



**CLINICAL  
PROCEDURES  
AND GUIDELINES**  
Comprehensive Edition  
2019 - 2022



**WELLINGTON  
FREE AMBULANCE**  
*kia ora te tangata*

We are the ones. 111



# Introduction

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

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

These CPGs will be reviewed at the end of 2020 and 2021, with updates being issued at that time if required. These CPGs expire at the end of February 2022 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 Wellington Free Ambulance personnel using these CPGs do so at their own risk. Neither Wellington Free Ambulance nor the National Ambulance Sector Clinical Working Group will be responsible for any loss, damage or injury suffered by any person as a result of, or arising out of, the use of these CPGs by persons other than authorised Wellington Free Ambulance personnel.

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**Dr Andy Swain**

Medical Director

# Contents

<b>1: General treatment principles</b>	<b>1</b>	<b>3: Cardiac</b>	<b>93</b>
1.1 Authority to practise and practice levels	1	3.1 Assessment for myocardial ischaemia	93
1.2 General principles	4	3.2 Myocardial ischaemia	101
1.3 Providing treatment that differs from that authorised in these CPGs	6	3.3 ST elevation myocardial infarction (STEMI)	104
1.4 Analgesia	11	3.4 Fibrinolytic therapy	111
1.5 Advance directives and advance care plans	21	3.5 Inter-hospital transfer of patients with STEMI	115
1.6 Patient competency	23	3.6 Cardiogenic pulmonary oedema	118
1.7 Calling the Clinical Desk	26	3.7 Determining the level of cardiovascular compromise	122
1.8 Personnel on the Clinical Desk providing advice	27	3.8 Ventricular tachycardia	124
1.9 Crew resource management	28	3.9 Supraventricular tachycardia	127
1.10 Handover	31	3.10 Atrial fibrillation or atrial flutter	131
1.11 Informed consent	32	3.11 Cardioversion checklist	135
1.12 Initial management of a major incident	34	3.12 Bradycardia	136
1.13 End of life care	38	3.13 Cardiogenic shock	140
1.14 Verification of death	40	3.14 Cardiac arrest	143
1.15 Oxygen administration	43	Cardiac arrest in special situations	152
1.16 Status codes	47	3.15 Treatment following return of spontaneous circulation	156
1.17 Requesting a helicopter	49	<b>4: Shock and trauma</b>	<b>160</b>
1.18 Treatment and referral decisions	54	4.1 Shock	160
1.19 Vital signs	59	4.2 Major trauma triage	163
1.20 Documentation	63	4.3 Anaphylaxis	172
<b>2: Respiratory</b>	<b>70</b>	4.4 Burns	175
2.1 Asthma	70	4.5 Crush injury	178
2.2 Chronic obstructive pulmonary disease (COPD)	78	4.6 Hypovolaemia from uncontrolled bleeding	181
2.3 Foreign body airway obstruction	85	4.7 Hypovolaemia from controlled bleeding	187
2.4 Positive end expiratory pressure (PEEP)	88	4.8 Hypovolaemia from fluid loss	191
2.5 Stridor	90	4.9 Concussion and minor traumatic brain injury	192
2.6 Croup	92	4.10 Severe traumatic brain injury	196
		4.11 Limb and/or soft tissue injuries	200
		4.12 Patella dislocation	206
		4.13 Shoulder dislocation	208
		4.14 Digit dislocation	212
		4.15 Other dislocations	213
		4.16 Spinal cord injury	216
		4.17 Cervical spine immobilisation	222

4.18	Tension pneumothorax	<b>230</b>	<b>9: Intubation and ventilation</b>	<b>343</b>	
4.19	Amputation	<b>234</b>	9.1	The principles of intubation and ventilation	<b>343</b>
4.20	Eye injuries	<b>237</b>	9.2	Preparation for RSI checklist	<b>345</b>
4.21	Wounds	<b>243</b>	9.3	Rapid sequence intubation (RSI)	<b>346</b>
<b>5: Altered consciousness/metabolic</b>		<b>246</b>	9.4	RSI checklist	<b>350</b>
5.1	Agitated delirium	<b>246</b>	9.5	Failed intubation drill	<b>351</b>
5.2	Hyperglycaemia	<b>252</b>	9.6	Post intubation	<b>352</b>
5.3	Hypoglycaemia	<b>254</b>	9.7	Mechanical ventilation	<b>357</b>
5.4	Poisoning from gases	<b>257</b>	<b>10: Mental Health</b>		<b>361</b>
5.5	Poisoning from medicines	<b>260</b>	10.1	Mental health conditions	<b>361</b>
5.6	Poisoning from recreational drugs	<b>264</b>	10.2	Assessing mental status	<b>364</b>
5.7	Poisoning from miscellaneous causes	<b>269</b>	10.3	Attempted and/or threatened suicide	<b>367</b>
5.8	Seizures	<b>274</b>	10.4	Non-suicidal self-harm	<b>370</b>
<b>6: Infection</b>		<b>280</b>	10.5	Psychological wellness	<b>371</b>
6.1	Assessing for sepsis	<b>280</b>	<b>11: Environmental</b>		<b>373</b>
6.2	Sepsis	<b>283</b>	11.1	Drowning	<b>373</b>
6.3	Meningococcal septicaemia	<b>288</b>	11.2	SCUBA diving emergencies	<b>376</b>
6.4	Cellulitis	<b>292</b>	11.3	Hyperthermia	<b>378</b>
6.5	Chest infection	<b>294</b>	11.4	Hypothermia	<b>382</b>
6.6	Influenza	<b>296</b>	<b>12: Miscellaneous</b>		<b>389</b>
6.7	Lower urinary tract infection (UTI)	<b>298</b>	12.1	Autonomic dysreflexia	<b>389</b>
6.8	Sore throat	<b>300</b>	12.2	Blocked urinary catheter	<b>392</b>
6.9	Infectious disease precautions	<b>302</b>	12.3	Epistaxis	<b>394</b>
<b>7: Paediatrics</b>		<b>305</b>	12.4	Minor allergy	<b>396</b>
7.1	Special considerations in young children	<b>305</b>	12.5	Nausea and/or vomiting	<b>397</b>
7.2	Paediatric equipment and drug doses	<b>310</b>	12.6	Stroke	<b>398</b>
7.3	Neonatal resuscitation	<b>326</b>	12.7	Transient ischaemic attack	<b>403</b>
<b>8: Pregnancy</b>		<b>331</b>	12.8	Inter-hospital transfer for stroke clot retrieval (SCR)	<b>404</b>
8.1	Antepartum haemorrhage	<b>331</b>	12.9	Special considerations in the elderly	<b>408</b>
8.2	Postpartum haemorrhage	<b>334</b>	12.10	Obesity	<b>412</b>
8.3	Pregnancy and birth	<b>338</b>	12.11	Patients with existing vascular access	<b>415</b>

<b>13: Flag tables</b>	<b>419</b>	14.18 Glyceryl trinitrate (GTN) patch	<b>484</b>
13.1 Making recommendations using the flag tables	<b>419</b>	14.19 Heparin	<b>487</b>
13.2 Abdominal pain	<b>420</b>	14.20 Hydrocortisone	<b>489</b>
13.3 Falls	<b>422</b>	14.21 Ibuprofen	<b>491</b>
13.4 Fever in patients aged under five years	<b>426</b>	14.22 Ipratropium	<b>494</b>
13.5 Fever in patients aged five years and over	<b>430</b>	14.23 Ketamine	<b>496</b>
13.6 Headache	<b>432</b>	14.24 Labetalol	<b>500</b>
13.7 Non-traumatic lumbar back pain	<b>436</b>	14.25 1% lignocaine	<b>502</b>
13.8 Syncope	<b>438</b>	14.26 Loratadine	<b>504</b>
13.9 Vertigo	<b>440</b>	14.27 Magnesium sulphate	<b>506</b>
<b>14: Medicines</b>	<b>444</b>	14.28 Metaraminol	<b>508</b>
14.1 Medicines	<b>444</b>	14.29 Methoxyflurane	<b>510</b>
14.2 Adenosine	<b>446</b>	14.30 Metoprolol	<b>513</b>
14.3 Adrenaline	<b>448</b>	14.31 Midazolam	<b>515</b>
14.4 Amiodarone	<b>451</b>	14.32 Naloxone	<b>517</b>
14.5 Amoxicillin/clavulanic acid	<b>454</b>	14.33 Olanzapine	<b>519</b>
14.6 Aspirin	<b>456</b>	14.34 Ondansetron	<b>521</b>
14.7 Atropine	<b>459</b>	14.35 Oxytocin	<b>523</b>
14.8 Calcium chloride	<b>461</b>	14.36 Paracetamol	<b>525</b>
14.9 Ceftriaxone	<b>463</b>	14.37 Prednisone and prednisolone	<b>527</b>
14.10 Clopidogrel	<b>465</b>	14.38 Promethazine	<b>530</b>
14.11 Droperidol	<b>467</b>	14.39 Rocuronium	<b>532</b>
14.12 Enoxaparin	<b>469</b>	14.40 0.75% ropivacaine	<b>535</b>
14.13 Fentanyl	<b>471</b>	14.41 Salbutamol	<b>537</b>
14.14 Gentamicin	<b>475</b>	14.42 8.4% sodium bicarbonate	<b>539</b>
14.15 Glucagon	<b>477</b>	14.43 Suxamethonium	<b>541</b>
14.16 Glucose gel	<b>479</b>	14.44 Tenecteplase	<b>544</b>
14.17 Glyceryl trinitrate (GTN) spray	<b>481</b>	14.45 Tramadol	<b>547</b>
		14.46 Tranexamic acid	<b>550</b>
		14.47 Valproate	<b>552</b>



Skill	EMT	Paramedic	ICP
Adrenaline IN, IM, nebulised and topical	✓	✓	✓
Aspirin PO	✓	✓	✓
Glucagon IM	✓	✓	✓
GTN SL and patch	✓	✓	✓
Ibuprofen PO	✓	✓	✓
Ipratropium nebulised	✓	✓	✓
Laryngeal mask airway	✓	✓	✓
Laryngoscopy (airway obstruction)	✓	✓	✓
Loratadine PO	✓	✓	✓
Methoxyflurane inhaled	✓	✓	✓
Ondansetron IM	✓	✓	✓
Paracetamol PO	✓	✓	✓
Prednisolone PO	✓	✓	✓
Prednisone PO	✓	✓	✓
PEEP	✓	✓	✓
Salbutamol nebulised	✓	✓	✓
Tramadol PO	✓	✓	✓
Adrenaline IV (cardiac arrest only)		✓	✓
Amiodarone IV (cardiac arrest only)		✓	✓
Amoxicillin/clavulanic acid IV		✓	✓
Ceftriaxone IM and IV		✓	✓
Clopidogrel PO		✓	✓
CPAP		✓	✓
Droperidol IM and IV		✓	✓
Enoxaparin SC		✓	✓
Fentanyl IN, IM and IV		✓	✓
Gentamicin IV		✓	✓
Glucose IV		✓	✓
Heparin IV		✓	✓
IO access		✓	✓
IV cannulation		✓	✓
Ketamine IM, PO and IV (analgesia only)		✓	✓
1% lignocaine SC and IO		✓	✓
Manual defibrillation		✓	✓
Midazolam IM (seizures and agitated delirium only)		✓	✓



Skill	EMT	Paramedic	ICP
Midazolam IV (seizures only)		✓	✓
Naloxone IM and IV		✓	✓
Olanzapine PO		✓	✓
Ondansetron IV		✓	✓
Oxytocin IM		✓	✓
0.9% sodium chloride IV		✓	✓
Synchronised cardioversion		✓	✓
Tenecteplase IV		✓	✓
Tranexamic acid IV		✓	✓
Valproate IV		✓	✓
Adenosine IV			✓
Adrenaline (all routes)			✓
Amiodarone IV			✓
Atropine IV			✓
Calcium chloride IV			✓
Chest decompression (needle)			✓
Cricothyroidotomy			✓
Endotracheal intubation			✓
Fascia iliaca block			✓
Finger thoracostomy			✓
GTN IV infusion			✓
Hydrocortisone IV			✓
Ketamine (analgesia and dissociation)			✓
Labetalol IV			✓
Magnesium IV			✓
Metaraminol IV			✓
Metoprolol IV			✓
Midazolam IV			✓
Pacing			✓
Promethazine IV			✓
Rocuronium IV			✓
0.75% ropivacaine SC			✓
8.4 % sodium bicarbonate IV			✓
Suxamethonium IV (RSI endorsed personnel only)			✓

## 1.2 General principles

### Standing orders

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

### General principles of treatment

- Although not listed in each section, all patients require a primary and secondary survey with appropriate intervention as required.
- Unless specified otherwise, all medicine doses and fluid volumes in these CPGs are for adults, and children whose weight has been rounded to 50 kg or more. See the paediatric drug dose section for children whose weight has been rounded to less than or equal to 40 kg.
- For the purposes of these CPGs a patient is an adult if they are aged greater than or equal to 16 years.

### Alternative care pathways

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

### Clinical trials

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

## Seeking clinical advice from personnel that are not at the scene

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



## **1.3 Providing treatment that differs from that authorised in these CPGs**

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

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

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

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

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

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

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

### **When the treatment is being provided by a registered health practitioner**

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

### **When the treatment is being provided following instructions from a registered medical or nurse practitioner**

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

- b) The instructions apply to the current circumstances, and
  - c) The treatment described is within their delegated scope of practice, and
  - d) If personnel are unsure they seek advice via the Clinical Desk.
3. When instructed to do so (including over the phone) by a registered medical or nurse practitioner. All personnel may follow such instructions (including to provide treatments outside their delegated scope of practice) provided:
- a) The instructions are clear, and
  - b) Personnel are capable of providing the treatment described, and
  - c) If personnel are unsure they seek advice via the Clinical Desk.

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

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

## When the treatment is being provided by a student

- Examples include:
  - a) Personnel enrolled in the New Zealand Diploma in Ambulance Practice.
  - b) Students enrolled in a paramedic degree programme with a tertiary institution undertaking clinical placements.
  - c) Student doctors, student nurses and New Zealand Defence Force medics undertaking clinical placements and/or electives.
- Students may administer treatment under supervision from personnel provided all of the following criteria are met:
  - a) The student is enrolled in the St John or Wellington Free Ambulance Supervised Clinical Practice Programme.
  - b) The student has been taught how to provide the treatment.
  - c) The person providing supervision has the treatment within their own delegated scope of practice.
  - d) The person providing supervision takes responsibility for provision of the treatment.
  - e) The supervising person is present and providing direct supervision in such a way that they can immediately intervene if required.
  - f) The patient (if competent) is asked to consent to have treatment provided by a student.

## Audit

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



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## 1.4 Analgesia

### For mild pain

- Administer paracetamol and ibuprofen.

### For moderate pain

- EMTs:
  - Administer paracetamol and ibuprofen.
  - Administer tramadol unless calling for backup for administration of fentanyl.
  - Administer methoxyflurane if pain is not adequately controlled.
- Paramedics and ICPs:
  - Consider a block using local anaesthesia if indicated.
  - Administer fentanyl and titrate further doses to effect.
  - Consider administering methoxyflurane if fentanyl cannot be administered.
  - Administer paracetamol and ibuprofen.
  - Consider administering tramadol, particularly if fentanyl is not administered.

### For severe pain

- EMTs:
  - Call for backup.
  - Administer methoxyflurane.
  - Consider administering paracetamol and/or ibuprofen once pain is sufficiently controlled for the patient to swallow, particularly if transport time is prolonged.
  - Administer tramadol if fentanyl and/or ketamine are unable to be administered.
- Paramedics and ICPs:
  - Consider a block using local anaesthesia if indicated.
  - Administer fentanyl and titrate further doses to effect.
  - Administer an analgesic dose of ketamine if pain is not adequately controlled and titrate further doses to effect.
  - Consider administering paracetamol and/or ibuprofen once pain is sufficiently controlled for the patient to swallow, particularly if transport time is prolonged.
  - Consider administering tramadol, particularly if fentanyl and/or ketamine are not administered.

### For dissociation

- EMTs and Paramedics: call for backup from an ICP.
- ICPs: administer a dissociative dose of ketamine.

## **Paracetamol**

- Indication: mild or moderate pain (usually in combination with ibuprofen).
- Cautions:
  - Paracetamol taken within the last four hours.
  - Abdominal pain, particularly if very unwell or vomiting.
  - Known severe liver disease.
- Dosage:
  - 1.5 g PO for an adult weighing greater than 80 kg.
  - 1 g for an adult weighing 80 kg or less.
  - See the paediatric drug dose tables for a child.

## **Ibuprofen**

- Indication: mild or moderate pain (usually in combination with paracetamol), particularly soft tissue pain, musculoskeletal pain or headache.
- Contraindication: third trimester of pregnancy.
- Cautions:
  - Ibuprofen taken within the last four hours.
  - Abdominal pain, particularly if very unwell or vomiting.
  - Aged greater than or equal to 75 years, particularly in the presence of illness, infection or dehydration.
  - Dehydration or shock.
  - Known renal impairment.
  - Known bleeding disorder or clinically significant bleeding.
  - Known worsening of bronchospasm with NSAIDs.
  - Taking warfarin.
  - Pregnancy.
- Dosage:
  - 600 mg PO for an adult weighing greater than 80 kg.
  - 400 mg PO for an adult weighing 80 kg or less.
  - See the paediatric drug dose tables for a child.

## **Tramadol**

- Indications:
  - Moderate pain, particularly if personnel are not available to administer fentanyl.
  - Severe pain, particularly if personnel are not available to administer fentanyl or ketamine.
- Contraindication: aged less than 12 years.
- Cautions:
  - Tramadol taken within the last four hours.
  - Abdominal pain, particularly if very unwell or vomiting.
  - Confusion.

- Aged greater than or equal to 75 years, particularly if there is a previous history of dementia or confusion.
- Pregnancy.
- Dosage: 50 mg PO.

## **Methoxyflurane**

- Indication: moderate or severe pain when personnel able to administer fentanyl and/or ketamine are not available within an appropriate time.
- Contraindications:
  - Personal or family history of malignant hyperthermia.
  - Unable to obey commands.
  - Known renal impairment.
  - Methoxyflurane administered within the last week.
- Cautions:
  - Aged greater than or equal to 75 years.
  - Pre-eclampsia.
  - In a confined space.
- Dosage:
  - Maximum of two doses (6 ml in total) if aged greater than or equal to 12 years.
  - Maximum of one dose (3 ml) if aged less than 12 years.

## **Fentanyl**

- Indication: moderate to severe pain, in addition to other medicines.
- Contraindications:
  - Unable to obey commands (exceptions: 'end of life care', 'rapid sequence intubation' and 'post intubation' sections).
  - Respiratory depression (exceptions: 'end of life care', 'rapid sequence intubation' and 'post intubation' sections).
- Cautions:
  - Aged less than one year.
  - High risk of respiratory depression.
  - Signs of shock.
  - Labour.
  - Concurrent administration of other opiates, ketamine or midazolam.
  - Elderly and/or frail.
- IV, IM and SC dosage:
  - 10-50 mcg IV every five minutes as required for an adult.
  - 50-100 mcg IM/SC for an adult if IV access cannot be obtained and IN administration is inappropriate. This may be repeated once after 20 minutes.
  - See the paediatric drug dose tables for a child.

- IN dosage:
  - 200 mcg IN for an adult weighing greater than 80 kg. Further doses of 100 mcg may be administered every ten minutes as required. Halve these doses if the patient is frail or physiologically unstable.
  - 100 mcg IN for an adult weighing 80 kg or less. Further doses of 50 mcg may be administered every ten minutes as required. Halve these doses if the patient is frail or physiologically unstable.
  - See the paediatric drug dose tables for a child. Further doses may be administered every ten minutes as required.

## **Ketamine**

- Indications:
  - Severe pain that has not been adequately controlled with fentanyl, particularly musculoskeletal or burn pain.
  - Inducing dissociation so that a painful procedure may be performed, for example cardioversion or realignment of a fracture.
- Contraindication: aged less than one year.
- Cautions:
  - Unable to obey commands.
  - Active psychosis.
  - Hypertension or a clinical condition that may be made worse by hypertension.
  - Current myocardial ischaemia.
  - Concurrent administration of sedatives or midazolam.
  - Elderly and/or frail.
- Analgesia dosage:
  - 30 mg IV administered over approximately 15 minutes for an adult weighing greater than 80 kg. Repeat as required.
  - 20 mg IV administered over approximately 15 minutes for an adult weighing 80 kg or less. Repeat as required.
  - 0.5 mg/kg IM or PO for an adult, up to a maximum of 50 mg if IV access cannot be obtained. This may be repeated once after 20 minutes.
  - See the paediatric drug dose tables for a child.
- Dissociation dosage:
  - 1 mg/kg IV for an adult, up to a maximum of 100 mg. This may be repeated once after five minutes.
  - 2 mg/kg IM for an adult, up to a maximum of 200 mg if IV access cannot be obtained. This may be repeated once after 20 minutes.
  - See the paediatric drug dose tables for a child.

## Midazolam

- Indication: ICPs may administer midazolam if pain is associated with severe muscle spasm or severe anxiety, if adequate analgesia is not being achieved with fentanyl, and ketamine is not indicated.
- Paramedics should seek clinical advice if backup from an ICP is not immediately available.
- Contraindications:
  - Aged less than 12 years.
  - Unable to obey commands.
- Cautions:
  - Altered level of consciousness.
  - High risk of respiratory depression.
  - Signs of shock.
  - Concurrent administration of opiates or ketamine.
  - Elderly and/or frail.
- Routinely administer oxygen and continually monitor the patient's SpO<sub>2</sub>, breathing and level of consciousness.
- Administer fentanyl IV until further doses are not providing additional analgesia and then administer midazolam in 1 mg doses IV every five minutes as required.
- There is no maximum total dose but the patient must be able to obey commands at all times.

## Intraosseous lignocaine

- Indication: significant bone pain associated with intraosseous administration.
- Dosage:
  - 50 mg (5 ml of 1% lignocaine) over two minutes for an adult. Wait one further minute before administering intraosseous fluid.
  - See the paediatric drug dose tables for a child.
  - The dose may be repeated once after 15 minutes.

## Ring blocks using 1% lignocaine

- Indication: moderate to severe pain associated with isolated injuries to digits.
- Contraindication: infection at the site of injection.
- Caution: taking an anticoagulant.
- Examine and record the presence or absence of sensation in the digits before administration.
- Maximum dosage:
  - 200 mg (20 ml of 1% lignocaine) for an adult. If more than 20 ml is required, do not dilute, and administer additional alternative analgesia.
  - See the paediatric drug dose tables for maximum doses for a child.

- Ring blocks using lignocaine may be repeated once after 30 minutes if they were effective and pain returns.

### **Ring blocks using 0.75% ropivacaine**

- Indication: moderate to severe pain associated with isolated injuries to fingers or toes.
- Contraindication: infection at the site of injection.
- Caution: taking an anticoagulant.
- Examine and record the presence or absence of sensation in the digits before administration.
- Maximum dosage:
  - 150 mg (20 ml of 0.75% ropivacaine) for an adult. If more than 20 ml is required dilute ropivacaine to 0.375%.
  - See the paediatric drug dose tables for maximum doses for a child.
- Ring blocks using ropivacaine may be repeated if they were effective and the pain returns:
  - Once after 60 minutes, or
  - Once after 30 minutes following ring blocks using 1% lignocaine.

### **Fascia iliaca block using 0.375% ropivacaine**

- Indication: moderate to severe pain associated with fractured neck of femur, fractured shaft of femur or dislocated hip.
- Contraindications:
  - Aged less than 12 years.
  - Infection at the site of injection.
  - Previous surgery in the groin.
  - Patient unable to cooperate.
- Caution: taking an anticoagulant.
- Gain IV access and administer fentanyl if required to enable appropriate positioning.
- Administer the block using 150 mg (40 ml of 0.375% ropivacaine).
- Monitor heart rate, blood pressure and GCS every 15 minutes.
- The block may be repeated once after 60 minutes if it was effective and pain returns.

## **Additional information**

### **General principles**

- Analgesia is usually best achieved by taking a multi-modal approach including: physical interventions (for example positioning, splinting and cold therapy with ice/ice packs), psychological interventions (for example demonstrating empathy, good communication and distraction) and the administration of medicines.
- A multi-modal approach to medicine administration that combines analgesic medicines with different mechanisms of action provides better analgesia than one analgesic medicine.
- The choice and dose of analgesic medicines administered requires clinical judgement and should be escalated in proportion to the level of the patient's pain.
- A Paramedic should be sufficient for the majority of patients requiring analgesia.
- If it is likely that ketamine administration will be required for dissociation an ICP should be requested early.

### **Paracetamol**

- Paracetamol may be administered in addition to other medicines for severe pain, particularly if the transport time is long. This is not a priority but will reduce the need for subsequent analgesia and improve the quality of pain relief.
- The described doses of paracetamol are higher than those usually recommended in many references. However, the described doses are safe provided they are not administered repeatedly.
- A patient may be administered paracetamol for pain associated with a minor condition and be given a recommendation that immediate referral to a medical facility is not required.

