shocked.
- If the patient has penetrating trauma and hypovolaemic shock, transport direct to a hospital that regularly receives patients with major trauma, whenever reasonably feasible.
- If you suspect the patient has a leaking abdominal aortic aneurysm, transport direct to a hospital with vascular surgical facilities, whenever reasonably feasible.

NOTES

- 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 in these patients is that the bleeding is usually from an artery and clotting often spontaneously occurs when blood pressure is relatively low. Fluid resuscitation results in increased blood pressure and dilution of clotting factors both of which reduce the chance of spontaneous clot formation and increase blood loss.

- The most important aspects of pre-hospital care are to stop external bleeding and rapidly transport to hospital, providing most treatments en route.
- If the time to surgical intervention is going to be prolonged (e.g. greater than an hour) it is appropriate to alter the threshold at which fluid is given if the patient has significant shock. Continue to follow the principle of deliberately allowing the patient to be relatively hypovolaemic but consider giving slightly more fluid than indicated above.
- Bleeding from solid organs (e.g. lung, liver, spleen or kidney) following trauma has a pattern of bleeding that is usually relatively controlled. For blood loss from such organs, use the 'hypovolaemia from other causes' section.
- Cover visible abdominal contents with cling film.
- When applying a tourniquet:
  a) Apply as distally as possible.
  b) Do not apply over a joint.
  c) Apply tight enough to stop visible bleeding.
  d) Record the time of application.
  e) Re-check the tourniquet following treatment. The tourniquet may need to be further tightened as blood pressure improves.
  f) Do not remove the tourniquet until the patient is in the presence of someone capable of gaining surgical control of the bleeding.

3.2 HYPOVOLAEMIA FROM OTHER CAUSES

This section is for hypovolaemia from:

a) Blunt trauma **or**
b) Fluid loss (e.g. from hyperglycaemia or diarrhoea) **or**
c) Peripheral blood loss that has been fully controlled **or**
d) Gastrointestinal bleeding **or**
e) Antepartum haemorrhage **or**
f) Hyperthermia.

Also use this section if the patient has signs of hypovolaemia or poor perfusion and the underlying problem does not obviously fit into another section.

- Gain large bore IV access.
- Give IV fluid if the patient has signs of poor perfusion:
  a) Give adults 1 litre of 0.9% NaCl.
  b) Give children 20 ml/kg of 0.9% NaCl.
  c) Give further boluses as required.
- Immobilise any fractures. In particular, firmly wrap the pelvis and tie the knees together if shock is associated with a possible pelvic fracture.
- If the patient has trauma and hypovolaemic shock, transport direct to a hospital that regularly receives patients with major trauma, whenever reasonably feasible.

NOTES

- 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 the following signs in response to fluid therapy is an important guide to treatment:
  a) Heart rate **and**
  b) Pulse strength **and**
  c) Capillary refill time **and**
  d) Pulse pressure **and**
  e) Blood pressure **and**
  f) Level of consciousness.
- Shock following blunt trauma is almost always caused by blood loss but it is important to exclude tension pneumothorax.

- Occasionally, shock following blunt trauma is due to spinal cord injury, resulting in loss of sympathetic tone to peripheral blood vessels.
- Some patients may not become tachycardic, despite significant hypovolaemia. Examples include:
  a) Patients taking beta blockers.
  b) Severe (end stage) hypovolaemic shock, with a falling heart rate.
  c) Ectopic pregnancy (dilatation of the fallopian tube may cause vagal stimulation).
  d) Miscarriage (dilatation of the cervix may cause vagal stimulation).

3.3 ANAPHYLAXIS

- Give 0.3-0.5 mg adrenaline IM if the patient is status one or status two.
- Any person may administer a patient's own adrenaline provided it has been prescribed for that patient and they are status one or status two.
- If the patient has upper airway oedema or swelling, give 5 mg nebulised adrenaline in addition to other treatment. Repeat as required.
- Gain large bore IV access.
- Give IV fluid if the patient has signs of poor perfusion:
  a) Give adults 1 litre of 0.9% NaCl.
  b) Give children 20 ml/kg of 0.9% NaCl.
  c) Give further boluses as required.
- Repeat IM adrenaline using the above doses after 10 minutes if the patient is status two and not improving.
- Give IV adrenaline if the patient is status one and not improving despite IM adrenaline. Place 1 mg adrenaline in a 1 litre bag of 0.9% NaCl:
  a) Give as an infusion (preferred approach). Start at 2 drops per second and adjust the rate to the patient's condition **or**
  b) Give 10 ml (0.01 mg) every 1-2 minutes.
- If wheeze is present use nebulised bronchodilators (using the asthma section) in addition to other treatments.
- If the patient has isolated oedema of the face or mouth, in the absence of systemic symptoms of anaphylaxis, treat with nebulised adrenaline alone.

NOTES

- 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 the involvement of one or more of the following systems:
  a) Respiratory, with any of the following: dyspnoea, chest or throat tightness, wheeze, stridor.
  b) Cardiovascular, with any of the following: shock, hypotension, fainting, collapse, altered level of consciousness.
  c) Gastrointestinal, with any of the following: persistent or severe nausea and/or vomiting, cramping abdominal pain, explosive diarrhoea.

- Exposure to an allergen results in the release of inflammatory mediators from mast cells and basophils, which causes the signs and symptoms described above. While there are a number of mediators, histamine is the most widely recognised.
- To be diagnosed with anaphylaxis, the patient 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 wheeze, shock or respiratory distress.
- Anaphylaxis can be triggered by exposure to almost anything but the majority of episodes are caused by exposure to venom (particularly wasps and bees), food (particularly peanuts and shellfish) or medications.
- Patients with stings and only localised swelling, redness or pain do not have anaphylaxis.
- 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 a second dose of adrenaline) is under-recognised. Have a relatively low threshold for using adrenaline if anaphylaxis is clear or highly suspected, even if it is not immediately life threatening. Have a low threshold for repeat adrenaline if there any signs of further deterioration.
- In general, a dose of 0.5 mg adrenaline IM is appropriate for the majority of adult patients. Reduce the dose if the patient is small, elderly or has ischaemic heart disease.
- The preferred site for IM adrenaline is the lateral thigh as this has the best absorption. If this site is not suitable use the lateral upper arm.
- Isolated oedema, particularly of the mouth and/or face in the absence of systemic signs of anaphylaxis is usually due to angioedema and not anaphylaxis. Angioedema is a condition that results in intermittent, unexpected swelling of the mouth and/or face. It often occurs in patients taking aspirin or angiotensin converting enzyme inhibitors. Angioedema does not usually respond to systemic adrenaline but does usually respond to nebulised adrenaline.

3.4 BURNS

- Give oxygen if the patient has possible smoke inhalation.
- Cool burns for at least 20 minutes. This should be at the scene unless there are immediate life threatening problems in the primary survey. If the burns are due to chemical exposure, all clothing must be removed (down to underwear) and the patient decontaminated.
- Irrigate chemical burns to the eye for at least 30 minutes.
- Estimate burn depth and size.
- Cover burns with cling film after cooling.
- Gain large bore IV access.
- Give IV fluid if the patient has signs of poor perfusion or the burn area is > 20%:
  a) Give adults 1 litre of 0.9% NaCl.
  b) Give children 20 ml/kg of 0.9% NaCl.
  c) Repeat if transport time is greater than 1 hour or if required for perfusion.
- If wheeze is present, administer nebulised bronchodilators using the asthma section.
- If the burn area is > 20%, transport direct to a hospital that regularly receives patients with large burns, whenever reasonably feasible.

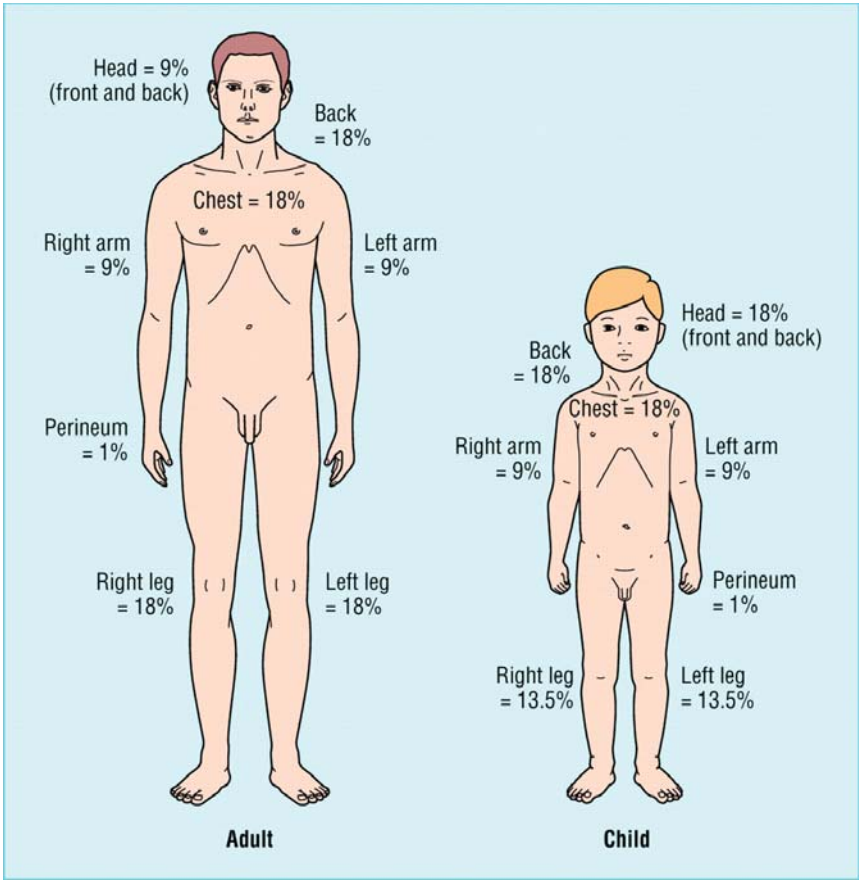
NOTES

- Patients with suspected airway burns must be transported to hospital immediately, as airway swelling may require early intubation or possible surgical intervention. Suspect airway burns if there is:
  a) Burns around the lips **or**
  b) Loss of nasal hair **or**
  c) Visible swelling or burns in the mouth **or**
  d) Hoarse voice **or**
  e) Stridor **or**
  f) Black sputum.
- Burns are preferably cooled using cool (not ice cold) running water. Beware of hypothermia during cooling, particularly in small children and in patients with large burns. If the burn area is > 40%, it is acceptable to shorten the duration of cooling if it risks causing clinically significant hypothermia. Cool the burn but keep the patient warm if at all possible.

- Chemical burns of the eye are potentially vision threatening. This is why irrigation must continue for at least 30 minutes. Chemical burns of the eye are not time critical in terms of transport to hospital and this irrigation should occur at the scene if possible.
- Dressing burns is not a priority but may make the burn less painful. Cling film can be applied after cooling and will provide some pain relief.
- Burn gels provide pain relief 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.
- Patients with burns are often in severe pain. Be prepared to be generous with morphine and add ketamine if required.
- To estimate burn depth:
  a) Superficial burns do not have blisters, are red and painful like sunburn.
  b) Partial thickness burns have blisters, weep fluid and are painful.
  c) Full thickness burns are charred, white, leathery and usually painless.
- Estimate burn size only after cooling is complete. The preferred method of estimating burn size is to cut out a piece of paper the same size as the patient's hand (including their fingers). This represents 1% of body size. Do not include superficial burns in the estimate. In general, ambulance personnel tend to significantly overestimate total burn size.
- Patients with burns following electrical injury may have significant muscle damage along the pathway of the current. They may also develop cardiac dysrhythmias. Provide continuous cardiac rhythm monitoring for these patients.

See page 66 for Lund and Browder chart.

Lund and Browder Chart



3.5 SEPTIC SHOCK

This section is for patients:

a) Aged 2 or more years **and**
b) With a temperature < 36 degrees or > 38 degrees **and**
c) With a clinical diagnosis of severe infection **and**
d) With clinical signs of shock **and**
e) More than 30 minutes from hospital.

- Gain large bore IV access and take blood for culture.
- Give IV fluid if the patient has signs of poor perfusion:
  a) Give adults 1 litre of 0.9% NaCl.
  b) Give children 20 ml/kg of 0.9% NaCl.
  c) Give further boluses as required.
- Give 2 g ceftriaxone IV.
- If unable to gain IV or IO access and the patient is status one, give 1 g ceftriaxone IM in two divided doses.
- Consider IV adrenaline if shock is severe and not improving despite a minimum of 2 litres of 0.9% NaCl. Place 1 mg adrenaline in a 1 litre bag of 0.9% NaCl:
  a) Give as an infusion (preferred approach). Start at 2 drops per second and adjust the rate to the patient's condition **or**
  b) Give 10 ml (0.01 mg) every 1-2 minutes.

NOTES

Infection and septic shock

- Septic shock occurs as a result of a widespread inflammatory state secondary to the immune response to infection. In septic shock there is usually a combination of vasodilatation, capillary leak and impaired cardiac function.
- To have septic shock, the patient must have both an infection and shock.
- To have an infection, the patient must have:
  a) A temperature < 36 degrees or > 38 degrees and
  b) An identified or highly suspected site of infection.
- Examples of sites of infection include:
  a) Urosepsis – particularly pyelonephritis.
  b) Pneumonia.
  c) Blood, e.g. meningococcemia.
  d) Cellulitis.

- To have shock, the patient must have:
  a) Tachycardia (unless beta blocked) **and**
  b) Tachypnoea (greater than 20/min for adults) **and**
  c) Hypotension or very poor perfusion. The patient does not have to be hypotensive but there must be clear signs of shock, including signs of very poor perfusion for the provisional diagnosis to be septic shock.
- Additional signs and/or symptoms associated with septic shock may include:
  a) Decreased urine output.
  b) Confusion.
  c) Diarrhoea.
  d) Nausea and vomiting.
  e) Aching muscles or joints.
  f) Petechial spots.

Taking blood for culture

- Withdraw 10 ml of blood via a cannula for adults and children ≥ 50 kg or 5 ml of blood for children < 50 kg.
- Withdrawal of blood is best done at the time of cannulation but can be done after this provided the 'luer' is well cleaned with alcohol.
- If fluid, including a flush, has already been given via the cannula, place a second cannula (provided this is easily accomplished) and withdraw blood for culture from the second cannula at the time of insertion.
- If a second cannula cannot be easily placed, withdraw and discard 5 ml of blood from the existing cannula, before withdrawing blood for culture.
- Use a single adult aerobic blood culture bottle for adults and children ≥ 50 kg or a single paediatric blood culture bottle for children < 50 kg.
- Attach a sharp needle to the syringe containing the blood and insert into the blood culture bottle. Allow the vacuum to draw in the required amount of blood. Do not force blood into the bottle under pressure.

Ceftriaxone administration

- If you are able to gain IV access but are unable to take a blood culture, give ceftriaxone, provided all of the other criteria are met.
- The preferred site for IM ceftriaxone is the lateral thigh as this has the best absorption. If this site is not suitable use the lateral upper arm.

3.6 TRAUMATIC BRAIN INJURY (TBI)

This section is for patients who cannot obey commands and have a mechanism of injury suggesting TBI.

- Intubation should not be attempted without rapid sequence intubation (RSI), unless the patient has a GCS of 3 with ineffective breathing.
- If the patient has a poor airway and their GCS is ≤ 10, call for an ICP or doctor skilled at RSI provided they can locate with you significantly faster than the patient can be transported to hospital.
- Gain large bore IV access.
- Give IV fluid if systolic BP < 120 mmHg in adults or below normal predicted systolic BP in children:
  a) Give adults 1 litre of 0.9% NaCl.
  b) Give children 20 ml/kg of 0.9% NaCl.
  c) Give further boluses as required.
- Transport the patient direct to a hospital that regularly receives patients with major trauma, whenever reasonably feasible.
- If the patient is combative, see the combative patient section.

All patients who have had a loss of consciousness following trauma must receive a firm recommendation that they be transported to an Emergency Department for assessment and a period of observation. This is in case they have a brain injury with bleeding that does not become apparent for several hours. If a competent patient refuses this recommendation the following advice must be given to them, and if at all possible to an accompanying responsible adult:

Problems could arise within the first 24 hours. Someone needs to be with you during that time. You, or the person looking after you, must phone 111 and ask for an ambulance if you develop any of the following:

- You have a headache that gets worse.
- You are drowsy or difficult to wake up.
- You have difficulty recognising people or places.
- You have any vomiting.
- You behave unusually or seem confused.
- You have seizures or fits.
- You have weak arms or legs or are unsteady on your feet.
- You have slurred speech.

NOTES

- The goal of treating a patient with TBI is to:
  a) Recognise TBI **and**
  b) Minimise or prevent secondary injury **and**
  c) Treat other life threatening injuries if present **and**
  d) Transport the patient direct to a hospital with the capacity to provide the resuscitation and treatment needs of the patient, whenever reasonably feasible.
- Secondary injury occurs when a further physiological insult occurs after the primary (initial) injury. Secondary injury increases mortality and worsens neurological recovery in survivors, predominantly by worsening cerebral ischaemia. Common forms of secondary injury include:
  a) Hypotension.
  b) Hypoxia.
  c) Hypercarbia.
  d) Hypocarbia.
- Intubation without RSI may worsen outcomes by increasing secondary injury and increasing intracranial pressure. This is why intubation without RSI is restricted to those patients with a GCS of 3 and ineffective breathing.
- Sedation increases the risk of secondary injury and must be avoided unless the patient is so combative they cannot be safely treated and/or transported.
- The goal of fluid therapy is to minimise hypotension, but not to give excessive volumes of fluid as this may increase brain swelling. Give the minimum amount of fluid required to achieve a systolic BP of 120 mmHg in adults or a normal systolic BP in children.
- All patients with alcohol or drug intoxication, who cannot obey commands following trauma should be presumed to have 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 TBI. A blood glucose level should always be measured.
- A brief seizure following TBI is relatively common, particularly in children. These seizures do not usually require treatment with medicines. For repeated or prolonged seizures use the seizure section.

- Patients on anticoagulants (e.g. warfarin or dabigatran) or antiplatelet medicines (e.g. clopidogrel) are at relatively high risk of developing bleeding following brain injury, even if they have not lost consciousness. Have a very low threshold for recommending transport to an Emergency Department for these patients.
- Do not hyperventilate patients with TBI. Hyperventilation worsens outcomes by causing cerebral vasoconstriction which decreases cerebral blood flow.
- Electronic capnometry is compulsory for all intubated patients.
- The target $ETCO_2$ 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.