### **Ibuprofen**

- Ibuprofen may be administered in addition to other measures for severe pain, particularly when the transport time is long. This is not a priority but will reduce the need for subsequent analgesia and improve the quality of pain relief.
- A patient may be administered ibuprofen for pain associated with a minor condition and be given a recommendation that immediate referral to a medical facility is not required.

## **Tramadol**

- Tramadol is usually administered in combination with paracetamol and/or ibuprofen.
- Do not routinely administer tramadol if fentanyl is administered because tramadol does not usually provide significant additional pain relief and may worsen side effects. However, tramadol may be administered taking into account the overall clinical scenario, particularly if the patient has taken tramadol before and found it effective.
- Do not administer tramadol if ketamine is administered because it does not usually produce significant additional pain relief and may worsen side effects.
- A patient may be administered tramadol (in combination with paracetamol and/or ibuprofen) for pain associated with a minor condition and be given a recommendation that immediate referral to a medical facility is not required provided:
  - Adequate pain control is achieved and
  - The patient is advised to be seen in primary care (preferably by their own GP) for a review of their condition within 24 hours.

## **Fentanyl**

- A patient administered fentanyl must be given a clear recommendation to be transported to a medical facility by ambulance, unless the patient is being treated using the 'end of life care' section, the 'shoulder dislocation' section or the 'patella dislocation' section.
- Transport should usually be to an ED unless the patient has been administered fentanyl for a chronic condition and can be taken to a primary care facility with staff that know the patient well.

## **Ketamine**

- Prior to administering ketamine for pain, sufficient fentanyl should be administered so that further doses are not providing additional analgesia. This will usually require 150-200 mcg of fentanyl for an adult.
- When administering ketamine for pain, administering the dose over approximately 15 minutes may result in a reduction in adverse side effects.
- When administering ketamine to induce dissociation, routinely administer oxygen and task one person to continually monitor the patient's SpO<sub>2</sub>, breathing and level of consciousness until the patient recovers.
- A patient administered ketamine must be given a clear recommendation to be transported to an ED by ambulance.

## **Midazolam**

- Midazolam does not have analgesic properties. However, midazolam has a role in reducing pain associated with severe muscle spasm or severe anxiety,



particularly if the patient has severe back pain or a dislocated joint.

- Prior to administering midazolam for pain, sufficient fentanyl should be administered that further doses are not providing additional analgesia. This will usually require 150-200 mcg of fentanyl for an adult.

### **Intraosseous lignocaine**

- Intraosseous administration will result in lignocaine uptake into the circulation and this may be harmful, particularly if the patient has severe shock. Uptake is minimised by waiting a minimum of one minute between lignocaine administration and fluid administration.

### **Fascia iliaca block**

- A fascia iliaca block is not required for all patients with a fractured neck of femur, fractured shaft of femur or dislocated hip. Clinical judgement is required when requesting an ICP to perform the block, taking into account:
  - The severity of the patient's pain, and
  - The time it will take for an ICP to arrive and perform the block, and
  - The time it will take to transport the patient to hospital.
- If the patient has painful injuries in addition to hip/femur pain, the block is not usually indicated unless the pain is predominantly from the hip/femur injury.
- The goal of a fascia iliaca block is to provide additional analgesia and reduce the need for fentanyl and/or ketamine, particularly if the patient is elderly and/or frail. It is uncommon for the block to produce complete control of pain and in approximately 25% of patients the block will have no discernible effect.
- It usually takes approximately ten minutes to perform the block and an additional ten minutes for the block to begin to provide analgesia. If effective, the block will usually provide analgesia for 2-3 hours.
- The block may be performed if the patient is taking an anticoagulant, but have a low threshold for stopping the procedure if it is difficult, and do not attempt multiple passes with the needle.
- It is acceptable to perform the block if the patient is taking antiplatelet medicines such as aspirin, clopidogrel or ticagrelor.
- 0.375% ropivacaine is achieved by diluting 0.75% ropivacaine with the same volume of 0.9% sodium chloride.

### **Recording an assessment of the severity of pain**

- An assessment of the severity of the patient's pain must always be recorded.
- As a minimum, pain severity should be recorded as part of the initial assessment and on arrival at a medical facility, or prior to leaving the scene if the patient is not transported by ambulance.
- The preferred approach is to record the patient's self-reported pain on a scale of 0-10, where 0 is no pain and 10 is the worst pain they can imagine.

- Record the patient's apparent severity of pain if they cannot describe severity or it is not possible to assess severity. For example, appears to have no pain, appears to have mild pain, appears to have moderate pain or appears to have severe pain.

### **Accompanying the patient en route to hospital**

- Personnel with an appropriate practice level should accompany the patient en route to hospital if fentanyl, ketamine or midazolam is administered. For example, a Paramedic should accompany the patient if fentanyl has been administered.
- Clinical judgement is required, but it is occasionally appropriate for personnel who have administered fentanyl, ketamine or midazolam to hand over to an EMT to transport the patient. This must only occur if all the following criteria are met:
  - There is an operational reason why the personnel who administered the medicines should not accompany the patient, and
  - The patient has adequate relief of pain, and
  - The patient is unlikely to require further pain relief, and
  - The patient is obeying commands, and
  - More than five minutes has elapsed since an IV dose, more than ten minutes has elapsed since an IN dose, or more than 20 minutes has elapsed since an IM dose.

### **Acute exacerbations of chronic pain**

- Chronic pain is a complex disorder that is often very difficult to treat.
- Acute exacerbations of chronic pain are physiologically very different to other forms of acute pain and administration of medicines may not be the most effective treatment.
- Good communication and demonstrating empathy are vital, noting that by the time an ambulance is called the patient and/or family may be very distressed.
- Follow the management/care plan if the patient has one and if possible seek advice from a clinician who knows the patient well.
- Utilise oral medicines that the patient has already been prescribed, as the preferred initial approach if possible.
- Avoid the administration of fentanyl and/or ketamine if possible, unless this is part of the management/care plan. Fentanyl and/or ketamine are not contraindicated, but these medicines do not usually have a role in treating acute exacerbations of chronic pain and may make the long-term treatment of chronic pain more difficult.
- If a patient is calling frequently and does not have a management/care plan, forward the patient's details to the appropriate manager.

## 1.5 Advance directives and advance care plans

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

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

### Advance directives

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

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

### Advance care plans

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

### Do not resuscitate orders/requests

Do not resuscitate (DNR) and do not attempt resuscitation (DNAR) orders are terms usually used to describe a medical decision that a patient should not be resuscitated in the event of cardiac arrest. Such decisions are commonly made in hospitals and aged residential care facilities 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 for whom some form of resuscitation (for example treatment for choking or anaphylaxis) would be appropriate, but resuscitation in the event of cardiac arrest would be inappropriate. When treating a patient described as having a DNR or DNAR order, always clarify what the order means in terms of the treatments that are appropriate for that patient.

## **Allow natural death orders/requests**

Allow natural death (AND) is a term that is commonly promoted as a more useful and precise term than DNR or DNAR. An allow natural death request is usually made for a patient who is at the end of their natural life and in whom life saving treatments should be withheld in the event of a life-threatening illness or injury. Treatments for relief of pain and suffering are never withheld and a patient with an allow natural death request should:

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

## **Complying with directives and plans**

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

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

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

## **Tattoos**

- Some patients have a tattoo, usually on their chest, that indicates they do not wish to be resuscitated.
- Tattoos have no legal standing as a legitimate advance directive and usually contain insufficient detail to allow appropriate decisions to be made.
- Decisions regarding resuscitation must be based on all the available information, including the tattoo, noting that the presence of a tattoo is likely to indicate that the patient has a firm view on what treatments they do not wish to receive.

## 1.6 Patient competency

- The term competency (or capacity) is used to describe the ability of a patient to be able to make informed decisions regarding their healthcare.
- A competent patient has the right to make informed decisions to refuse treatments, including life saving treatments.
- A patient is presumed to be competent to make informed decisions unless there are reasonable grounds for believing a patient is not competent.
- Reasonable grounds exist for determining that a patient is not competent if the patient:
  - a) Appears unable to understand information, or
  - b) Appears unable to understand the consequences of their decisions, or
  - c) Appears unable to remember information, or
  - d) Has attempted suicide, or
  - e) Has expressed serious thoughts of attempting suicide.
- If personnel believe the patient is not competent to make informed decisions, treatment may be provided against the patient's will if:
  - a) Personnel believe treatment is in the patient's best interests, and
  - b) Personnel believe the risks associated with providing treatment are less than the risks of not providing treatment, and
  - c) The treatment is not contradicting a valid advance directive.

### Additional information

#### Children

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

## **Attempted or threatened suicide**

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

## **When the patient appears to be not competent**

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

## When a competent patient declines recommendations

- A competent patient has the right to decline recommendations. In this setting personnel must:
  - Explain the implications of the patient's decisions to them, and
  - Involve the patient's family, friends or GP, provided the patient consents to this and it is appropriate to do so, and
  - Provide the patient with appropriate advice on what to do if they do not improve, and
  - Ask the patient to sign the 'patient declined transport' section of the documentation, and
  - Fully document their assessment, interventions, recommendations and interactions, and
  - Provide the patient with a copy of the ePRF or instructions on how to access a copy of the ePRF.



# 1.7 Calling the Clinical Desk

## Communicate using the ISBAR template

- **Identify yourself.** State your name, practice level, vehicle call sign and where you are calling from.
- **Situation.** State a succinct reason for calling, for example, “I am calling for permission to administer adrenaline IM” or “I am calling for advice”.
- **Background.** Briefly describe the background of the incident.
- **Assessment.** Describe your assessment of the patient. Ensure that any information that is likely to be required is available, for example, vital signs or a 12 lead ECG.
- **Recommend and review.** State what you think is required and listen carefully to instructions. Review and confirm the plan before ending the call.

## If your call is not answered immediately

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





## 1.8 Personnel on the Clinical Desk providing advice

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

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

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

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

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

# 1.9 Crew resource management

## Introduction

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

## Call for help

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

## Establish a team leader

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

- The team leader should avoid performing tasks unless this is absolutely necessary, as this risks the team leader becoming task-focused and losing situational awareness.
- Changing the team leader during the incident should be avoided unless this is necessary. However, if this needs to occur it is important that there is a clear handover process and that all team members are aware that the team leader has changed.

### **Communicate effectively**

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

### **Utilise resources appropriately**

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

### **Step back and reassess**

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

## Additional information

### Graded escalation of concerns

- Even in the presence of a flattened hierarchy, it is important to take a graded approach to escalation of concerns. This is also called graded assertiveness.
- Follow the steps below to escalate a concern. Move to the next step if your concern is not resolved and move straight to the last step if there is an immediate risk of severe harm.
  - Make a suggestion or offer to help. For example, “have you considered..?” or “would you like me to..?”
  - State how you feel. For example, “I am concerned that...” or “I feel that...”
  - Make a strong statement. For example, “stop, we must...”

### Interaction with other healthcare personnel

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

### Debriefing

- A short debrief following the job should occur.
- Involve all team members.
- Review the five principles of CRM. Discuss what aspects went well and what aspects could have been improved upon.
- If an area for improvement is identified, focus on constructive discussion on the principles and not on critique of an individual.
- Although debriefing is most important following an emergency, debriefing is always useful and will usually identify an area that could have been improved upon. Personnel are encouraged to debrief at least one incident per day to help embed the culture of regular self-review and continual improvement into business as usual.

## 1.10 Handover

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

- **I**dentification of the patient.
- **M**echanism of injury or the medical complaint.
- **I**njuries identified or information related to the medical complaint.
- **S**igns and symptoms.
- **T**reatment provided and trends.
- **A**llergies.
- **M**edicines.
- **B**ackground, including previous medical history.
- **O**ther, including information on family and social situation.

### **Additional information**

- Handover is a very important part of the patient's care. Loss of important information during handover is a common contributor to adverse incidents and patient harm.
- Prior to handover, review the details so that they can be delivered in a proficient and succinct manner. It is important to determine what information to include because irrelevant information risks the possibility of important information not being noted.
- Aim to deliver the handover in 30-60 seconds.
- When handing over to a team, ask the team leader if they want the handover before or after moving the patient from the stretcher. Our preference is to provide a handover before moving the patient from the stretcher, as this helps focus the team members on listening to the handover. Pause at the end of the handover and ask if there are any questions.
- Complete the ePRF and ask if there are any further questions before leaving.



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# 1.11 Informed consent

## Introduction

- Informed consent is an interactive process involving communication between personnel and a patient, during which the patient gains an understanding of their condition and makes an informed choice regarding their treatment.
- Personnel have a statutory obligation to abide by The Code of Health and Disability Services Consumers' Rights. One of the rights is to make an informed choice and to give informed consent, noting that a competent patient has the right to refuse or withdraw consent at any time.
- When a patient is not competent to make an informed choice, it may be appropriate to provide treatment without informed consent. Additional relevant information is contained within the sections titled 'assessing competency' and 'treatment and referral decisions'.

## Obtaining informed consent

- Personnel must obtain informed consent whenever it is possible to do so.
- When obtaining informed consent personnel must:
  - Fully inform the patient by providing an explanation (using non-clinical language) including:
    - a) The nature of their condition.
    - b) The recommendations being made.
    - c) The reasons for the recommendations.
    - d) The benefits and risks of the proposed treatments, including the benefits and risks of any alternative courses of action.
    - e) The estimated costs if relevant and appropriate.
    - f) Introducing the people who will be providing treatment. The patient must be explicitly informed if a student is present or will perform any interventions and be given the opportunity to decline the student's involvement.
  - Fully assess the patient's competency to make informed decisions.
  - Allow the patient to ask questions.
  - Fully answer the patient's questions.

## Providing information

- Good communication is the key factor in obtaining informed consent. It is important to take the time required to ensure the patient understands the issues as much as possible. Utilise a translator if appropriate.
- Clinical judgement is required when providing information to a patient:
  - It is not feasible to provide all of the information relating to each condition.
  - The patient should receive the information that another patient in the same setting would reasonably expect to receive.

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

## Documentation

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



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## 1.12 Initial management of a major incident

- This is a summary of the initial management of a major incident. Further details are contained within ambulance service operational plans and procedures.
  - Establish a clear command structure utilising a central incident control point.
  - Establish clear communication with Comms through one single point.
  - Triage the patients.
  - Prioritise the patients for treatment and transport.
  - Distribute the patients across hospitals/facilities, provided this is feasible.

### Major incident folder

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

### Situation report (sitrep)

- Place a sitrep using METHANE as soon as possible:
  - **M**ajor incident declaration.
  - **E**xact location of incident.
  - **T**ype of incident.
  - **H**azards (significant) identified.
  - **A**ccess and egress.
  - **N**umber (estimated) of patients.
  - **E**mergency services already present and extra resources required.

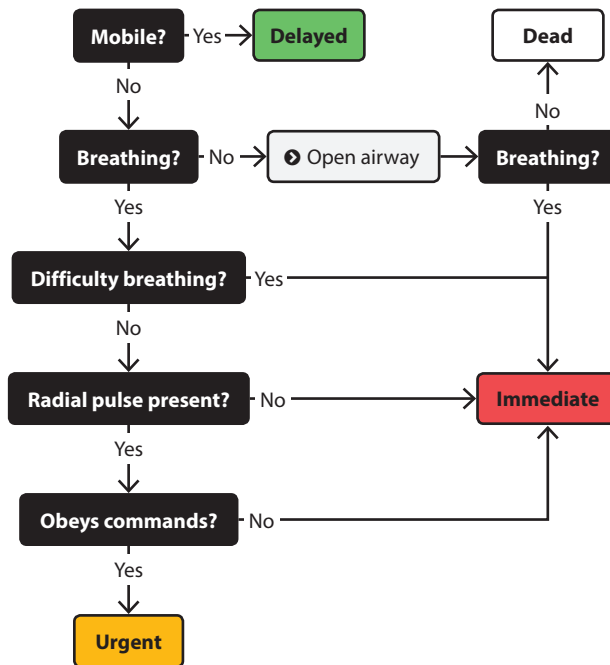
### Primary triage

- Perform primary (or initial) triage using status codes.

Status	Triage urgency	Triage tag colour
Zero	Dead	Black/white
One	Immediate	Red
Two	Urgent	Orange/yellow
Three	Delayed	Green
Four	Delayed	Green

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





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

## Secondary triage

- Perform secondary triage at the casualty clearing point, utilising a primary and secondary survey on all patients in order of their priority as determined by primary triage.
- During secondary triage allocate each patient a number, for example if there are nine patients at the scene allocate 'patient one' to 'patient nine'.
- Create a central record of all patients that includes the number allocated to each patient, their approximate age, a summary of their injuries and their status.
- If a patient's status changes replace the triage tag (or wristband) with a new tag and ensure the central record is updated.

## Treatment

- Initiate treatment on patients in order of priority as determined by their triage colour following secondary triage. Appropriate prioritisation of treatments optimises outcomes. The general principles are:
  - Group patients with the same triage colour together around a central equipment pool, when feasible.
  - Treatment decisions should be made by experienced personnel who task others to provide those treatments.
  - Patients who have the greatest chance of survival with the least expenditure of time, equipment and personnel should be treated first.
  - Treatments that are highly unlikely to be successful (for example CPR) should not usually be performed unless there are sufficient personnel and a good clinical reason to do so.
  - Treatments that take significant time (for example rapid sequence intubation) should not usually be performed unless there are sufficient personnel and a good clinical reason to do so.
  - The greater the number of patients, the greater the importance of restricting the treatments to those that are immediately life saving.

## Transport

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

## Patients considered almost certain to die

- It is impossible to predict with certainty which patients will die no matter what treatment they receive. However, in the setting of a major incident some patients have injuries that are so severe that death is highly likely. Examples include patients with:
  - Respiratory arrest.
  - Severe shock with a falling heart rate.
  - A GCS of 3 with bilateral dilated and unreactive pupils.
- Patients considered almost certain to die are allocated a red triage colour. However, if the number of severely injured patients is high, it is appropriate for patients considered almost certain to die to have treatment and transport initially withheld, allowing other immediate and urgent patients to be treated and transported first. Patients considered almost certain to die should then be reassessed and further decisions made regarding treatment and transport, noting that only very clinically experienced personnel should make these decisions.



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## 1.13 End of life care

This section is for patients receiving end of life care.

- Locate and follow the patient's advance care plan if possible.
- Contact healthcare personnel coordinating the patient's care and seek their advice if possible.
- Provide treatment for relief of symptoms. For example:
  - a) Administer fentanyl for pain or shortness of breath. Patients that are already taking opiates may need higher doses than anticipated to achieve symptom control. If the patient is already taking an opiate, administer double the IV or IM/SC dose that you would usually administer to a patient of the same size and administer additional doses as required. There is no total maximum dose and the goal is to provide adequate symptom relief without intentionally hastening the patient's death.
  - b) Administer midazolam for anxiety, agitation or symptoms that do not respond to an opiate. Administer 1-2 mg IV or 5 mg IM/SC and administer additional doses as required. There is no total maximum dose and the goal is to provide adequate symptom relief without intentionally hastening the patient's death.
  - c) Administer droperidol for agitation that does not respond to midazolam. Administer one or two doses of 10 mg IV/IM/SC.
- The patient may have been issued with medicines for administration in the event of severe distress. All personnel may administer such medicines, even if outside their delegated scope of practice, provided:
  - a) There are clear written instructions, and
  - b) No other suitable personnel are available to administer the medicine, and
  - c) The ePRF is sent for audit.
- All personnel may administer medicines outside their delegated scope of practice if instructed to do so (including over the phone) by a registered medical or nurse practitioner.

### Referral and transport

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

## Additional information

- The terms ‘palliative care’ and ‘end of life care’ do not mean the same thing.
- A patient may be under the care of a palliative care team or hospice team for many months before reaching a point where their treatment becomes focused on end of life care. It may be appropriate to initiate some resuscitative treatments for a patient that is receiving palliative care, but is not yet receiving end of life care and clinical advice should be sought if there is any doubt.
- A summary of the patient’s advance care plan (or instructions on where the plan can be found) may sometimes be on the front of the fridge.
- The most important aspects of end of life care are to ensure that:
  - The patient and their family feel safe and supported.
  - There is good communication with the patient, their family and the patient’s healthcare providers.
  - The patient is provided with adequate comfort and relief of symptoms.
- It is inappropriate to provide treatments that artificially prolong the process of dying, for example CPR, IV fluid or assisted ventilation.
- It is inappropriate to routinely measure vital signs or to perform an examination that could cause additional unnecessary discomfort and/or will not change the treatment that the patient receives. For example, it is usually inappropriate to measure the patient’s blood pressure before or after administering medicines for symptom relief.
- Most hospice and palliative care staff utilise the SC route for administration of medicines:
  - Personnel may choose to administer medicines via the IV route provided IV access is easy to obtain.
  - However, administration of medicines via the SC route is usually effective and is a viable option. Personnel may choose to administer medicines via the SC route, noting that the doses administered should be the same as an IM dose.
  - An SC access line may be in place and personnel may utilise this noting that a flush is not required.
- To administer a medicine SC, pinch a fold of skin over the anterior abdominal wall between thumb and forefinger. Introduce the entire length of the needle using a dart technique and inject.
- If IV access has been gained and the patient is not being transported, discuss the possibility of leaving the IV access in place with the patient and/or family, particularly if it is likely that an ambulance may be requested again within 24 hours. This allows the option of additional IV treatment by ambulance personnel.

## 1.14 Verification of death

Death may be verified when:

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

### Clinical criteria

- To verify death using clinical criteria:
  - a) There must be no signs of breathing for one minute, and
  - b) There must be no palpable central pulse, and
  - c) There must be no audible heart sounds, and
  - d) The pupils must be dilated and unreactive to light.
- After ten minutes all the above examinations (a-d) must be repeated and at this time a 3 lead ECG must show asystole. Document this as the time of death.
- A patient may be dead but may not be in asystole at the second examination after ten minutes. For example:
  - a) There may be slow broad complexes. If this is the case wait until asystole is present before verifying death.
  - b) A patient with a pacemaker may have electrical activity generated by the pacemaker for many hours after death. In this setting it is appropriate to verify death despite electrical activity on the ECG, provided all the other clinical criteria are met.

## Additional information

### General principles

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

palpable and palpation for a minimum of ten seconds is required.

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

### **Deaths that must be reported to the Coroner**

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

### **After death has been verified**

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

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





## 1.15 Oxygen administration

- Few sections contain specific instructions on oxygen administration and clinical judgement is required.
- Oxygen should usually only be administered if the patient has one of the following clinical conditions:
  - a) An SpO<sub>2</sub> less than 94% on air (exceptions – see high risk patients below and the ‘neonatal resuscitation’ section).
  - b) Airway obstruction.
  - c) Severe respiratory distress (exception – see high risk patients).
  - d) Severe shock.
  - e) Severe traumatic brain injury.
  - f) Suspected carbon monoxide (CO) poisoning.
  - g) Smoke inhalation.
  - h) Decompression illness.
  - i) A condition requiring sedation to be administered.
  - j) Cluster headache.
- Use the simplest device and lowest flow rate required to achieve an SpO<sub>2</sub> of 94-97%. If the patient has suspected CO poisoning, administer 10 litres/minute via a reservoir mask. If pulse oximetry is unreliable or unavailable, administer oxygen as appropriate for the patient’s clinical condition.
- The oxygen flow rates usually used are:
  - a) Nasal prongs 1-4 litres/minute.
  - b) Simple mask 6-8 litres/minute.
  - c) Nebuliser mask 8 litres/minute.
  - d) Reservoir mask 10-15 litres/minute.
  - e) Manual ventilation bag 10-15 litres/minute.

### Patients at high risk

- Patients at high risk may have carbon dioxide clearance that is altered by oxygen administration and excess oxygen administration may cause hypercarbia.
- Patients at high risk include patients with COPD, morbid obesity, those on home oxygen, neonates and those on home CPAP or BIPAP.
- Oxygen flow rates should be titrated to the patient’s normal SpO<sub>2</sub> if this is known. If this is not known, titrate the oxygen flow rate to an SpO<sub>2</sub> of 88-92%.

## Additional information

### Oxygen administration

- Oxygen is a treatment for hypoxia and not a general treatment for patients that are ill or injured.
- Oxygen administration is restricted to those patients that have an indication to receive it, because when oxygen levels within blood are higher than normal:
  - Blood vessels (particularly small arteries) vasoconstrict. This has the potential to lower blood flow to tissues and organs.
  - Inflammation is increased and this may worsen inflammatory states.

### Delivery devices

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

### Pulse oximetry

- A pulse oximeter gives a reading of how much oxygen (as a percentage of maximum capacity) is bound to haemoglobin within arterial blood.
- A pulse oximetry reading provides a much better indication of a patient's oxygenation than clinical examination.
- A pulse oximetry reading does not indicate how well a patient is breathing. How well a patient is breathing is determined by clinical examination and end tidal carbon dioxide (ETCO<sub>2</sub>) measurement if this is available.
- Pulse oximetry can be unreliable if the patient is very vasoconstricted, shaking, moving, has very dirty fingers, or has been exposed to CO.
- Do not spend long periods of time trying to get a pulse oximetry reading, noting that a common cause of failure to get a reading is severe vasoconstriction.
- Low pulse oximetry readings may be invalid if the plethysmograph waveform (the SpO<sub>2</sub> graphical waveform on the monitor) is damped, flat or irregular. A wide and regular plethysmograph waveform is a sign that the pulse oximetry reading is likely to be valid.

### Cyanosis

- Cyanosis is blue discolouration of skin or mucous membranes. It is due to the presence of haemoglobin that does not have oxygen bound to it.

- A patient may be significantly hypoxic without being cyanosed because cyanosis is usually only detectable with an SpO<sub>2</sub> less than 80%.
- Cyanosis is much more difficult to detect in a patient who is anaemic, has brown or black skin, or has been exposed to CO.
- Central cyanosis (for example of the mouth and lips) is usually due to severe hypoxia. Peripheral cyanosis (for example of the extremities) in the absence of central cyanosis is usually due to vasoconstriction.

## Oxygen administration and COPD

- Some patients have carbon dioxide clearance that is altered by oxygen administration and excess oxygen administration in these patients may cause hypercarbia. Bronchodilators should be nebulised using air if possible. If oxygen is administered, titrate the oxygen flow rate to an SpO<sub>2</sub> of 88-92%.
- The mechanisms by which excess oxygen administration causes hypercarbia are controversial and complex. They include:
  - Reversal of hypoxic pulmonary vasoconstriction, causing high levels of CO<sub>2</sub> in poorly ventilated alveoli to diffuse back into the circulation.
  - Decreased ventilatory drive.
  - Decreased CO<sub>2</sub> buffering capacity of haemoglobin.
  - Absorption of CO<sub>2</sub> from alveoli beyond obstructed airways.
  - The higher density of oxygen compared with air causing increased work of breathing.
- Patients at risk of hypercarbia often have a card or letter describing specific instructions for oxygen therapy. These instructions should be followed.
- If using oxygen to nebulise bronchodilators, alternating five minutes with the mask on and five minutes with the mask off should only occur if the SpO<sub>2</sub> climbs above 92% during nebuliser delivery. This is done to limit oxygen exposure whilst delivering most of the nebulised bronchodilator. If the SpO<sub>2</sub> remains at or below 92% during nebulisation, this alternating does not need to occur.
- If using air to nebulise bronchodilators, administer bronchodilators using a flow rate of 8 litres/minute and administer oxygen via nasal prongs if required, adjusting the oxygen flow rate to achieve an SpO<sub>2</sub> of 88-92%.
- The signs of a rising carbon dioxide level are usually confusion, drowsiness, agitation and a falling level of consciousness. If a patient is suspected of developing hypercarbia, oxygen administration should not be discontinued immediately. Instead, oxygen administration should be reduced to a lower flow rate (targeting an SpO<sub>2</sub> of 88-92%) and the patient reassessed.
- Consider assisting the patient's ventilation early (without added oxygen unless hypoxia is severe), using a manual ventilation bag if:
  - SpO<sub>2</sub> continues to fall below 80% despite treatments, or
  - The patient is becoming exhausted, or

- The patient is suspected of developing hypercarbic respiratory failure despite lowering the oxygen flow.
- A T-piece may be used (T-pieces are not available on all ambulances) to administer nebulised medications if the patient's ventilation is being assisted with a manual ventilation bag, noting that the administration of nebulised medicines is not a priority in this setting.

### **Oxygen administration and smoke inhalation**

- Oxygen administration is not routinely required following smoke inhalation and should be reserved for patients that have suspected CO poisoning as a result of clinically significant smoke inhalation.
- See the 'poisoning from gases' section for more information.

### **Oxygen administration following bleomycin treatment or paraquat poisoning**

- Oxygen administration can cause severe lung inflammation in patients previously treated with bleomycin (a chemotherapy drug) and should usually only be administered for an SpO<sub>2</sub> less than 88%.
- This sensitivity to oxygen is lifelong following exposure to bleomycin.
- Most patients that have received bleomycin have been specifically warned about this and know to tell healthcare personnel that oxygen should only be administered if necessary.
- Oxygen administration following paraquat poisoning worsens outcomes in animal experimental models and for this reason it is sometimes recommended that oxygen is only administered for very severe hypoxia. There is however, little evidence to support this in humans and oxygen should be administered if required, with the minimum flow needed to achieve an SpO<sub>2</sub> of 94-97%.

### **Oxygen administration in confined spaces**

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

## 1.16 Status codes

- Status codes are:
  - A numerical estimate of the severity of a patient’s clinical condition.
  - Qualitative and require clinical judgement.
  - Allocated to a patient after taking into account the nature of the illness or injuries, the vital signs and the potential threat to life.
  - Not directly altered by the mechanism of injury, the physical environment (for example, trapped or not trapped) or the patient’s age.
- Status codes are not ideal for pregnant women in that the code cannot always be used to describe the potential threat to life for the unborn baby and the mother. Consideration should be given to adjusting the status code of the mother to take into account the threat to life for the unborn baby if the baby is at risk.

Status	Triage urgency	Triage tag colour
Zero	Dead	Black/white
One	Immediate	Red
Two	Urgent	Orange/yellow
Three	Delayed	Green
Four	Delayed	Green

### Examples

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

#### Status one

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

## Status two

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

## Status three

- Mild stridor.
- Mild respiratory distress.
- Dysrhythmia causing mild cardiovascular compromise.
- Myocardial ischaemia with symptoms, or signs on 12 lead ECG, that have resolved following treatment with nitrates. Note: the patient is status two if the signs or symptoms return and further administration of nitrates is required.
- Isolated fracture of one bone. This includes the shaft of the femur and compound fractures, provided there are no signs of limb ischaemia.
- Dislocations of joints without distal limb ischaemia.
- Spinal pain without signs or symptoms of spinal cord injury.
- Loss of consciousness with normal or near normal (GCS 14 or 15) recovery.
- Transient ischaemic attack.

## Status four

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

## 1.17 Requesting a helicopter

### Making the request

- Provide all of the following information:
  - a) The main request criteria (see below), and
  - b) Your assessment so far, and
  - c) Any specific requirements. For example, winching, blood, or you are following a specific pathway.

### Request criteria

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

#### The time saving must be clinically significant:

Time saving		Patient status		Condition
More than 15 minutes	+	Status one	+	Time critical condition
More than 30 minutes	+	Status two	+	Time sensitive condition
More than 60 minutes	+	Status three	+	Time sensitive condition

### Preparing for helicopter arrival

- Designate personnel to secure an appropriate landing site.
- Update the helicopter crew approximately ten minutes prior to their arrival with:
  - a) A description of the landing site and any obvious hazards.
  - b) The patient's age and vital signs.
  - c) Any significant changes in the patient's condition.

## Additional information

### The advantages and disadvantages of using a helicopter

- Deciding to use a helicopter requires clinical judgement that balances the advantages and disadvantages.
- Helicopters can help save lives. They can enable patients to be extricated from difficult terrain, deliver skilled personnel to the patient and reduce the time for the patient to reach hospital.
- However, when used inappropriately helicopters can compromise the treatment provided to the patient and in some situations can increase the time for the patient to get to hospital.
- Transporting a patient by helicopter compromises the ability to provide treatment to the patient, in comparison to the same level of personnel treating the patient in a road ambulance. This is because helicopters:
  - Have significantly less space than a road ambulance.
  - Are noisy and this restricts communication, even with modern headsets.
  - Have reduced light at night in order to maintain night vision for the helicopter crew.
  - Cannot stop quickly to overcome movement during clinical interventions.
- Unless access is the indication, the restricted ability to treat a patient in the helicopter must be outweighed by the advantage of a clinically significant reduction in the time it takes for the patient to receive skilled personnel, or to be transported to hospital.

### Request criteria

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



## Requesting a helicopter

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

## Time critical and time sensitive conditions

- Not all patients that are status one have a time critical condition and clinical judgement is required. For example, a patient with severe hypovolaemic shock secondary to intra-abdominal bleeding has a time critical condition, but a patient with unconsciousness secondary to a stroke who lives in an aged residential care facility and is receiving end of life care does not.
- Cardiac arrest is not usually an indication to request a helicopter:
  - It is uncommon for a helicopter to be able to locate within a time frame that could make a difference to the patient, but a helicopter should be dispatched if it is required for access, or the helicopter can locate faster than a road ambulance.
  - Clinical judgement from Air Desk personnel is required when deciding to dispatch a helicopter to a patient in cardiac arrest. Air Desk personnel may decide to utilise a helicopter to deliver an ICP or HEMS team to the scene in selected circumstances, particularly when it is clear that resuscitation will be attempted and it is likely that the additional skills of an ICP or HEMS team will improve the patient's outcome. Examples include but are not limited to, neonates and cardiac arrest secondary to drowning.
  - If the patient achieves ROSC it is appropriate to consider calling for a helicopter, noting that if the patient has another cardiac arrest it is usually

safest if the patient is in a road ambulance because resuscitation efforts are restricted by the limited space available in a helicopter, even when a mechanical CPR device is available. For this reason a patient that is post cardiac arrest should usually be transported by road unless a very significant time saving will be achieved by using a helicopter.

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

### **Selecting a landing site**

- In many areas of New Zealand there are commonly used landing sites that are well known to the helicopter crews and these should be used whenever feasible.
- If it is not feasible to use a commonly used landing site, select a landing site that is:
  - As large as possible. A minimum of 20 metres by 20 metres is preferred (approximately two tennis courts).
  - As flat as possible. Less than five degrees of slope is preferred.
  - Free of surrounding wires, poles and trees if possible.
  - Free of loose objects. Remove loose objects that may move with the helicopter downwash prior to helicopter arrival.
  - Free of long grass. Less than 30 cm is preferred.
  - Free of livestock.
- It is not necessary to routinely utilise Fire personnel to secure a landing site and judgement is required. Fire personnel should be requested if they are required to help ensure the landing site is safe, for example if the landing site is on a public road.
- It is not necessary to mark the outer edges of the landing site. In particular do not use objects such as cones that may move in the helicopter downwash. Low intensity lights may be used to mark the landing site at night but this is not routinely required.
- At night do not use headlights to mark the landing site or shine lights toward the helicopter, both of which may impair the night vision of the helicopter crew.

- Be prepared for the possibility that the helicopter crew may choose an alternative landing site.

**Prior to the helicopter arriving**

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



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## 1.18 Treatment and referral decisions

- Whenever personnel are assessing a patient, the following initial decisions must be made:
  - Is treatment required?
  - Is referral to a medical facility required?
  - If referral to a medical facility is required, what type of medical facility is most appropriate?
  - If referral to a medical facility is required, what mode of transport is most appropriate?

### Obligations of personnel

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

### Deciding if the patient requires referral to a medical facility

- Not all patients assessed by ambulance personnel require referral to a medical facility. It is appropriate for a patient with minor illness or minor injury to be managed in the community provided:
  - The obligations previously outlined have all been followed, and
  - The patient receives appropriate advice on what to do if they do not improve, including when to seek further clinical advice, and
  - The non-transport pause and checklist is used, and
  - Appropriate documentation is completed.

## **Criteria for immediate referral to a medical facility**

- Personnel must recommend immediate referral to a medical facility if any of the following criteria are met:
  - Personnel are unable to reasonably exclude serious illness or injury or
  - There is a significant abnormality in any vital sign recording.
- Further details on specific referral criteria are contained within each section.

## **Non-transport pause and checklist**

- If a patient is being given a recommendation by ambulance personnel that transport to a medical facility by ambulance is not required, the crew must pause briefly to go through the non-transport checklist (below) and agree that non-transport is the right decision. If consensus is unable to be easily achieved, personnel should have a low threshold for seeking clinical advice or recommending the patient is transported.
- The following non-transport checklist must be completed prior to leaving the scene:
  - The patient has been fully assessed including a set of vital signs and appropriate investigations, and
  - No vital signs (excluding temperature) are significantly abnormal, and
  - Serious illness or injury has been reasonably excluded, and
  - No red flags requiring transport to ED are present, and
  - The patient is seen to mobilise (when able to normally do so), noting that if the patient is unable to mobilise there must be a minor or long-standing condition preventing this, and
  - The patient and/or caregivers have been given a verbal and written explanation of when to seek further clinical advice.

## **Deciding where the patient should be referred**

- If a patient is being referred to a medical facility, referral should be to the most appropriate medical facility taking into account:
  - The patient's expected healthcare requirements, including investigation and treatment, and
  - The most effective and efficient way of meeting those requirements.
- The patient may not require referral to an ED. It is preferable to refer the patient to a primary care facility, provided that:
  - The patient's healthcare requirements can be reasonably met at that facility, and
  - It is reasonable and practical to refer the patient to that facility.

## **When a competent adult patient declines recommendations**

- A competent adult patient has the right to decline recommendations. In this setting personnel must:
  - Explain the implications of the patient's decisions to them, and
  - Involve the patient's family, friends or GP, provided the patient consents to this and it is appropriate to do so, and
  - Provide the patient with appropriate advice on what to do if they do not improve, and
  - Ask the patient to sign the 'patient declined transport' section of the ePRF, and
  - Fully document the assessment, interventions, recommendations, and interactions (consider utilising the recording function on ePRF if available), and
  - Provide the patient with instructions on how to access a copy of the ePRF.

## **When an adult patient appears to be not competent**

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

## **When the patient is a child**

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

## **The mode of transport**

- Not all patients requiring transport to a medical facility require transport in an ambulance. It is appropriate to recommend private transport provided all of the following criteria are met:
  - The patient is very unlikely to require treatment or intervention during transport, and
  - The referral guidelines within each section are followed, and
  - A reasonable and appropriate alternative form of transport is available, and
  - Personnel are reasonably assured the patient and/or family will comply with transport arrangements.

## **When the patient or family members insist on transport by ambulance**

- A competent patient has the right to decline recommendations but neither a patient nor family members have the right to insist on transport that personnel do not think is clinically indicated.
- However, if the insistence appears to be based upon genuine concern and no other reasonable transport option is available, then the patient should be transported by ambulance. If the insistence appears to be based on maliciousness, convenience or petty concerns, then personnel may decline to transport the patient provided they:
  - Explain the reasons for not providing transport, and
  - Fully document their involvement with the patient and family, and
  - Seek a second opinion via the Clinical Desk, and
  - Forward the ePRF for audit.

## **When a registered health professional insists on transport by ambulance**

- A registered health professional might insist on transport by ambulance that personnel do not think is clinically indicated.
- Personnel should try to resolve this by achieving consensus via collegial discussion, taking into account that the registered health professional may know the patient well. However, if consensus cannot be achieved, personnel should follow the principles contained within the previous paragraph.



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## 1.19 Vital signs

### When vital signs must be recorded

- Vital signs must be recorded when the incident involves a single patient who has been assessed and is being given a recommendation that transport to a medical facility is not required:
  - A set of vital signs that includes as a minimum: respiratory rate, heart rate, blood pressure, capillary refill time, SpO<sub>2</sub> and GCS.
  - Personnel should have a lowered threshold for recording two sets of vital signs if any of the first set were at the outer limits of normal.
- Vital signs must be recorded when they are a prerequisite to providing treatment. For example, a blood pressure must be recorded before administering GTN.
- Vital signs must be recorded following treatment that has been initiated in response to abnormal vital signs. For example, if 0.9% sodium chloride has been administered for tachycardia and a narrowed pulse pressure, these vital signs must be recorded after administration.

### When vital signs do not have to be recorded

- Not all vital signs have to be recorded if the patient has a time critical problem and the results will not change the treatment that is provided. For example:
  - A patient that is very close to hospital with a severe TBI, an obstructed airway and poor breathing. This is because a rapid approach to commencing transport and treating en route is expected, with a focus on maintaining airway and breathing and recording a blood pressure will not change the treatment that is provided.
  - Prior to adrenaline administration if a patient has anaphylaxis that is clearly immediately life-threatening.
- Vital signs do not need to be routinely recorded if multiple patients are being assessed at the scene. Most commonly this will be a road crash scene where patients appear to be uninjured or to have minor peripheral injuries only. However, if a patient appears to have more than minor peripheral injuries, a set of vital signs must be recorded before making a recommendation that transport to a medical facility is not required.
- Clinical judgement is required if the patient is receiving end of life care. In this setting vital signs are not a prerequisite for providing treatment and it is usually not appropriate to take recordings or perform examinations that will cause additional unnecessary discomfort.
- When vital signs are not recorded (or are unable to be recorded), the reason for this must be documented on the ePRF.

## The frequency of vital sign recordings

- Clinical judgement is required when determining how frequently to record vital signs:
  - Vital signs should usually be recorded every 10-15 minutes for a patient that is status one or status two, noting that vital signs are not required if the patient has a time critical problem and the result will not change the treatment that is provided.
  - Vital signs should usually be recorded every 20-30 minutes for patients that are status three.
- Some vital signs are monitored continually (for example heart rate via ECG leads) but are recorded at intervals. It is appropriate to record these if a significant change occurs, or other vital signs (such as blood pressure) are being recorded simultaneously.
- It is usually inappropriate to stop a moving ambulance for the purpose of measuring and/or recording vital signs.

## Specific vital signs

- **Respiratory rate.** Tachypnoea is a subtle but important sign that a patient is unwell or injured. The respiratory rate must be counted and not estimated. The trend of the respiratory rate is more important than a single recording.
- **Heart rate.** Unexplained tachycardia is a subtle but important sign that a patient is unwell or injured. The trend of the heart rate is more important than a single recording.
- **Blood pressure.** Blood pressure alone is a poor indicator of the adequacy of cardiac output. Take note of the pulse pressure and the trend, noting that a narrowed pulse pressure is a sign of vasoconstriction, usually in response to reduced cardiac output. A standing and lying/sitting blood pressure should be measured if postural hypotension may have contributed to the patient's clinical condition and non-transport is being considered.
- **Capillary refill time.** In the absence of hypothermia or significant peripheral vascular disease, a prolonged capillary refill time is a sign of vasoconstriction, usually in response to reduced cardiac output. The trend of the capillary refill time is more important than a single recording.
- **GCS.** Carefully determine each component noting that the motor score is the most important component of the GCS.
- **SpO<sub>2</sub>.** This measures how much oxygen is bound to the haemoglobin in arterial blood as a percentage of maximum. It measures how well a patient is oxygenated, but does not measure how well a patient is breathing (ventilating). How well a patient is breathing is determined by clinical examination and use of ETCO<sub>2</sub>. Failure of the pulse oximeter probe to record an SpO<sub>2</sub> is often an indication that the patient is vasoconstricted and poorly perfused.

- **Blood glucose.** The blood glucose concentration does not need to be routinely recorded in all patients. It should be recorded to rule out hypoglycaemia or hyperglycaemia, taking into account the overall clinical picture. For example, a blood glucose must be recorded in all:
  - Patients with diabetes.
  - Patients with an altered level of consciousness.
  - Patients who are unwell without an obvious cause.
  - Patients with signs of infection. In particular, children under five years of age are particularly prone to hypoglycaemia if they have severe infection.
  - Patients with poisoning where hypoglycaemic medicines may have been taken.
  - Patients with signs or symptoms of a stroke.
  - Patients who have had a seizure.
- **Temperature.** Hyperthermia is most commonly due to infection, but normothermia does not rule out infection. There is no specific temperature that correlates well with severity of illness, however:
  - A temperature must be recorded if the patient has a clinical condition that does not involve trauma, and a recommendation is being made that transport to a medical facility is not required.
  - A temperature greater than 40°C must result in a patient being given a recommendation to be transported to a medical facility.
  - Hypothermia is an important clinical sign as it is often a sign of low cardiac output. A temperature below 35°C should usually result in a patient being given a recommendation to be transported to a medical facility.
- **ETCO<sub>2</sub>.** This must be measured continually via capnography and regularly recorded if the patient has been intubated with an ETT. ETCO<sub>2</sub> should be measured via an LMA, noting that the trend is more important than individual recordings, as these are affected by any leak around the cuff. ETCO<sub>2</sub> may be measured in a spontaneously breathing patient using nasal prongs if these are available, noting that clinical examination must be used in conjunction with the waveform and the ETCO<sub>2</sub>. ETCO<sub>2</sub> may be measured if the patient is being ventilated via a face mask, noting that the trend is more important than individual recordings, as these are affected by any leak around the mask.

### Other clinical signs

- Other clinical signs are elicited by examining the patient. They are just as important as the vital signs and include:
  - Features of general concern such as pallor or sweating.
  - Airway noise such as stridor or grunting.
  - Lung sounds such as wheeze or crackles.
  - Signs of increased work of breathing such as indrawing and nasal flaring.
  - Interaction and activity, particularly in small children.
  - The ability to mobilise normally without assistance.

# Adult Glasgow Coma Scale

<b>Best eye opening</b>	
Spontaneous	4
To command, speech or sound	3
To pain or pressure	2
None	1
<b>Best verbal response</b>	
Orientated with normal content	5
Confused but speaks in sentences	4
Discernible words only	3
Groans/grunts only with no discernible words	2
None	1
<b>Best motor response</b>	
Obeys commands	6
Localises or has purposeful movement	5
Withdraws from pain or normal flexion	4
Abnormal (spastic) flexion	3
Extension or rigid	2
None	1



## 1.20 Documentation

### General principles

- Documentation must be accurate and complete.
- Comprehensive documentation is particularly important when a patient is not transported to a medical facility.
- Documentation must be objective and subjective statements should be avoided. Take particular care to avoid subjective statements about the behaviour or demeanour of the patient, their family or other healthcare professionals, as they may subsequently read the documentation.
- As a general rule, a third party (for example, The Health and Disability Commissioner) will assume that if something is not recorded it did not occur.
- A third party should be able to read the documentation and understand what happened and why.
- One person will usually lead the patient assessment and treatment and this person should usually complete the electronic patient report form (ePRF). However, all clinical personnel in the crew are responsible for ensuring the documentation is accurate and complete.
- Documentation must occur on a paper PRF if an ePRF device is not available, and subsequently entered into the ePRF system when possible.
- A separate ePRF is required for each patient transported. This includes for example, a separate ePRF for a mother and her newborn.
- An ePRF should be completed whenever personnel are uncertain if one is required.

### Information documented in the ePRF

- The ePRF must include all the following:
  - The patient and incident details.
  - The history and assessment of the patient.
  - A description of all significant treatment administered and/or interventions provided prior to ambulance arrival.
  - All treatment administered and interventions provided by ambulance personnel or by people assisting ambulance personnel, for example PRIME responders.
  - A description of any clinical advice received, for example via the Clinical Desk.
  - At least one set of vital signs. See the 'vital signs' section for more information.
  - Known allergies to medicines.
- The ePRF must contain all relevant information for the entire incident if the care and/or transport of the patient is transferred from one crew to another.

- The use of abbreviations should be minimised.
- Do not use terminology specific to ambulance personnel, for example R codes.

### **When an ePRF must be completed**

An ePRF must be completed whenever:

- A single patient is assessed (even if vital signs are not recorded) following dispatch of an ambulance and is not transported to a medical facility. If more than one patient is assessed at an incident an ePRF is not always required for each patient, see below for more information.
- A patient is transported to a medical facility. This includes referrals from primary care to hospital or hospice, but does not include DHB inter-facility transfers unless ambulance personnel administer treatment or perform a significant clinical intervention.
- A medicine other than paracetamol or ibuprofen is administered to the patient. For example, at an event a patient may be administered paracetamol for minor pain without completing an ePRF, but if tramadol is administered an ePRF must be completed.
- A significant clinical intervention is provided. What is 'significant' cannot be tightly defined and requires clinical judgement. For example, placing an ice pack on a soft tissue injury at an event is not considered a significant clinical intervention but reducing a dislocated patella is.
- A patient has died. In this setting an ePRF is required for each patient.

### **When a 'no ePRF' may be completed**

A 'no ePRF' may only be completed in one of the following circumstances:

- No patient was found at the scene.
- The patient is not transported to a medical facility and there are insufficient patient details to complete an ePRF. For example, a competent patient refuses assessment without providing sufficient details to enable the patient details section of the ePRF to be completed.
- An ambulance was called by someone other than the patient, the patient clearly does not require an ambulance and refuses assessment.
- The patient accidentally activates their medical alarm.
- Multiple patients are assessed at the scene and not transported to a medical facility. For example, multiple patients are assessed at the scene of a minor road crash. In this setting personnel should have a low threshold for completing an ePRF if a patient has vital signs measured or is advised to seek further clinical assessment.
- An ePRF is accidentally created as a duplicate to another incident.
- In the setting of a declared major incident. In this setting documentation must occur on the MCI patient information tags and an ePRF should be completed by the transporting crew if feasible.