3.7 CERVICAL SPINE IMMOBILISATION

Significant abnormalities within the primary survey always take priority over the cervical spine. The possibility of cervical spine injury should be considered in all patients suffering from trauma, except those with isolated peripheral injury. Patients suffering from trauma as a result of road crash (particularly if it involves roll over or ejection), or significant fall, or patients with pre-existing cervical spine abnormalities (such as rheumatoid arthritis) are particularly at risk.

If the patient has any one of the following signs or symptoms they should have their cervical spine immobilised:

a) Tenderness at the posterior midline of the cervical spine **or**
b) Focal neurological deficit **or**
c) Decreased level of alertness **or**
d) Evidence of intoxication **or**
e) Clinically apparent pain that might distract the patient from the pain of a cervical spine injury.

NOTES

Clearing the cervical spine clinically

- The criteria described above may be used in children, provided the child is old enough to cooperate with having a history taken and being examined.
- Begin by taking a history:
  a) Do they have neck pain?
  b) Do they have numbness or tingling anywhere?
  c) Do they have pain anywhere else?
- Next, examine the patient:
  a) Feel for midline tenderness by palpating the posterior cervical spine from the skull to the prominence of the first thoracic vertebrae. Lateral muscular tenderness is not a sign of cervical spine injury.
  b) Check they have normal sensation to light touch in their hands and feet.
  c) Check they can move their hands and feet normally.
  d) Look for signs of intoxication.
- The patient has a focal neurological deficit if they have any altered sensation or motor power (strength) in their limbs.

- The patient has a decreased level of alertness if they have any of the following:
  a) GCS less than 15 **or**
  b) Disorientation to person, place, time or events **or**
  c) Short term memory loss **or**
  d) Delayed or inappropriate response to external stimuli.
- Deciding if a patient has evidence of intoxication requires clinical judgement. In general, to have evidence of intoxication the patient must show some signs of a decreased level of alertness.
- Deciding if a patient has clinically apparent pain that might distract the patient from the pain of a cervical spine injury requires clinical judgement. To be considered distracting, the pain must be significant enough that it might prevent the patient from noticing their neck is sore.
- Use extra caution when clearing the cervical spine clinically if the patient is not in clinically apparent pain but has an injury that would normally be expected to cause pain. Examples include long bone fractures and dislocations.

Immobilising the cervical spine

- Immobilisation must not impair the maintenance of an adequate airway, breathing or circulation.
- The most important part of immobilisation is the application of a correctly sized, well fitted hard collar. Getting the size and the fit right is very important and worth the extra time.
- Place the patient flat with their spine in a neutral position. For most adults in the supine position, this will require 3-4 cm of flat pillow or folded towel behind the head. If the patient is placed on their side, keep the spine in alignment.
- Clinical judgement is required for uncooperative patients. If attempts to immobilise the cervical spine result in the patient becoming agitated and/or uncooperative, it is sufficient to verbally discourage the patient from moving.
- All patients with a suspected cervical spine injury should be treated and transported in a flat position if possible, noting that:
  a) Patients should be transported supine if they are obeying commands or have been intubated with an endotracheal tube.
  b) Patients should be transported tilted on their side if they are not obeying commands or are vomiting.
  c) Patients should be sat to 45 degrees if they have respiratory distress.

- Patients with an immobilised cervical spine may be transported directly on an ambulance stretcher, provided they are suitably restrained, with their spine in a neutral position.
- The head and shoulders must not be independently immobilised. If the head and shoulders are immobilised, the entire body must be immobilised.

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.
- All of these devices carry the risk of creating pressure areas if the patient is on them for longer than 30 minutes. If the patient is anticipated to be on the device for longer than 30 minutes, they should be removed from it prior to transport, provided this is feasible.
- If a patient is transported on such a device, they should be removed from it as soon as reasonably possible after arrival at hospital.
- If an immobilised patient is being transported on such a device, they require full body immobilisation with:
  a) A well fitted cervical collar **and**
  b) The head and body firmly restrained to the device **and**
  c) Rolled towels or blocks placed alongside the head.

Prophylaxis of nausea and vomiting

- Prophylactic administration of ondansetron is not routinely required for patients with an immobilised cervical spine.
- Consider administering ondansetron if:
  a) The patient has nausea **or**
  b) The patient has a known history of motion sickness **or**
  c) The nature of the patient's injuries and the transport position is such that vomiting would be particularly problematic.

Intubation

- The maintenance of an adequate airway and breathing always take priority over the cervical spine. If you have to intubate the patient to maintain airway and breathing then do so, even though this will mean the cervical spine is moved.
- Patients requiring intubation should have the front of their cervical collar undone during intubation. This allows for maximal mouth opening, which minimises cervical spine movement during intubation.
- Apply in line stabilisation, not traction, if you have an appropriately trained person available.

PERSONAL NOTES

4.0 HYPERGLYCAEMIA

Diabetic ketoacidosis (DKA)

This is the most common condition causing patients to call an ambulance with clinically significant hyperglycaemia. It develops in patients with type one diabetes who have a relative lack of insulin. Patients with clinically significant DKA have:

- Hyperglycaemia, usually greater than 20 mmol/L.
- Hypovolaemia from a combination of osmotic diuresis secondary to the hyperglycaemia, reduced oral intake and vomiting.
- Acidosis from metabolism of fatty acids to ketones. The most common sign of this is tachypnoea and non-specific unwellness. Their breath may have a fruity smell from ketones.

Occasionally patients with DKA present with non-specific abdominal pain.

These patients require IV fluid titrated to signs of intra-vascular volume and transport to hospital. There is no role for transport to a GP unless it is for back up en route to hospital. There is no role for pre-hospital administration of insulin in these patients because rapid falls in glucose risk causing cerebral oedema.

Hyperglycaemia without acidosis

Type two diabetics can develop clinically significant hyperglycaemia without acidosis because there is sufficient insulin present to prevent cells shifting to predominantly metabolising fatty acids. These patients may be very hypovolaemic from osmotic diuresis but will usually not have a significant acidosis.

The principles of pre-hospital treatment are the same as for patients with DKA.

Diabetic patients who are unwell

Diabetic patients often have significant comorbidities including: ischaemic heart disease, peripheral vascular disease and renal impairment. They are at increased risk of developing any of the following: infection, silent myocardial ischaemia or metabolic/electrolyte disorders. Have a very low threshold for referring diabetic patients who are unwell to a doctor, even if there are no signs of clinically significant hyperglycaemia.

4.1 HYPOGLYCAEMIA

- If the blood glucose is less than 3.5 mmol/L:
  a) Give oral glucose if the patient is conscious and able to swallow.
  b) Gain IV access and give IV glucose if the patient has an altered level of consciousness or cannot swallow. Give adults 100 ml of 10% glucose and children 2 ml/kg of 10% glucose.
  c) Give IM glucagon if unable to gain IV access. For adults and children ≥ 30 kg give 1 mg, for children < 30 kg give 0.5 mg.
  d) Repeat the glucose measurement every 10 minutes until stable. Give further doses of IV glucose if required but do not repeat IM glucagon.
- Patients may receive treatment for hypoglycaemia and have a recommendation made to them that they do not need immediate referral to a doctor, provided all of the following criteria are met:
  a) It is an isolated single episode (check the history of their glucose meter if they have one) **and**
  b) There is a clear and easily treatable cause (e.g. a missed meal) **and**
  c) It is not due to overdose (including accidental) of insulin or oral hypoglycaemics **and**
  d) It is not complicated by seizure or injury **and**
  e) They fully recover and can safely mobilise **and**
  f) Their blood glucose is > 3.5 mmol/L, 10 (or more) minutes after their last glucose administration **and**
  g) They are given a complex carbohydrate to eat **and**
  h) They have an adult who can stay with them for the next 4 hours **and**
  i) They are instructed to measure their glucose hourly for the next 4 hours **and**
  j) They are instructed to see their GP for a review of their treatment.

NOTES

- Do not use the patient's own glucose meter to record their blood glucose.
- Hypoglycaemia usually occurs in diabetic patients taking insulin or oral hypoglycaemics.

- Less common causes of hypoglycaemia include septic shock (particularly in children), poisoning with agents that lower glucose or liver failure.
- Oral glucose is best given as a simple carbohydrate that is rapidly absorbed. Examples include 10% glucose, glucose tablets, sugar dissolved in water, 'non-diet' jam or similar glucose containing spreads and 'non-diet' soft drinks.
- Rapidly absorbed forms of glucose are also rapidly metabolised and there is a risk of hypoglycaemia occurring post treatment unless an ongoing source of glucose is eaten by the patient. This is particularly the case if the patient has taken a long acting insulin or a long acting oral hypoglycaemic agent. For this reason the patient must eat a complex carbohydrate, e.g. a sandwich containing cheese or meat or peanut butter.
- The patient may be initially hyperglycaemic following treatment. They must be instructed not to treat this with insulin. Hypoglycaemia may then occur several hours later. This is why eating a complex carbohydrate is important and why the patient is instructed to measure their glucose hourly for 4 hours.
- Some oral hypoglycaemics are excreted primarily by the kidneys. Suspect unrecognised deterioration in kidney function if a patient taking oral hypoglycaemics develops hypoglycaemia.

4.2 SEIZURES

- Measure blood glucose and treat accordingly.
- Give midazolam if the seizures are generalised and do not stop or recur:
  a) Give 1-2 mg IV (preferred route) every 3-5 minutes to a maximum of 10 mg **or**
  b) Give 5-10 mg IM every 15 minutes to a maximum of 15 mg **or**
  c) Give 10-15 mg IN every 15 minutes to a maximum of 30 mg.
  d) If IV midazolam is to be given after an initial IM or IN dose, wait 10 minutes before giving small IV doses.
- Some patients have pre-prescribed medicines to be given 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 seizures are prolonged.
- A recommendation may be made to the patient that they do not require immediate referral to a doctor, even if they have received pre-prescribed medicine, provided all of the following criteria are met:
  a) They have known epilepsy **and**
  b) The seizure has not been complicated by injury **and**
  c) They have recovered to their usual neurological state **and**
  d) They can be left in the care of a competent adult **and**
  e) They are instructed to see their GP for a review of their treatment.

NOTES

Treating seizures

- 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.
- Medication should be given for recurrent or prolonged seizures. Use a midazolam dose at the lower end of the ranges described if the patient is small, elderly or physiologically unstable. Take into account sedative medication already administered by others, to avoid excessive doses.
- Very prolonged (more than 30 minutes) or rapidly recurring generalised seizures (status epilepticus) can cause brain injury via a combination of hypoxia and hyperthermia. Consider requesting back up for RSI in such patients.

Types of seizures

- Seizures may be classified as generalised (grand mal convulsions) or partial (focal or localised). Partial seizures may be simple (with no loss of consciousness) or complex (in which consciousness is lost).
- Patients having partial seizures commonly present without obvious convulsions and are commonly able to interact during seizure activity. They may present with any combination of the following: habitual repetitive movements (automatisms), sensory symptoms, visual or auditory hallucinations, emotional outbursts or unusual feelings (such as feeling like they are outside their body). They may shout or growl or adopt a totally blank gaze.
- The most common cause of partial seizures is temporal lobe epilepsy. It is very common for partial seizures to be misdiagnosed as pseudo-seizures. Partial seizures may respond to midazolam. If the seizure is prolonged and causing significant distress it is appropriate to consider treatment with midazolam.

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 6 years.
- Fever in association 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. Provided this is not the case, cool the child slowly by uncovering them.
- The most common cause of febrile seizures in children is a viral illness but always look for signs of meningococcaemia, e.g. petechiae (non-blanching small bruises or spots), purpura (large bruises) or signs of shock.

4.3 POISONING

- Measure blood glucose and treat accordingly.
- Gain IV access if the patient has an abnormal primary survey or if there is clinical concern that they may deteriorate.
- Give naloxone if opiate poisoning is suspected and the patient has an impaired level of consciousness or impaired breathing:
  a) Give 0.1-0.4 mg naloxone IV every 3-5 minutes **or**
  b) Give 0.8 mg naloxone IM and repeat every 15 minutes if they improve and then deteriorate again **or**
  c) Give 1.6 mg naloxone IN and repeat every 15 minutes if they improve and then deteriorate again.
- Give IV fluid if cyclic poisoning is suspected and: the patient is tachycardic, or has QRS prolongation, or has signs of poor perfusion, or has an altered level of consciousness:
  a) Give adults 1-2 litres of 0.9% NaCl.
  b) Give children 20-40 ml/kg of 0.9% NaCl.

NOTES

- 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 should focus on supporting airway, breathing and circulation.
- The New Zealand National Poisons Centre can be contacted on 0800 764 766 for information if you have the name of the poison but do not know what it is or you do not know what the effects might be. Do not use the Poisons Centre for advice regarding treatment or interventions. Such advice should be sought from a Medical Advisor or another medical specialist.
- Do not induce vomiting as this may cause oesophageal injury. This is particularly the case with dishwashing powders or other alkaline products. If the patient has ingested a known alkali or acid, encourage them to sip water provided this does not induce vomiting and their airway is normal.
- IV fluid is not a treatment for alcohol poisoning, it is a treatment for hypovolaemia.

- 'Recreational' poisons are often taken in combination (particularly with alcohol) producing uncertain and compounding effects. Common 'recreational' poisons include:
  a) Alcohol. Patients usually present with an altered level of consciousness and vomiting. They may have a poor airway but usually have intact breathing provided their airway is maintained and their breathing is not impaired by choking on vomit or aspirating vomit.
  b) Gamma hydroxy butyrate (GHB). Patients usually present deeply unconscious with poor airway and poor breathing with intermittent apnoea. They commonly require assisted ventilation and improve rapidly after 20 to 30 minutes. They may take longer to improve if they have also taken another sedative, e.g. alcohol.
  c) Ecstasy. This rarely causes poisoning requiring admission to hospital but may cause altered level of consciousness, seizures and hyperthermia.
  d) Ketamine. This rarely causes poisoning requiring admission to hospital but may cause hallucinations or an altered level of consciousness. If the latter occurs, airway and breathing are usually well maintained.
  e) Amphetamines and methamphetamines. These drugs rarely cause poisoning requiring admission to hospital but are commonly associated with other events, such as violence or attempted suicide, that result in admission to hospital. They may precipitate unpredictable and violent behaviour. See the combative patient section.
  f) Cannabis and cannabinoids (including synthetic sources). These drugs rarely cause poisoning requiring admission to hospital but may cause mental dissociation, anxiety, tachycardia, palpitations, chest pain, nausea and vomiting.
  g) Herbal Highs. This is broad term used to describe a wide range of drugs. These drugs rarely cause poisoning requiring admission to hospital but may cause anxiety, tachycardia, palpitations, seizures, coma and intracranial haemorrhage.

4.4 THE COMBATIVE PATIENT

- Look for and treat reversible causes such as hypoglycaemia, hypovolaemia, hypoxia and hypercarbia. Move to the appropriate section if a clear cause is found.
- The patient may be sedated and/or restrained to allow safe treatment and/or transport provided that:
  a) They are not competent to make decisions **and**
  b) There is risk of serious harm to them or others **and**
  c) They have normal airway and breathing **and**
  d) Their motor score is ≥ 5.
- Begin with IV morphine if the patient appears to be in pain. Give 1-5 mg morphine IV every 3-5 minutes.
- Give midazolam if either: morphine is unsuccessful or the patient does not appear to be in pain:
  a) Give 1-2 mg midazolam IV every 3-5 minutes to a maximum of 10 mg **or**
  b) Give 5-10 mg midazolam IM, if IV access cannot be obtained, every 15 minutes to a maximum of 15 mg.
- If the above measures fail and there is immediate and substantial danger to either the patient or treating personnel, give 2 mg/kg ketamine IM up to a maximum of 200 mg.
- Contact a medical specialist for advice if the situation is not easily brought under control.

NOTES

Competency

- A competent patient has the right to refuse treatment. Every patient is presumed to be competent to make decisions unless there are reasonable grounds to believe otherwise.
- Patients can be deemed to be competent to make decisions if they meet all of the following criteria:
  a) They appear to understand information given to them and can recall this when asked **and**
  b) They appear to understand the implications of their decisions and can recall these when asked **and**
  c) They communicate on these issues consistently **and**
  d) They are over 16 years of age **and**
  e) They have not attempted, or expressed thoughts of self harm.
- Always act in the best interest of a patient who is not competent to make decisions.

- The law in New Zealand is not clear on the age at which a child becomes competent to make decisions regarding healthcare. Although we are using an age guideline of 16 years (below which we are automatically deeming a child to be not competent), all children should be communicated with and treated as if they are competent. If a child younger than 16 years of age is making a decision, which in the opinion of the treating personnel is not in their best interest, then that child should be deemed to be not competent.
- Personnel should seek advice from a Medical Advisor or another medical specialist if the situation is difficult.

Sedating and/or restraining a combative patient

- A reasonable attempt must be made to de-escalate the situation and calm the patient by talking to them. Utilise family and/or friends if appropriate.
- Sedation and/or restraint both carry risks, which must be balanced against the risk of not treating and/or transporting the patient. Use the minimum amount of sedation and/or restraint to provide treatment and/or transport in a safe manner.
- Never restrain the patient face down and never restrain them with weight on their chest or back, as these manoeuvres risk respiratory or cardiac arrest from positional asphyxia. All forms of physical restraint must be recorded on the patient report form. Consider requesting assistance from the Police if there is significant risk of physical danger to personnel.
- Use a dose of morphine and/or midazolam at the lower end of the ranges described if the patient is small, elderly or physiologically unstable.
- Continually monitor the patient's airway, breathing and level of consciousness. Monitor the patient's pulse, blood pressure and capillary refill time, particularly in the restrained limbs, if possible.
- Contact a Medical Advisor or another medical specialist if the situation is not easily brought under control.

PERSONAL NOTES

5.0 SPECIAL CONSIDERATIONS IN CHILDREN

Children, particularly small children, have unique physiologic and anatomic characteristics that differ from adults in many ways.

The child's general appearance is one of the most important things to consider when determining how severe the illness or injury is, the need for treatment and the response to therapy.

Communication

- The child may be frightened and confused. This will be caused by the injury or illness and the feeling and discomfort associated with it. It is also likely that the child will identify you as a stranger and be frightened of you.
- The child will only be able to communicate with you up to their understanding of vocabulary. Younger children will not understand much of what you are asking them and this should be taken into account. You may not be able to get any answers from a child who 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 they are anxious and to keep a calm manner, without appearing to be overly relaxed or unconcerned.
- Whenever possible, do not separate children from their parents or caregivers.

Interaction and activity

- Small children will have reduced interaction and activity if they are very unwell or badly injured.
- Signs of reduced activity include:
  a) Lethargy.
  b) Abnormal cry.
  c) Failure to interact with people or objects.
  d) Reduced tone or floppiness.

The respiratory system

- Children rely heavily on the rate of respiration 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 further downward against their abdominal organs. This means that 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. This 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 ribs. This means that an increase in work of breathing will cause indrawing or retraction.
- Signs of respiratory distress include:
  a) Tachypnoea.
  b) Nasal flaring.
  c) Grunting.
  d) Weak cry.
  e) Indrawing or retraction. Look for this in the supraclavicular, intercostal and substernal sites.
  f) Accessory muscle use.
  g) Stridor.
  h) Abnormal positioning, for example, sitting forward, the sniffing position, the tripod position or refusing to lie down.
  i) 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 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 low blood pressure is a very late sign of shock. However, the trend of blood pressure and pulse pressure over time may be useful.
- The signs of shock in children are:
  a) Tachycardia.
  b) Tachypnoea.
  c) Vasoconstriction with prolonged capillary refill time. This will also often produce mottled skin.
  d) Reduced activity and interaction.

- Although children have a higher blood volume per kg, 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, children's upper airways tend to get obstructed by their 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 rib fractures.

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 they are exposed to cold weather, have burns, are cooled or are undressed during examination and treatment.

Normal 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 Score

Best eye response	
Spontaneously	4
To voice or touch	3
To pain	2
None	1
Best verbal response	
Smiles, babbles, coos	5
Cries normally	4
Cries only to pain	3
Moans or grunts	2
None	1
Best motor response	
Normal spontaneous movement	6
Localises	5
Withdraws	4
Flexes	3
Extends	2
None	1

5.1 PAEDIATRIC DRUG DOSES

For children the doses of drugs, defibrillation energy and fluid therapy are based on body weight when this is known. If the body weight is not known, it can be estimated from the child's age using the formulae in the table. The formulae are a guide only with some children being heavier than predicted. Many children will require a different sized ETT or length at lips than predicted by the formulae.

Weight (kg)	
• Under 1 year old	5
• 1-10 years	2 x (age in years + 4)
• 11-14 years	3 x age in years
Endotrachael tube (ETT) size (mm)	
• Newborn to 1 year	3-4
• 1 year and over	(age in years/4) + 4
Endotrachael 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 all 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 to the nearest of 5, 10, 20, 30, 40 or 50 kg. All children whose weight is rounded to 50 kg can be given adult doses.
- The tables do not incorporate all administration information. A good knowledge of each drug is required.

- The tables indicate the dose of each drug for a given weight, the concentration of solution that should be obtained and the volume that should be administered from that solution.
- For drugs where there is a dose range in adults (e.g. IV morphine) the dose for children has been calculated using the upper portion of the dose range. Consider reducing the dose if the child is physiologically unstable.
- Drug doses for rapid sequence intubation (RSI) are not in these tables but are in the RSI section.

Drug Dilution
Adrenaline 1/10,000 • Using a 10 ml syringe, draw up 1 ml adrenaline from 1 mg/ml ampoule • Add 9 ml 0.9% NaCl to make a total volume of 10 ml
Adrenaline 1/1,000,000 • Use a 1 litre bag of 0.9% NaCl • Add 1 ml adrenaline from 1mg/ml ampoule • Shake well and label
[1]Ceftriaxone IV 100 mg/ml • Add 5 ml 0.9% NaCl to each of two ampoules, shake until dissolved • Using a 20 ml syringe, draw up both ampoules • Add 10 ml 0.9% NaCl to make a total volume of 20 ml
[2]Ceftriaxone IM 200 mg/ml • Add 5 ml 0.9% NaCl to one ampoule, shake until dissolved • Using a 5 ml syringe, draw up the ampoule
[3]Ketamine IV 2 mg/ml • Use a 100 ml bag of 5% glucose • Add 2 ml ketamine from 200 mg/2 ml ampoule • Shake well and label
[4]Morphine IV 1 mg/ml • Using a 10 ml syringe, draw up 1 ml morphine from 10 mg/ml ampoule • Add 9 ml 0.9% NaCl to make a total volume of 10 ml
[5]Naloxone IV 0.1 mg/ml • Using a 5 ml syringe, draw up 1 ml naloxone from 0.4 mg/ml ampoule • Add 3 ml 0.9% NaCl to make a total volume of 4 ml
[6]Vecuronium IV 1 mg/ml • Add 5 ml 0.9% NaCl to ampoule, shake until dissolved • Using a 10 ml syringe, draw up the ampoule • Add 5 ml 0.9% NaCl to make a total volume of 10 ml

5 kg (approximately 3 months)

5 kg (approximately 3 months)

Asthma and Anaphylaxis		
	Dose	**Volume**
Adrenaline IM	**0.05 mg**	**0.5 ml of 1/10,000**
	1/10,000 = 1 mg adrenaline + 9 ml 0.9% NaCl	
Adrenaline IV	**0.001 mg**	**1 ml of 1/1,000,000**
	1/1,000,000 = 1 mg adrenaline + 1 L 0.9% NaCl	

Cardiac Arrest		
	Dose	**Volume**
Adrenaline IV (every 4 minutes)	**0.1 mg**	**1 ml of 1/10,000**
	1/10,000 = 1 mg adrenaline + 9 ml 0.9% NaCl	
Amiodarone IV (VF/VT any time after 1st dose of adrenaline)	**25 mg**	**0.5 ml**
	Undiluted (150 mg/3 ml ampoule)	
Manual Defibrillation	**20 joules**	
LMA	**Size 1**	
ETT	**Size 4**	
	Estimated length at lips: 12 cm	

5 kg (approximately 3 months)

5 kg (approximately 3 months)

Other Drugs		
	Dose	**Volume**
Ceftriaxone IV	n/a	n/a
Ceftriaxone IM	n/a	n/a
Fentanyl IV	n/a	n/a
Fentanyl IN (halve if second dose or opiate/ketamine given)	n/a	n/a
Glucagon IM	0.5 mg	0.5 ml undiluted
Ketamine IV (halve if opiate or IM/PO ketamine given)	n/a	n/a
Ketamine IM, PO	n/a	n/a
1% Lignocaine IO	n/a	n/a
Loratadine PO	n/a	n/a
Midazolam IV	0.2 mg	0.2 ml of 1 mg/ml
Midazolam IM	1 mg	0.2 ml of 5 mg/ml
Midazolam IN	1.5 mg	0.3 ml of 5 mg/ml
Morphine IV	0.5 mg	0.5 ml of 1 mg/ml[4]
Morphine IM	1 mg	0.1 ml undiluted
Naloxone IV	0.05 mg	0.5 ml of 0.1 mg/ml[5]
Naloxone IM	0.1 mg	0.25 ml undiluted
Naloxone IN	0.2 mg	0.5 ml undiluted
Ondansetron PO	n/a	n/a
Ondansetron IV, IM	n/a	n/a
Paracetamol Liquid (always round weight down)	100 mg	2 ml (250 mg/5 ml)
Paracetamol Tablet	n/a	n/a
Vecuronium IV	1 mg	1 ml of 1mg/ml[6]
0.9% NaCl	20 ml/kg	100 ml
10% Glucose IV	2 ml/kg	10 ml

10 kg (approximately 1 year)

10 kg (approximately 1 year)

Asthma and Anaphylaxis		
	Dose	**Volume**
Adrenaline IM	**0.1 mg**	**0.1 ml undiluted**
Adrenaline IV	**0.002 mg**	**2 ml of 1/1,000,000**
	1/1,000,000 = 1 mg adrenaline + 1 L 0.9% NaCl	

Cardiac Arrest		
	Dose	**Volume**
Adrenaline IV (every 4 minutes)	**0.2 mg**	**2 ml of 1/10,000**
	1/10,000 = 1 mg adrenaline + 9 ml 0.9% NaCl	
Amiodarone IV (VF/VT any time after 1st dose of adrenaline)	**50 mg**	**1 ml**
	Undiluted (150 mg/3 ml ampoule)	
Manual Defibrillation	**50 joules**	
LMA	**Size 2**	
ETT	**Size 4**	
	Estimated length at lips: 12 cm	

10 kg (approximately 1 year)

10 kg (approximately 1 year)

Other Drugs		
	Dose	**Volume**
Ceftriaxone IV	n/a	n/a
Ceftriaxone IM	n/a	n/a
Fentanyl IV	n/a	n/a
Fentanyl IN (halve if second dose or opiate/ketamine given)	n/a	n/a
Glucagon IM	0.5 mg	0.5 ml undiluted
Ketamine IV (halve if opiate or IM/PO ketamine given)	n/a	n/a
Ketamine IM, PO	n/a	n/a
1% Lignocaine IO	10 mg	1 ml undiluted
Loratadine PO	n/a	n/a
Midazolam IV	0.4 mg	0.4 ml of 1 mg/ml
Midazolam IM	2 mg	0.4 ml of 5 mg/ml
Midazolam IN	3 mg	0.6 ml of 5 mg/ml
Morphine IV	1 mg	1 ml of 1 mg/ml[4]
Morphine IM	2 mg	0.2 ml undiluted
Naloxone IV	0.1 mg	1 ml of 0.1 mg/ml[5]
Naloxone IM	0.2 mg	0.5 ml undiluted
Naloxone IN	0.4 mg	1 ml undiluted
Ondansetron PO	n/a	n/a
Ondansetron IV, IM	n/a	n/a
Paracetamol Liquid (always round weight down)	200 mg	4 ml (250 mg/5 ml)
Paracetamol Tablet	n/a	n/a
Vecuronium IV	2 mg	2 ml of 1mg/ml[6]
0.9% NaCl	20 ml/kg	200 ml
10% Glucose IV	2 ml/kg	20 ml

20 kg (approximately 5 years)

20 kg (approximately 5 years)

Asthma and Anaphylaxis		
	Dose	**Volume**
Adrenaline IM	**0.2 mg**	**0.2 ml undiluted**
Adrenaline IV	**0.004 mg**	**4 ml of 1/1,000,000**
	1/1,000,000 = 1 mg adrenaline + 1 L 0.9% NaCl	

Cardiac Arrest		
	Dose	**Volume**
Adrenaline IV (every 4 minutes)	**0.4 mg**	**4 ml of 1/10,000**
	1/10,000 = 1 mg adrenaline + 9 ml 0.9% NaCl	
Amiodarone IV (VF/VT any time after 1st dose of adrenaline)	**100 mg**	**2 ml**
	Undiluted (150 mg/3 ml ampoule)	
Manual Defibrillation	**100 joules**	
LMA	**Size 2**	
ETT	**Size 5**	
	Estimated length at lips: 15 cm	

20 kg (approximately 5 years)

20 kg (approximately 5 years)

Other Drugs		
	Dose	**Volume**
Ceftriaxone IV	800 mg	8 ml of 100 mg/ml[1]
Ceftriaxone IM	400 mg	2 ml of 200 mg/ml[2]
Fentanyl IV	20 mcg	0.4 ml undiluted
Fentanyl IN (halve if second dose or opiate/ketamine given)	40 mcg	0.8 ml undiluted
Glucagon IM	0.5 mg	0.5 ml undiluted
Ketamine IV (halve if opiate or IM/PO ketamine given)	16 mg	8 ml of 2 mg/ml[3]
Ketamine IM, PO	20 mg	0.2 ml undiluted
1% Lignocaine IO	20 mg	2 ml undiluted
Loratadine PO	5 mg	$^1/_2$ of 10 mg tablet
Midazolam IV	0.8 mg	0.8 ml of 1 mg/ml
Midazolam IM	4 mg	0.8 ml of 5 mg/ml
Midazolam IN	6 mg	1.2 ml of 5 mg/ml
Morphine IV	2 mg	2 ml of 1 mg/ml[4]
Morphine IM	4 mg	0.4 ml undiluted
Naloxone IV	0.2 mg	2 ml of 0.1 mg/ml[5]
Naloxone IM	0.4 mg	1 ml undiluted
Naloxone IN	0.8 mg	2 ml undiluted
Ondansetron PO	4 mg	1 wafer
Ondansetron IV, IM	2 mg	1 ml undiluted
Paracetamol Liquid (always round weight down)	400 mg	8 ml (250 mg/5 ml)
Paracetamol Tablet	n/a	n/a
Vecuronium IV	4 mg	4 ml of 1mg/ml[6]
0.9% NaCl	20 ml/kg	400 ml
10% Glucose IV	2 ml/kg	40 ml

30 kg (approximately 10 years)

30 kg (approximately 10 years)

Asthma and Anaphylaxis		
	Dose	**Volume**
Adrenaline IM	**0.3 mg**	**0.3 ml undiluted**
Adrenaline IV	**0.006 mg**	**6 ml of 1/1,000,000**
	1/1,000,000 = 1 mg adrenaline + 1 L 0.9% NaCl	

Cardiac Arrest		
	Dose	**Volume**
Adrenaline IV (every 4 minutes)	**0.6 mg**	**6 ml of 1/10,000**
	1/10,000 = 1 mg adrenaline + 9 ml 0.9% NaCl	
Amiodarone IV (VF/VT any time after 1st dose of adrenaline)	**150 mg**	**3 ml**
	Undiluted (150 mg/3 ml ampoule)	
Manual Defibrillation	**150 joules**	
LMA	**Size 3**	
ETT	**Size 6**	
	Estimated length at lips: 17 cm	

30 kg (approximately 10 years)

30 kg (approximately 10 years)

Other Drugs		
	Dose	**Volume**
Ceftriaxone IV	1.2 g	12 ml of 100 mg/ml[1]
Ceftriaxone IM	600 mg	3 ml of 200 mg/ml[2]
Fentanyl IV	30 mcg	0.6 ml undiluted
Fentanyl IN (halve if second dose or opiate/ketamine given)	60 mcg	1.2 ml undiluted
Glucagon IM	1 mg	1 ml undiluted
Ketamine IV (halve if opiate or IM/PO ketamine given)	24 mg	12 ml of 2 mg/ml[3]
Ketamine IM, PO	30 mg	0.3 ml undiluted
1% Lignocaine IO	30 mg	3 ml undiluted
Loratadine PO	5 mg	$^1/_2$ of 10 mg tablet
Midazolam IV	1.2 mg	1.2 ml of 1 mg/ml
Midazolam IM	6 mg	1.2 ml of 5 mg/ml
Midazolam IN	9 mg	1.8 ml of 5 mg/ml
Morphine IV	3 mg	3 ml of 1 mg/ml[4]
Morphine IM	6 mg	0.6 ml undiluted
Naloxone IV	0.3 mg	3 ml of 0.1 mg/ml[5]
Naloxone IM	0.6 mg	1.5 ml undiluted
Naloxone IN	1.2 mg	3 ml undiluted
Ondansetron PO	4 mg	1 wafer
Ondansetron IV, IM	3 mg	1.5 ml undiluted
Paracetamol Liquid (always round weight down)	600 mg	12 ml (250 mg/5 ml)
Paracetamol Tablet	500 mg	1 tablet
Vecuronium IV	6 mg	6 ml of 1mg/ml[6]
0.9% NaCl	20 ml/kg	600 ml
10% Glucose IV	2 ml/kg	60 ml

40 kg (approximately 13 years)

40 kg (approximately 13 years)

Asthma and Anaphylaxis		
	Dose	**Volume**
Adrenaline IM	**0.4 mg**	**0.4 ml undiluted**
Adrenaline IV	**0.008 mg**	**8 ml of 1/1,000,000**
	1/1,000,000 = 1 mg adrenaline + 1 L 0.9% NaCl	

Cardiac Arrest		
	Dose	**Volume**
Adrenaline IV (every 4 minutes)	**0.8 mg**	**8 ml of 1/10,000**
	1/10,000 = 1 mg adrenaline + 9 ml 0.9% NaCl	
Amiodarone IV (VF/VT any time after 1st dose of adrenaline)	**200 mg**	**4 ml**
	Undiluted (150 mg/3 ml ampoule)	
Manual Defibrillation	**200 joules**	
LMA	**Size 3**	
ETT	**Size 7**	
	Estimated length at lips: 19 cm	

40 kg (approximately 13 years)

40 kg (approximately 13 years)

Other Drugs		
	Dose	**Volume**
Ceftriaxone IV	1.6 g	16 ml of 100 mg/ml[1]
Ceftriaxone IM	800 mg	4 ml of 200 mg/ml[2]
Fentanyl IV	40 mcg	0.8 ml undiluted
Fentanyl IN (halve if second dose or opiate/ketamine given)	80 mcg	1.6 ml undiluted
Glucagon IM	1 mg	1 ml undiluted
Ketamine IV (halve if opiate or IM/PO ketamine given)	32 mg	16 ml of 2 mg/ml[3]
Ketamine IM, PO	40 mg	0.4 ml undiluted
1% Lignocaine IO	40 mg	4 ml undiluted
Loratadine PO	5 mg	$^1/_2$ of 10 mg tablet
Midazolam IV	1.6 mg	1.6 ml of 1 mg/ml
Midazolam IM	8 mg	1.6 ml of 5 mg/ml
Midazolam IN	12 mg	2.4 ml of 5 mg/ml
Morphine IV	4 mg	4 ml of 1 mg/ml[4]
Morphine IM	8 mg	0.8 ml undiluted
Naloxone IV	0.4 mg	4 ml of 0.1 mg/ml[5]
Naloxone IM	0.8 mg	2 ml undiluted
Naloxone IN	1.6 mg	4 ml undiluted
Ondansetron PO	4 mg	1 wafer
Ondansetron IV, IM	4 mg	2 ml undiluted
Paracetamol Liquid (always round weight down)	800 mg	16 ml (250 mg/5 ml)
Paracetamol Tablet	750 mg	1 $^1/_2$ tablets
Vecuronium IV	8 mg	8 ml of 1mg/ml[6]
0.9% NaCl	20 ml/kg	800 ml
10% Glucose IV	2 ml/kg	80 ml

5.2 NEWBORN RESUSCITATION

If breathing is adequate and the heart rate is > 100/min dry the baby, keep it warm and do not give oxygen. Continue to monitor breathing and heart rate.

If breathing is inadequate and the heart rate is ≤ 100/min ventilate with a manual ventilation bag at a rate of 40-60/min without added oxygen. Continually monitor the heart rate:

If the heart rate climbs to > 100/min	If the heart rate remains 60 – 100/min	If the heart rate falls to < 60/min
• Dry the baby, keep it warm and do not give oxygen. • Continually monitor breathing and heart rate. Be prepared to support breathing if required.	• Focus on ventilation and continually monitor heart rate. • If the heart rate fails to improve continue to focus on ventilation and add oxygen. • If no improvement, consider placing an LMA.	• Start CPR at a ratio of 3:1. • Continue to focus on ventilation. • Consider placing an LMA. • Gain IV or IO access, but good CPR takes priority. • Give a 20 ml/kg bolus of 0.9% NaCl.