## **When a patient is not transported to a medical facility**

- When a single patient is assessed following dispatch of an ambulance and not transported to a medical facility, the documentation must include all the following:
  - The patient and incident details, the assessment, all treatment administered, all interventions performed and at least one set of vital signs. See the 'vital signs' section for more information.
  - A clear description of the recommendation made to the patient and/or family/guardians/caregivers, including why the recommendation was made.
  - A clear description of the communication between ambulance personnel and the patient and/or family/guardians/caregivers if a recommendation to be transported to a medical facility by ambulance is declined.
  - A competent patient or guardian must be asked to sign the 'patient declined transport' section of the ePRF if they decline a recommendation for transport to a medical facility by ambulance. They must not be asked to sign the 'patient declined transport' section of the ePRF if they are deemed not competent to make decisions, or if a recommendation was made that transport to a medical facility by ambulance was not required.
  - An electronic copy (or photograph) of the 12 lead ECG if one was acquired.
  - Completion of the non-transport pause and checklist.

## **Providing advice to a patient not transported to a medical facility**

- When a patient is not transported to a medical facility, advice on when to seek further clinical assessment and/or treatment should be provided.
- Advice should be provided in writing whenever this is feasible, for example using an ambulance care summary advice sheet.
- Where applicable, information sheets (such as the concussion information sheet) must be provided.
- Written advice should be photographed using the ePRF device.
- Advice should be provided to:
  - The patient if they appear to be competent.
  - An appropriate person, for example a guardian or caregiver, if the patient appears to be not competent.
  - A parent or guardian if the patient is a child.

## **Checking the ePRF before it is finalised and submitted**

- The ePRF must be checked to ensure it is complete and accurate prior to it being finalised and submitted, unless the crew are required to immediately respond to an urgent incident.
- All clinical personnel in the crew that assessed the patient are responsible for ensuring the ePRF is checked if the patient is not transported to a medical facility.

- All clinical personnel in the crew that transported the patient are responsible for ensuring the ePRF is checked if the patient is transported.
- The ePRF check must include confirmation that:
  - All appropriate sections have been completed.
  - The information is accurate and free of errors.
  - The information adequately reflects all that occurred, in a manner that ensures a third party could read the ePRF and understand what happened.
  - The discarding of controlled medicines that were drawn up but not administered is documented. The discarding of controlled medicines must be witnessed by a second crew member whenever possible.

### **Providing access to a copy of the ePRF**

- When a patient is not transported to a medical facility and an ePRF has been completed, instructions on how to obtain a copy of the ePRF, for example using an ambulance care summary advice sheet, must be given to:
  - The patient if they appear to be competent.
  - An appropriate person, for example a guardian or caregiver, if the patient is deemed not competent.
  - A parent or guardian if the patient is a child.
- A copy of the ePRF or instructions on how to obtain a copy of the ePRF, should be provided to police personnel if the patient has died and the death is being referred to the Coroner. In all other circumstances police personnel must apply via the ambulance service organisation for a copy.

### **Sending a copy of the ePRF to the patient's General Practitioner**

- A copy of the ePRF should be routinely sent to the patient's GP if the patient is not being transported to a medical facility, unless the patient indicates that this must not occur.
- To send a copy of the ePRF to the patient's GP, personnel should select 'yes' under 'copy to GP' in the disposition section of ePRF.
- A copy of the ePRF should not be sent to the patient's GP if the patient is transported to a medical facility, because the GP will receive an electronic summary from the medical facility.
- When sending a copy of the ePRF to the patient's GP, personnel may write a note to the GP in the box provided. When writing a note to the GP:
  - The language may be less formal than that used in the body of the ePRF but must be professional and abbreviations should be avoided.
  - Additional information should be included that personnel believe the patient's GP should be made aware of.
- Sending a copy of the ePRF to the patient's GP is not considered a transfer of care. If immediate follow up is required, personnel must phone staff at the medical facility because the copy of the ePRF may not be seen by the GP for several days.



## **Taking photographs using the ePRF tablet**

- Photographs add considerably to the electronic storage requirements of the ePRF system and should only be taken if the information is important for the clinical care of the patient or for the ePRF record.
- Clinical judgement is required when deciding to take a photograph, noting the following:
  - Photographs of 12 lead ECGs must be taken.
  - A photograph of asystole during verification of death must be taken.
  - Photographs of 3 lead ECGs should not usually be taken unless there is a need to record a specific rhythm, for example VT.
  - The body of a patient that has died must not be photographed.
  - Photographs of the scene rarely contribute to the assessment or treatment of the patient and should not be taken unless the information is vital.
  - A photograph of First Responder documentation (for example a Fire First Responder Patient Handover Form or Event Form) must be taken.
  - Verbal consent should be obtained before taking a photograph of a patient, whenever this is feasible.
  - Photographs of significant wounds should usually be taken prior to dressing the wound as this enables medical facility personnel to see the nature of the wound during handover, without removing the dressing.
  - Photographs of dislocated joints or significantly displaced fractures should usually be taken prior to relocation/realignment.
  - A photograph of referral letters, for example from primary care personnel, should usually be taken.
  - A photograph of written advice should usually be taken.
  - A photograph of the medication list may be taken, but this does not negate the need to record the patient’s medications in ePRF.

## **Recording audio using the ePRF tablet**

- Audio recordings add considerably to the electronic storage requirements of the ePRF system and should only be recorded if the information is important for the ePRF record.
- If an audio file is being recorded the patient and bystanders should be informed this is occurring.
- Clinical judgement is required when deciding to record an audio file, noting the following:
  - It may be appropriate to record the conversation when a competent patient or guardian is declining a recommendation for transport to a medical facility, but is unable to sign or refusing to sign, the ‘patient declined transport’ section of the ePRF.
  - It may be appropriate to record the conversation if the patient is verbally abusive to personnel, taking into account the possibility this may cause the patient’s behaviour to worsen



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## 2.1 Asthma

### Mild or moderate asthma

- Follow the patient's asthma action plan if they have one.
- Measure and record the patient's peak expiratory flow rate (PEFR) before and after treatment if a PEFR meter is available.
- Administer bronchodilators:
  - a) Use the patient's metered dose inhaler (MDI) if it is available, or
  - b) Administer 5 mg of salbutamol nebulised in combination with 0.5 mg of ipratropium nebulised if the patient's MDI is unavailable.
- Administer an oral steroid:
  - a) 40 mg of prednisone PO for an adult.
  - b) See the paediatric drug dose tables for a child.
  - c) Do not routinely administer an oral steroid to a child aged less than five years. Consider administering an oral steroid if there is a clear history of asthma and the child has previously been prescribed oral steroids.
- Consider the likelihood that transport may not be required if the patient rapidly improves with bronchodilators via an MDI, or following one dose of nebulised bronchodilators.
- Administer further doses of salbutamol as required.

### Severe asthma

- Call for backup from an ICP.
- Measure and record the patient's PEFR before and after treatment if a PEFR meter is available, but this is not a priority if the patient is too short of breath to use one.
- Administer 5 mg of salbutamol nebulised in combination with 0.5 mg of ipratropium nebulised.
- Administer continuous salbutamol nebulised until improvement occurs.
- Administer adrenaline IM if the patient is not improving:
  - a) Administer 0.5 mg IM for an adult.
  - b) See the paediatric drug dose tables for a child.
- Gain IV access.
- Adrenaline IM may be repeated every ten minutes if the patient is deteriorating and adrenaline IV is not being administered.
- Begin transport without delay, providing most treatments en route.
- Administer magnesium IV:
  - a) Administer 10 mmol (2.47 g) IV over approximately 15 minutes for an adult.
  - b) See the paediatric drug dose tables for a child and administer over approximately 15 minutes.

- c) A second dose may be administered if transport time is longer than 30 minutes and the patient is not improving.
- The administration of an oral steroid is not a priority, but should occur if the patient is able to swallow, using the doses described above.

### **Immediately life-threatening asthma**

- Administer adrenaline IV in addition to the treatments for severe asthma.

#### **Adrenaline for an adult:**

- a) Administer an adrenaline infusion via an infusion pump. Start at a rate of 0.5 mg/hour and adjust the rate as required, or
- b) Place 1 mg of adrenaline into a 1 litre bag of 0.9% sodium chloride (1:1,000,000 solution):
  - Administer as an infusion. Start at 2 drops/second and adjust the rate as required, or
  - Administer a bolus of 0.01 mg adrenaline (10 ml) IV every 1-2 minutes as required.

#### **Adrenaline for a child aged 5-14 years:**

- a) Administer an adrenaline infusion via an infusion pump. Start at a rate of 0.25 mg/hour and adjust the rate as required, or
- b) Place 1 mg of adrenaline into a 1 litre bag of 0.9% sodium chloride (1:1,000,000 solution):
  - Administer as an infusion. Start at 1 drop/second and adjust the rate as required, or
  - Administer IV boluses (see the paediatric drug dose tables) every 1-2 minutes as required.

#### **Adrenaline for a child aged less than five years:**

- a) Administer IV boluses (see the paediatric drug dose tables) every 1-2 minutes as required.
- b) Do not administer adrenaline as an IV infusion.
- An ICP may administer ketamine if the patient is severely agitated and this is preventing the ability to safely provide treatment or transport:
  - a) Administer 50 mg of ketamine IV every 5-10 minutes (to a maximum of 200 mg) for an adult.
  - b) See the paediatric drug dose tables for a child.

### **Backup**

- Backup from an ICP must be requested if the patient has severe asthma.
- Backup from a Paramedic or PRIME responder should be requested if an ICP is not immediately available.
- Backup from an ICP or a doctor able to perform RSI must be requested if the patient has immediately life-threatening asthma.

## Referral and transport

- All patients with severe to immediately life-threatening asthma must receive a clear recommendation to be transported to an ED by ambulance.
- Most patients with mild to moderate asthma who are clearly improving will be suitable to receive a clear recommendation for treatment without transport, or to be transported to primary care provided this is feasible.
- EMTs may recommend that a patient aged greater than or equal to 12 years with mild to moderate asthma is not transported to a medical facility by ambulance, provided the patient has clearly improved with bronchodilators via an MDI, no bronchodilators have been administered by nebuliser and all the non-transport criteria (see below) are met.
- Paramedics and ICPs may recommend that a patient aged greater than or equal to 12 years with mild to moderate asthma is not transported to a medical facility by ambulance, provided the patient has clearly improved with bronchodilators via an MDI or a maximum of one administration of nebulised bronchodilators, and all the non-transport criteria (see below) are met.

## Non-transport criteria

- All the following criteria must be met:
  - Known asthma, and
  - Talking in full sentences, and
  - An SpO<sub>2</sub> greater than or equal to 94% when breathing air, and
  - Observed by ambulance personnel for a minimum of 20 minutes following completion of the last bronchodilator administration, and
  - Observed to mobilise normally, and
  - A PEFr greater than 70% of their normal PEFr (do not use this if the patient does not normally use a PEFr meter), and
  - Able to see a doctor (preferably their own GP) within two days, and
  - Provided with a prednisone pack (if appropriate), an information sheet and the information within it is explained to them and to any carers.
- If the patient has signs of a chest infection (for example fever or purulent sputum), the patient should be seen by a doctor within 12 hours. This should usually be in primary care (preferably by their own GP) if all of the other non-transport criteria are met.

## Additional information

### General principles

- Asthma is characterised by reversible bronchospasm. It is caused by an inflammatory state within the lungs resulting in recurrent attacks of breathlessness and wheezing. It is often associated with mucus plugging of airways.
- The dose of nebulised salbutamol and nebulised ipratropium is the same for adults and children.

### Determining the severity of asthma

- Patients with mild to moderate asthma are short of breath but are able to speak in sentences, are usually moving enough air to generate a loud wheeze, do not have significant chest or neck indrawing, have a normal SpO<sub>2</sub> and a normal level of consciousness.
- Patients with severe asthma are very short of breath, are only able to speak a few words with each breath, may only be moving enough air to generate a quiet wheeze, usually have significant chest or neck indrawing, may be in the tripod position, usually have an SpO<sub>2</sub> of greater than 90% (SpO<sub>2</sub> falls very late in the progression of asthma) and may be agitated.
- Patients with immediately life-threatening asthma are extremely short of breath, are usually unable to speak, are moving very little air and may not be moving enough air to create wheeze, usually have marked indrawing but this may not be present if they are exhausted, may have a rapidly falling SpO<sub>2</sub> and usually have severe agitation or a falling level of consciousness.

### Summary table (not all clinical features need to be present)

Mild to moderate asthma	Severe asthma	Immediately life-threatening asthma
<ul style="list-style-type: none"><li>• Short of breath</li><li>• Able to speak in sentences</li><li>• Usually have a loud wheeze</li><li>• No significant chest/neck indrawing</li><li>• Normal SpO<sub>2</sub></li><li>• Normal LOC</li></ul>	<ul style="list-style-type: none"><li>• Very short of breath</li><li>• Able to only speak a few words per breath</li><li>• May only have a quiet wheeze</li><li>• Significant chest/neck indrawing</li><li>• Tripod positioning</li><li>• SpO<sub>2</sub> usually &gt; 90%</li><li>• May be agitated</li></ul>	<ul style="list-style-type: none"><li>• Extremely short of breath</li><li>• Unable to speak</li><li>• May not have wheeze</li><li>• Marked indrawing, unless exhausted</li><li>• Rapidly falling SpO<sub>2</sub></li><li>• Severe agitation</li><li>• Falling LOC</li></ul>

## Measuring peak expiratory flow rate

- The peak expiratory flow rate (PEFR) is the maximum flow rate achieved by the patient during forced/rapid expiration and is measured in litres/minute.
- The PEFR is an objective measure of the severity of obstruction to air flow through bronchi, for example from bronchospasm.
- Measuring the PEFR requires a PEFR meter, the patient to be able to follow instructions and attention to good technique.
- Measuring the PEFR is not a priority if the patient is too short of breath to use a PEFR meter, cannot follow instructions or does not usually use a PEFR meter.
- Ambulance personnel do not normally have a PEFR meter and the patient's PEFR meter should be used if they have one.
- To measure and record a PEFR:
  - In a sitting position have the patient hold the PEFR meter, ensuring the flow indicator has been set to zero.
  - Ask the patient to take a deep breath and seal their lips around the intake.
  - Ask the patient to blow as hard and fast as they can.
  - Note the PEFR.
  - Reset the flow indicator to zero and repeat (preferably three times in total).
  - Record the best PEFR achieved.
- The normal or predicted PEFR is dependent on the patient's age, sex and height, but what is most important is how the PEFR compares with their usual PEFR when well.
- A PEFR below 70% of the patient's usual PEFR is considered significant.

## Spacers

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

## Children

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



- Gaining IV access in young children is a balance of risk. It may cause distress and worsen their work of breathing, but will be required if their exacerbation is severe or immediately life-threatening.
- Steroid administration does not usually have a role in children aged less than five years because it does not generally alter the course of their asthma exacerbation. However, an oral steroid is indicated if the child has a clear history of asthma and has previously received oral steroids.

### **Oral steroid administration**

- Ambulance personnel normally have prednisone tablets and prednisolone syrup available.
- Patients aged ten years and over should usually be administered prednisone tablets, but may be administered the same dose of prednisolone syrup.
- Patients aged under ten years should usually be administered prednisolone syrup, but may be administered the same dose of prednisone tablets, noting that crushing prednisone tablets should be avoided because they are bitter.
- Prednisone is a prodrug that is metabolised to prednisolone in the liver. A dose of prednisone provides slightly less steroid equivalence than the same dose of prednisolone, but this is not clinically significant.

### **Adrenaline administration**

- Adrenaline IM is reserved for severe asthma that is not improving with nebulised bronchodilators.
- A dose of 0.5 mg adrenaline IM is appropriate for the majority of adults. Paramedics and ICPs may make a decision to reduce the dose, particularly if the patient is small, frail, or has ischaemic heart disease.
- Adrenaline IV is reserved for immediately life-threatening asthma.
- When administering adrenaline IV to patients aged five years and over, an infusion is preferred over IV boluses because this reduces the adverse effects of surges of adrenaline.

### **Magnesium administration**

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

## **Ketamine administration**

- Clinical judgement is required and ketamine administration should only occur if the patient's agitation is severe enough to impair the ability to safely provide treatment and/or transport. Although ketamine may have some bronchodilator activity, in this setting the focus is on treating severe agitation. Personnel should seek clinical advice if uncertain.
- Patients with severe agitation are likely to require RSI and suitable backup must be requested early.
- If an ICP or doctor able to perform RSI is not available, ICPs should have a low threshold for calling for assistance from a second ICP.

## **Differentiating asthma from cardiogenic pulmonary oedema**

- Pulmonary oedema may produce a wheeze that sounds like asthma.
- If the patient does not have a history of asthma, the possibility of cardiogenic pulmonary oedema should be considered. Cardiogenic pulmonary oedema is the likely diagnosis when the patient has been supine (for example in bed), and the wheeze is worse bilaterally in the lower zones. The patient is often hypertensive, clammy and peripherally vasoconstricted.
- The patient may have a history of both asthma and pulmonary oedema. In this setting the patient may be able to tell you which condition is causing their shortness of breath.
- Asthma is the likely diagnosis if the onset is associated with a cough and the wheeze is heard evenly through all lung fields. The patient is usually normotensive and not peripherally vasoconstricted.

## **Differentiating asthma from COPD**

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

## **Differentiating asthma from a chest infection**

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

## **Dynamic hyperinflation**

- Dynamic hyperinflation (gas trapping) occurs when the amount of gas within the lungs increases in the presence of severe bronchoconstriction.
- This occurs because the resistance to gas leaving the lungs during expiration is higher than the resistance to gas entering the lungs during inspiration.

- Dynamic hyperinflation rarely causes pneumothorax, but it commonly causes reduced venous return to the heart by increasing intrathoracic pressure.
- Dynamic hyperinflation occurs in spontaneously breathing patients when their asthma is severe, but those most at risk of life-threatening dynamic hyperinflation are those receiving ventilation via an LMA or ETT. For this reason the ventilation rate must be kept at six breaths/minute in patients receiving ventilation, including those that are receiving assisted ventilation via a mask.
- External chest compression (or bilateral external chest pressure) during expiration may reduce dynamic hyperinflation. However, it is not clear that it is always beneficial and it must only be applied during expiration in patients who are being ventilated.

## **Tension pneumothorax**

- Tension pneumothorax due to asthma is very rare unless the patient is receiving positive pressure ventilation via an LMA or ETT. Even in the setting of positive pressure ventilation, if the patient is deteriorating with signs of shock the cause is usually dynamic hyperinflation rather than tension pneumothorax.
- Needle chest decompression in the setting of life-threatening asthma carries a significant risk of causing pneumothorax. Chest decompression should only be undertaken if there are very convincing clinical signs of a tension pneumothorax and the preferred technique is finger thoracostomy, provided the patient is ventilated (see 'tension pneumothorax' section).
- Diagnosing tension pneumothorax can be very difficult in the presence of life-threatening asthma:
  - Breath sounds are already reduced because the patient is moving very little air.
  - The jugular veins are already distended because of raised intrathoracic pressure.
  - Cardiac output is already reduced because of dynamic hyperinflation.
  - The percussion note is already hyperresonant because of dynamic hyperinflation.
- In the setting of life-threatening asthma the convincing signs of tension pneumothorax are most likely to be:
  - A very clear difference in breath sounds and percussion note between the two sides, and
  - Signs of a progressively falling cardiac output in the absence of signs of dynamic hyperinflation.

## **Other causes of bronchospasm**

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

## 2.2 Chronic obstructive pulmonary disease (COPD)

### General principles of oxygen and nebulised bronchodilator administration

- Only administer oxygen if the patient has an SpO<sub>2</sub> less than 88%. Titrate the oxygen flow to maintain an SpO<sub>2</sub> of 88-92%.
- Do not use oxygen to nebulise bronchodilators if air or an alternative nebuliser device is available. If supplemental oxygen is required when using air as the nebulising gas, place nasal prongs under the nebuliser mask and titrate the oxygen flow to maintain an SpO<sub>2</sub> of 88-92%.
- If oxygen is required to nebulise bronchodilators and the SpO<sub>2</sub> climbs above 92% during nebuliser delivery, alternate five minutes with the nebuliser mask on and five minutes with the nebuliser mask off.

### Mild to moderate COPD

- Follow the patient's COPD action plan if they have one.
- Measure and record the patient's peak expiratory flow rate (PEFR) before and after treatment if a PEFR meter is available.
- Administer bronchodilators:
  - a) Use the patient's metered dose inhaler (MDI) if it is available, or
  - b) Administer 5 mg of salbutamol nebulised in combination with 0.5 mg of ipratropium nebulised if the patient's MDI is unavailable.
- Administer 40 mg of prednisone PO.
- Consider the possibility that transport may not be required if the patient rapidly improves with only one dose of nebulised bronchodilators.
- Administer further doses of salbutamol as required.

### Severe COPD

- Measure and record the patient's PEFR before and after treatment if a PEFR meter is available, but this is not a priority.
- Administer 5 mg of salbutamol nebulised in combination with 0.5 mg of ipratropium nebulised.
- Administer continuous salbutamol until improvement occurs.
- Gain IV access.
- Begin transport without delay, providing most treatments en route.
- An ICP may administer midazolam in 0.5 mg doses IV, sparingly for severe anxiety provided the patient is able to obey commands at all times.
- Prednisone administration is not a priority. Administer 40 mg of prednisone PO if the patient improves sufficiently to be able to swallow tablets.

## **Imminent respiratory arrest**

- Administer adrenaline IV in addition to bronchodilators as described for severe COPD:
  - a) Administer an adrenaline infusion via an infusion pump. Start at a rate of 0.5 mg/hour and adjust the rate to the patient's condition, or
  - b) Place 1 mg of adrenaline into a 1 litre bag of 0.9% sodium chloride (1:1,000,000):
    - Administer as an infusion. Start at 2 drops/second and adjust the rate to the patient's condition, or
    - Administer a bolus of 0.01 mg adrenaline (10 ml) IV every 1-2 minutes as required.
- Do not administer midazolam.

## **Backup**

- Backup from an ICP should be requested if the patient has severe anxiety or imminent respiratory arrest.

## **Referral and transport**

- All patients with severe (or worse) COPD must receive a clear recommendation to be transported to an ED by ambulance.
- Most patients with mild to moderate COPD who are clearly improving will be suitable to receive a clear recommendation for treatment without transport, or to be transported to primary care provided this is feasible.
- Formalised alternative care pathways have been introduced in some areas and these should be followed whenever it is feasible and safe to do so.
- EMTs may recommend that a patient with mild to moderate COPD is not transported to a medical facility by ambulance, provided the patient has clearly improved with bronchodilators via an MDI, no bronchodilators have been administered by nebuliser and all the non-transport criteria (see below) are met.
- Paramedics and ICPs may recommend that a patient with mild to moderate COPD is not transported to a medical facility by ambulance, provided the patient has clearly improved with bronchodilators via an MDI or a maximum of one administration of nebulised bronchodilators, and all the non-transport criteria (see below) are met.

## **Non-transport criteria**

- All the following criteria must be met:
  - Known COPD, and
  - Improves to their usual respiratory state, and
  - An SpO<sub>2</sub> greater than or equal to 88% when breathing air, and

- Observed by ambulance personnel for a minimum of 20 minutes following completion of the last bronchodilator administration, and
  - Observed to mobilise in a way that is normal for the patient, and
  - Able to see a doctor (preferably by their own GP) within two days, and
  - Provided with a prednisone pack (if appropriate), an information sheet and the information within it is explained to them and to any carers.
- If the patient has signs of a chest infection (for example fever or purulent sputum), the patient should be seen by a doctor within 12 hours. This should usually be in primary care (preferably by their own GP) if all of the other non-transport criteria are met.

## Additional information

### General principles

- COPD is a term used to encompass chronic inflammatory and destructive diseases within the lung, including chronic bronchitis and emphysema. The bronchoconstriction present in COPD is not completely reversible.
- COPD should be suspected in patients with chronic respiratory illness, particularly if they have risk factors such as: age over 50 years, long-term exposure to cigarette smoke (including second hand exposure), or long-term exposure to environmental or industrial pollutants.

### Determining the severity of COPD

- Patients with mild to moderate COPD are short of breath, able to speak in sentences, moving enough air to generate wheeze, usually have some chest and/or neck indrawing, have an SpO<sub>2</sub> that is near their normal level and a normal level of consciousness.
- Patients with severe COPD are very short of breath, usually only able to speak a few words with each breath, may not be moving enough air to generate wheeze, usually have severe chest and/or neck indrawing, may be in the tripod position, may have an SpO<sub>2</sub> that is significantly below their normal level and may have agitation.
- Patients with imminent respiratory arrest are extremely short of breath, usually unable to speak, may not be moving enough air to generate wheeze or to have chest and/or neck indrawing, usually have a rapidly falling SpO<sub>2</sub> and usually have severe agitation and/or a falling level of consciousness.
- Many patients with COPD are short of breath and have signs of indrawing, even when well and it is easy to overestimate the severity of their COPD. If possible ask how their shortness of breath compares with their usual state.

## Summary table (not all clinical features need to be present)

Mild to moderate COPD	Severe COPD	Imminent respiratory arrest
<ul style="list-style-type: none"> <li>• Short of breath</li> <li>• Able to speak in sentences</li> <li>• Usually have wheeze</li> <li>• Usually have some chest/neck indrawing</li> <li>• SpO<sub>2</sub> near their normal level</li> <li>• Normal LOC</li> </ul>	<ul style="list-style-type: none"> <li>• Very short of breath</li> <li>• Only able to speak a few words per breath</li> <li>• May not have a wheeze</li> <li>• Usually have severe neck/chest indrawing</li> <li>• Tripod positioning</li> <li>• SpO<sub>2</sub> significantly below their normal level</li> <li>• May have agitation</li> </ul>	<ul style="list-style-type: none"> <li>• Extremely short of breath</li> <li>• Unable to speak</li> <li>• May not have a wheeze</li> <li>• May not have chest/neck indrawing</li> <li>• SpO<sub>2</sub> rapidly falling</li> <li>• Severe agitation and/or falling LOC</li> </ul>

### Measuring peak expiratory flow rate

- The peak expiratory flow rate (PEFR) is the maximum flow rate achieved by the patient during forced/rapid expiration and is measured in litres/minute.
- The PEFR is an objective measure of the severity of obstruction to air flow through bronchi, for example from bronchospasm.
- Measuring the PEFR requires a PEFR meter, the patient to be able to follow instructions and attention to good technique.
- Measuring the PEFR is not a priority if the patient is too short of breath to use a PEFR meter, cannot follow instructions or does not usually use a PEFR meter.
- Ambulance personnel do not normally have a PEFR meter and the patient's PEFR meter should be used if they have one.
- To measure and record a PEFR:
  - In a sitting position have the patient hold the PEFR meter, ensuring the flow indicator has been set to zero.
  - Ask the patient to take a deep breath and seal their lips around the intake.
  - Ask the patient to blow as hard and fast as they can.
  - Note the PEFR.
  - Reset the flow indicator to zero and repeat (preferably three times in total).
  - Record the best PEFR achieved.
- The normal or predicted PEFR is dependent on the patient's age, sex and height, but what is most important is how the PEFR compares with their usual PEFR when well.
- A PEFR below 70% of the patient's usual PEFR is considered significant.

## Spacers

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

## Oxygen administration and hypercarbia

- Some patients have carbon dioxide clearance that is altered by oxygen administration. Excess oxygen administration in these patients may cause hypercarbia and bronchodilators should be nebulised using air as the driving gas, provided equipment is available to do this. If oxygen is administered, titrate the oxygen flow to an SpO<sub>2</sub> of 88-92%.
- The mechanisms by which excess oxygen administration causes hypercarbia are controversial and complex. They include:
  - Reversal of hypoxic pulmonary vasoconstriction, causing high levels of CO<sub>2</sub> in poorly ventilated alveoli to diffuse back into the circulation.
  - Decrease in ventilatory drive.
  - Decreased CO<sub>2</sub> buffering capacity of haemoglobin.
  - Absorption of CO<sub>2</sub> from alveoli beyond obstructed airways.
  - The density of oxygen relative to air, increasing the work of breathing.
- Patients at risk of hypercarbia often have a card or letter describing specific instructions for oxygen therapy and these instructions should be followed.
- If using oxygen to nebulise bronchodilators, alternating five minutes with the mask on and five minutes with the mask off should only occur if the SpO<sub>2</sub> climbs above 92%. This is done to limit oxygen exposure whilst delivering most of the nebulised bronchodilator. If the SpO<sub>2</sub> remains at or below 92% during nebulisation, alternating does not need to occur.
- The signs of a rising carbon dioxide level are usually confusion, drowsiness, agitation and a falling level of consciousness. If the patient is suspected of developing hypercarbia, oxygen administration should not be discontinued immediately. Instead, oxygen administration should be reduced to a lower flow rate (targeting an SpO<sub>2</sub> of 88-92%) and the patient reassessed.
- Consider assisting the patient's ventilation (without added oxygen unless hypoxia is severe), using a manual ventilation bag if:
  - SpO<sub>2</sub> continues to fall below 80% despite treatments, or
  - The patient is becoming exhausted, or
  - The patient is suspected of developing hypercarbic respiratory failure despite lowering the oxygen flow.



## **Differentiating COPD from asthma**

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

## **Differentiating COPD from cardiogenic pulmonary oedema**

- Cardiogenic pulmonary oedema may produce a wheeze that sounds like COPD. Differentiating COPD from cardiogenic pulmonary oedema is not always easy:
  - Cardiogenic pulmonary oedema is the likely diagnosis when the patient has been supine (for example in bed) and the wheeze is worse bilaterally in the lower zones. The patient is often hypertensive, clammy and peripherally vasoconstricted.
  - COPD is the likely diagnosis if it is associated with a productive cough and the wheeze is evenly heard through all lung fields. The patient is usually normotensive and not peripherally vasoconstricted.
- Some patients may have a history of both COPD and cardiogenic pulmonary oedema. In this setting they may be able to tell you which condition is causing their shortness of breath.

## **Oral steroid administration**

- Ambulance personnel normally have prednisone tablets and prednisolone syrup available.
- Patients with COPD should usually be administered prednisone tablets, but may be administered the same dose of prednisolone syrup.
- Prednisone is a prodrug that is metabolised to prednisolone in the liver. A dose of prednisone provides slightly less steroid equivalence than the same dose of prednisolone, but this is not clinically significant.

## **Adrenaline administration**

- Adrenaline administration is reserved for imminent respiratory arrest.
- The decision to administer adrenaline must weigh up the potential benefits against the potential risks. Adrenaline may result in bronchodilation, but it may also cause tachydysrhythmias and myocardial ischaemia. Patients with COPD are at very high risk of the adverse effects of adrenaline and this is why it is reserved for imminent respiratory arrest.
- Adrenaline administration (particularly IV bolus administration) can make the patient tachypnoeic and look or feel awful. It is important to differentiate

this from a worsening of their COPD and not to automatically respond by administering more adrenaline.

- When administering adrenaline IV, an IV infusion is preferred over IV boluses because this reduces the adverse effects of surges of adrenaline.

### **Midazolam administration**

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

### **Magnesium administration**

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



## 2.3 Foreign body airway obstruction

### If the patient is conscious and ventilation is adequate

- Do not provide any specific intervention.
- Be prepared to intervene if deterioration occurs.

### If the patient is conscious and ventilation is inadequate

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

### If the patient is unconscious and ventilation is adequate

- Place the patient on their side.
- Be prepared to intervene if deterioration occurs.

### If the patient is unconscious and ventilation is inadequate

- Try to remove the foreign body under direct vision with a finger sweep and move sequentially through the steps below if the obstruction is not cleared.
- Try to remove the foreign body using a laryngoscope and Magill forceps.
- Perform five chest compressions and recheck the airway using a laryngoscope and Magill forceps.
- Commence CPR and try to ventilate using a manual ventilation bag and mask.
- Intubate with an endotracheal tube, inserting the tube as far as possible and then withdrawing the tube to the usual position.
- Perform a cricothyroidotomy, if indicated.

### Backup

- Backup from an ICP must be requested for patients with signs of persisting foreign body airway obstruction following initial intervention.

## Additional information

### General

- Foreign body airway obstruction occurs most commonly in young children, the elderly, the intoxicated and the intellectually impaired.
- A patient that has adequate ventilation and/or is coughing does not require immediate intervention.
- Check the patient for signs of relief of the obstruction between each intervention.

- When performing back blows position the patient with their head below their shoulders, provided this is feasible.
- Abdominal thrusts (also known as the Heimlich manoeuvre) are no longer recommended because they are associated with a risk of intra-abdominal injury and do not appear to be associated with a higher chance of success than chest thrusts.
- During intubation, the reason the endotracheal tube is inserted as far as possible and then withdrawn is to try to push the foreign body down one bronchus, allowing ventilation to occur through the other bronchus.

## **Oesophageal obstruction**

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

## **Foreign body ingestion**

- This is most common in young children.
- A clear recommendation must be made to be assessed in an ED if the patient is symptomatic, for example: drooling, gagging, difficulty swallowing, abdominal pain, or a sensation of the foreign body.
- A clear recommendation must be made to be assessed in an ED if the swallowed object is potentially dangerous, such as a battery, a magnet (especially if there is more than one) or a sharp object such as a pin:
  - This is the case even if the patient is asymptomatic.
  - Transport to a hospital with surgical facilities is preferred. However, transport to a hospital without surgical facilities may occur, because surgical referral and intervention is not usually time critical.
  - Batteries and in particular button (or disc) batteries can cause severe injury to the oesophagus or bowel and may need to be surgically removed. If a battery of the same size is available it should also be taken to the ED.
  - Patients that have swallowed button batteries are time sensitive and should be assessed in an ED without significant delay, noting that transport by ambulance may not be required.
  - Button batteries can be mistaken for coins. If the patient is thought to have swallowed a coin, but it is possible it is a button battery, the patient should be treated as if a battery has been swallowed.

- A clear recommendation may be made to remain in the community if the patient is asymptomatic and there is clear evidence that the swallowed object is not dangerous, for example a button or marble. In this setting the patient or parent/caregiver should be advised that the object will most likely pass through the bowel and that medical advice should be sought if symptoms develop.



## 2.4 Positive end expiratory pressure (PEEP)

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

### **For an adult:**

- a) Do not attach PEEP during cardiac arrest.
- b) Apply PEEP set to 5 cmH<sub>2</sub>O if the patient has TBI.
- c) Apply PEEP set to 10 cmH<sub>2</sub>O for all other conditions.

### **For a child:**

- a) Do not attach PEEP during cardiac arrest.
- b) Apply PEEP set to 5 cmH<sub>2</sub>O for all other conditions.

### **For a neonate:**

- a) Apply PEEP set to 5 cmH<sub>2</sub>O, including during cardiac arrest.

### **For an adult with cardiogenic pulmonary oedema if CPAP is indicated but unavailable:**

- a) Apply PEEP set to 10 cmH<sub>2</sub>O. Focus on ensuring a tight seal with the mask and do not assist the patient's breathing unless it is ineffective.
  - b) Increase the PEEP to 15 cmH<sub>2</sub>O if the patient is not improving.
- Use PEEP with caution if:
    - Ventilation is occurring via an ETT or LMA and the patient has signs of shock.
    - PEEP is being applied using a manual ventilation bag and mask, and the patient has an altered level of consciousness or vomiting.

## Additional information

### **General principles**

- PEEP is not applied to adults and children during CPR because an increase in intrathoracic pressure reduces the blood flow achieved during CPR. If ROSC is achieved it is appropriate to apply PEEP, but this is not an immediate priority.
- PEEP is applied to neonates during CPR because the cause of the cardiac arrest is usually respiratory failure and the balance of risk is in favour of improving ventilation, even though this may reduce the blood flow achieved during CPR.
- PEEP reduces cardiac output and should be used with caution in patients showing signs of shock. The reduction in cardiac output may be significant if PEEP is combined with positive pressure ventilation in patients with:
  - A clinical condition reducing right ventricular filling, such as hypovolaemia.
  - A clinical condition increasing right ventricular afterload, such as pulmonary embolism.

- Patients with a clinical condition reducing right ventricular filling or increasing right ventricular afterload require correction of the underlying problem (if possible) and expansion of their intravascular volume with 0.9% sodium chloride prior to the application of PEEP, whenever feasible.
- PEEP increases intracranial pressure in patients with TBI by reducing venous return from the brain. In this setting there is a balance between the benefit of PEEP improving oxygenation and the risk of PEEP increasing intracranial pressure. This is why PEEP is set to 5 cmH<sub>2</sub>O for these patients.

### **The physiological effects of PEEP**

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

### **PEEP being provided during transport**

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

## 2.5 Stridor

This section is for any form of upper airway obstruction secondary to infection or swelling other than croup. If stridor from croup is present, see the 'croup' section.

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

### Backup

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

### Referral and transport

- All patients with stridor must be given a clear recommendation to be transported to an ED by ambulance.

## Additional information

### General principles

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



## The differential diagnosis

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

## 2.6 Croup

This section is for children with a provisional diagnosis of croup. See the 'stridor' section if the cause is unclear.

- Administer 5 mg of adrenaline nebulised if stridor is causing moderate or severe respiratory distress.
- Repeat adrenaline as required every ten minutes.
- Administer prednisolone syrup PO, but this is not a priority if adrenaline is being administered. See the paediatric drug dose tables for dosages.

### Backup

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

### Referral and transport

- Children with mild respiratory distress from croup should usually be treated in the community provided:
  - Nebulised adrenaline has not been administered, and
  - Oral prednisolone has been administered, and
  - The patient's SpO<sub>2</sub> is greater than or equal to 94% on air, and
  - The parents or guardians are advised the patient needs to see a doctor within 24 hours because a further course of oral steroids is required.
- The parent/caregivers must be given a clear recommendation that the child is transported to a medical facility by ambulance if adrenaline is administered. Transport should usually be to an ED, but may be to a primary care provider if the child is rapidly improving and only one dose of adrenaline is administered.

## Additional information

### General principles

- Croup is a viral infection of the upper airway. It is the most common cause of stridor in children, especially children aged six months to two years.
- The child usually has an onset of illness over the preceding days, a barking cough that is worse at night and a low grade fever.
- It is important to keep the child as calm as possible, because stridor will usually get worse if they become upset or cry. Although a young child is more likely to remain calm if they are kept in the arms of a parent, they must be transported in an approved restraint and not in the arms of a parent.
- Do not treat stridor with nebulised water or nebulised saline.

## 3.1 Assessment for myocardial ischaemia

### Introduction

- Chest pain/discomfort or shortness of breath without an obvious non-cardiac cause in patients over 35 years of age must be considered to be possible myocardial ischaemia until proven otherwise. The distribution of the autonomic nerve supply to the intrathoracic and upper abdominal organs is such that the pain/discomfort from myocardial ischaemia may mimic the pain from many other causes in terms of location, sensation and radiation.
- Even if myocardial ischaemia is considered unlikely, a patient with chest pain/discomfort will usually require assessment in an ED because of the possibility of a potentially life-threatening cause, for example, pulmonary embolism, myocarditis, oesophageal tear/rupture, aortic dissection and pneumothorax.
- Personnel must have a very low threshold for clearly recommending that a patient with chest pain/discomfort or shortness of breath without an obvious cause is transported to an ED by ambulance.

### History

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

### Symptoms

- Patients with myocardial ischaemia will usually describe central chest pain or discomfort which is dull, heavy or compressing in nature and radiates to their neck, jaw or arms. However, myocardial ischaemia may present with atypical symptoms including:
  - Sharp or non-specific pain.
  - Epigastric (upper abdominal) pain.
  - Burning or indigestion-like pain.
  - Pain in the tongue or mouth.
  - Breathlessness without pain.
  - A feeling of impending doom.
- Some patients have silent myocardial ischaemia without typical pain or discomfort.
- Patients with autonomic neuropathy are at particular risk of this because the pain of myocardial ischaemia is carried by autonomic nerves. Patients who are elderly or have diabetes are at increased risk of having autonomic neuropathy. They may present with shortness of breath, fatigue, weakness, non-specific malaise or feeling light-headed. However, it is unusual for a patient to develop silent ST elevation myocardial infarction (STEMI) and if this is suspected personnel should seek clinical advice prior to treating the patient as having STEMI.

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

## Investigations and examination

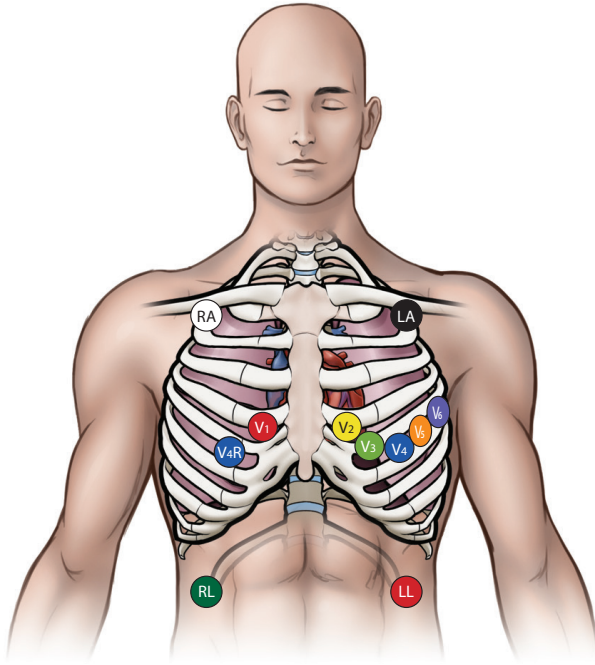
- A 12 lead ECG should be obtained in all patients with either typical or atypical symptoms, noting that a normal 12 lead ECG does not rule out myocardial ischaemia. Up to 50% of patients having an acute myocardial infarction have a 12 lead ECG that is initially normal. In the absence of a clear diagnosis, a 12 lead ECG should be repeated every 10-15 minutes looking for evolving ECG changes.
- Although a patient with myocardial ischaemia may be pale and sweaty, physical examination usually reveals no significant abnormality.

## 12 lead ECG lead placement

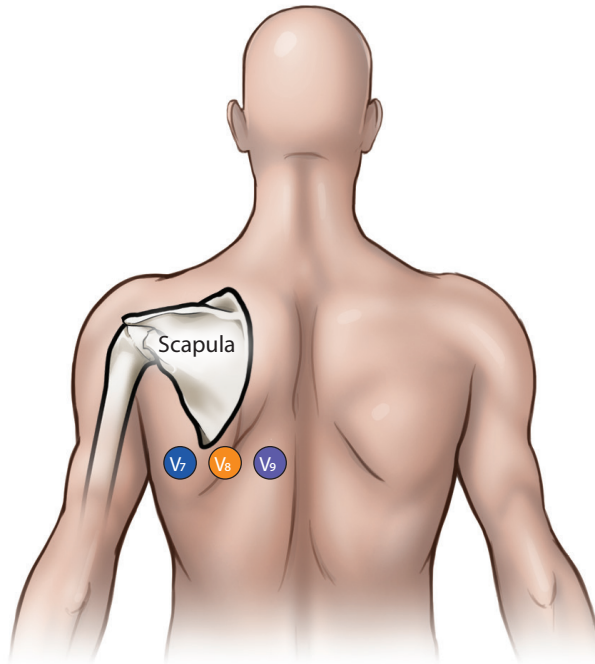
- Limb leads:
  - a) Place the RA (right arm), LA (left arm), RL (right leg) and LL (left leg) electrodes on the torso if feasible. If placement on the torso is not feasible, place the electrodes on the limbs.
  - b) Ensure the leads are an equal distance from the centre of the chest.
- Precordial leads:
  - a) V1: 4<sup>th</sup> intercostal space on the right side of the sternum.
  - b) V2: 4<sup>th</sup> intercostal space on the left side of the sternum.
  - c) V4: 5<sup>th</sup> intercostal space in the midclavicular line.
  - d) V3: midway between V2 and V4.
  - e) V6: 5<sup>th</sup> intercostal space in the midaxillary line.
  - f) V5: 5<sup>th</sup> intercostal space midway between V4 and V6.

## Additional leads

- V4R:
  - a) Shift the V4 lead to the 5<sup>th</sup> intercostal space in the midclavicular line on the right side of the chest.
  - b) Leave all of the other leads in the usual position.
  - c) Clearly label the V4 lead on the 12 lead ECG as V4R.
- Posterior leads:
  - a) V8: shift V5 to just below the tip of the left scapula.
  - b) V7: shift V4 to the left posterior axillary line in the same intercostal space as V8.
  - c) V9: shift V6 to midway between V8 and the spine.
  - d) Clearly label the 12 lead ECG as a posterior ECG and label V4 as V7, V5 as V8 and V6 as V9.



**Anterior lead placement (including V4R)**



**Posterior lead placement**

## 12 lead ECG acquisition in women

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

## Troubleshooting

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

## STEMI diagnosis and 12 lead ECG interpretation

- All monitors provide an automated analysis of the 12 lead ECG and although this is useful, the software will often indicate STEMI is present when it is not. Personnel must always independently analyse the ECG and take into account the clinical scenario before making a provisional diagnosis.
- Personnel not confident in 12 lead ECG interpretation must seek clinical advice or call for backup if the patient has symptoms of myocardial ischaemia and the automated analysis of the ECG is indicating STEMI.
- The 12 lead ECG criteria used to diagnose STEMI vary internationally and the following 12 lead ECG criteria have been selected for out-of-hospital diagnosis of STEMI in New Zealand by the National Cardiac Network:
  - a) More than or equal to 2 mm of ST elevation in two or more leads V1-3, or
  - b) More than or equal to 1 mm of ST elevation in two or more contiguous leads in any other area (V4-6, I, II, III, aVL or aVF), or
  - c) More than or equal to 1 mm of ST elevation in two or more contiguous posterior leads (V7-9), or
  - d) Left bundle branch block that is known to be new.
- While clinically significant ST segment elevation is required for STEMI, other concurrent ECG changes can support the diagnosis, including T wave changes, evolving ST elevation, pathological Q waves and reciprocal changes.

- T wave changes:
  - a) Early in STEMI the T waves may be tall and peaked. These are often referred to as hyperacute T waves.
  - b) As STEMI progresses (over hours to a few days) the T waves may reduce and then invert.
  - c) Myocardial ischaemia without STEMI is often associated with flattened or inverted T waves.
- Evolving ST elevation: if STEMI is present, the ST elevation will usually be evolving and this is often most evident when two or more ECGs are acquired approximately 15 minutes apart.
- ST depression in the absence of left ventricular hypertrophy or bundle branch block is usually due to myocardial ischaemia.
- Pathological Q waves:
  - a) A Q wave that is one third (or more) of the height of the R wave and/or greater than 0.03 seconds wide is considered pathological.
  - b) STEMI with a pathological Q wave is associated with increased tissue damage and higher mortality.
- Reciprocal changes:
  - a) Two electrodes viewing the same area of the heart from opposite angles produce a mirror image on the ECG. Thus, ST elevation associated with STEMI should be mirrored by ST depression in reciprocal leads.
  - b) For example, inferior and lateral (including high lateral) leads are reciprocal, as are septal and posterior leads.
  - c) Reciprocal changes are not always required to diagnose STEMI, but if absent reduce the likelihood of STEMI.
- Isolated ST elevation in aVR may be associated with proximal occlusion of the left coronary artery but is not diagnostic of STEMI. If isolated ST elevation is present in aVR and the patient has significant symptoms of myocardial ischaemia that are not rapidly resolving with GTN, consider transporting the patient to a hospital with cardiac catheter facilities and seek clinical advice if doing so will involve bypassing other hospitals.

### **STEMI mimics**

- Not all patients with chest pain and ST elevation on their 12 lead ECG will be having STEMI. Many will have a STEMI mimic.
- There are a number of clinical conditions other than STEMI, which can cause ST elevation on a 12 lead ECG. Examples include left ventricular hypertrophy, pericarditis, myocarditis, left ventricular aneurysm, ventricular pacing, subarachnoid hemorrhage and myocardial contusion.
- There are a number of ECG abnormalities other than STEMI, which can cause ST elevation on a 12 lead ECG and most produce septal or anterior ST elevation. Examples include LBBB, RBBB and benign early repolarisation.

- LBBB is a very common mimic of septal and anterior STEMI.
  - a) STEMI should only be considered likely if the LBBB is known to be new and the clinical presentation is consistent with STEMI.
  - b) In most cases, there will not be a previous ECG to compare with and thus it will not be possible to confirm that the LBBB is new. In this setting the patient should not be treated as having STEMI unless there is clearly evolving ST elevation and the clinical presentation is consistent with STEMI.
  - c) Recognition of STEMI with LBBB is possible using the Sgarbossa and modified Sgarbossa criteria. However, these criteria are complex, are not routinely taught and personnel are not expected to use them.
- Taking into account the information from automated analysis, consider a STEMI mimic to be likely if:
  - a) The clinical presentation is inconsistent with STEMI, or
  - b) There is an absence of reciprocal ST depression, or
  - c) There is an absence of dynamic ST segment or T wave changes.

Causes of ST elevation	Causes of ST depression
<ul style="list-style-type: none"> <li>• Acute pericarditis</li> <li>• Benign early repolarisation</li> <li>• Left ventricular aneurysm</li> <li>• Bundle branch block (left and right)</li> <li>• Left ventricular hypertrophy</li> <li>• Ventricular paced rhythm</li> <li>• Cardiomyopathy</li> <li>• Acute myocarditis</li> <li>• Hypothermia</li> <li>• Hyperkalaemia</li> <li>• Post-electrical cardioversion</li> <li>• Non-ACS myocardial injury</li> <li>• CNS injury</li> <li>• Brugada syndrome</li> <li>• Pre-excitation syndrome</li> </ul>	<ul style="list-style-type: none"> <li>• Bundle branch block</li> <li>• Left ventricular hypertrophy</li> <li>• Ventricular paced rhythm</li> <li>• Digoxin toxicity</li> <li>• Tachycardia/rate-related</li> <li>• Post-electrical cardioversion</li> <li>• Non-ACS myocardial injury</li> </ul>



## 12 lead ECG territories

<b>Lead I</b> <b>High lateral</b>	<b>aVR</b>	<b>Lead V1</b> <b>Septal</b>	<b>Lead V4</b> <b>Anterior</b>
<b>Lead II</b> <b>Inferior</b>	<b>Lead aVL</b> <b>High lateral</b>	<b>Lead V2</b> <b>Septal</b>	<b>Lead V5</b> <b>Lateral</b>
<b>Lead III</b> <b>Inferior</b>	<b>Lead aVF</b> <b>Inferior</b>	<b>Lead V3</b> <b>Anterior</b>	<b>Lead V6</b> <b>Lateral</b>

- Additional 12 lead ECG territory nomenclature:
  - Anteroseptal: V1-V4.
  - Anterolateral: V3-V6, I, and aVL.
  - Extensive anterior: V1-V6.
  - Inferolateral: II, III, aVF, V5, V6 and/or I, and aVL.
  - Posterior: V7-V9.