- Resuscitation of the newborn is completely different to resuscitation of older children in that the focus is primarily on supporting breathing.
- Assessment and interventions are based primarily on the baby's breathing and heart rate. Reassess these every 30 seconds.
- If the lead maternity carer (LMC, for example, a midwife, obstetrician or GP) is present, the LMC is in charge of leading the treatment provided to the baby unless they formally hand this responsibility over to another healthcare provider.
- Request early back up and support from a hospital team or LMC if one is available. Begin to transport as soon as possible.
- Measure blood glucose (heel prick) and treat accordingly if the baby does not have normal activity. This is not a priority if the baby is requiring resuscitation.

NOTES

- A crying and/or active baby requires no specific intervention and should stay with the mother. It is normal for a baby to have central blueness and an SpO_2 of 50-70% at the time of delivery.
  It is normal for the peripheries to remain blue for many minutes and the SpO_2 to be around 90% at 5 minutes.
- Preventing heat loss is vitally important, particularly in premature babies:
  a) Premature babies should be immediately wrapped in plastic (leaving the face free) without being dried. They should be placed under radiant heat as soon as possible.
  b) Term babies should be dried and resuscitated in a warm environment if possible.
  c) A hat should be placed on the baby if one is available.
- Oxygen administration during newborn resuscitation appears to make outcomes worse. This is why oxygen is reserved for deterioration despite initial ventilation.
- Suctioning a baby's mouth and nose before the body is delivered is not required unless there is a large amount of meconium visible around the mouth or nose. Ventilation takes priority over suctioning meconium.
- The presence of fluid within the lungs may mean that lung inflation pressures for the initial breaths may need to be higher than that set on the relief valves of manual ventilation bags. It is acceptable to close the relief valve for the first few breaths to aid initial expansion of the lungs.
- Ventilation with a manual ventilation bag can result in distension of the stomach. If the abdomen is visibly distended, decompress the stomach by placing a small suction catheter into the stomach via the nose and applying suction. Do not spend a long time trying to do this if it is difficult.
- There is no urgency to cut the umbilical cord provided the baby is not requiring resuscitation. In the absence of urgency, the cord is usually cut after 1 minute. If you are required to clamp and cut the umbilical cord, leave at least 5 cm of intact cord to facilitate later access to the cord vessels.
- Do not give naloxone to a baby whose mother has received opiates during or prior to labour (including self administration). This is because of the risk of naloxone precipitating intra-cranial bleeding.

PERSONAL NOTES

PERSONAL NOTES

6.1 PAIN RELIEF

Paracetamol

- Indicated for mild pain or in addition to other measures for moderate pain. May be used if the patient is febrile with a temperature greater than 39 degrees and the fever is causing discomfort. Not indicated for pain associated with myocardial ischaemia.
- Contraindicated if the patient:
  a) Has taken any paracetamol within the last 4 hours **or**
  b) Has current paracetamol poisoning.
- Give 1.5 g to large adults (> 70 kg) and 1 g to small adults (50-70 kg).
- A patient may be given paracetamol and have a recommendation made to them that they do not require immediate referral to a doctor, provided no compulsory criteria for recommending immediate referral to a doctor are met.

Paracetamol notes

- The doses described are slightly higher than those commonly used in healthcare and in the community. These doses are effective and safe provided they are not continued for a prolonged period of time.
- Paracetamol is not indicated for the treatment of fever alone as fever confers some benefit if the patient has an infection. It may be given if the patient's temperature is high (greater than 39 degrees) and the fever is causing discomfort.
- Patients with neutropenia (very low white cell count) following chemotherapy or bone marrow transplantation often have a pre-arranged treatment pathway that is partly determined by the presence of fever. Paracetamol administration may mask fever in such patients and should be avoided unless the patient's temperature is very high (greater than 40 degrees).

Entonox

- Indicated for moderate to severe pain.
- Contraindicated if the patient:
  a) Is unable to obey commands **or**
  b) Has a suspected pneumothorax **or**
  c) Has a suspected bowel obstruction **or**
  d) Has been SCUBA diving in the last 24 hours or has a diving related emergency.

Entonox notes

- The nitrous oxide in entonox expands gas filled spaces in the body. This is the reason for many of its contraindications.
- Entonox is not contraindicated in patients 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 patients with abdominal pain but is contraindicated if a bowel obstruction is suspected. Bowel obstruction most commonly presents with vomiting and abdominal discomfort. Abdominal distension and reduced frequency of bowel motions or passing of gas may be present.
- In general, only one form of inhalational pain relief (either entonox or methoxyflurane) should be used but it is acceptable to swap from one to the other if there is a good indication to do so.

Methoxyflurane

- Indicated for moderate to severe pain.
- Contraindicated if the patient:
  a) Is unable to obey commands **or**
  b) Has known renal impairment (note: renal failure with dialysis, kidney stones and/or renal colic are not contraindications) **or**
  c) Has a personal or family history of malignant hyperthermia **or**
  d) Has received methoxyflurane within the last week.
- Relatively contraindicated if the patient:
  a) Has toxaemia of pregnancy **or**
  b) Is in labour with known signs of foetal distress.
- The maximum dose for patients aged ≤ 10 years is 1 dose (3 ml) and for patients aged > 10 years is 2 doses (6 ml).
- Administer 1 dose (3 ml) at a time and always use with a charcoal filter.

Methoxyflurane notes

- One of the metabolic products of methoxyflurane is fluoride ions and these may cause renal impairment in high concentrations. The concentrations of fluoride ions following analgesia doses of methoxyflurane are extremely low.
- Do not add supplemental oxygen to the inhaler as this significantly increases the amount of methoxyflurane lost through evaporation.
- Place the inhaler in a closed zip lock bag if the methoxyflurane has not been fully used. It may be reused by the same patient.

Morphine

- Indicated for moderate to severe pain.
- Contraindicated if the patient:
  a) Is unable to obey commands (exceptions – see combative patient and post intubation sections) **or**
  b) Has respiratory depression **or**
  c) Is in premature labour.
- Dosing:
  a) Give 1-5 mg IV every 3-5 minutes.
  b) Give 5-10 mg IM if unable to obtain IV access. This may be repeated once after 15 minutes.

Morphine notes

- Use doses at the lower end of the ranges described if the patient is small, elderly or physiologically unstable.
- Do not use the IM route if the patient is shocked and avoid the IM route in children if possible.
- Histamine release is very common after morphine administration. This is not a drug allergy provided it is isolated to skin involvement and self limiting.
- Nausea, vomiting and itch after morphine are all side effects and are not drug allergies. True allergy to morphine is rare but some patients experience severe side effects and refuse to receive it again. Consider using fentanyl in such patients.

Fentanyl

- Indicated for moderate to severe pain when the patient:
  a) Requires intense pain relief very quickly **or**
  b) Requires intense pain relief for a short period of time only **or**
  c) Is cardiovascularly unstable **or**
  d) Is a child without IV access.
- Contraindicated if the patient:
  a) Is aged less than 2 years **or**
  b) Is unable to obey commands (exception – see RSI section) **or**
  c) Has respiratory depression **or**
  d) Is in premature labour.
- Give adults 10-50 mcg IV every 3-5 minutes.

- Give intra-nasal fentanyl to children without IV access:
  a) Give 2 mcg/kg provided no opiate or ketamine has already been given.
  b) Give 1 mcg/kg if an opiate or ketamine has already been given.
  c) Give a further dose of 1 mcg/kg after 15 minutes if required, once only.

Fentanyl notes

- Use doses at the lower end of the ranges described if the patient is small, elderly or physiologically unstable.
- Fentanyl usually results in less histamine release and less of a fall in blood pressure than morphine. However, fentanyl will still drop blood pressure in a cardiovascularly unstable patient.
- The preferred route is IV. Reserve intra-nasal administration for children when IV access cannot be obtained or will be very difficult to obtain.

Ketamine

Indicated for severe pain, particularly musculoskeletal or burn pain.
Is preferably used in combination with an opiate.

- Contraindicated if the patient:
  a) Is aged less than 2 years **or**
  b) Is unable to obey commands (exception – see combative patient section) **or**
  c) Has active psychosis (exception – see combative patient section) **or**
  d) Has current myocardial ischaemia.
- Use with caution if the patient is hypertensive.
- Dosing:
  a) Give 10-20 mg IV every 3-5 minutes if an opiate or IM/oral ketamine has already been given **or**
  b) Give 10-40 mg every 3-5 minutes if an opiate or IM/oral ketamine has not already been given.
  c) Give 1 mg/kg (rounded off to the nearest 10 kg) IM or oral, up to a maximum of 100 mg, if unable to gain IV access. This may be repeated once after 15 minutes.

Ketamine notes

- Warn the patient they are likely to feel 'strange' following ketamine administration and ask them to tell you if this occurs or they feel 'awful'.

- Some patients may experience hallucinations with ketamine. Do not focus on warning the patient specifically about these as such warnings appear to increase the likelihood of their occurrence. Hallucinations or 'awful' experiences appear more common if small sub-therapeutic doses of ketamine are given.
- Do not routinely treat hallucinations with midazolam. This is 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, low dose IV midazolam may be given if the hallucinations are very severe, provided the patient is physiologically stable.

Intraosseous lignocaine

- Indicated for significant bone pain associated with intraosseous infusion.
- Give adults 5 ml of 1% lignocaine over 2 minutes and wait 1 further minute before giving intraosseous fluid.
- This may be repeated once after 15 minutes.

6.2 MINOR ALLERGY

This section is for minor allergic reactions (including bites and stings) that are confined to skin involvement.

- Give loratadine if itch is prominent.
- Loratadine is contraindicated if the patient is aged less than 2 years or is taking erythromycin or roxithromycin.
- Loratadine dosing:
  a) Give adults 10 mg.
  b) Give children aged 2 years and over 5 mg.
- Patients may be given loratadine and have a recommendation made to them that they do not require immediate referral to a doctor provided:
  a) There are no signs of systemic involvement **and**
  b) There is no facial or intra-oral swelling **and**
  c) There are no signs of blistering or peeling **and**
  d) No adrenaline (including self-administration) has been used.

NOTES

- Loratadine may be given for prominent itch, after treatment for anaphylaxis, provided the systemic signs and symptoms have all resolved.
- Systemic signs and symptoms include any of the following: shortness of breath, wheezing, tachycardia, hypotension, abdominal pain, vomiting or diarrhoea.

6.3 NAUSEA AND/OR VOMITING

- Give ondansetron for severe nausea and/or vomiting provided the patient is aged 2 or more years.
- Give oral ondansetron provided vomiting is not continuous.
- Give IV ondansetron if vomiting is continuous or if oral ondansetron has failed.
- Ondansetron dosing for adults:
  a) 8 mg oral.
  b) 4 mg IV or IM.

NOTES

- The oral route is preferred.
- The IV route is reserved for patients who have continuous vomiting or where severe nausea and/or vomiting persist despite oral ondansetron.
- The IM route is less preferable than the IV route but may be used if IV access cannot be obtained.
- Prophylactic administration of ondansetron is not routinely required for patients with an immobilised cervical spine. Consider administering ondansetron if:
  a) The patient has nausea **or**
  b) The patient has a known history of motion sickness **or**
  c) The nature of the patient's injuries and transport position is such that vomiting would be particularly problematic.

6.4 STROKE AND TIA

Stroke

The FAST assessment Use this for assessing a conscious patient with a possible stroke	
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 or leg weakness: • Ask the patient to raise their arms (to 90 degrees from the body) with their palms facing upward. Then ask them to close their eyes and hold their arms there for 5 seconds while you count aloud. Look for one arm that drifts downwards. • Ask the patient to walk. Look for abnormal gait.
SPEECH:	Look for new onset of abnormal speech: • Ask the patient to repeat a sentence. Look for slurring of words. • Show the patient several common objects and ask them to name them. Look for difficulty or inability to name objects.
TIME:	Note the time of onset of symptoms. This is defined as the time that the patient **was last seen to be normal**. If the patient has woken up with the signs or symptoms, then the time of onset of symptoms is the time that the patient went to sleep.
Patients with new onset of abnormalities as detected by the FAST assessment are having a stroke until proven otherwise.	

- Measure blood glucose and treat accordingly.
- Transport to hospital without delay.
- In general, transport to hospital should be by road. Consider discussing the possibility of transport by helicopter (with the intensive care paramedic on the clinical desk within the EACC or with a Medical Advisor) if:
  a) The patient is aged under 70 years of age **and**
  b) The patient has significant signs of weakness **and**

c) The patient can reach hospital within 3.5 hours of the onset of symptoms **and**
d) Helicopter transport will save more than 1 hour compared to road transport.

NOTES

- Hypoglycaemia can cause signs and symptoms that mimic a stroke.
- Patients with an ischaemic stroke have signs and symptoms that relate to the part of the brain that has lost its blood supply. Most commonly these include any combination of new onset:
  a) Unilateral face weakness **or**
  b) Unilateral arm weakness **or**
  c) Unilateral leg weakness **or**
  d) Speech disturbance **or**
  e) Visual disturbance.
- Patients with an ischaemic stroke are usually able to obey commands on their 'good side'. If they cannot, it is unlikely they have had an ischaemic stroke.
- Patients with a haemorrhagic stroke present with sudden onset of headache with signs and symptoms, including all of those listed above, that relate to the part of the brain in which the bleed has occurred. Patients with a haemorrhagic stroke are less likely to be able to obey commands than a patient with an ischaemic stroke.
- It is not possible to clinically distinguish between an ischaemic stroke and a haemorrhagic stroke with a high degree of confidence without a CT scan.
- Patients with an ischaemic stroke who can be transported to a hospital with a CT scanner within 3.5 hours of the onset of symptoms are potential candidates for treatment with thrombolysis. The earlier they are thrombolysed the better their outcome. For this reason, the patient should be transported to hospital without delay. There is no role for transport to a GP unless it is for back up for specific problems en route to hospital.
- Patients who cannot be transported to a hospital with a CT scanner within 3.5 hours of the onset of symptoms are usually not candidates for treatment with thrombolysis. While transport to hospital should not be unnecessarily delayed, it is not time critical.

TIA

The ABCD2 Score	SCORE
AGE: if ≥ 60 years	1
BLOOD PRESSURE: if SBP >140 and/or DBP > 90	1
CLINICAL FEATURES: (choose one) • Unilateral weakness • Speech disturbance without weakness	 2 1
DURATION OF SYMPTOMS: • ≥ 60 minutes • 10-59 minutes • < 10 minutes	 2 1 0
DIABETES: if present	1

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 the risk (maximum score 7).
- A patient with an ABCD2 score ≤ 3 is at low risk and can be urgently referred to a TIA clinic, provided a formal pathway exists for this. If such a formal pathway does not exist, the patient should receive a recommendation to be transported to hospital.
- A patient with an ABCD2 score > 3 is at medium to high risk and should receive a recommendation to be transported to hospital.

NOTES

- TIA is defined as stroke symptoms or signs that completely resolve within 24 hours.
- Patients who have had a TIA are at increased risk of subsequently developing a stroke.
- If the patient is having recurrent TIAs they should have a recommendation made to them that they are transported to hospital.
- If the patient has had a single TIA they should have a recommendation made to them that they are immediately referred to a doctor. Whether they should be seen in an Emergency Department or in a TIA clinic is dependent upon:
  a) Their ABCD2 score **and**
  b) Whether or not a formal pathway exists in that area for patients with low risk TIAs. See the ABCD2 score table.

6.5 OBSTETRIC PROBLEMS

General principles

- If a pregnant patient has a problem that is not primarily an obstetric problem (such as seizures or asthma) treat them as per the appropriate section. In this situation the patient must be transported to an Emergency Department and not a maternity unit or delivery suite.
- If the patient has an obstetric problem and is status one or two, they should be transported to an Emergency Department and not a maternity unit or delivery suite. Whenever feasible, this Emergency Department should be in a hospital with an obstetric unit.
- If the patient has an obstetric problem, and the lead maternity carer (LMC, for example, a midwife, obstetrician or GP) is present, the LMC is in charge of leading the treatment provided to the mother and baby unless they formally hand this responsibility over to another healthcare provider.

Miscarriage

- Patients with spontaneous miscarriage occurring during the first trimester do not require immediate referral or transport to hospital unless:
  a) Pain is significant **or**
  b) The nature of the pain is different to that of menstrual pain **or**
  c) Bleeding is clinically significant (more than a heavy period).
- If none of the above criteria are present, recommend that the patient sees their LMC or GP within 24-48 hours

Pregnancy and abdominal or pelvic trauma

All pregnant patients with abdominal or pelvic trauma occurring during the second or third trimester should be immediately referred to hospital, even if the trauma is relatively minor.

Supine hypotension

The uterus can impede veinous return through the inferior vena cava in the supine position. To prevent this, tilt the patient to their left by placing a rolled towel or pillow under the right hip.

Antepartum haemorrhage

- This is obstetric related bleeding occurring after 20 weeks gestation and prior to delivery of the baby.
- This usually presents with vaginal blood loss. Any vaginal blood loss must be considered to be antepartum haemorrhage until proven otherwise.
- There can be significant antepartum haemorrhage without visible vaginal blood loss, e.g. with placental abruption.
- All patients with antepartum haemorrhage should be immediately referred to hospital.
- Use the section titled 'hypovolaemia from other causes' if the patient has signs of hypovolaemia.

Premature labour

- Transport to hospital immediately.
- Be prepared to provide neonatal resuscitation.
- Do not give any medicines to slow down labour unless requested to do so by an LMC.

Normal delivery

- Allow the patient to adopt the position she wishes to.
- Support the baby's head and shoulders as they appear, without pulling on the baby or applying traction.
- Dry the baby.
- Place the baby 'skin to skin' with the mother, provided the baby does not require resuscitation. Cover them both with a blanket and place a hat on the baby if one is available.
- Clamping and cutting the cord is not urgent but can be done after 1 minute. Clamp the cord 5 cm from the baby.
- Allow the placenta to deliver spontaneously, without applying traction. This may take up to 30 minutes.
- Following delivery of the placenta, feel for the uterus at approximately umbilical level and rub it until it feels firm.

If the baby gets stuck

If the baby's head appears but the body does not after 2 contractions with pushing:

- Get the patient to grab her knees, pull them to her chest and push as hard as she can with the next 2 contractions.