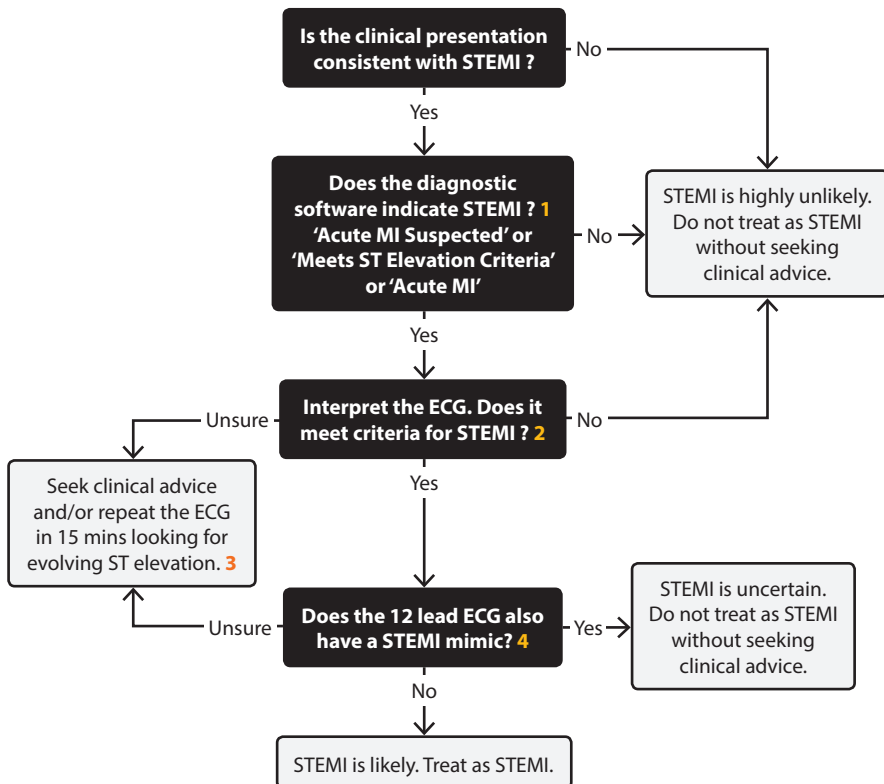
### Risk factors

- Risk factors such as family history, smoking, obesity, hypertension, diabetes and hypercholesterolaemia are important. However, many patients without risk factors develop myocardial ischaemia and the presence or absence of risk factors should not form part of clinical decision making as to the likelihood of the patient having myocardial ischaemia.
- Myocardial ischaemia can occur in relatively young people. Patients are at higher risk if they:
  - Have a family history of ischaemic heart disease, or
  - Are diabetic, or
  - Have a personal or family history of a connective tissue disorder, or
  - Come from a high risk ethnic group. Indians and Fijian Indians are at very high risk. Māori and Pacific People are at increased risk.
- It is possible for patients under 36 years of age to have myocardial ischaemia. The cause is not usually atherosclerosis of the coronary arteries, but may be from other conditions such as coronary artery spasm, coronary artery dissection or aortic dissection. If a patient less than 36 years of age has symptoms suggesting myocardial ischaemia the patient must be given a clear recommendation to be transported to a medical facility by ambulance.

## Response to treatment

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

## STEMI diagnosis summary



- 1 Personnel not confident in 12 lead ECG interpretation must seek clinical advice or call for backup.
- 2 The presence of ST depression in reciprocal leads increases the likelihood of STEMI.
- 3 The presence of evolving ST elevation increases the likelihood of STEMI.
- 4 In particular: LBBB (usually mimics anterior STEMI), RBBB (usually mimics anterior STEMI), LVH (usually mimics anterior STEMI), paced rhythm, benign early repolarisation.

## 3.2 Myocardial ischaemia

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

- Acquire a 12 lead ECG.
  - a) Acquire an additional 12 lead ECG using a V4R lead position if an inferior STEMI is suspected.
  - b) Acquire an additional 12 lead ECG using V7-9 posterior lead positions if a posterior STEMI is suspected.
- Treat as per the 'STEMI' section if the patient has STEMI.
- Administer oxygen if required to achieve an SpO<sub>2</sub> ≥94%.
- Administer 300 mg of aspirin PO provided the patient is not in the third trimester of pregnancy.
- Administer 0.4 mg of GTN SL provided that:
  - a) The systolic BP is greater than 100 mmHg, and
  - b) The heart rate is greater than 40/minute and less than 150/minute.
- Repeat GTN every 3-5 minutes provided it relieves symptoms.
- Use GTN with caution and increase the dosing interval to ten minutes if the patient:
  - a) Has STEMI, or
  - b) Is small, frail or physiologically unstable, or
  - c) Has poor perfusion, or
  - d) Has dysrhythmia, or
  - e) Has taken a drug for erectile dysfunction in the last 24 hours, or
  - f) Has known aortic or mitral stenosis.
- Gain IV access if the patient has:
  - a) Significant pain, or
  - b) STEMI, or
  - c) Dysrhythmia, or
  - d) Poor perfusion or signs of shock.
- Administer fentanyl IV as required for moderate to severe pain.

### Backup

- Personnel not confident in 12 lead ECG interpretation must seek clinical advice or call for backup if the patient has symptoms of myocardial ischaemia and the automated analysis of the ECG is indicating the presence of STEMI.
- Backup is not required if the patient has significant relief of symptoms following GTN and has near normal vital signs.
- Backup from a Paramedic, PRIME responder or ICP should be requested if the patient has significant pain despite GTN, noting that most patients do not require an ICP.

- Backup from an ICP must be requested if the patient has:
  - Bradydysrhythmia, or
  - Tachydysrhythmia, or
  - Signs of shock.

### **Referral and transport**

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

## **Additional information**

### **The timing of 12 lead ECG acquisition**

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

### **Atypical symptoms**

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

### **Silent myocardial ischaemia**

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

## Opiate administration

- Registry data indicates an association between opiate administration and an increase in mortality rate in patients with an acute coronary syndrome. It is not clear why this association exists, but it is possible that it is due to reduced absorption of antiplatelet drugs as a result of reduced gastrointestinal motility and/or an increased risk of vomiting. Fentanyl should not be withheld but have a low threshold for administering an antiemetic.



### 3.3 ST elevation myocardial infarction (STEMI)

This section is for adults that clearly have STEMI. Do not use this section without seeking clinical advice if the diagnosis is unclear.

- Determine the most appropriate reperfusion pathway:
  - a) Use the primary PCI pathway if transport to a hospital with facilities for immediate PCI can clearly occur within 90 minutes of the diagnosis of STEMI being made.
  - b) Use the fibrinolytic therapy pathway if transport to a hospital with facilities for immediate PCI cannot clearly occur within 90 minutes of the diagnosis of STEMI being made.
  - c) Seek clinical advice if the most appropriate reperfusion pathway or hospital destination is not clear.

#### All patients

- Call the dispatcher by radio and notify “code STEMI” if helicopter transport is being considered. Ensure the dispatcher is informed of:
  - a) The hospital the patient is likely to be transported to, and
  - b) The cell phone number for Air Desk personnel to call.
- Transmit the 12 lead ECG to the STEMI coordinator.
- Complete the fibrinolytic therapy/PCI checklist.
- Administer oxygen only if required to achieve an SpO<sub>2</sub> ≥94%.
- Administer 300 mg of aspirin PO.
- Gain IV access, preferably in the left arm.
- Administer GTN with caution and withhold GTN if signs of low cardiac output are present. GTN in 0.4 mg doses may be administered provided:
  - a) The systolic BP is greater than 100 mmHg, and
  - b) The heart rate is greater than 40/minute and less than 150/minute.
- Repeat GTN every ten minutes only if it clearly improves symptoms.
- Administer fentanyl IV as required for moderate to severe pain.

#### Primary PCI pathway

- Commence transport as soon as possible.
- Phone the STEMI coordinator as soon as possible (preferably before leaving the scene) and inform them of the patient’s details:
  - Surname, age and NHI.
  - Time of symptom onset and summary of the patient’s overall condition.
  - 12 lead ECG findings.
  - Expected time of arrival.
  - Ensure there is explicit discussion if there are any contraindications or cautions present from the fibrinolytic therapy/PCI checklist.

## **Fibrinolytic therapy pathway**

- Administer fibrinolytic therapy as soon as possible provided there are no contraindications or cautions present from the fibrinolytic therapy/PCI checklist.
- See the 'fibrinolytic therapy' section.

## **Fibrinolytic therapy/PCI checklist**

- Does the patient have any of the following contraindications to fibrinolytic therapy?
  - Suspected aortic dissection.
  - Major surgery, major trauma or severe brain injury within the last six weeks.
  - Intracranial surgery within the last six months.
  - Ischaemic stroke within the last six months.
  - Previous intracerebral haemorrhage.
  - Known cerebral aneurysm, arteriovenous malformation or tumour.
- Does the patient have any of the following cautions to fibrinolytic therapy?
  - More than ten minutes of CPR.
  - Non-compressible vascular puncture (including organ biopsy) within the last 24 hours.
  - Internal bleeding within the last six weeks.
  - Lumbar puncture or epidural insertion within the last six weeks.
  - TIA within the last three months.
  - Known bleeding disorder.
  - Taking an anticoagulant. If the patient is taking warfarin document their last known INR result if possible.
  - Systolic BP greater than 180 mmHg or diastolic BP greater than 110 mmHg.
  - Known to be pregnant or less than two weeks postpartum.
  - The time of onset of symptoms was greater than 12 hours ago.
  - The patient is dependent on others for their activities of daily living.
  - The patient has another disease, for example metastatic malignancy, that significantly shortens their life expectancy.
  - The patient is very frail.

## **Backup**

- EMTs must request backup (a Paramedic is sufficient for the majority of patients) and begin the process of completing the checklist above.
- Personnel not confident in ECG interpretation should transmit the ECG to the Clinical Desk and seek clinical advice if the diagnosis is uncertain and the automated analysis of the ECG is indicating the presence of STEMI.
- Backup from an ICP must be requested if the patient has:
  - Bradydysrhythmia, or
  - Tachydysrhythmia, or
  - Signs of shock.

## Referral and transport

- All patients with STEMI must receive a clear recommendation to be transported to hospital by ambulance.
- Transport the patient direct to a hospital with the facilities for immediate PCI whenever this is feasible and safe.
- Transport to a hospital with facilities for immediate PCI may occur via another medical facility if fibrinolytic therapy is going to be provided by medical facility staff.
- The patient will be staged if the receiving medical facility is a hospital:
  - The transporting crew must activate staging and notify the dispatcher as soon as possible (and preferably before leaving the scene) that staging is being activated.
  - Onward transport of the patient to a hospital with the facilities for immediate PCI is the responsibility of ambulance personnel.
  - Road ambulance personnel must notify receiving medical facility staff that staging has been activated.
  - A suitable crew will be dispatched by helicopter to the medical facility to transport the patient to a hospital with facilities for immediate PCI.
  - The helicopter transport from the medical facility to the hospital with facilities for immediate PCI will occur as an out-of-hospital mission and not as an inter-hospital transfer.
  - If a helicopter cannot be tasked (for example, due to weather) ambulance communications centre personnel will notify staff looking after the patient and discuss alternative arrangements for onward transport.

## Additional information

### General principles

- Be prepared to treat cardiac arrest but do not routinely attach defibrillation pads.
- Patient outcomes are improved if the occluded coronary artery is opened as soon as possible.
- IV access is preferably gained in the left arm because if the patient has PCI the cardiologist will usually gain access via the right radial artery. Large bore IV access is not required and 18 or 20 gauge cannulae are sufficient.
- Silent STEMI is rare and if this is suspected clinical advice must be sought prior to treating the patient as having STEMI.



## ECG transmission

- Transmitting a 12 lead ECG requires clinical judgement. If the patient clearly has STEMI the 12 lead ECG must be transmitted whenever possible. However, transmitting 12 lead ECGs where the patient does not clearly have STEMI is counterproductive, because it does not change what happens to the patient and desensitises hospital staff to the importance of transmission of 12 lead ECGs.
- Ensure the patient's surname and NHI (if known) are entered into the 12 lead ECG before transmission.
- Personnel should transmit the 12 lead ECG to the Clinical Desk and seek clinical advice if there is uncertainty if STEMI is present.
- Personnel should seek clinical advice if they are unable to speak to the STEMI coordinator.
- Briefly attempt troubleshooting if transmission is unsuccessful:
  - Check the correct site was chosen.
  - Check there is cell phone coverage.
  - Check the equipment (for example the modem or cell phone) is connected, on and paired with the defibrillator/monitor.
  - If transmission remains unsuccessful, continue with the most appropriate treatment pathway and speak to the STEMI coordinator or seek clinical advice, as soon as possible.

## The fibrinolytic therapy/PCI checklist

- The conditions within the checklist place the patient at increased risk of bleeding with fibrinolytic therapy and PCI.
- Aortic dissection may involve the coronary arteries and cause STEMI. Aortic dissection usually presents with a sudden onset of severe pain that is maximal at the time of onset and often described as sharp, tearing or stabbing and may radiate to the back.
- Major surgery is any form of surgery where if subsequent bleeding developed, it could be life-threatening. Examples include surgery within a body cavity (for example the chest or abdomen), surgery involving the spine and any form of joint replacement.
- Major trauma is trauma severe enough to cause an injury where if subsequent bleeding developed, it could be life-threatening. Examples include multiple rib fractures, intra-abdominal injury and pelvic fractures.
- Severe brain injury is an injury that was severe enough to result in an injury visible on a CT scan.
- Intracranial surgery includes any operation or procedure involving the brain.
- Ischaemic stroke within the last six months includes thrombotic and embolic strokes, even if the patient was successfully treated. It is possible for an area of dead brain from a recent ischaemic stroke to be converted into a

haemorrhagic stroke if fibrinolytic therapy is administered.

- Previous intracerebral haemorrhage includes all forms of previous bleeding within the brain.
- A cerebral aneurysm is a known weakness in the wall of a cerebral artery causing dilation of the vessel. If the patient has not heard the term 'cerebral or brain aneurysm' it is highly unlikely the patient has one.
- An arteriovenous (AV) malformation is an abnormal connection between an artery and a vein. The vein is exposed to arterial pressure because there is no capillary bed to reduce the pressure so the vein dilates and may rupture. If the patient has not heard of the term 'AV malformation' it is highly unlikely the patient has one.
- A cerebral tumour is any form of brain tumour (primary or metastatic).
- Non-compressible vascular puncture includes any invasive procedure involving a non-compressible organ (for example liver or kidney biopsy) or a blood vessel (for example a subclavian central line).
- Internal bleeding includes gastrointestinal bleeding, bleeding from the urinary tract and bleeding from the lung. 'Coffee ground' vomit is very non-specific and is not a reliable clinical sign of gastrointestinal bleeding. Normal menstrual bleeding is not a caution.
- A lumbar puncture is a procedure in which a needle is inserted between two lumbar vertebrae, most commonly to collect cerebrospinal fluid for diagnostic testing. An epidural insertion is a procedure in which a needle is inserted between two vertebrae, most commonly for the placement of a local anaesthetic agent. Following recent lumbar puncture or epidural insertion, the administration of fibrinolytic therapy may cause bleeding into the spine resulting in paraplegia.
- Anticoagulants include warfarin, dabigatran, rivaroxaban and apixaban, but not antiplatelet medicines such as aspirin, clopidogrel and ticagrelor.
- Hypertension significantly increases the risk of intracranial bleeding following fibrinolytic therapy. However, fibrinolytic therapy may be safely administered if the hypertension is controlled.

### **Primary PCI pathway**

- Primary PCI is the preferred reperfusion pathway, provided the patient can clearly be transported to a hospital with the facilities to provide immediate PCI within 90 minutes of the diagnosis of STEMI being made. The balance of risk is in favour of administering fibrinolytic therapy if there is uncertainty on the transport time to a hospital with the facilities for immediate PCI, for example if transport is occurring by helicopter and it is uncertain when a helicopter will arrive.
- Personnel should begin transport toward hospital while completing the fibrinolytic therapy/PCI checklist.

- Ideally it should be the transporting crew that phone the STEMI coordinator.
- The STEMI coordinator will activate cardiac catheter room/lab staff.
- En route to hospital phone the receiving clinician approximately 30 minutes prior to arrival, update them on the patient's condition and confirm where in the hospital the patient is expected.
- The patient should usually be transferred directly to the cardiac catheter room/lab on the ambulance stretcher, provided cardiac catheter room/lab staff are ready.

### **The STEMI coordinator**

- Each area has a group of doctors that undertake the role of being the STEMI coordinator. The STEMI coordinator role has been allocated by the Regional Cardiac Network in each area and ambulance personnel must know how to contact the STEMI coordinator in their area.
- The role of the STEMI coordinator is to:
  - Provide advice if required, and
  - Help determine the treatment pathway and/or hospital destination if this is unclear, and
  - Activate cardiac catheter room/lab staff if required.
- The STEMI coordinator may be a cardiologist/interventional cardiologist, cardiology registrar, ED specialist or the doctor on-call for the Clinical Desk.
- Personnel should seek clinical advice if they do not know how to contact the STEMI coordinator.
- Provide as much notification to the STEMI coordinator as possible. If cardiac catheter room/lab staff have to be called in from home this may take 30-40 minutes.

### **Code STEMI**

- On receipt of a radio call stating “code STEMI” the dispatcher must immediately notify Air Desk personnel of the incident, the expected hospital destination and the cell phone number at the scene to call.
- Air Desk personnel must immediately undertake the following:
  - Determine the most appropriate helicopter and calculate the expected time of arrival at the scene and the expected time of arrival at the designated hospital.
  - Arrange for immediate dispatch of the helicopter if one is available within a suitable time.
  - Phone personnel at the scene and update them on the expected time of arrival of the helicopter, or to discuss an alternative plan if a helicopter is not available within a suitable time.

**If cardiac arrest occurs**

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



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## 3.4 Fibrinolytic therapy

This section is for adults receiving fibrinolytic therapy for STEMI. Provide the following treatment in addition to that described within the 'STEMI' section. Do not use this section without seeking clinical advice if the diagnosis is unclear.

- Gain IV access, preferably in both arms.
- Administer fibrinolytic therapy as soon as possible, but seek clinical advice prior to administering fibrinolytic therapy if any contraindications or cautions are present from the fibrinolytic therapy/PCI checklist.
- Control hypertension prior to administering fibrinolytic therapy if the systolic BP is greater than 180 mmHg or the diastolic BP is greater than 110 mmHg. Commence treatment as below and move sequentially through the steps if the BP remains uncontrolled:
  - a) Administer 0.4-0.8 mg of GTN SL every 3-5 minutes, provided the heart rate is greater than 40/minute and less than 150/minute.
  - b) Apply a TTS 10 GTN patch or commence a GTN infusion IV, using the heart rate contraindications above, if hypertension is not rapidly controlled with GTN SL. If a GTN infusion is commenced, titrate this to a systolic BP of 150-170 mmHg.
  - c) Administer labetalol or metoprolol IV provided the heart rate is greater than 60/minute:
    - Administer 10 mg of labetalol IV over 1-2 minutes. This may be repeated every ten minutes to a maximum of 50 mg, or
    - Administer 2.5 mg of metoprolol IV over 1-2 minutes. This may be repeated every ten minutes to a maximum of 10 mg.
  - d) Remove the GTN patch if the systolic BP falls below 100 mmHg.
- Seek clinical advice if the blood pressure is difficult to control.
- Discuss hospital destination with the STEMI coordinator before commencing transport if the hospital destination is unclear, particularly if the patient is being transported by helicopter.

## If the patient is aged less than 75 years

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

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

## If the patient is aged greater than or equal to 75 years

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

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

## Post fibrinolytic therapy

- Phone the STEMI coordinator to discuss hospital destination prior to commencing transport and inform them of the patient's details:
  - Surname, age and NHI.
  - Time of symptom onset and summary of the patient's overall condition.
  - 12 lead ECG findings.
  - Expected time of arrival.
- Transport will usually be to a hospital with the facilities to provide immediate PCI, whenever this is feasible and safe, provided the patient is suitable to receive PCI if reperfusion does not occur.
- Record the patient's blood pressure, heart rate and capillary refill time every ten minutes.

- Monitor the patient closely for signs of bleeding or reperfusion complications (such as dysrhythmia).
- En route to hospital phone the receiving clinician approximately 30 minutes prior to arrival, update them on the patient's condition and confirm where in the hospital the patient is expected.
- Repeat a 12 lead ECG every 30 minutes but do not transmit these unless asked to do so by the STEMI coordinator.
- Seek clinical advice if there is any significant deterioration in the patient's condition.

## Additional information

### General principles

- If primary PCI is not the chosen reperfusion pathway, fibrinolytic therapy must be initiated as soon as possible provided there are no contraindications or cautions in the checklist.
  - Even if the patient is close to a medical facility, provided a Paramedic or ICP is with the patient, administering fibrinolytic therapy in the out-of-hospital setting will usually result in a faster time to treatment than will be achieved by transporting the patient to a medical facility.
  - The patient should be transported to a medical facility with personnel able to administer fibrinolytic therapy if there will be a significant delay in the arrival of ambulance or PRIME personnel able to do this. 'Significant delay' cannot be tightly defined and requires clinical judgement taking into account the time it will take to transport the patient to the medical facility versus the time it will take for suitable personnel to arrive.
  - If the patient is being transported to a hospital for fibrinolytic therapy personnel should initiate staging via the Air Desk as soon as possible, and preferably prior to leaving the scene.
- Bilateral IV access is preferred but do not delay commencing treatment to achieve this if IV access is difficult. Large bore IV access is not required and 18 or 20 gauge cannulae are sufficient.
- Fibrinolytic therapy may be administered via IO access if IV access cannot be obtained, but IO access must be secure.
- Following fibrinolytic therapy, the patient should usually be transported to a hospital with facilities for immediate PCI, whenever this is feasible and safe.
  - Approximately 40% of patients receiving fibrinolytic therapy will not achieve reperfusion and will require immediate (or rescue) PCI.
  - The diagnosis that reperfusion is not occurring is usually made approximately 60-90 minutes post fibrinolytic therapy and if the patient is in (or en route to) a hospital with facilities for immediate PCI, then time to reperfusion and outcomes are improved.

- The STEMI coordinator may decide the patient should be transported to an alternative hospital if the patient is not suitable to receive rescue PCI. Examples include patients with severe comorbidities or other diseases that significantly shorten their life expectancy.
- The patient must be transported by a Paramedic or an ICP following fibrinolytic therapy.

### **Informed consent**

- Written consent is not required for fibrinolytic therapy, but the patient needs to provide informed consent. For example:
  - Inform the patient they are having a ‘heart attack’ and this is life-threatening. The heart attack is due to a clot blocking one of the blood vessels in their heart.
  - The clot busting drug helps dissolve clots and this reduces the chances that they will die or be left with permanent heart damage. The earlier the clot busting drug is administered, the more likely it is to work.
  - Rarely the clot busting drug can cause bleeding, for example from wounds or inside the body. Very rarely this bleeding can cause death. The likelihood of bleeding into the brain is less than 1%.
  - There is good evidence that clot busting drugs are more likely to help the patient than to harm them.

### **Complications following fibrinolytic therapy**

- Treat the patient using the appropriate section if complications from STEMI occur.
- Seek clinical advice if complications from fibrinolytic therapy occur and have a low threshold for seeking backup from an ICP.

### **Fibrinolytic therapy being provided by primary care personnel**

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



## 3.5 Inter-hospital transfer of patients with STEMI

Only ICPs may use this section for the inter-hospital transfer of adult patients with STEMI. Seek clinical advice if the patient is a child.

- Receive a handover from the treating staff and commence transport without delay.
- Be prepared to treat cardiac arrest and consider attaching defibrillation pads if transport is occurring by air.
- If a fibrinolytic infusion is running, continue this until complete.
- Monitor and record vital signs every ten minutes.
- Phone the receiving clinician approximately 30 minutes prior to arrival, update them on the patient's condition (including any treatment provided en route), and confirm where in the hospital the patient is expected.
- Seek clinical advice for any significant changes in patient condition that are not easily managed.

### Treatment of hypertension

- Control hypertension if the systolic BP is greater than 180 mmHg or the diastolic BP is greater than 110 mmHg. Commence treatment as below and move sequentially through the steps if the BP remains uncontrolled:
  - a) Administer 0.4-0.8 mg of GTN SL every 3-5 minutes, provided the heart rate is greater than 40/minute and less than 150/minute.
  - b) Apply a TTS 10 GTN patch or commence a GTN infusion IV, using the heart rate contraindications above, if hypertension is not rapidly controlled with GTN SL. If a GTN infusion is commenced, titrate this to a systolic BP of 150-170 mmHg.
  - c) Administer labetalol or metoprolol IV provided the heart rate is greater than 60/minute:
    - Administer 10 mg of labetalol IV over 1-2 minutes. This may be repeated every ten minutes to a maximum of 50 mg, or
    - Administer 2.5 mg of metoprolol IV over 1-2 minutes. This may be repeated every ten minutes to a maximum of 10 mg.
  - d) Remove the GTN patch if the systolic BP falls below 100 mmHg.
- Seek clinical advice if the BP is difficult to control.

## Additional information

### Introduction

- Transfer may be occurring because the patient:
  - Is being transferred for primary PCI, or
  - May have received fibrinolytic therapy and is being transferred so that they are in the right hospital for immediate coronary intervention (rescue PCI) in the event of failure of reperfusion.
- The role of the ICP in inter-hospital transfer is to ensure rapid and safe transfer, while being prepared to treat any complications that may occur.
- Most patients requiring inter-hospital transfer for STEMI are suitable to be escorted by an ICP. Personnel should seek clinical advice prior to commencing transfer if they believe an ICU retrieval team is required, for example if the patient is ventilated or requires ventilation.

### Transfer mode

- The fastest transfer mode should be used provided this is feasible and safe, with the most appropriate mode usually being determined by transport time.
- Transfer by road ambulance will usually be the most appropriate mode if the transport time by road between hospitals is less than 60 minutes.
- Transfer by helicopter will usually be the most appropriate mode if the transport time by road between hospitals is more than 60 minutes.
- Transfer by plane should be rare and personnel must not provide transfer by plane unless they have been trained to do so.

### Patient handover at the pick-up hospital

- Receive a handover from treating personnel at the pick-up hospital, including:
  - The history and any relevant additional information, for example allergies.
  - Current therapy including whether a fibrinolytic infusion is running and if so, the total dose to be administered, the rate of infusion and whether additional bag/syringe changes are required en route.
  - The patient's vital signs.
  - The name and phone number of the receiving clinician at the destination hospital.
  - Any relevant medical records.
- Minimise delays during handover, patient preparation and leaving the hospital. Personnel should aim to leave the hospital within 15 minutes of arrival.
- Do not insert additional IV lines unless absolutely necessary.

## Fibrinolytic therapy

- The most common drug used is tenecteplase and this does not require an infusion.
- If an infusion is running, ideally it should be set up prior to leaving the referring hospital so that no additional changing of bags or syringes is required en route.
- Ensure the rate of infusion is known in case the infusion has to be stopped and restarted during transfer.
- Angioedema is rare following fibrinolytic therapy for STEMI. If it occurs stop the fibrinolytic infusion (if still running) and treat as per the 'stridor' section.

## On arrival at the destination hospital

- Meet the receiving team at the arranged location.
- Provide a handover and help convey the patient to the cardiac catheter room/lab on the ambulance stretcher if the patient is going to receive immediate coronary intervention.

## GTN infusion

- A GTN infusion may only be administered by ICPs with:
  - Specific training on GTN administration via an IV infusion, and
  - Written service guidelines for infusion dilution and pump set up, and
  - A written standing order.



## 3.6 Cardiogenic pulmonary oedema

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

- Acquire a 12 lead ECG.
- Administer 0.8 mg of GTN SL provided that:
  - a) The systolic BP is greater than 100 mmHg, and
  - b) The heart rate is greater than 40/minute and less than 150/minute.
- Continue to administer 0.8 mg GTN SL every 3-5 minutes as above if the patient is not improving.
- Apply a TTS 10 GTN patch or commence a GTN infusion IV if the patient is not rapidly improving, using the systolic BP and heart rate contraindications above. Remove the patch if the systolic BP subsequently falls below 100 mmHg.
- Continue to administer GTN SL as above if the patient is not improving. Use caution and increase the dosing interval to ten minutes if the patient:
  - a) Has STEMI, or
  - b) Is small, frail or physiologically unstable, or
  - c) Has poor perfusion, or
  - d) Has dysrhythmia, or
  - e) Has taken a drug for erectile dysfunction in the last 24 hours, or
  - f) Has known aortic or mitral stenosis.
- Gain IV access if the patient has:
  - a) Significant respiratory distress, or
  - b) Signs of poor perfusion.
- Increase the dose and frequency of GTN SL administration if the patient is not improving, provided the systolic blood pressure is greater than 100 mmHg.
- Fentanyl in 10-20 mcg doses IV may be administered every five minutes as required for severe anxiety.

### CPAP

- Apply CPAP at 10 cmH<sub>2</sub>O if the patient has:
  - a) Severe respiratory distress despite treatment, or
  - b) An SpO<sub>2</sub> less than 92% despite treatment.
- Note that a lower SpO<sub>2</sub> threshold of less than 88% should be used if the patient also has COPD.
- Use CPAP with caution if the patient has an altered level of consciousness, vomiting or signs of shock.

## PEEP

- If CPAP is indicated but unavailable, apply PEEP at 10 cmH<sub>2</sub>O and increase this to 15 cmH<sub>2</sub>O if the patient is not improving.
- Use PEEP with caution if the patient has an altered level of consciousness, vomiting or signs of shock.

## Backup

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

## Referral and transport

- All patients treated for cardiogenic pulmonary oedema must be given a clear recommendation to be transported to a medical facility by ambulance.
- The medical facility should usually be an ED, unless the patient is rapidly improving and can be taken to an appropriate primary care facility.

## Additional information

### General

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

### Differentiating cardiogenic pulmonary oedema from asthma

- Pulmonary oedema may produce a wheeze that sounds like asthma. If the patient has no history of asthma, the wheeze is unlikely to be due to asthma and the possibility of cardiogenic pulmonary oedema should be considered.
- Cardiogenic pulmonary oedema is the likely diagnosis when the patient has been supine (for example in bed) and the wheeze is worse bilaterally in the lower zones. The patient is often hypertensive, clammy and peripherally vasoconstricted.

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

### **Differentiating cardiogenic pulmonary oedema from chest infection**

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

### **Medicines for erectile dysfunction**

- A range of medicines are used for erectile dysfunction and some (particularly sildenafil) are also used in the treatment of pulmonary hypertension.
- GTN may interact with such medicines if they have been taken within the last 24 hours, causing severe and prolonged hypotension.
- GTN is not contraindicated in this setting, but there must be a strong indication, the dose should be reduced to 0.4 mg and the dosing interval increased to ten minutes. If in doubt seek clinical advice.

### **Negative pressure pulmonary oedema**

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

### **The physiological effects of CPAP and PEEP**

- CPAP and PEEP improve oxygenation, improve ventilation and reduce the workload of breathing, via the following physiological effects:
  - Fluid within the airways causes areas of lung to collapse and this causes shunting of blood because these areas have blood supply but do not contribute to gas exchange. CPAP reduces shunting because the inspiratory pressure assists areas of the lung that have collapsed to expand (also called recruitment).

- Wet lungs become stiff and this increases the workload of breathing. CPAP reduces this workload because the inspiratory pressure assists inspiration.
- The expiratory pressure assists small and medium sized airways to remain open during expiration, preventing lung collapse by splinting the airways open. Preventing areas of lung from collapsing is important because once collapsed, significant additional pressures are required to re-expand them.
- The positive pressure in the thoracic cavity reduces the preload (filling) of the right ventricle by reducing venous return to the heart (this will be further compounded by administration of GTN).
- The positive pressure in the thoracic cavity increases the afterload of the right ventricle and reduces venous return to the heart. This reduces blood flow through lung vessels, reducing the amount of fluid entering the lungs.
- The expiratory pressure increases the amount of air remaining in the lungs at the end of expiration (also called the functional residual capacity) and this causes the lungs to be more expanded. From this more expanded resting position, less work is required to inspire as a result of the non-linear compliance of the lungs, particularly when the lungs are wet.

### **CPAP or PEEP being provided during transport**

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

### **GTN infusion**

- A GTN infusion may only be administered by ICPs with:
  - Specific training on GTN administration via an IV infusion, and
  - Written service guidelines for infusion dilution and pump set up, and
  - A written standing order.

## 3.7 Determining the level of cardiovascular compromise

- The treatment provided to a patient with a dysrhythmia is determined by the level of their cardiovascular compromise.
- There is a continuum of compromise and determining the level of compromise requires clinical judgement that divides this continuum into four categories.

### Not compromised

- The patient is not compromised if their vital signs are normal (ignoring heart rate which is abnormal by definition) and there are no symptoms of myocardial ischaemia present.
- The assessment of the level of cardiovascular compromise can be further validated by a visual assessment of the status code. If the patient 'looks status four' the patient is usually not compromised.

### Mildly compromised

- The patient is mildly compromised if their vital signs are near normal (ignoring the heart rate which is abnormal by definition) or mild symptoms of myocardial ischaemia are present. For example, when the patient has:
  - Near normal blood pressure and peripheral capillary refill time, or
  - Normal level of consciousness, or
  - Normal or near normal breathing, or
  - Mild symptoms of myocardial ischaemia.
- The assessment of the level of cardiovascular compromise can be further validated by a visual assessment of the status code. If the patient 'looks status three' the patient is usually mildly compromised.

### Moderately compromised

- The patient is moderately compromised if their vital signs are abnormal (ignoring the heart rate which is abnormal by definition), or significant symptoms of myocardial ischaemia are present. For example, when the patient has:
  - Hypotension or prolonged capillary refill time, or
  - An altered level of consciousness with an ability to obey commands, or
  - Moderate shortness of breath, or
  - Significant symptoms of myocardial ischaemia.
- The assessment of the level of cardiovascular compromise can be further validated by a visual assessment of the status code. If the patient 'looks status two' the patient is usually moderately compromised.



## Severely compromised

- The patient is severely compromised if their vital signs are markedly abnormal (ignoring heart rate which is abnormal by definition) such that there is a high risk of cardiac arrest unless immediate interventions are carried out. For example, when the patient has:
  - Severe hypotension, an unrecordable blood pressure or absent radial pulses (noting that the absence of a palpable pulse does not equate to a specific blood pressure), or
  - An inability to obey commands, or
  - Severe shortness of breath.
- The assessment of the level of cardiovascular compromise can be further validated by a visual assessment of the status code. If the patient ‘looks status one’ the patient is usually severely compromised.

## Summary table

Not compromised	Mildly compromised
<ul style="list-style-type: none"> <li>• Normal vital signs</li> <li>• No symptoms of myocardial ischaemia</li> <li>• ‘Looks status four’</li> </ul>	<ul style="list-style-type: none"> <li>• Near normal vital signs e.g. near normal BP and CRT, normal LOC, normal or near normal breathing</li> <li>• Mild symptoms of myocardial ischaemia</li> <li>• ‘Looks status three’</li> </ul>
Moderately compromised	Severely compromised
<ul style="list-style-type: none"> <li>• Abnormal vital signs e.g. hypotension or prolonged CRT, altered LOC but can obey commands, moderate shortness of breath</li> <li>• Significant symptoms of myocardial ischaemia</li> <li>• ‘Looks status two’</li> </ul>	<ul style="list-style-type: none"> <li>• Markedly abnormal vital signs e.g. severe hypotension, inability to obey commands, severe shortness of breath</li> <li>• High risk of cardiac arrest</li> <li>• ‘Looks status one’</li> </ul>



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## 3.8 Ventricular tachycardia

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

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

### If the patient is not severely compromised

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

### If the patient is severely compromised

- If the patient can obey commands:
  - a) Gain IV access, administer 1 mg/kg of ketamine IV (up to a maximum of 100 mg) to induce dissociation, and
  - b) Cardiovert using maximum joules in synchronised mode. Repeat this once if the rhythm fails to revert.
- If the patient cannot obey commands:
  - a) Cardiovert using maximum joules in synchronised mode. Repeat this once if the rhythm fails to revert, or
  - b) Attach and use a defibrillator in automatic mode if you cannot use it in manual mode.

### Backup

- Backup from an ICP must be requested for all patients in VT, even if it has spontaneously reverted.
- Seek urgent clinical advice and request backup from a Paramedic or PRIME responder if an ICP is not immediately available.

### Referral and transport

- All patients that have been in VT, even if it has spontaneously reverted, must be given a clear recommendation to be transported to an ED by ambulance.

## **Additional information**

### **General principles**

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

### **The timing of 12 lead ECG acquisition**

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

### **Differentiating VT from SVT with abnormal conduction**

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

## **GTN and VT**

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

## **Amiodarone and VT**

- If amiodarone is commenced the full dose should be administered, even if the rhythm reverts to sinus rhythm, unless severe hypotension or bradycardia occurs.
- Amiodarone should be administered if there is recurrent VT, even if the runs of VT spontaneously revert.

## **Sedation before cardioversion**

- Deep sedation, for example ketamine to induce dissociation, is required prior to cardioversion unless the patient cannot obey commands.
- Routinely administer oxygen and task one person to continually monitor the patient's SpO<sub>2</sub>, breathing and level of consciousness.
- Have a manual ventilation bag and mask immediately available.
- Paramedics should seek clinical advice if sedation is required for cardioversion and an ICP is not immediately available.

## **VT secondary to poisoning**

- VT occasionally occurs secondary to poisoning, particularly poisoning associated with cyclic antidepressants. The cardiac toxicity may be reduced by a large bolus of sodium ions which is best accomplished using 0.9% sodium chloride:
  - a) 2-3 litres IV for an adult.
  - b) 40-60 ml/kg IV for a child.
- If 8.4% sodium bicarbonate is immediately available or can be delivered to the scene within ten minutes, in addition to 0.9% sodium chloride, administer:
  - a) 100 ml IV over 5-10 minutes for an adult.
  - b) 2 ml/kg IV over 5-10 minutes for a child.
- Amiodarone should not be administered in this setting because it can be associated with severe worsening of shock without resolution of the rhythm.

## 3.9 Supraventricular tachycardia

This section is for patients aged greater than or equal to 12 years with supraventricular tachycardia (SVT) and a ventricular rate greater than or equal to 150/minute. Seek clinical advice if the patient is aged less than 12 years.

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

### If the patient is not compromised or is mildly compromised

- Try up to two Valsalva manoeuvres.
- Gain IV access and administer adenosine IV if the rhythm fails to revert and the patient has a history of recurrent SVT that is known to be responsive to adenosine.

### If the patient is moderately compromised

- Try up to two Valsalva manoeuvres.
- Gain IV access and administer adenosine if the rhythm fails to revert.

### If the patient is severely compromised

- Reconsider the diagnosis as it is rare for SVT to cause severe compromise.
- If the patient can obey commands:
  - a) Attempt up to two Valsalva manoeuvres provided this is feasible.
  - b) Gain IV access, administer 1 mg/kg of ketamine IV (up to a maximum of 100 mg) to induce dissociation, and
  - c) Cardiovert using maximum joules in synchronised mode. Repeat this once if the rhythm fails to revert.
- If the patient cannot obey commands:
  - a) Cardiovert using maximum joules in synchronised mode. Repeat this once if the rhythm fails to revert, or
  - b) Attach and use a defibrillator in automatic mode if you cannot use it in manual mode.

### Administration of adenosine

- Adenosine is contraindicated if the patient has:
  - a) Known sick sinus syndrome without an internal pacemaker, or
  - b) Previous 2<sup>nd</sup> or 3<sup>rd</sup> degree heart block without an internal pacemaker, or
  - c) Had a previous heart transplant without an internal pacemaker.

- Use adenosine with caution if the patient has:
  - a) Asthma, or
  - b) COPD, or
  - c) WPW syndrome if the rhythm is possibly fast atrial fibrillation.
- To administer adenosine:
  - a) Do not routinely attach defibrillation pads.
  - b) The preferred site of injection is the antecubital fossa.
  - c) Administer 6 mg of adenosine IV as a rapid bolus followed immediately by a rapid flush of a minimum of 20 ml 0.9% sodium chloride.
  - d) If the rhythm fails to revert, administer a further 12 mg of adenosine IV.

### **In addition**

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

### **Backup**

- Backup from an ICP must be requested if the patient is moderately or severely compromised, and the rhythm fails to revert following a Valsalva manoeuvre.

### **Referral and transport**

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

## **Additional information**

### **General principles**

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

## The timing of 12 lead ECG acquisition

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

## SVT and cardiovascular compromise

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

## Differentiating SVT from atrial fibrillation

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

## **Differentiating SVT from atrial flutter**

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

## **The Valsalva manoeuvre**

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

## **Adenosine**

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

## **Sedation before cardioversion**

- Deep sedation, for example ketamine to induce dissociation, is required prior to cardioversion unless the patient cannot obey commands.
- Routinely administer oxygen and task one person to continually monitor the patient's SpO<sub>2</sub>, breathing and level of consciousness.
- Have a manual ventilation bag and mask immediately available.
- Paramedics should seek clinical advice if sedation is required for cardioversion and an ICP is not immediately available.



## 3.10 Atrial fibrillation or atrial flutter

This section is for adults with atrial fibrillation or atrial flutter, with a ventricular rate persistently greater than 130/minute and cardiovascular compromise, particularly myocardial ischaemia. If the patient is a child seek clinical advice.

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

### **If the patient is not compromised or is mildly compromised**

- Do not provide specific treatment for the dysrhythmia.

### **If the patient is moderately compromised**

- Administer 300 mg of amiodarone IV over approximately 30 minutes, provided the patient's systolic BP is greater than 100 mmHg.
- Administer a further 150 mg of amiodarone IV over approximately 30 minutes, using the same indications if the patient remains in atrial fibrillation or atrial flutter.
- Use amiodarone with caution if the patient is poorly perfused and reduce the rate of administration if there is a significant fall in blood pressure.

### **If the patient is severely compromised**

- Reconsider the diagnosis because it is very rare for atrial fibrillation or atrial flutter to cause severe compromise.
- If the patient can obey commands:
  - a) Gain IV access, administer 1 mg/kg of ketamine IV (up to a maximum of 100 mg) to induce dissociation, and
  - b) Cardiovert using maximum joules in synchronised mode. Repeat this once if the rhythm fails to revert.
- If the patient cannot obey commands:
  - a) Cardiovert using maximum joules in synchronised mode. Repeat this once if the rhythm fails to revert, or
  - b) Attach and use a defibrillator in automatic mode if you cannot use it in manual mode.

### **In addition**

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

## Backup

- Backup from an ICP must be requested if the patient has severe compromise.
- Backup from an ICP should be requested if the patient has moderate compromise.
- Backup from a Paramedic or PRIME responder should be requested if backup from an ICP is not immediately available.

## Referral and transport

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

## Additional information

### Atrial fibrillation

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

### Atrial fibrillation and sepsis

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

## Differentiating SVT from atrial fibrillation

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

## Atrial flutter

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

## The timing of 12 lead ECG acquisition

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



## 3.11 Cardioversion checklist

- Place pads in either the apex/sternum (recommended) or anterior/posterior position, in addition to ECG electrodes.
- Ensure the defibrillator is in manual mode.
- Select a lead with a visible R wave and ensure that artefact is minimised.
- Select synchronised mode.
- Confirm there are detection symbols with most QRS complexes.
- Ensure the patient has received adequate sedation if indicated.
- Select maximum joules, charge the defibrillator and confirm everyone is clear.
- Press and hold the shock button until the shock is delivered.
- Determine the rhythm and reassess vital signs.
- If administering a second cardioversion, confirm the defibrillator is still in synchronised mode and the patient is adequately sedated.



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## 3.12 Bradycardia

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

- Acquire a 12 lead ECG whenever feasible and determine the rhythm.
- Gain IV access and provide appropriate treatment if there is a clear underlying cause.
- Initiate treatment if the heart rate is less than 40/minute and there is moderate or severe cardiovascular compromise.

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

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

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

- Initiate pacing.
- Stop pacing and administer adrenaline IV if the bradycardia is unresponsive to pacing:
  - a) Administer an adrenaline infusion via an infusion pump. Start at a rate of 0.5 mg/hour and adjust the rate as required, or
  - b) Place 1 mg of adrenaline into a 1 litre bag of 0.9% sodium chloride (1:1,000,000 solution):
    - Administer as an infusion. Start at 2 drops/second and adjust the rate as required, or
    - Administer a bolus of 0.01 mg adrenaline (10 ml) IV every 1-2 minutes as required.

### **Pacing checklist**

- Place the pads in either the anterior/posterior (recommended) or apex/sternum position in addition to ECG electrodes.
- Select a lead with a visible R wave and ensure artefact is minimised.
- Select pacing.
- Confirm there are detection symbols with most QRS complexes.

- Confirm pacing is in demand mode (not applicable to all models).
- Set the pacing rate to 70/minute.
- Select current and increase this until pacing capture occurs. Confirm there is a pacing spike before each QRS complex.
- Increase the current 10 mA above the capture threshold.
- Administer fentanyl IV and add ketamine IV if required.
- Confirm there is mechanical capture with a palpable pulse, an improvement in the SpO<sub>2</sub> waveform or other signs of increased cardiac output.
- Increase the pacing rate to 80/minute if there is electrical capture, but no signs of increased cardiac output.
- Change to fixed or non-demand mode (not applicable to all models) if pacing is ineffective due to artefact.

## Backup

- Backup from an ICP must be requested if the patient has moderate to severe cardiovascular compromise.
- Personnel should request backup from a Paramedic or PRIME responder and seek clinical advice if an ICP is not immediately available.
- An ICP should consider calling for assistance from a second ICP if the patient is receiving pacing.

## Referral and transport

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

## Additional information

### General principles

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

## **The timing of 12 lead ECG acquisition**

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

## **The pharmacological treatment of bradycardia**

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

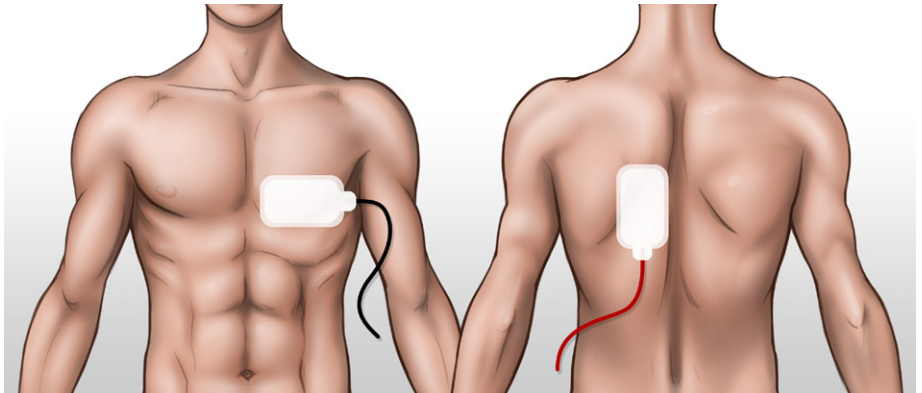
## **Bradycardia secondary to poisoning with beta-blockers**

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



## Pacing

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



**Recommended pad placement for pacing**



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## 3.13 Cardiogenic shock

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

- Acquire a 12 lead ECG whenever feasible and determine the rhythm.
- Gain IV access.
- Administer 0.9% sodium chloride IV if there are signs of poor perfusion, provided the patient has no signs or symptoms of pulmonary oedema and the primary problem is not dysrhythmia:
  - a) Administer 250-500 ml 0.9% sodium chloride IV.
  - b) This may be repeated as required, up to a maximum of 1 litre.
  - c) Stop the fluid if the patient develops signs or symptoms of pulmonary oedema.
- Administer metaraminol if the systolic blood pressure is less than 100 mmHg:
  - a) Administer via an infusion pump:
    - Administer an initial bolus of 0.5-1 mg metaraminol IV.
    - Start the infusion at 2 mg/hour and adjust the rate as required.
  - b) Alternatively, administer a bolus of 0.5-1 mg metaraminol IV every 5-10 minutes as required.
- Consider administering adrenaline IV if the blood pressure is unresponsive to metaraminol or the patient is hypotensive and bradycardic:
  - a) Administer an adrenaline infusion via an infusion pump. Start at a rate of 0.5 mg/hour and adjust the rate as required, or
  - b) Place 1 mg of adrenaline into a 1 litre bag of 0.9% sodium chloride (1:1,000,000 solution):
    - Administer as an infusion. Start at 2 drops/second and adjust the rate as required, or
    - Administer a bolus of 0.01 mg adrenaline (10 ml) IV every 1-2 minutes as required.

### In addition

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

### Backup

- Backup from an ICP must be requested.
- Backup from a Paramedic or PRIME responder should be requested if backup from an ICP is not immediately available.

### Referral and transport

- Transport the patient to a hospital with a cardiac catheter room/lab whenever it is feasible and safe to do so.