- 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.
- If the above fails, seek immediate help and advice from a midwife or doctor and 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, then do not do so and continue with delivery.

Prolapsed umbilical cord and breech delivery

Prolapsed umbilical cord is when the umbilical cord appears in the vagina ahead of the baby. Breech delivery is when the baby is coming out feet or buttocks first.

- Both presentations risk the baby having poor blood supply from the cord being compressed and both require urgent delivery of the baby.
- Seek immediate help and advice from a midwife or doctor and transport urgently.
- Tell the patient not to push. Position her so that her hips are higher than her shoulders. These manoeuvres are designed to take the weight of the baby off the cord and delay delivery until expert help is available. Either:
  a) Position her on her back with her hips on a pillow and the stretcher head down **or**
  b) Position her on her elbows and knees with her head down and the stretcher head down.
- If the baby appears in the vagina and the patient wants to push, allow delivery to occur.

Retained placenta

This is when the placenta has not been delivered within 30 minutes of the baby.

- Transport to hospital without delay.
- Be prepared to treat postpartum haemorrhage.

Postpartum haemorrhage

This is abnormal bleeding (> 500 ml) following delivery of the baby.

- Use the section titled 'hypovolaemic shock from uncontrolled bleeding' if the patient has signs of hypovolaemia.
- Transport urgently and seek help and advice from a midwife or doctor.
- Compress any obvious bleeding site, e.g. a visible vaginal laceration.
- Feel for the uterus at approximately umbilical level and massage it firmly using two hands.
- Encourage the baby to begin breast feeding or ask the patient or partner to stimulate both nipples by rolling them back and forth between their fingers and thumbs for approximately 15 minutes. This is designed to release oxytocin to help the uterus contract. This is not a priority if it is difficult to achieve.
- Perform bimanual compression of the uterus if the bleeding is severe and the patient is deteriorating. Place one hand in the vagina, as far as you can and form a fist. Push upward with this hand toward the patient's umbilicus. Place your other hand on the abdomen, feel for the uterus and push both hands firmly toward each other.

6.6 DIVING EMERGENCIES

- Position the patient flat, either on their back if they are obeying commands or on their side if they are not obeying commands.
- Give oxygen via a reservoir mask.
- Gain IV access.
- Give 0.9% NaCl IV using the section titled 'hypovolaemia from other causes' if the patient has signs of hypovolaemia.
- Give analgesia if required but do not give entonox.
- Transport to the nearest appropriate hospital. Do not transport direct to a recompression facility.
- Avoid transporting the patient higher than 300 m above sea level if feasible.

NOTES

- The most common diving emergency is decompression sickness or 'the bends'. This occurs when gases (predominantly nitrogen) that are dissolved in body fluids form bubbles.
- When a person has been diving at depth, the increased ambient pressure results in an increase in the amount of gases dissolved in body fluids. As the diver ascends these dissolved gases come out of body fluids and are 'breathed out' through the lungs. If the amount of dissolved gases is very high and the ascent is too rapid, the gases leaving body fluids can form bubbles.
- Patients with decompression sickness commonly have joint pain, particularly in large joints. Patients may have any combination of the following:
  a) Joint pain.
  b) Headache.
  c) Visual disturbance.
  d) Itching skin or a feeling of 'tiny insects crawling on the skin'.
  e) Altered peripheral sensation or motor power.
  f) Confusion.
  g) Reduced level of consciousness.
  h) Seizures.
  i) Chest pain.
  j) Shortness of breath.
- Approximately 50% of patients with decompression sickness will develop symptoms within 1 hour of diving. The remaining 50% may slowly develop symptoms up to 24 hours later. For this reason, decompression sickness must be considered a possibility in any patient with unexplained symptoms occurring within 24 hours of diving.

- Arterial gas embolism occurs when gas bubbles directly enter the circulation and end up within arteries. The gas bubbles usually come from a lung that has been damaged by expansion of gas during ascent. Patients with arterial gas embolism most commonly develop sudden onset of coma or sudden onset of stroke like symptoms, during or immediately after ascent/surfacing. The treatment of patients with arterial gas embolism is the same as the treatment of patients with decompression sickness.
- Decompression sickness and arterial gas embolism may be made worse by transport at altitude. This is because the decreased ambient pressure causes any gas bubbles present to enlarge.
- We no longer recommend transport direct to a recompression facility. This is because the majority of patients require assessment in an Emergency Department prior to referral to a recompression facility.

6.7 PEEP

If the patient weighs ≥ 50kg and a manual ventilation bag is being used:

- Do not attach PEEP if CPR is in progress.
- Attach PEEP set to 5 if the patient has traumatic brain injury.
- Attach PEEP set to 10 for all other patients.

If the patient has cardiogenic pulmonary oedema and severe respiratory distress that is not improving:

- Apply PEEP set to 10. Focus on ensuring a tight seal with the mask. Do not assist the patient's breathing unless it is ineffective.
- Increase the PEEP to 15 if the patient does not improve.

NOTES

- PEEP increases the resistance to exhalation and increases intra-thoracic pressure. The application of PEEP:
  a) Helps expand collapsed alveoli, improving oxygenation and ventilation.
  b) Splints medium sized airways open during exhalation, improving ventilation.
  c) Reduces the preload of the left ventricle by increasing the afterload of the right ventricle. This reduces the amount of fluid entering the lungs by reducing the pressure within lung blood vessels.
- PEEP is not applied during CPR because an increase in intra-thoracic pressure reduces the blood flow achieved during CPR. If a patient in cardiac arrest gains ROSC it is appropriate to attach PEEP to the manual ventilation bag, but this is not an immediate priority.
- PEEP increases intra-cranial pressure in patients with traumatic brain injury by reducing veinous return from the brain. In this setting there is a balance between the benefit of PEEP improving oxygenation and the risk of PEEP increasing intra-cranial pressure. This is why PEEP is set to 5 for these patients.
- PEEP reduces cardiac output by increasing the afterload of the right ventricle and reducing the preload of the left ventricle. This reduction in cardiac output may be substantial if PEEP is combined with positive pressure ventilation in a patient with:
  a) An underlying problem reducing right ventricular preload, such as hypovolaemia, tension pneumothorax or cardiac tamponade.
  b) An underlying problem increasing right ventricular afterload, such as pulmonary embolism.
- Patients with the above underlying problems require correction of the underlying problem (if possible) and expansion of their intra-vascular volume with 0.9% NaCl. This should occur prior to the application of positive pressure ventilation and PEEP, provided this is feasible.

6.8 END OF LIFE CARE

This section is for patients who are receiving end of life care. The terms 'palliative care' and 'end of life care' do not necessarily mean the same thing. Some patients receiving care from palliative care teams or hospices are not receiving end of life care. For these patients it may be appropriate to institute some resuscitative treatments. If there is any doubt medical advice should be sought.

- Confirm the patient is receiving end of life care. Locate and read the patient's care plan if possible.
- Contact the people coordinating the patient's end of life care (e.g. hospice, palliative care personnel or GP) whenever possible.
- It is appropriate for ambulance personnel to provide treatments that are aimed at comfort and relief of symptoms, e.g. relief of pain, anxiety or shortness of breath.
- Personnel may administer medicines and not immediately refer the patient to a doctor, provided this is consistent with adequate ongoing symptom control.
- It is inappropriate to give treatments that artificially prolong the process of dying, e.g. CPR or assisted ventilation.
- Whenever possible, follow the patient's wishes regarding hospital admission (they may wish to die at home), taking into account the views of the family. If transport is required, this should be to a hospice if at all possible, provided this is arranged by phone.
- Some patients are issued with medicines for self-administration in the event of severe distress. All personnel may administer such medicines, even if outside their delegated scope of practice, provided the following criteria are met:
  a) There are clear written instructions **and**
  b) The patient is in severe distress **and**
  c) No other suitable personnel are available to administer the medicine **and**
  d) The PRF is sent for audit, along with a note describing the circumstances. The person administering the treatment is responsible for ensuring this occurs.

6.9 DETERMINATION OF DEATH

- Death may be determined when:
  a) There are clear and obvious signs of death, such as decomposition, rigor mortis or decapitation **or**
  b) The clinical criteria listed below are all met.
- To determine death using clinical criteria:
  a) There must be no clinical signs of breathing (the chest and abdomen must be both uncovered and the patient examined for signs of breathing over 1 full minute) **and**
  b) There must be no palpable pulse at a central site (carotid or femoral) **and**
  c) The pupils must be dilated and unreactive to light **and**
  d) After 10 minutes all of the above examinations must be repeated and there must be no signs of breathing, no palpable pulses and no pupillary reaction to light **and**
  e) A 3 lead ECG must then be taken showing asystole*.

* Some patients may have electrical activity present at 10 minutes:

a) There may be slow, bizarre complexes consistent with a dying heart. If this is the case, wait another 10 minutes and repeat the ECG.
b) Patients with a pacemaker may have electrical activity generated by the pacemaker for many hours after death. In this setting it is appropriate to determine the patient to be dead despite electrical activity on the ECG, provided all of the other clinical criteria are met.

NOTES

- There are a significant number of case reports of patients who have been asystolic for some time during resuscitation, who have spontaneously developed ROSC 5 to 10 minutes after resuscitation attempts were discontinued. This is the reason for the 10 minute time period between clinical examinations.
- This section has been designed to provide criteria for determining death. It has not been designed to determine whether or not further resuscitation attempts are futile. There is an important distinction between the two.
- If there is any uncertainty, the patient should not be determined to be dead.
- A death certificate is a certificate listing the cause of death. Only a doctor can fill out and sign a death certificate.

- A Police life extinct form, also sometimes called a Police deceased person certificate, is a form used by the Police to certify that a person has been declared dead. Historically, this form was only completed by doctors but in some parts of the country Police will allow intensive care paramedics to complete it.
- There must be clear documentation of the process used to determine death.

6.10 ADVANCE DIRECTIVES

Introduction

Advance directives (sometimes called living wills) are a means by which patients indicate their choices, regarding possible future treatments. Advance directives are implemented only when the patient is no longer competent to make, or communicate, decisions for themselves. Most commonly, advance directives are used to indicate that patients do not want a specific treatment, for example they may not want resuscitation in the event of cardiac arrest.

In an advance directive, a patient cannot demand or refuse a treatment, which they cannot demand or refuse when they are competent. For example a patient cannot demand a treatment that is not clinically indicated or refuse treatment for self-harm.

Complying with advance directives

Ambulance personnel must take into account the information in a patient's advance directive. Advance directives are usually in writing, but clearly described verbal advance directives must also be taken into account. Ambulance personnel should comply with the requests in an advance directive provided that:

- The advance directive applies to the current situation **and**
- There is evidence (preferably written) of the advance directive **and**
- The advance directive is clear.

If there is uncertainty, resuscitation should commence if personnel believe that it is in the best interest of the patient. At the same time personnel should urgently seek additional information from the family and advice from a doctor.

Do not resuscitate orders

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 where some form of resuscitation, for example, treatment for choking or anaphylaxis, is appropriate but resuscitation in the event of cardiac arrest is not appropriate. When treating a patient described as having a DNR or DNAR order, always clarify what the order means in terms of what treatments are appropriate for that patient.

Allow natural death (AND) is a relatively new term commonly promoted as a more useful and precise term than DNR or DNAR. A patient with an 'allow natural death' order or request should:

- Receive 'ordinary and non-invasive' treatments, for example pain relief, for non-life threatening illnesses.
- Not receive 'extraordinary and invasive' treatments, for example ventilation or CPR, for a life threatening illness.

6.11 ASSESSING COMPETENCY

In this setting the term competency is used to describe the ability of the patient to understand information and make informed decisions. Patients can be deemed to be competent to make decisions if they meet all of the following criteria:

- They appear to understand information given to them and can recall this when asked **and**
- They appear to understand the implications of their decisions and can recall these when asked **and**
- They communicate on these issues consistently **and**
- They are over the age of 16 years **and**
- They have not attempted (or expressed thoughts of) self-harm.

If all of these criteria are not met, competency is in question and personnel must act in the best interest of the patient. For additional information refer to Section 6.12.

6.12 REFERRAL AND NON-TRANSPORT DECISIONS

Whenever personnel are assessing a patient they must make four initial decisions:

1) Is treatment required?
2) Is referral to a medical facility required?
3) If referral is required – what type of medical facility is most appropriate?
4) If referral 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 always:

- Fully assess the patient including a detailed history, primary survey, secondary survey and the measurement of appropriate vital signs. The assessment must include seeing the patient mobilise (providing they can normally do so) prior to them receiving a recommendation that they do not require immediate referral to a doctor.
- Fully assess the patient's competency to understand information and make informed decisions.
- Take into account all available information, including non-clinical aspects such as social factors.
- Fully inform 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 competent patients 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 assessment, interventions and recommendations.
- Contact a doctor or manager for advice if the situation is difficult.

Deciding if the patient requires referral to a medical facility

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

- The patient has been appropriately assessed **and**
- The decision making points 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

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

- Personnel are unable to confidently exclude serious illness or injury **or**
- A significant treatment (medicine or IV fluid) or a significant intervention has been provided (for exceptions, see below*) **or**
- There is a significant abnormality in any vital sign recording.

*There are some situations where a significant treatment or a significant intervention can be provided and then a recommendation made that immediate referral to a medical facility is not required. These situations are restricted to any of the following:

- A formally documented alternative pathway has been established and is to be followed.
- A doctor or nurse specialist has been directly consulted with (at the time and by personnel dealing with the patient) and has agreed that immediate referral is not required. The name and contact details of the doctor or nurse specialist and a summary of the discussion must be recorded on the PRF.
- Paracetamol has been given for minor discomfort.
- Uncomplicated hypoglycaemia (see the relevant section).
- Uncomplicated epilepsy (see the relevant section).
- Uncomplicated minor allergy (see the relevant section).
- Uncomplicated supraventricular tachycardia (see the relevant section).
- End of life care (see the relevant section).

Deciding what type of medical facility the patient should be referred to

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

- The patient's expected healthcare requirements (treatment and/or investigations) **and**
- How these healthcare requirements are most appropriately and efficiently met.

Not all patients require referral to an Emergency Department. It is preferable to refer a patient to their GP, or an accident and medical clinic, provided that:

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

When a competent patient declines recommendations made to them

Competent patients have the right to decline recommendations made 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, including when to see their GP **and**
- Read the patient the 'patient declined transport' statement of the PRF **and**
- Ask the patient to sign the 'patient declined transport' section of the PRF **and**
- Fully document the assessment, interventions, recommendations and interactions **and**
- Provide the patient with the patient copy of the PRF.

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 their will must be balanced against the risks of their illness or injury. In this setting personnel must:

- Encourage the patient to accept their recommendations **and**
- Involve the patient's family, friends or GP when appropriate **and**
- Fully document the assessment, interventions, recommendations and interactions.

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.

Although we are using an age guideline of 16 years (below which we are automatically deeming a child to be not competent), all children should be communicated with and treated as if they are competent. If a child younger than 16 years of age is making a decision, which in the opinion of the treating personnel is not in their best interest, then that child should be deemed to be not competent. Personnel should seek advice from a medical specialist if the situation is difficult.

Parents or guardians, have the right to decline recommendations on behalf of the child, but personnel should insist on treatment and/or transport if they believe the parents or guardians, are placing the child at risk.

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 significant treatment or significant intervention during transport **and**
- The patient has not had any significant treatment (noting that the exceptions listed under 'criteria for immediate referral' also apply here) or significant intervention provided by personnel **and**
- A reasonable and appropriate alternative form of transport is available.

When the patient or family insist on transport by ambulance

Competent patients have the right to decline recommendations but patients and families do not have the right to insist on transport that personnel do not think is clinically indicated.

If the insistence of the patient or family 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 of the patient or family 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**
- Discuss the situation with a manager **and**
- Forward the audit copy of the PRF for formal audit.

When the patient or family insist on treatment but are declining transport

These clinical practice guidelines are based on the premise that patients receiving a significant treatment (medicines or IV fluid) will have a firm recommendation made to them that they are immediately transported to a medical facility. Such treatment should not be provided to a patient if they (or their family) are insisting on treatment but are already declining transport, unless that treatment is required for a life threatening condition.

Documentation

Comprehensive documentation is always important but this is particularly the case when a patient is not being transported to a medical facility. As a general rule, a third party (e.g. 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 patient assessment and findings.
- An assessment of the patient's competence.
- All treatment and interventions provided.
- What was recommended and the reasons why.
- A summary of what was said to the patient and/or family.
- A summary of what the patient and/or family said.
- Why the patient was not transported.

When a patient is not transported to a medical facility:

- If the patient appears competent, the patient copy of the PRF must be given to them.
- If the patient appears to be not competent, the patient copy of the PRF should be given to an appropriate person (for example, a caregiver).
- If the patient is a child, the patient copy of the PRF should be given to a parent or guardian.

6.13 THE PRIMARY SURVEY

The primary survey is a rapid assessment of immediate threats to life. The primary survey is important for all patients, not just those suffering from trauma. Any deterioration in the patient's condition must prompt a reassessment of the primary survey looking for a cause.

Airway

- Examine for and establish an adequate airway.
- Consider the possibility of cervical spine injury, but the airway takes priority.

Breathing

- Examine for and establish adequate breathing.
- Look at and feel chest movement.

Circulation

- Examine for and establish adequate circulation.
- Feel pulse rate and strength, look at and feel peripheral perfusion and capillary refill.
- Check for (and compress) external bleeding.

Disability

- Check the level of consciousness using AVPU or the motor score of the GCS.
- Consider immobilising the cervical spine if appropriate.

Exposure, examination and environmental control

- Appropriately expose and examine the patient.
- Keep them warm.

6.14 THE SECONDARY SURVEY

The secondary survey follows the primary survey. Do not conduct a detailed secondary survey if there are major abnormalities in the primary survey.

Central nervous system

- Record a GCS. Individually examine and record each component.
- Check the patient can talk normally, move their face and move and feel all four limbs.
- Look for unilateral weakness.

Head and Face

- Look and feel for deformity, tenderness and bleeding.
- Look for pupil asymmetry and reaction to light.

Neck

- Look and feel for deformity and tenderness.
- Immobilise the cervical spine if required and not already done.

Chest

- Look, feel and listen for symmetry of air entry, breath sounds, tenderness and crepitus.

Abdomen and pelvis

- Look and feel for tenderness or distension.

Extremities

- Look and feel for wounds, fractures, colour, capillary refill, gross sensation and movement.

Back

- Look and feel for tenderness and deformity.

6.15 STATUS CODES

Status	Condition	Triage tag 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 means of describing an estimate of the severity of a patient's condition.
- They are qualitative, require clinical judgement and are allocated to a patient after taking into account their illness or injuries, their vital signs and the potential threat to their life.
- They are not altered by the mechanism of injury, the physical environment, e.g. trapped or not trapped, or the age of the patient.
- The examples below are not an exhaustive list, but are indicative only.

Examples

- **Status one**: obstructed airway or airway needing intervention, severe stridor, severe respiratory distress, shock unresponsive to fluid loading, multisystem trauma with abnormal vital signs, cardiac arrest or post cardiac arrest, cardiogenic shock, anterior ST elevation myocardial infarction on 12 lead ECG, status epilepticus, coma with GCS ≤ 9.

- **Status two**: moderate stridor, moderate respiratory distress, shock responsive to fluid loading, multisystem trauma with normal or near normal vital signs, multiple long bone fractures, inferior ST elevation myocardial infarction on 12 lead ECG, myocardial ischaemia unrelieved (or not significantly relieved) by nitrates alone, abnormal level of consciousness with GCS 10-13, stroke.

- **Status three**: mild stridor, mild respiratory distress, isolated SVT with no other symptoms, myocardial ischaemia relieved (or mostly relieved) by nitrates alone, isolated long bone fractures (including compound fractures), loss of consciousness with normal or near normal (GCS 14 or 15) recovery, transient ischaemic attack.

- **Status four**: isolated minor fractures, isolated hand injuries, strains and sprains, lacerations with controlled bleeding.

6.16 INITIAL MANAGEMENT OF A MAJOR INCIDENT

This is a summary of the initial management. Details are contained within the Ambulance National Major Incident Plan (AMPLANZ).

In a major incident the number of patients and the severity of their injuries initially exceed the capacity of the service and staff. The keys to successful management are to:

- Establish a clear command structure.
- Establish clear communication with the EACC through one single point.
- Triage the patients.
- Prioritise the patients for treatment and transport.
- Distribute the patients across multiple facilities if the numbers of patients are high and it is feasible to do so.

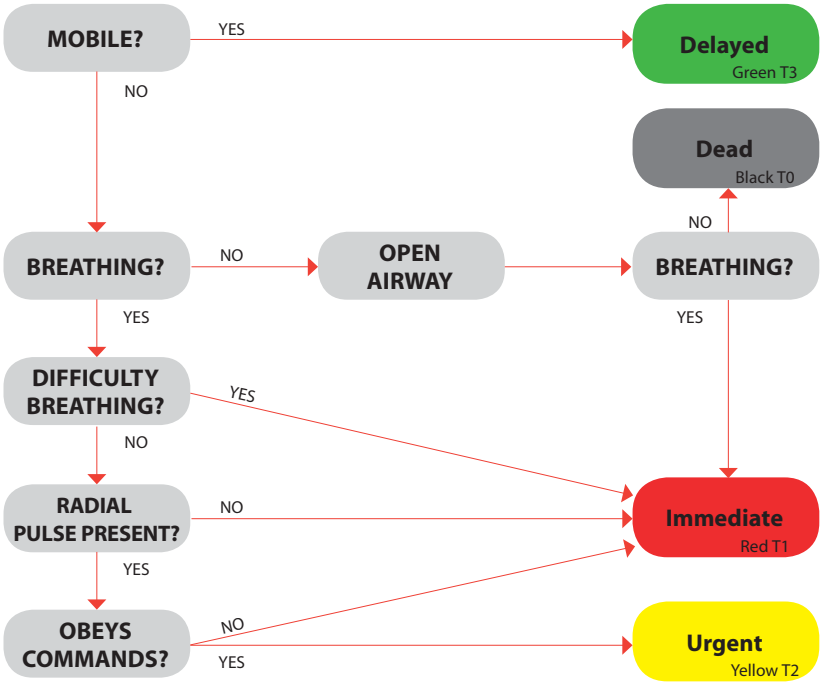
Begin with a sitrep using METHANE:

- **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.

See page 138 for initial triage.

Initial triage

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



Alternatively patients may be triaged using status codes:

- Status zero patients are dead.
- Status one patients are red (immediate care).
- Status two patients are orange/yellow (urgent care).
- Status three and four patients are green (delayed care).

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

Secondary triage

Perform secondary triage. Perform a primary and secondary survey on all patients in order of priority as determined by their initial triage category. If as a result of secondary triage a patient's triage category changes, replace the tag with a new tag, noting on the new tag the patient's initial triage category.

Treatment

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

- Treatment decisions should be made by an experienced person who tasks others to provide those treatments.
- Patients who have the greatest chance of survival with the least use of time, equipment and personnel should be treated first.
- Treatments that are highly unlikely to be successful (e.g. CPR) should not be provided unless there is a very good reason.
- Treatments that take significant time and/or 'tie up' personnel (e.g. intubation and ventilation) should not be provided unless there is a very good reason.
- 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 category following secondary triage. The general principles are:

- Patients should be taken to hospitals capable of meeting their immediate resuscitation and treatment/intervention needs, provided this is feasible.
- Patients should be distributed across hospitals if the number of patients is high, provided this is feasible. A clinically experienced person should be specifically tasked to coordinate this.
- Consideration should be given to utilising medical centres for patients allocated a delayed triage category if the number of patients taken to hospital is high.
- Family members should be transported to the same hospital/medical facility provided this is feasible.

Continued on page 140.

Patients considered unsalvageable

It is impossible to predict with 100% accuracy that a patient who is alive is going to die no matter what is done. However, in the setting of a major incident some patients have injuries so severe that death is highly likely Some examples include patients with:

- Respiratory arrest.
- Severe shock with a falling heart rate.
- GCS of 3 with bilateral dilated and unreactive pupils.
- Severe life threatening injuries in the elderly.

If the numbers of severely injured patients are high, it is appropriate for patients considered unsalvageable to have treatment and transport initially withheld. This allows other immediate and urgent patients to be treated and transported first. The patients considered unsalvageable can be reassessed and further decisions made regarding treatment and transport. Only very clinically experienced personnel should make these decisions.

6.17 PRINCIPLES OF INTUBATION AND VENTILATION

The risks and benefits of intubation and ventilation

The risks of intubation and ventilation include:

a) Hypoxia and hypercarbia during laryngoscopy **and**
b) Raised intra-cranial pressure during laryngoscopy **and**
c) Inadvertent hyperventilation post intubation **and**
d) Interruption of chest compressions (if CPR is in progress) during laryngoscopy **and**
e) Reduced blood flow during CPR if ventilation rates are greater than 10 breaths per minute (note – this risk exists with supra-glottic airway devices too) **and**
f) Unrecognised oesophageal intubation.

The benefits of 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) Allowing continuous chest compressions to occur (if CPR is in progress), without interruptions for ventilation.

For the majority of unconscious patients being treated by ambulance personnel, the risks of intubation and ventilation without rapid sequence intubation (RSI) outweigh the benefits. For this reason intubation and ventilation without RSI should only be attempted in patients with 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 a supra-glottic airway device is in place and ventilation appears clinically adequate. Replacing the supra-glottic airway device with an endotracheal tube (ETT) is not a priority unless there is clinically significant vomiting or ventilation is clinically inadequate.
- Ideally, intubation should occur when a pulse check is indicated and chest compressions should be paused for the minimum time necessary (preferably less than 15 seconds) to perform intubation.

Measurement of $ETCO_2$

- Intubation with an ETT must not be attempted unless electronic measurement of CO_2 is immediately available.

- Once the patient is intubated with an ETT, continuous measurement of $ETCO_2$ by electronic means is compulsory for all patients, including those in cardiac arrest.
- The ETT must be removed if $ETCO_2$ is below 5 mmHg, including during cardiac arrest, even if it is thought that the lack of $ETCO_2$ is due to technical error. This is because the risk of unrecognised oesophageal intubation is too high, even when the tube is thought to be clinically within the trachea.
- $ETCO_2$ is proportional to ventilation when cardiac output is near normal. In this setting the target $ETCO_2$ is 30-35 mmHg. This target is designed to ensure arterial levels of CO_2 are at the lower end of normal.
- Patients with life threatening asthma or CORD, who are intubated and ventilated will have a very high $ETCO_2$. In this setting targeting an $ETCO_2$ of 30-35 mmHg risks cardiac arrest from dynamic hyperinflation. Ventilate the patient with a low respiratory rate (approximately 6 breaths per minute) and allow the $ETCO_2$ to be high.
- $ETCO_2$ is proportional to blood flow when cardiac output is very low. The most common clinical setting for this is during cardiac arrest. Typically $ETCO_2$ will be 10-20 mmHg during cardiac arrest with CPR in progress.
- If the ETT is within the oesophagus and the stomach contains CO_2 (for example, from CO_2 containing drinks or following mouth to mouth ventilation), $ETCO_2$ may be measurable for the first 2 to 4 ventilations and then fall rapidly below 5 mmHg.

6.18 RAPID SEQUENCE INTUBATION

- Indicated for patients with:
  a) GCS ≤10 **and**
  b) Clinically significant airway or ventilatory compromise.
- Absolute contraindications:
  a) Personal or family history of malignant hyperthermia **or**
  b) Pre-existing paraplegia or quadriplegia **or**
  c) Any muscle disorder with long term weakness **or**
  d) Hyperkalaemia is strongly suspected **or**
  e) Electronic capnometry is unavailable **or**
  f) A dedicated suitable assistant is unavailable.
- Relative contraindications:
  a) Age < 5 or > 75 years **or**
  b) Age > 75 years with stroke or CORD as underlying cause **or**
  c) Predicted difficult intubation **or**
  d) Less than 15 minutes to hospital **or**
  e) Underlying cause is likely to rapidly improve.
- Medicines:
  a) Give IV fentanyl 2-3 minutes before induction.
  b) Regimen 1: for all patients without shock, give IV midazolam and IV suxamethonium.
  c) Regimen 2: for all patients with shock, give IV ketamine and IV suxamethonium.
- Intubate and confirm ETT position with electronic capnometry.
- Follow the post intubation section.

See page 144 for RSI drug doses.

RSI Drug Dose Table

Weight	10 kg	20 kg	30 kg	40 kg	50 kg
Fentanyl (1 mcg/kg)	10 mcg	20 mcg	30 mcg	40 mcg	50 mcg
Midazolam (0.05 mg/kg)	0.5 mg	1 mg	1.5 mg	2 mg	2.5 mg
Ketamine (1.5 mg/kg)	15 mg	30 mg	45 mg	60 mg	75 mg
Suxamethonium (1.5 mg/kg)	15 mg	30 mg	45 mg	60 mg	75 mg
Vecuronium (0.1-0.2 mg/kg)	2 mg	4 mg	6 mg	8 mg	10 mg

Weight	60 kg	70 kg	80 kg	90 kg	100 + kg
Fentanyl* (1 mcg/kg)	60 mcg	70 mcg	80 mcg	90 mcg	100 mcg
Midazolam* (0.05 mg/kg)	3 mg	3.5 mg	4 mg	4.5 mg	5 mg
Ketamine (1.5 mg/kg)	90 mg	100 mg	120 mg	140 mg	150 mg
Suxamethonium (1.5 mg/kg)	90 mg	100 mg	120 mg	140 mg	150 mg
Vecuronium (0.1-0.2 mg/kg)	10 mg	10 mg	10 mg	10 mg	10 mg

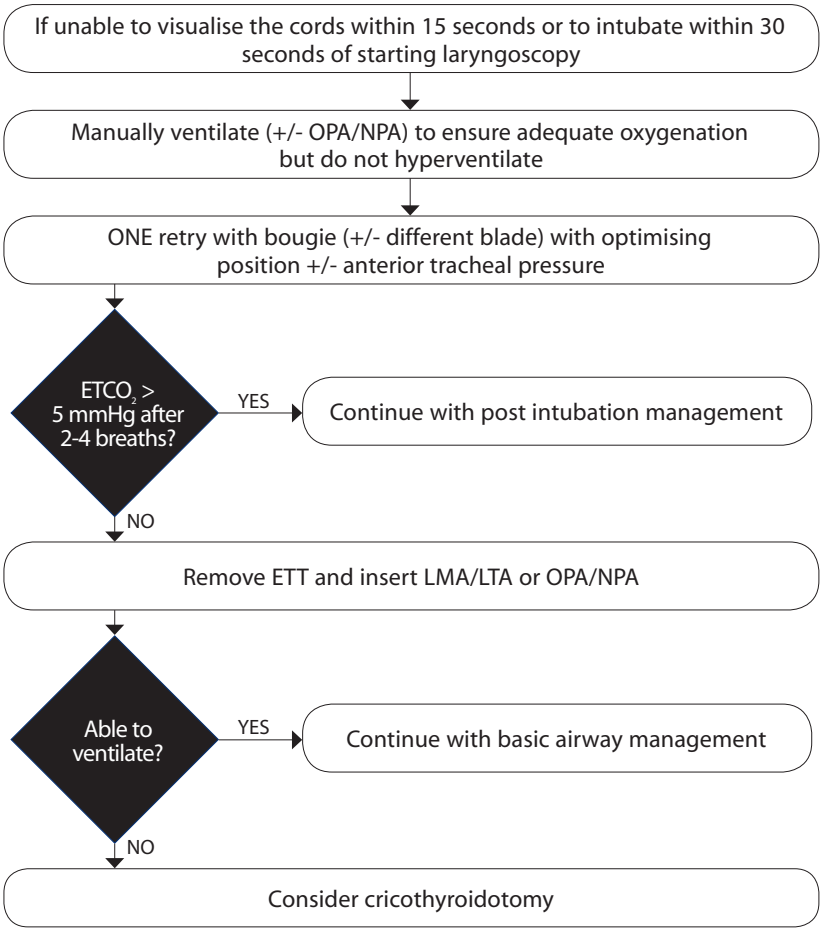
*Halve fentanyl and midazolam dose if:

a) Age > 60 years **or**
b) HR > 100/min **or**
c) Systolic BP < 100 mmHg.

NOTES

- The patients most likely to meet the indications for RSI are those with TBI or those who are post cardiac arrest.
- Personnel calling for RSI must weigh up how long it will take for RSI capable backup to arrive. To be appropriately utilised, such backup must arrive at least 15 minutes faster than the patient can be transported to an appropriate hospital.
- Examples of underlying causes of coma that are likely to rapidly improve include: hypoglycaemia, seizures (or post ictal state), carbon monoxide poisoning, GHB poisoning and alcohol poisoning.
- Patients with known major comorbidities that significantly restrict their daily functioning are usually poor candidates for RSI. Whenever feasible such patients should be discussed with a medical specialist prior to RSI.

6.19 FAILED INTUBATION DRILL



6.20 POST INTUBATION CARE

Use this section if:

a) The patient has been intubated (with or without RSI) **and**
b) ETT placement has been confirmed by electronic capnometry **and**
c) The patient is not currently in cardiac arrest. If the patient has been intubated during cardiac arrest, use this section only if they develop return of spontaneous circulation (ROSC).

- Give 10 mg vecuronium IV and repeat as required.
- Give ongoing IV sedation (midazolam 1-3 mg and morphine 1-3 mg) and repeat as required every 3-5 minutes.
- Ventilate to an $ETCO_2$ of 30-35 mmHg.

NOTES

- Vecuronium is given to prevent the patient from moving, to help maintain the ongoing safe presence of the ETT. Vecuronium is given prior to sedation to optimise safety.
- Give further vecuronium if the patient shows any signs of moving, gagging or coughing. Most patients will require a further dose of vecuronium after 20 to 30 minutes.
- Sedation is given to ensure that:
  a) Intra-cranial pressure is minimised in patients where it may be raised (this is predominantly in patients with TBI) **and**
  b) The patient is not awake and aware that they are unable to move. This is most likely if the underlying cause of the coma rapidly improves and the patient wakes up. Examples include seizures, carbon monoxide poisoning, GHB poisoning and alcohol poisoning.
- Use doses of sedation at the lower end of the described dose range if the patient is elderly, small or cardiovascularly unstable.
- Titrate sedation to heart rate and blood pressure, increasing the dose of sedation if the patient is tachycardic and hypertensive.

PERSONAL NOTES

PERSONAL NOTES

7.0 MEDICINES AND FLUIDS

Introduction

This section contains additional information on medicines and fluids. The information has been limited to that relevant to pre-hospital care. For example, only adverse effects and contraindications relevant to pre-hospital use are listed.

Universal contraindications

All medicines have universal contraindications and they are not repeatedly listed with each medicine. They are:

a) Life threatening allergy to the medicine or its constituents is an absolute contraindication.
b) Significant (but not life threatening) allergy is a relative contraindication and the medicine should not be administered unless there is a very strong indication.
c) Pregnancy, particularly in the first trimester, or breast feeding are relative contraindications and the medicine should not be administered unless there is a very strong indication.

Drawing up medicines for administration

The following guidelines are aimed at reducing medication errors and should be followed whenever possible:

a) A second clinical person should be shown the ampoule and asked to name it.
b) Use the dilutions and syringe sizes specified.
c) Label the syringe with the name of the medicine. Include the concentration if the medicine has been diluted.
d) A second clinical person 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) If a medicine has a maximum dose and more than this maximum has been drawn up – discard the excess dose before beginning to administer it to the patient.
g) Draw up 0.9% NaCl flushes in a different sized syringe to that containing the medicines being administered.

7.1 ADENOSINE

Preparation: Ampoule containing 6 mg in 2 ml.

Mechanism of action: Adenosine depresses conduction through the AV node. This interrupts re-entry circuits and may restore sinus rhythm in patients with paroxysmal SVT.

Indications: The treatment of narrow complex SVT.

Contraindications: The contraindications predominantly relate to the risk of life threatening bradycardia following reversion. They are:

a) Known sick sinus syndrome without an internal pacemaker in place **or**
b) Previous 2nd or 3rd degree heart block without an internal pacemaker in place.

Relative contraindications:

a) Asthma (adenosine may precipitate bronchospasm).
b) CORD (adenosine may precipitate bronchospasm).
c) Previous heart transplantation (adenosine may cause severe bradycardia in a denervated heart).

Onset of effect: IV: 2-5 seconds.

Duration of effect: 10-20 seconds. This short duration of effect is due to adenosine being rapidly taken up and metabolised by red blood cells and vascular endothelial cells.

Common adverse effects: Bradycardia, sinus pause (which may be occasionally 10-30 seconds), ventricular ectopy, shortness of breath, the urge to breathe deeply, exacerbation of bronchospasm, headache, light headedness, nausea, flushing, feeling of chest pressure, feeling of apprehension.

Interactions: Dipyridamole inhibits adenosine cellular uptake and may produce a prolonged adenosine effect of up to 40 seconds.

Administration: Give undiluted as a rapid bolus followed by a 20 ml rapid flush of 0.9% NaCl, preferably via an ante-cubital fossa vein.

Additional information: Adenosine usually causes a brief period of very low cardiac output. Warn the patient they will feel 'awful' and may feel light headed and short of breath. Tell them this feeling will pass quickly.

7.2 ADRENALINE

Preparation: Ampoule containing 1 mg in 1 ml.

Mechanism of action: Adrenaline is an alpha and beta receptor agonist (stimulator). Adrenaline has an additional action of stabilising mast cell membranes and reducing histamine release from mast cells.

a) Alpha stimulation causes vasoconstriction of vascular smooth muscle, increasing peripheral resistance.
b) Beta one stimulation causes increased heart rate and contractility, increasing cardiac output.
c) Beta two stimulation causes bronchodilatation.

Indications: The treatment of – cardiac arrest, anaphylaxis, severe asthma, severe bradycardia, septic shock unresponsive to volume loading or stridor (nebulised).

Contraindications: None.

Relative contraindications: Myocardial ischaemia or tachydysrhythmias.

Onset of effect: IV: 5-20 seconds. IM: 3-5 minutes (dependent on absorption). Nebulised: instant on contact with target site.

Duration of effect: The cardiovascular effects last 2-15 minutes. The mast cell membrane effects may last for several hours.

Common adverse effects: Tachycardia, tachydysrhythmias, myocardial ischaemia, ventricular ectopy, hypertension, nausea, vomiting, tremor, headache, anxiety.

Interactions: Increased doses may be required in patients taking beta blockers and/or calcium antagonists.

Administration:

a) Cardiac arrest in adults and children ≥ 50 kg – use undiluted and give as a fast IV push.
b) Cardiac arrest in children < 50 kg – dilute 1 mg adrenaline to a total volume of 10 ml using a 10 ml syringe. This final solution contains 0.1 mg/ml. Draw up the dose from this solution. Give as a fast IV push.
c) IV use in adults and children not in cardiac arrest – insert 1 mg adrenaline into a 1 litre bag of 0.9% NaCl. Shake well and label. This final solution contains 0.001 mg/ml. Draw up all doses from this solution and give IV over 1-2 minutes. This solution may also be given by infusion to adults and children ≥ 50 kg.
d) IM – undiluted. The preferred IM site is the lateral thigh. If this site is not suitable use the lateral upper arm.
e) Nebulised – undiluted.

Additional information:

a) In general, a dose of 0.5 mg adrenaline IM is appropriate for the majority of adult patients. Reduce the dose if the patient is small, elderly or has ischaemic heart disease.

b) Adrenaline administration can make a patient tachypnoeic and look or feel awful. It is important to differentiate this from a worsening of their underlying problem and not to automatically respond by giving more adrenaline.

7.3 AMIODARONE

Preparation: Ampoule containing 150 mg in 3 ml.

Mechanism of action: Amiodarone is an antiarrhythmic agent with predominantly class lll activity. Amiodarone prolongs the action potential duration and the refractory period duration of atrial, nodal and ventricular tissues. These actions result in amiodarone having broad activity in both atrial and ventricular tachydysrhythmias.

Indications:

a) Cardiac arrest with persistent VF or VT **or**
b) Persistent VT (in the absence of cardiac arrest) **or**
c) Fast atrial fibrillation or atrial flutter causing compromise (particularly myocardial ischaemia).

Contraindications: None.

Relative contraindications: There are no relative contraindications if the patient is in cardiac arrest. Outside this setting, they predominantly relate to the negative inotropic effect of amiodarone (causing a fall in cardiac output) and the risk of life threatening bradycardia following reversion. They are:

a) Hypotension or poor perfusion (may be made worse by amiodarone) **or**
b) Known sick sinus syndrome without an internal pacemaker in place **or**
c) Previous 2nd or 3rd degree heart block without an internal pacemaker in place.

Onset of effect: 5-10 minutes.

Duration of effect: 1-2 hours after a single dose.

Common adverse effects: Hypotension, nausea, light headedness, bradydysrhythmia.

Interactions: May potentiate the action of tricyclic antidepressants in cyclic poisoning. May cause cardiac dysrhythmias in the presence of other antiarrhythmic agents. May cause bradycardia following reversion if the patient is on a beta blocker and/or a calcium antagonist.

Administration:

a) Cardiac arrest – use undiluted and give as a fast IV push.
b) Tachydysrhythmia without cardiac arrest in adults – place 300 mg amiodarone into a 100 ml bag of 5% glucose. Shake well and label. Administer slowly over 30 minutes. Slow the rate of infusion if hypotension occurs.
c) If it is impractical to give amiodarone as an infusion, it is acceptable to dilute 300 mg to a total volume of 20 ml (using 5% glucose) and give slowly over 30 minutes.

Additional information: Amiodarone is often described as relatively contraindicated in the presence of a prolonged QT interval but this only applies to long term administration.

7.4 ASPIRIN

Preparation: 300 mg tablets.

Mechanism of action: Aspirin inhibits the enzyme cycloxygenase. This inhibition reduces the production of a number of prostaglandins, resulting in antipyretic, anti-inflammatory, antiplatelet and analgesic effects. Aspirin is only given pre-hospital for its antiplatelet effect.
A platelet exposed to aspirin has permanent cycloxygenase inhibition – for the life of that platelet. The body has to produce more platelets (that are not exposed to aspirin) to overcome the antiplatelet effect. Each day the body produces new platelets at a rate of approximately 10% of total.

Indications: As part of the treatment of clinically significant myocardial ischaemia.

Contraindications: None. Many patients taking an anticoagulant (such as warfarin or dabigatran) are commonly told not to take aspirin but this applies to chronic use for pain or fever and does not apply to the acute use of aspirin for myocardial ischaemia.

Relative contraindications:

a) A small group of patients with asthma or CORD have known worsening of bronchospasm with aspirin. If this is the case a decision must be made based on the balance of risk. If there is a clear history of significant bronchospasm with aspirin, it should be avoided.
b) Aspirin has been associated with premature delivery and premature closure of the ductus arteriosus, when given in the third trimester of pregnancy. However, these adverse effects have predominantly been reported with chronic use of aspirin, rather than after a single dose. In general aspirin should not be given to pregnant patients without discussion with a medical specialist.

Onset of effect: 30-60 minutes.

Duration of effect: The antiplatelet effect will last for the life of the platelet. This means that the clinical effect on platelet function lasts for several days.

Common adverse effects: Bronchospasm in some patients with asthma or CORD. Other adverse effects such as indigestion, gastrointestinal ulceration and bleeding are only associated with chronic use.

Interactions: No common interactions.

Administration: Use a dissolvable or chewable form of aspirin. Do not use enteric coated aspirin as this is absorbed slowly over 12-24 hours.

7.5 ATROPINE

Preparation: Ampoule containing 0.6 mg in 1 ml.

Mechanism of action: Atropine is an anticholinergenic agent with predominantly antimuscarinic activity. Atropine antagonises (blocks) acetylcholine receptors causing vagal nerve inhibition. The predominant effects are on exocrine glands, smooth muscle and cardiac muscle.

Indications: The treatment of severe bradycardia.

Contraindications: None.

Relative contraindications: Myocardial ischaemia.

Onset of effect: 5-20 seconds.

Duration of effect: The cardiovascular effects last 15-60 minutes. The exocrine and smooth muscle effects last 4-6 hours.

Common adverse effects: Tachycardia, myocardial ischaemia, tremor, nausea, vomiting, headache, flushing, transient bradycardia followed by tachycardia, confusion (particularly in the elderly), dry mouth, blurred vision.

Interactions: The action of atropine may be potentiated if the patient is taking other drugs with antimuscarinic properties, such as phenothiazines, some antihistamines (such as promethazine but not loratadine), tricyclic antidepressants and antiparkinson medications.

Administration: IV – use undiluted and give as a fast IV push (slow administration may result in transient bradycardia).

7.6 CEFTRIAXONE

Preparation: Ampoule containing 1 g as a powder.

Mechanism of action: Ceftriaxone is a broad spectrum cephalosporin antibiotic. Cephalosporins disrupt bacterial cell walls resulting in rupture of the cell.

Indications: The treatment of septic shock.

Contraindications: None. Penicillin allergy (including anaphylaxis) is not a contraindication to ceftriaxone.

Relative contraindications: None.

Onset of effect: IV: 2-5 minutes. IM: 5-10 minutes (dependent on absorption).

Duration of effect: 12-24 hours.

Common adverse effects: Nausea, vomiting, itch.

Interactions: No common interactions.

Administration:

a) IV – dilute 2 g (two ampoules) to a total of 20 ml using a 20 ml syringe. Place 5 ml of 0.9% NaCl in each ampoule and shake until all of the powder is dissolved. Draw up both ampoules into a 20 ml syringe and draw up additional 0.9% NaCl to a total of 20 ml. This solution contains 100 mg/ml. Give IV over 1-2 minutes.
b) IM – dilute 1 g (one ampoule) to a total of 5 ml using a 5ml syringe. Place 5 ml of 0.9% NaCl into the ampoule and shake until all of the powder is dissolved. Give half of the dose into two different sites. The preferred site for IM ceftriaxone is the lateral thigh. If this site is not suitable use the lateral upper arm.

Additional information: Some patients develop severe shock 10-20 minutes after antibiotic administration. This is particularly the case in patients with meningococcemia. This is because large amounts of endotoxin are released from some bacteria as they die. Endotoxin causes impaired cardiac function, vasodilatation and capillary leak (with fluid loss). Be prepared to give the patient a large volume load of 0.9% NaCl and be prepared to administer adrenaline.

7.7 ENTONOX

Preparation: 50% nitrous oxide and 50% oxygen in a cylinder.

Mechanism of action: It is not clear what the exact mechanism of action is but nitrous oxide causes analgesia via effects on the central nervous system.

Indications: Moderate to severe pain.

Contraindications: If the patient:

a) Is unable to obey commands **or**
b) Has a suspected pneumothorax **or**
c) Has a suspected bowel obstruction **or**
d) Has been SCUBA diving in the last 24 hours or has a diving related emergency.

Relative contraindications: Repeated use is 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. In general, entonox should be avoided in these patients.

Onset of effect: 2-5 minutes.

Duration of effect: 2-5 minutes after stopping administration.

Common adverse effects: Sedation, euphoria, nausea, metallic taste, auditory disturbances (echo).

Interactions: The effects of entonox will be increased in the presence of other pain relieving medicines or sedatives, e.g. opiates, benzodiazepines or alcohol.

Administration:

a) Whenever possible have the patient self administer entonox.
b) If the cylinder has been subjected to low temperatures, the nitrous oxide and oxygen will 'separate out' and the cylinder should be inverted 3 times prior to administration to 'remix' them.
c) Keep away from open flame.

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Additional information:

a) The nitrous oxide in entonox expands gas filled spaces in the body. This is the reason for many of its contraindications.
b) Entonox is not contraindicated in patients 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.
c) Entonox is not contraindicated in patients with abdominal pain but is contraindicated if a bowel obstruction is suspected. Bowel obstruction most commonly presents with vomiting and abdominal discomfort. Abdominal distension and reduced frequency of bowel motions or passing of gas may be present.

7.8 FENTANYL

Preparation: Ampoule containing 100 mcg in 2 ml.

Mechanism of action: Fentanyl binds to opiate receptors within the brain, spinal cord and other tissues.

a) Mu receptor stimulation causes vomiting, euphoria, respiratory depression and analgesia.
b) Kappa receptor stimulation causes analgesia, miosis and sedation.
c) Sigma receptor stimulation causes dysphoria, restlessness, sedation and hallucinations.
d) Epsilon receptor stimulation causes dysphoria.
e) Delta receptor stimulation causes behavioural changes and hallucinations.

Indications: The treatment of moderate to severe pain when the patient:

a) Requires intense pain relief very quickly **or**
b) Requires intense pain relief for a short period of time only **or**
c) Is cardiovascularly unstable **or**
d) Is a child without IV access.

Contraindications: If the patient:

a) Is aged less than 2 years **or**
b) Is unable to obey commands (exception – see RSI section) **or**
c) Has respiratory depression **or**
d) Is in premature labour.

Relative contraindications: None.

Onset of effect: IV: 1-2 minutes. Intranasal: 2-5 minutes.

Duration of effect: 30-60 minutes.

Common adverse effects: Respiratory depression, bradycardia, hypotension, sedation, nausea, vomiting.

Interactions: The effects of fentanyl will be increased in the presence of other pain relieving medicines or sedatives, e.g. opiates, ketamine, benzodiazepines or alcohol.

Administration:

a) IV – dilute 100 mcg to a total volume of 10 ml using a 10 ml syringe. This final solution contains 10 mcg/ml. Give IV doses over 1-2 minutes.
b) Intranasal – use undiluted. Give half of the dose into each nostril.

Additional information:

a) Use low doses if the patient is small, elderly or physiologically unstable.
b) Fentanyl usually results in less histamine release and less of a fall in blood pressure than morphine. However, fentanyl will still drop blood pressure in a cardiovascularly unstable patient.
c) The preferred route is IV. Reserve intranasal administration for children when IV access cannot be obtained or will be very difficult to obtain.

7.9 GLUCAGON

Preparation: Ampoule containing 1mg as powder within a 'hypo-kit'.

Mechanism of action: Glucagon increases the blood glucose level by stimulating glycogenolysis. This causes stored glycogen to be broken down into glucose, predominantly within the liver.

Indications: The treatment of hypoglycaemia when the patient cannot swallow glucose or food or when IV access cannot be obtained.

Contraindications: None.

Relative contraindications: None.

Onset of effect: 5-10 minutes (depending on absorption).

Duration of effect: 10-30 minutes.

Common adverse effects: None.

Interactions: No common interactions.

Administration: Dissolve the powder using the syringe within the 'hypo-kit'. Give IM. The preferred IM site is the lateral thigh. If this site is not suitable use the lateral upper arm.

Additional information: Glucagon relies on stored glycogen being available to exert its effect. If glycogen stores are not available, e.g. if the patient has undergone strenuous exercise or has not eaten food for more than 12 hours, glucagon may be ineffective.

7.10 GLUCOSE 10%

Preparation: 500 ml bag of sterile water containing 50 g of glucose.

Mechanism of action: Provides a source of glucose.

Indications: The treatment of hypoglycaemia.

Contraindications: None.

Relative contraindications: None.

Onset of effect: IV: 1-2 minutes.

Duration of Effect: 30-60 minutes depending on dose. 100 ml of 10% glucose will provide 10 g of glucose, which will provide approximately 40 kilocalories of energy. This will last 30-60 minutes in most patients.

Common adverse effects: None.

Interactions: No common interactions.

Administration: Give IV undiluted. May be given orally if no other suitable oral form of glucose is available.

Additional information: Administer 10% glucose into a large vein whenever possible because it is hyperosmolar and may cause phlebitis in small veins. The short duration of effect means the patient must eat a meal containing a complex carbohydrate as soon as feasible.

7.11 GLYCERYL TRINITRATE (GTN)

Preparation: Metered dose bottle delivering 0.4 mg doses.

Mechanism of action: GTN is a vasodilator. GTN dilates veins and arteries but the predominant effect is on veins. The exact 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) Veinous dilation, which causes peripheral pooling of blood, reducing veinous return and preload. This reduces ventricular filling and cardiac output, which reduces myocardial work and myocardial oxygen demand.
b) Arterial dilation, reducing peripheral resistance and afterload. This reduces the force the left ventricle must overcome to eject blood into the systemic circulation, reducing myocardial oxygen demand.
c) A small amount of dilation of the coronary arteries. This increases the supply of blood to the myocardium.

Indications: The treatment of myocardial ischaemia or cardiogenic pulmonary oedema.

Contraindications:

a) Systolic BP less than 100 mmHg **or**
b) HR less than 40/min **or**
c) HR greater than 150/min.

Relative contraindications:

a) Right ventricular infarct **or**
b) Poor perfusion **or**
c) Dysrhythmia is present **or**
d) The patient has taken a drug for erectile dysfunction in the last 24 hours.

Onset of effect: 1-2 minutes.

Duration of effect: The vasodilator effects of GTN are relatively short and usually last 10-30 minutes. However, in some patients the effect on blood pressure may be quite prolonged, lasting several hours (even in the absence of drugs for erectile dysfunction).

Common adverse effects: Hypotension, flushing, headache, tachycardia, light headedness.

Interactions:

a) The effects of GTN will be increased in patients taking beta blockers and other antihypertensives.

b) There is a range of medicines (with multiple different names) used for erectile dysfunction and some of them (particularly sildenafil) are also used in the treatment of pulmonary hypertension. These medicines are long acting (12-24 hours) inhibitors of one of the subtypes of the enzyme phosphodiesterase. Inhibition of phosphodiesterase results in an enhanced effect of nitric oxide, which is a vasodilator. GTN may interact with such medicines, causing severe and prolonged hypotension if they have been taken within the last 24 hours. GTN is not contraindicated in this setting, but if used there must be a very strong indication and it must be used in 0.4 mg doses. If in doubt seek medical advice.

Administration: Spray under the tongue. If this cannot be achieved it is acceptable to spray onto the tongue.

7.12 IPRATROPIUM

Preparation: Ampoule containing 0.5 mg in 2 ml.

Mechanism of action: Ipratropium is an anticholinergic agent. It inhibits the action of acetylcholine, the transmitter agent released from the vagus nerve. In doing so ipratropium reduces parasympathetic mediated bronchospasm.

Indications: The treatment of bronchospasm.

Contraindications: None.

Relative contraindications: None.

Onset of effect: 3-5 minutes.

Duration of effect: 1-6 hours.

Common adverse effects: Nausea, dry mouth, blurred vision, tachycardia. May worsen pre-existing glaucoma if multiple repeat doses are given.

Interactions: No common interactions.

Administration: Give by nebuliser in combination with salbutamol.

7.13 KETAMINE

Preparation: Ampoule containing 200 mg in 2 ml.

Mechanism of action: Ketamine acts at a number of receptors in the central nervous system but predominantly acts as an N-Methyl-D-Aspartate (NMDA) receptor antagonist. NMDA receptors bind glutamate, which is an excitatory neurotransmitter. Blocking NMDA receptors causes analgesia, sedation and amnesia. In medium doses ketamine causes dissociation and in high doses ketamine causes anaesthesia.

Indications: The treatment of moderate to severe pain, particularly pain from musculoskeletal injury or burns. May be used in the treatment of combative patients if there is immediate and substantial danger to either the patient or treating personnel.

Contraindications: If the patient:

a) Is aged less than 2 years **or**
b) Is unable to obey commands (exception – see combative patient section) **or**
c) Has active psychosis (exception – see combative patient section) **or**
d) Has current myocardial ischaemia.

Relative contraindications: The presence of hypertension or any condition that may be made worse by hypertension, e.g. haemorrhagic stroke.

Onset of effect: IV: 1-2 minutes. IM: 5-10 minutes. Oral: 10-20 minutes.

Duration of effect: 30-60 minutes.

Common adverse effects: Transient hypertension, tachycardia, nausea, vomiting, sedation, hallucinations.

Interactions: The effects of ketamine will be increased in the presence of other pain relieving medicines or sedatives, e.g. opiates, benzodiazepines or alcohol.

Administration:

a) IV analgesia – place 200 mg (2 ml) in a 100 ml bag of 5% glucose. Shake well and label. This final solution contains 2 mg/ml. Draw up the required dose from this solution. Administer IV boluses over 1-2 minutes.
b) IV use during RSI – for adults use undiluted. For children dilute 200 mg to a total volume of 20 ml using a 20 ml syringe. This final solution contains 10 mg/ml. Administer as a fast IV push.

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c) IM – use undiluted. The preferred IM site is the lateral thigh. If this site is not suitable use the lateral upper arm.
d) Oral – mix undiluted ketamine with paracetamol syrup or any other liquid able to be swallowed.

Additional information:

a) Warn the patient they are likely to feel 'strange' following ketamine administration and ask them to tell you if this occurs or they feel 'awful'.
b) Some patients may experience hallucinations with ketamine. Do not focus on warning the patient specifically about these as such warnings appear to increase the likelihood of their occurrence. Hallucinations or 'awful' experiences appear more common if small sub-therapeutic doses of ketamine are given.

7.14 LIGNOCAINE 1%

Preparation: Ampoule containing 50 mg in 5 ml.

Mechanism of action: Lignocaine causes localised analgesia by reversibly blocking impulse propagation along nerve fibres. It does this by blocking the inward movement of sodium ions across the nerve cell membrane.

Indications: Intraosseous for bone pain associated with fluid infusion through an intraosseous needle. Subcutaneous for prophylaxis of pain from IV insertion.

Contraindications: None.

Relative contraindications: None.

Onset of effect: 1-2 minutes.

Duration of effect: 30-60 minutes.

Common adverse effects: Stinging.

Interactions: No common interactions.

Administration:

a) Intraosseous – give slowly over 2 minutes and wait 1 further minute before infusing more fluid. This is intended to limit the amount of lignocaine flushed into the circulation.

b) Subcutaneous – give directly into the subcutaneous tissue, raising a 'bleb'. Wait at least 1 minute before inserting the IV cannula. Warming lignocaine, for example having the ampoule in your pocket, reduces the stinging associated with subcutaneous injection.

7.15 LORATADINE

Preparation: 10 mg tablets.

Mechanism of action: Loratadine is a long-acting, non sedating antihistamine. It has selective peripheral H1 receptor antagonistic activity. Loratadine blocks the action of histamine, reducing itching, redness and hives.

Indications: The treatment of minor allergic reactions that are confined to skin involvement.

Contraindications:

a) Age less than 2 years **or**
b) The patient is taking erythromycin or roxithromycin. This is because the combination of antihistamines and macrolide antibiotics has been reported to cause QT prolongation. This hasn't been reported with loratadine but we have included it as a contraindication.

Relative contraindications: None.

Onset of effect: 10-20 minutes.

Duration of effect: 12-24 hours.

Common adverse effects: None.

Interactions: No common interactions.

Administration: Give orally.

7.16 METHOXYFLURANE

Preparation: 3 ml bottle accompanying a plastic inhaler.

Mechanism of action: Methoxyflurane causes analgesia via effects on the central nervous system.

Indications: Moderate to severe pain.

Contraindications: If the patient:

a) Has a personal or family history of malignant hyperthermia **or**
b) Is unable to obey commands **or**
c) Has known renal impairment (note: renal failure with dialysis, kidney stones and/or renal colic are not contraindications) **or**
d) Has received methoxyflurane within the last week.

Relative contraindications: If the patient:

a) Has toxaemia of pregnancy **or**
b) Is in labour with known signs of foetal distress.

Onset of effect: 2-5 minutes.

Duration of effect: 2-5 minutes after stopping administration.

Common adverse effects: Drowsiness, light headedness, nausea, dislike of the taste.

Interactions: No common interactions.

Administration:

a) Whenever possible have the patient self administer methoxyflurane.
b) Administer 3 ml at a time and always use with a charcoal filter.
c) Whenever possible, ensure the patient breathes out through the inhaler.
d) Do not add supplemental oxygen to the inhaler as this significantly increases the amount of methoxyflurane lost through evaporation.
e) Place the inhaler in a closed zip lock bag if the methoxyflurane has not been fully used. It may be reused by the same patient.

Additional information:

a) Malignant hyperthermia is an inherited disorder that makes the patient susceptible to a life threatening increase in metabolism and temperature, when they are exposed to an inhalational anaesthetic agent (including methoxyflurane). Patients with a known history (or known family history) of malignant hyperthermia will usually know about it. Always ask if the patient has been told that an anaesthetic might be life threatening for them. If there is any doubt – do not administer methoxyflurane.
b) One of the metabolic products of methoxyflurane is fluoride ions and these may cause renal impairment in high concentrations. The concentrations of fluoride ions following analgesia doses of methoxyflurane are extremely low.

7.17 MIDAZOLAM

Preparation: Ampoules containing 5 mg in 5 ml and 15 mg in 3 ml.

Mechanism of action: Midazolam is a benzodiazepine. Benzodiazepines stimulate the Gamma Amino Butyric Acid (GABA) receptors in the central nervous system. GABA is an inhibitory neurotransmitter. Stimulating GABA receptors results in anticonvulsant activity, sedation, amnesia and anxiolysis.

Indications: The treatment of prolonged seizures. May be used as part of the treatment for a combative patient.

Contraindications: None.

Relative contraindications: None.

Onset of effect: IV: 1-2 minutes. Intranasal: 2-5 minutes. IM: 5-10 minutes (depending on absorption).

Duration of effect: 30-60 minutes. The sedative effects may last much longer than this, particularly in the elderly.

Common adverse effects: Sedation, respiratory depression, hypotension, amnesia, hallucinations.

Interactions: The effects of midazolam will be increased in the presence of other sedatives or pain relieving medicines, e.g. other benzodiazepines, alcohol or opiates.

Administration:

a) IV – use the 5 mg in 5 ml preparation undiluted. Give as a fast IV push.
b) IM – Use the 15 mg in 3 ml preparation undiluted. The preferred IM site is the lateral thigh. If this site is not suitable use the lateral upper arm.
c) Intranasal – use the 15 mg in 3 ml preparation undiluted. Give half of the dose into each nostril.

Additional information: Use low doses if the patient is small, elderly or physiologically unstable.

7.18 MORPHINE

Preparation: Ampoule containing 10 mg in 1 ml.

Mechanism of action: Morphine binds to opiate receptors within the brain, spinal cord and other tissues.

a) Mu receptor stimulation causes vomiting, euphoria, respiratory depression and analgesia.
b) Kappa receptor stimulation causes analgesia, miosis and sedation.
c) Sigma receptor stimulation causes dysphoria, restlessness, sedation and hallucinations.
d) Epsilon receptor stimulation causes dysphoria.
e) Delta receptor stimulation causes behavioural changes and hallucinations.

Indications: The treatment of moderate to severe pain.

Contraindications: If the patient:

a) Is unable to obey commands (exceptions – see combative patient and post intubation sections) **or**
b) Has respiratory depression **or**
c) Is in premature labour.

Relative contraindications: None.

Onset of effect: IV: 1-2 minutes. IM: 5-10 minutes (depending on absorption).

Duration of effect: 30-60 minutes. This may be much longer in the elderly.

Adverse effects: Respiratory depression, hypotension, sedation, nausea, vomiting, bradycardia.

Interactions: The effects of morphine will be increased in the presence of other pain relieving medicines or sedatives, e.g. opiates, ketamine, benzodiazepines or alcohol.

Administration:

a) IV – dilute 10 mg to a total volume of 10 ml using a 10 ml syringe. This final solution contains 1 mg/ml. Give IV doses over 1-2 minutes.
b) IM – use undiluted. Do not use the IM route if the patient is shocked and avoid the IM route in children, if possible. The preferred IM site is the lateral thigh. If this site is not suitable use the lateral upper arm.

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Additional information:

a) Use low doses if the patient is small, elderly or physiologically unstable.

b) Histamine release is very common after morphine administration. This is not a drug allergy provided it is isolated to skin involvement and self limiting.

c) Nausea, vomiting and itch after morphine are all side effects and are not drug allergies. True allergy to morphine is rare but some patients experience severe side effects and refuse to receive it again. Consider using fentanyl in such patients.

7.19 NALOXONE

Preparation: Ampoule containing 0.4 mg in 1 ml.

Mechanism of action: Naloxone is an opiate receptor antagonist (blocker). Naloxone prevents or reverses the effects of opiates, including respiratory depression, sedation and hypotension.

Indications: The treatment of opiate poisoning or the treatment of excess adverse effects from opiates.

Contraindications: None.

Relative contraindications: None.

Onset of effect: IV: 1-2 minutes. Intranasal: 2-5 minutes.
IM: 5-10 minutes (dependent on absorption).

Duration of effect: 30-60 minutes. The duration of effect of naloxone may be less than the duration of effect of the opiate it is being used to antagonise.

Common adverse effects: Nausea, vomiting, sweating, tachycardia, hypertension, seizures. These adverse effects predominantly relate to the physiological effects of opiate withdrawal. The adverse effects may be minimised by giving the minimum amount of naloxone required to reverse the adverse effects of the opiate.

Interactions: No common interactions.

Administration:

a) IV – dilute 0.4 mg to a total volume of 4 ml using a 5 ml syringe. This final solution contains 0.1 mg/ml. Give IV doses over 1-2 minutes.
b) IM – use undiluted. The preferred IM site is the lateral thigh. If this site is not suitable use the lateral upper arm.
c) Intranasal – use undiluted. Give half of the dose into each nostril.

Additional information: Naloxone does not have a role in the treatment of cardiac arrest following opiate poisoning.

7.20 ONDANSETRON

Preparation: 4 mg tablets (wafers). Ampoule containing 4 mg in 2 ml.

Mechanism of action: Ondansetron is a selective 5-HT3 receptor antagonist. It reduces nausea and vomiting by blocking 5-HT3 receptors centrally in the brain and peripherally in the gastrointestinal tract.

Indications: The treatment of severe nausea and/or vomiting.

Contraindications: Age less than 2 years.

Relative contraindications: None.

Onset of effect: IV: 2-5 minutes. IM: 5-10 minutes (depending on absorption). Oral: 10-20 minutes.

Duration of effect: 4-8 hours.

Common adverse effects: Headache, flushing, metallic taste.

Interactions: No common interactions.

Administration:

a) Oral – place in the mouth and allow to dissolve.
b) IV – use undiluted. Give IV doses over 1-2 minutes.
c) IM – use undiluted. The preferred IM site is the lateral thigh. If this site is not suitable use the lateral upper arm.

7.21 OXYGEN

Preparation: 100% oxygen in a cylinder.

Mechanism of action: Oxygen is absorbed by the lungs and then bound to haemoglobin. Oxygen is required for aerobic metabolism.

Indications:

a) The treatment of hypoxia. In general, supplemental oxygen is only required if a patient has an SpO_2 less than 94% on air. Note – patients with CORD have a lower SpO_2 target than this.
b) The treatment of carbon monoxide poisoning.
c) The prevention of hypoxia in the setting of – airway obstruction, respiratory distress, shock or traumatic brain injury.

Contraindications: None.

Relative contraindications: If the patient:

a) Has CORD with an SpO_2 greater than 92%.
b) Is a newborn and not requiring resuscitation.
c) Has paraquat poisoning.
d) Has previously been treated with bleomycin.

Onset of effect: 30-60 seconds (depending on lung absorption).

Duration of effect: 1-2 minutes after stopping administration.

Common adverse effects: When oxygen levels within blood are higher than normal, it causes blood vessels, particularly small arteries, to vasoconstrict. This has the potential to lower blood flow to tissue and organs, particularly if blood flow is already low. This is why oxygen administration is restricted to those patients who have an indication to receive it.

Interactions:

a) Oxygen worsens the effect of paraquat poisoning and should usually only be given in this setting if hypoxia is severe, e.g an SpO_2 less than 88%.
b) Oxygen can cause severe lung inflammation in patients previously treated with bleomycin (a chemotherapy drug) and should usually only be given in this setting if hypoxia is severe, e.g an SpO_2 less than 88%.

Administration: Use the simplest device and lowest flow rates to achieve the desired SpO_2. The oxygen flow rates to be used are:

a) Nasal prongs 1-4 l/min.
b) Simple mask 6-8 l/min.
c) Nebulised medicines 8 l/min.
d) Reservoir mask 10-15 l/min.
e) Manual ventilation bag 10-15 l/min.

7.22 PARACETAMOL

Preparation: 500 mg tablets. Syrup containing 50 mg/ml.

Mechanism of action: Paracetamol inhibits the production of a number of prostaglandins. In doing so, paracetamol has analgesic and antipyretic effects.

Indications:

a) The treatment of mild pain or in addition to other measures for moderate pain.
b) May be used if the patient is febrile with a temperature greater than 39 degrees and the fever is causing discomfort.

Contraindications: If the patient:

a) Has taken any paracetamol within the last 4 hours or
b) Has current paracetamol poisoning.

Relative contraindications: None.

Onset of effect: 10-20 minutes.

Duration of effect: 4-6 hours.

Common adverse effects: None.

Interactions: No common interactions.

Administration: Give orally.

Additional information:

a) Paracetamol is contained in many products, such as cold and flu tablets, cold and flu drinks, cough mixtures, combination pain relievers and migraine tablets. Always check what the patient has already taken.
b) Paracetamol is not indicated for the treatment of fever alone as fever confers some benefit if the patient has an infection. It may be given if the patient's temperature is high (greater than 39 degrees) and the fever is causing discomfort.
c) Patients with neutropenia (very low white cell count) following chemotherapy or bone marrow transplantation often have a pre-arranged treatment pathway that is partly determined by the presence of fever. Paracetamol administration may mask fever in such patients and should be avoided unless the patient's temperature is very high (greater than 40 degrees).

7.23 SALBUTAMOL

Preparation: Ampoule containing 5 mg in 2.5 ml.

Mechanism of action: Salbutamol is a beta 2 receptor agonist (stimulator). Stimulating beta 2 receptors in bronchial smooth muscle causes bronchodilation.

Indications: The treatment of bronchospasm.

Contraindications: None.

Relative contraindications: None.

Onset of effect: 3-5 minutes.

Duration of effect: 1-2 hours.

Common adverse effects: Tremor, tachycardia, tachydysrhythmia, headache, hypokalaemia.

Interactions: Salbutamol will be less effective in the presence of a non-selective beta blocker (such as propranolol).

Administration: By nebuliser in combination with ipratropium.

7.24 SODIUM CHLORIDE 0.9%

Preparation: Sterile water containing 150 mmol/L of sodium (Na) and 150 mmol/L of chloride (Cl).

Mechanism of action: 0.9% NaCl expands intravascular fluid volume and extracellular fluid volume.

Indications:

a) Hypovolaemia.
b) IV flushes.

Contraindications: None.

Relative contraindications: None.

Onset of effect: Immediate.

Duration of effect: Not Applicable.

Adverse effects: No common adverse effects.

Interactions: No common interactions

Administration: Give IV.

Additional information: Small volume flushes (5-10 ml) of 0.9% NaCl do not need to be recorded on the PRF. If a bag of 0.9% NaCl is used as a running flush (for example, during cardiac arrest) an estimate of the total amount of 0.9% NaCl administered should be recorded.

7.25 SUXAMETHONIUM

Preparation: Ampoule containing 100 mg in 2 ml.

Mechanism of action: Suxamethonium antagonises (blocks) acetylcholine receptors at the neuromuscular junction of skeletal muscle. In doing so it prevents skeletal muscles from contracting. When it first binds to the receptor it causes brief stimulation (depolarisation). This is why suxamethonium is often called a depolarising neuromuscular blocker.

Indications: Rapid skeletal muscle paralysis as part of rapid sequence intubation.

Contraindications:

a) Personal or family history of malignant hyperthermia.
b) Pre-existing paraplegia or quadriplegia.
c) Any muscle disorder with long term weakness.
d) Hyperkalaemia is strongly suspected.

Relative contraindications: Predicted difficult intubation.

Onset of effect: 30-60 seconds.

Duration of effect: 5-10 minutes. A very small number of patients have a cholinesterase (the enzyme that metabolises suxamethonium) deficiency. In these patients the duration of effect will be 6-18 hours.

Common adverse effects: Salivation, bradycardia (particularly in children).

Interactions: No common interactions.

Administration:

a) Adults and large children – use undiluted. Give as a rapid IV push.
b) Small children – dilute 100 mg to a total volume of 10 ml using a 10 ml syringe. This final solution contains 10 mg/ml. Give as a rapid IV push.

Additional information: Without refrigeration, suxamethonium loses approximately 10% of its activity per month. Suxamethonium may be stored in kits provided it is discarded monthly. Suxamethonium in stores and on station should remain refrigerated.

7.26 VECURONIUM

Preparation: Ampoule containing 10 mg as a powder.

Mechanism of action: Vecuronium antagonises (blocks) acetylcholine receptors at the neuromuscular junction of skeletal muscle. In doing so it prevents skeletal muscles from contracting. When it first binds to the receptor it does not cause stimulation (does not cause depolarisation). This is why vecuronium is often called a non-depolarising neuromuscular blocker.

Indications: Skeletal muscle paralysis following endotracheal intubation, provided endotracheal placement has been confirmed by electronic capnometry. Note – vecuronium is not indicated if the patient is currently in cardiac arrest.

Contraindications: None.

Relative contraindications: None.

Onset of effect: 2-5 minutes.

Duration of effect: 20-40 minutes.

Common adverse effects: None.

Interactions: No common interactions.

Administration:

a) Adults and large children – dissolve powder and give IV as a fast push.
b) Small children – dissolve powder and dilute to a total volume of 10 ml using a 10 ml syringe. This final solution contains 1 mg/ml. Give IV as a fast push.

Additional information: Vecuronium provides no sedation.

PERSONAL NOTES

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