## Additional information

### General

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

### Cardiogenic shock secondary to poor left ventricular function

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

### Cardiogenic shock secondary to poor right ventricular function

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

### Improving outcomes from cardiogenic shock

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

### Metaraminol administration

- Metaraminol is the preferred vasopressor because it does not increase myocardial oxygen consumption and is less likely to cause tachycardia and/or tachydysrhythmia than adrenaline.

## Adrenaline administration

- Adrenaline is the preferred vasopressor if the blood pressure is unresponsive to metaraminol or the patient is hypotensive and bradycardic.
- The decision to administer adrenaline must weigh up the potential benefit of improving cardiac output against the potential risks of raising myocardial oxygen consumption and causing tachycardia and/or tachydysrhythmia.
- Adrenaline administration (particularly IV bolus administration) can make the patient tachypnoeic and look or feel awful. It is important to differentiate this from a worsening of their shock and not to automatically respond by administering more adrenaline.
- An IV infusion is preferred over IV boluses because this reduces the adverse effects of surges of adrenaline.



## 3.14 Cardiac arrest

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

### Backup

- Backup from an ICP must always be requested.
- Backup from a Paramedic or PRIME responder must be requested if backup from an ICP is not immediately available.

### Cardiac arrest checklist

- Identify a team leader.
- The team leader must ensure:
  - Roles allocated and confirmed.
  - Space maximised and layout functional.
  - Two minute cycles, timer on if available.
  - CPR feedback device on if available.
  - Metronome on if available.
  - Defibrillator screen visible to the team leader.
  - Airway adjunct or ETT in place and ventilation adequate.
  - Suction positioned at the head of the patient.

- ETCO<sub>2</sub> attached and waveform visible if LMA or ETT placed.
- Oxygen flow and supply adequate.
- IV/IO access secure, two sites if possible.
- Consider underlying and reversible causes.
- Initiate documentation.
- Communication with family/bystanders.
- Extrication plan if ROSC occurs.

## Additional information

### Definitions

- A patient is in cardiac arrest when the patient is unconscious and has no signs of life. Agonal gasping is common during cardiac arrest, particularly in the presence of good CPR and is not considered a sign of life in this setting.
- A witnessed cardiac arrest is one where the patient is seen or heard to collapse, regardless of whether this is by a member of the public or by ambulance personnel.
- A primary cardiac arrest is one where the cardiac arrest is clearly caused by a cardiac problem, or there is no obvious cause.
- A secondary cardiac arrest is one where there is an obvious non-cardiac cause, for example asthma, drowning, trauma or poisoning.
- Return of spontaneous circulation (ROSC) is the presence of a palpable pulse, or clear signs of spontaneous circulation (such as non-agonal breathing, normal ETCO<sub>2</sub> or active movement) in the absence of CPR.
- Severe comorbidities are chronic diseases that significantly limit a patient's life expectancy. Examples include dementia, severe COPD, heart failure causing inability to exercise normally, a requirement for aged residential care and metastatic cancer with weight loss.

### Deciding to start resuscitation

- Resuscitation should start unless there is a clear reason not to. Clear reasons for not starting resuscitation include:
  - Signs of rigor mortis or post-mortem lividity.
  - A clear advance directive not to receive resuscitation for cardiac arrest.
  - Scenarios where resuscitation is futile or clearly not in the best interest of the patient. Examples include unwitnessed cardiac arrest with asystole as the initial rhythm, patients who are dying from cancer and patients with severe comorbidities.
- Family members do not have the right to demand resuscitation on behalf of a patient, but their opinion of what the patient would want must be taken into consideration.

- Family members do not have the right to decline resuscitation on behalf of a patient unless they have an Enduring Power of Attorney. See the 'patient competency' section for more information.
- Ambulance personnel must take into account all available information (including the patient's known wishes) and act in what they believe is the best interest of the patient.
- If there is doubt regarding the appropriateness of a resuscitation attempt, resuscitation should begin while further information is gained.
- There must be clear documentation regarding decisions made.

### **Deciding to stop resuscitation**

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

### **Deciding to stop resuscitation: EMTs**

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

### **Deciding to stop resuscitation: Paramedics and ICPs**

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

## The prognosis of cardiac arrest

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

Worse prognostic factors	Better prognostic factors
<ul style="list-style-type: none"><li>• Secondary cardiac arrest</li><li>• Unwitnessed</li><li>• No bystander CPR</li><li>• Response time &gt; 8 minutes</li><li>• Initial rhythm asystole or PEA</li><li>• Time in cardiac arrest &gt; 30 minutes</li><li>• Severe comorbidities present</li><li>• Living in aged residential care</li><li>• Age &gt; 85 years</li><li>• <math>\text{ETCO}_2 &lt; 15</math> mmHg or falling despite CPR</li></ul>	<ul style="list-style-type: none"><li>• Primary cardiac arrest</li><li>• Witnessed</li><li>• Bystander CPR</li><li>• Response time &lt; 8 minutes</li><li>• Initial rhythm VT or VF</li><li>• Time in cardiac arrest &lt; 30 minutes</li><li>• No severe comorbidities present</li><li>• Living independently</li><li>• Age <math>\leq</math> 85 years</li><li>• <math>\text{ETCO}_2 &gt; 25</math> mmHg with CPR</li></ul>

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

## The important aspects of high performance CPR

- For an adult the CPR compression to ventilation ratio is 30:2 when ventilation is via a bag and mask. This ratio prioritises chest compressions on the basis that an adult is most likely to have had a primary cardiac arrest. If an adult has had a cardiac arrest secondary to asphyxiation or respiratory failure, alter the ratio to 15:2.
- For a child the CPR compression to ventilation ratio is 15:2 when ventilation is via a bag and mask (exception – the ratio is 3:1 for neonates). The 15:2 ratio reduces the priority of chest compressions on the basis that a child is most likely to have had a cardiac arrest secondary to respiratory failure. If a child has had a primary cardiac arrest, alter the ratio to 30:2.
- Do not interrupt chest compressions for any longer than three seconds.
- Perform continuous chest compressions if an LMA (or other supraglottic airway) is present and this does not obviously impair ventilation via the LMA. If however, continuous chest compressions obviously impair ventilation via the LMA, interrupt the chest compressions to provide ventilation. If there is uncertainty, perform continuous chest compressions.



- Perform continuous chest compressions if the patient has been intubated with an ETT. Intubation with an ETT is not a high priority during the initial treatment of cardiac arrest. If ROSC has not been achieved within ten minutes, intubation with an ETT should occur provided this does not interrupt chest compressions.
- Perform chest compressions at 100-120/minute, ensure adequate depth and allow complete recoil, minimise pauses and perform uninterrupted compressions whenever possible.
- If a CPR feedback device is available it must be used.
- If a metronome is available it must be used.
- Ventilation has a low priority during the first few minutes of resuscitation if the patient has had a primary cardiac arrest. During continuous chest compressions ventilate adults and children with 10 breaths/minute, preferably using a ventilation timing light. Ventilation rates higher than this reduce the blood flow achieved during CPR, as a result of increased intrathoracic pressure and reduced venous return.
- CPR is performed for two-minute cycles between rhythm checks. The person performing chest compressions should ideally change every two minutes, or earlier if tired.

### **The important aspects of using a defibrillator**

- Attach and charge a defibrillator as soon as possible, preferably while continual chest compressions are being performed. Defibrillation (if indicated) must not be delayed by performing other interventions.
- Personnel able to use defibrillators in manual mode must do so whenever possible. This reduces delays to defibrillation and pauses in chest compressions.
- In manual mode, defibrillators should be charged toward the end of the two-minute cycle, while chest compressions continue. This minimises the time delay between stopping chest compressions and delivering a shock. If a shock is not required, the charge should be cancelled.
- Minimise the pre-shock pause. This is the time between stopping chest compressions and delivering a shock. Ideally pre-shock pauses should be less than two seconds.
- Minimise the post-shock pause by having the person performing chest compressions hover approximately 5 cm above the chest during rhythm analysis. Immediately resume chest compressions following a shock/cancellation of the charge, without performing a pulse/ROSC check.
- Perform a brief pulse/ROSC check at the end of each two-minute cycle, only if the rhythm looks capable of producing cardiac output, noting that this is highly unlikely if ETCO<sub>2</sub> is low. If there is any doubt that cardiac output is present, chest compressions must be immediately restarted.
- Each time there is a recognised change from one rhythm to another, move to

the appropriate algorithm for the new rhythm.

- Defibrillators in advisory (automatic) mode must be used in children (including infants) if a defibrillator in manual mode is not immediately available.
- Deliver a precordial thump if VF/VT cardiac arrest occurs in the presence of personnel and a shock is going to be delayed, noting that precordial thumps are rarely successful.

## **IV access and IV drugs**

- Gaining IV access and administering IV drugs has a lower priority than providing high performance CPR.
- IV access is preferred over IO access. Clinical judgement should be used and IO access should usually be obtained if IV access cannot be gained, and resuscitation is ongoing.
- All doses of IV drugs should be flushed with a running line of 0.9% sodium chloride or a minimum of 20 ml 0.9% sodium chloride.

## **End tidal CO<sub>2</sub>**

- The level of end tidal CO<sub>2</sub> (ETCO<sub>2</sub>) is a marker of the blood flow being achieved during CPR. With good CPR an ETCO<sub>2</sub> of greater than 20 mmHg should usually be achieved, unless there is an obstruction to blood flow, for example from a pulmonary embolus.
- ETCO<sub>2</sub> must be used to confirm ETT placement and must be continually measured if the patient has been intubated with an ETT.
- ETCO<sub>2</sub> should be continually measured if the patient is being ventilated via an LMA, noting that the ETCO<sub>2</sub> will be reduced if there is significant leak around the cuff. In this setting the trend of the ETCO<sub>2</sub> is more important than single measurements.
- ETCO<sub>2</sub> may be measured if the patient is being ventilated via a face mask, noting that the ETCO<sub>2</sub> will be reduced if there is significant leak around the mask. In this setting the trend of the ETCO<sub>2</sub> is more important than single measurements.
- A falling ETCO<sub>2</sub> despite CPR is a poor prognostic factor and must prompt a focus on ensuring high performance CPR is being provided and the ventilation rate is at or below 10/minute.
- An ETCO<sub>2</sub> of less than 15 mmHg despite CPR is a very poor prognostic factor.
- A sudden increase in ETCO<sub>2</sub> is usually an indicator that ROSC has occurred.

## **VF and VT**

- Routinely place pads in the anterior/posterior position for small children and morbidly obese patients.
- Consider placing pads in the anterior/posterior position for patients in persistent VF or VT.

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

### **Pulseless electrical activity (PEA)**

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

- If the patient remains in PEA despite resuscitation attempts, consider the possibility that there is cardiac output that cannot be detected clinically. In this setting stop chest compressions and observe the ETCO<sub>2</sub> for one minute while ventilating at a rate of 10/minute:
  - If the ETCO<sub>2</sub> rapidly falls to below 10 mmHg the patient is in cardiac arrest.
  - If the ETCO<sub>2</sub> is maintained at or above 10 mmHg, the patient has low cardiac output and should be treated accordingly.

## **Asystole**

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

## **Single responder resuscitation**

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

## **Transport to hospital with CPR en route**

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

## Mechanical CPR

- Mechanical CPR does not usually improve outcomes and should not be routinely used. However, if mechanical CPR is available it has a role and should be considered, for example when:
  - It is not safe to perform manual chest compressions, for example in a moving ambulance.
  - There is insufficient room to perform chest compressions, for example in a helicopter.
  - A prolonged resuscitation attempt is anticipated, for example following beta-blocker poisoning.
- Personnel must be trained to use the mechanical CPR device.
- One trained person must be tasked to exclusively supervise the mechanical CPR device during use.
- Mechanical CPR devices are not usually suitable for use on small children or very large adults.

## Defibrillator failure checklist

- Use this checklist if a defibrillator fails and there is not another defibrillator (including an AED) immediately available. At each defibrillator intervention, pause briefly to determine if the problem has been fixed.
  - Task specific personnel to focus on resuscitating the patient.
  - Task specific personnel to focus on troubleshooting the defibrillator.
  - Call Comms and ensure another vehicle is responding.
  - Ensure the pads are attached and connected.
  - Ensure the ECG leads are attached.
  - Change the lead shown on the screen so that the rhythm is visible.
  - Turn the defibrillator off for 30 seconds and turn it back on again.
  - Remove and replace the batteries, utilising spare batteries if possible.
  - Attach and connect a new set of pads.
  - Switch to automatic mode if in manual mode.
  - Turn the defibrillator off for 30 seconds and turn it back on again.
  - Log a reportable event if you reach the point of turning the defibrillator off for 30 seconds.



# Cardiac arrest in special situations

## Cardiac arrest secondary to drowning

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

## Cardiac arrest secondary to hanging

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

## Cardiac arrest secondary to trauma

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

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

### **Cardiac arrest secondary to asthma**

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

### **Cardiac arrest secondary to anaphylaxis**

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

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

### **Cardiac arrest secondary to cyclic antidepressant poisoning**

- The cardiac toxicity of cyclic antidepressants is partly caused by blockade of sodium channels within the heart.
- This cardiac toxicity may be reduced by a large bolus of sodium ions which is best accomplished using 0.9% sodium chloride:
  - a) 2-3 litres IV for an adult.
  - b) 40-60 ml/kg IV for a child.
- If 8.4% sodium bicarbonate is immediately available or can be delivered to the scene within ten minutes, in addition to 0.9% sodium chloride, administer:
  - a) 100 ml IV for an adult.
  - b) 2 ml/kg IV for a child.
- Do not administer amiodarone.

### **Cardiac arrest during pregnancy**

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

### **Cardiac arrest secondary to hypothermia**

- It is important to differentiate cardiac arrest secondary to hypothermia, from the circumstance where a patient has died and then cooled after death, particularly if the patient is elderly and/or frail.
- It is possible for patients to survive prolonged cardiac arrest secondary to hypothermia because the metabolic rate drops significantly with severe hypothermia.
- Follow standard procedures but if ROSC is not achieved within ten minutes, seek clinical advice regarding the possibility of transport to hospital with CPR en route. Survival in this setting usually requires cardiopulmonary bypass or extracorporeal membrane oxygenation (ECMO) while the patient is warmed, and liaison with hospital specialists will be required prior to arrival.
- See the 'hypothermia' section for additional information.



## **Cardiac arrest secondary to opiate poisoning**

- There is no role for naloxone because cardiac arrest is secondary to respiratory arrest and once cardiac arrest has occurred naloxone has no useful effect.
- The best treatment is CPR that includes a focus on ventilation.
- If ROSC occurs, naloxone should still not be administered because it may be associated with seizures, hypertension, pulmonary oedema or severe agitation.

## **Cardiac arrest and implanted defibrillators/pacemakers**

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

## **Cardiac arrest occurring in infants during sleep**

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

## **Movement during cardiac arrest**

- The patient may move during cardiac arrest if cerebral blood flow is being maintained by very good CPR.
- This can cause personnel to believe that the patient is not in cardiac arrest and may lead to delayed defibrillation and/or inappropriate pauses in CPR.
- It is appropriate to briefly pause CPR to confirm the patient is in cardiac arrest.
- If the movement is significant enough to interfere with resuscitation:
  - Administer ketamine noting that the blood flow generated by CPR may be insufficient to deliver adequate levels of ketamine to the brain. Administer 1 mg/kg (up to a maximum of 100 mg) of ketamine IV once.
  - If significant movement continues despite administering ketamine, rocuronium may be administered provided an ETT has been placed and the position confirmed using ETCO<sub>2</sub>. The blood flow generated by CPR may be insufficient to deliver adequate levels of rocuronium to skeletal muscle and neuromuscular blockade may not occur.
  - If rocuronium has been administered, neuromuscular blockade will occur if sustained ROSC is achieved and the patient will then require an adequate level of sedation.

## 3.15 Treatment following return of spontaneous circulation

### If the patient is obeying commands

- Gain IV access if not already achieved.
- Acquire a 12 lead ECG and treat as per the 'STEMI' section if the patient has STEMI.
- Treat as per the 'cardiogenic shock' section if shock is present.
- Utilise the post cardiac arrest checklist prior to commencing transport.

### If the patient is not obeying commands

- Gain IV access if not already achieved.
- Ensure an adequate airway and adequate breathing, but avoid hyperventilation:
  - a) Ventilate to an  $\text{ETCO}_2$  of 35-45 mmHg if an ETT or LMA has been placed.
  - b) If the patient is ventilated via an ETT, administer sedation, analgesia and neuromuscular blockade if required, using the 'post intubation' section.
  - c) Titrate the oxygen flow rate to an  $\text{SpO}_2$  of 94-97%, provided pulse oximetry is reliable.
- Acquire a 12 lead ECG and treat as per the 'STEMI' section if the patient has STEMI.
- Cover the patient with a single sheet and do not provide active warming.
- Utilise the post cardiac arrest checklist prior to commencing transport.
- The target systolic BP is greater than or equal to 120 mmHg in an adult, and greater than or equal to the normal predicted systolic BP in a child. If the systolic BP is lower than the target:

#### For an adult:

- Consider administering 1 litre of 0.9% sodium chloride IV once only.
- Administer metaraminol IV:
  - a) Administer via an infusion pump:
    - Administer an initial bolus of 0.5-1 mg metaraminol IV.
    - Start the infusion at 2 mg/hour and adjust the rate as required.
  - b) Alternatively, administer a bolus of 0.5-1 mg metaraminol IV every 5-10 minutes as required.
- Consider administering adrenaline if the blood pressure is unresponsive to metaraminol, or the patient is hypotensive and bradycardic:
  - a) Administer an adrenaline infusion via an infusion pump. Start at a rate of 0.5 mg/hour and adjust the rate as required, or

- b) Place 1 mg of adrenaline into a 1 litre bag of 0.9% sodium chloride (1:1,000,000 solution):
- Administer as an infusion. Start at 2 drops/second and adjust the rate as required, or
  - Administer a bolus of 0.01 mg adrenaline (10 ml) IV every 1-2 minutes as required.

**For a child aged 5-14 years:**

- Consider administering 20 ml/kg of 0.9% sodium chloride IV once only.
- Administer a bolus of metaraminol IV (see the paediatric drug dose tables) every 5-10 minutes as required.
- Consider administering adrenaline if the blood pressure is unresponsive to metaraminol or the patient is hypotensive and bradycardic:
  - a) Administer an adrenaline infusion via an infusion pump. Start at a rate of 0.25 mg/hour and adjust the rate as required, or
  - b) Place 1 mg of adrenaline into a 1 litre bag of 0.9% sodium chloride (1:1,000,000 solution):
    - Administer as an infusion. Start at 1 drop/second and adjust the rate as required, or
    - Administer IV boluses (see the paediatric drug dose tables) every 1-2 minutes as required.

**For a child aged less than five years:**

- Consider administering 20 ml/kg of 0.9% sodium chloride IV once only.
- Administer a bolus of metaraminol IV (see the paediatric drug dose tables) every 5-10 minutes as required.
- Consider administering adrenaline IV if the blood pressure is unresponsive to metaraminol or the patient is hypotensive and bradycardic.
  - a) Administer IV boluses (see the paediatric drug dose tables) every 1-2 minutes as required.
  - b) Do not administer adrenaline as an IV infusion.

**Backup**

- Backup from an ICP must be requested. Backup from a Paramedic or PRIME responder should be requested if an ICP is not immediately available.
- Backup from an ICP or doctor able to perform RSI should be requested if the patient has a GCS less than or equal to 10.

**Referral and transport**

- Transport to a hospital with PCI facilities if the patient has STEMI provided this is feasible and safe.
- Transport to a hospital with intensive care facilities if the patient is not obeying commands, provided this is feasible and safe.

## Post cardiac arrest checklist

- Airway and ventilation are adequate/secure.
- Backup for RSI called for if indicated.
- ETCO<sub>2</sub> 35-45 mmHg if ventilated.
- Sedation, analgesia and neuromuscular blockade if indicated.
- 12 lead ECG.
- SpO<sub>2</sub> 94-97% and oxygen flow adjusted if indicated.
- IV access secure.
- BP above target if not obeying commands.
- Cover with single sheet if not obeying commands.
- Transmit cardiac arrest data if possible.

## Additional information

### General principles

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

### Targeted temperature management

- Targeted temperature management (TTM) may also be described as therapeutic hypothermia.
- TTM improves outcomes in patients remaining unconscious following a cardiac arrest, probably by reducing the inflammatory state that occurs within the brain.
- If TTM is being utilised by hospital personnel, a temperature of 35-36°C is usually targeted. Following ROSC, most patients covered with a single sheet will achieve a temperature of approximately 35°C provided active warming does not occur.
- It is useful to document the patient's tympanic temperature post ROSC, but this is not a priority.
- There is no role for active cooling (for example using ice packs or cold 0.9% sodium chloride IV) unless the patient has hyperthermia.

## Oxygenation and ventilation

- There is some evidence that very high levels of oxygen at a tissue level post cardiac arrest may worsen outcomes by causing vasoconstriction (which lowers blood supply to the brain) and promoting inflammation within the brain.
- If pulse oximetry is reliable, the oxygen flow rate should be adjusted to achieve an SpO<sub>2</sub> of 94-97%, noting that this is not a priority in the first few minutes post ROSC.
  - a) If the SpO<sub>2</sub> is above 97%, lower the oxygen flow rate to 6 litres/minute and titrate the flow rate by further increments of 2 litres/minute every 5-10 minutes.
  - b) If pulse oximetry is unreliable, ventilate with an oxygen flow rate of 10-15 litres/minute.
- The target ETCO<sub>2</sub> for a patient ventilated via an endotracheal tube or an LMA is 35-45 mmHg. This is intended to ensure that arterial CO<sub>2</sub> levels are at the upper end of normal, which maximises cerebral blood flow.

## Blood pressure

- There is reduced blood flow to the brain post cardiac arrest, even if blood pressure is normal.
- Any fall in blood pressure will further reduce blood flow to the brain and this is why a systolic blood pressure greater than 120 mmHg is targeted for an adult, and a blood pressure above the normal predicted systolic blood pressure is targeted for a child.
- Metaraminol is the preferred vasopressor because it does not increase myocardial oxygen consumption and is less likely to cause tachycardia and/or tachydysrhythmia than adrenaline.
- Adrenaline is the preferred vasopressor if the blood pressure is unresponsive to metaraminol or the patient is hypotensive and bradycardic.



# 4.1 Shock

## Introduction

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

## Signs of shock

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

## Blood pressure and shock

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

## Causes of shock

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

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





## 4.2 Major trauma triage

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

### Life-threatening problems requiring immediate intervention

- Transport the patient to the closest appropriate medical facility if the patient has a life-threatening problem requiring immediate intervention that cannot be provided by personnel on scene.
- Activate staging, preferably before leaving the scene, via Comms if the medical facility is not a major trauma hospital.
- Notify staff in the staging facility as soon as possible that staging is being activated.

### Severe traumatic brain injury (TBI)

- Transport the patient to a major trauma hospital with neurosurgical facilities provided this is feasible and safe, if the patient has TBI and any of the following are present:
  - a) Intubated and ventilated.
  - b) Lateralising neurological signs.
  - c) Clinically obvious penetrating brain injury.

### Complex multi-system trauma

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

### Abnormal primary survey

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

### Injury patterns

- Transport the patient to the most appropriate major trauma hospital if the patient has any of the following injury patterns:
  - a) Penetrating trauma to the neck or torso.
  - b) Crush injury to the neck or torso.
  - c) Flail chest.
  - d) Penetrating trauma to a limb with arterial injury.

- e) More than one long bone fracture.
- f) Crushed, amputated, mangled or pulseless limb.
- g) Clinically obvious pelvic fracture.
- h) Clinically significant signs and/or symptoms of acute spinal cord injury.
- i) Burns involving the airway.
- j) Burns greater than 20% of body surface area.

### **Additional risk factors**

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

### **Staging**

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

### **If no features of major trauma are present**

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

## **Additional information**

### **General principles**

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

### **Life-threatening problems requiring immediate intervention**

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

## Status codes

- Status codes cannot be used to define the presence or absence of major trauma, for example not all patients assigned a status code of two will have major trauma.
- The major trauma triage criteria must be used to determine whether or not the patient has major trauma.

## Severe TBI

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

## Complex multi-system trauma

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

## Airway obstruction

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

## **Motor score of the GCS**

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

## **Penetrating injury**

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

## **Crush injury**

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

## **Flail chest**

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

## **Fractures of long bones**

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

## **Clinically obvious pelvic fracture**

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

## **Spinal cord injury**

- If the patient has clinically significant signs or symptoms of acute spinal cord injury, the patient should be transported directly to a spinal cord impairment (SCI) centre whenever this is feasible and safe. The patient should be transported to a SCI centre if there are other signs of major trauma in addition to that of spinal cord injury, provided this is feasible and safe, as the SCI centres are also major trauma hospitals.
- If it is not feasible or safe to transport to a SCI centre, for example the patient has other major injuries and is deteriorating, the patient should be transported to the most appropriate major trauma hospital.
- Seek clinical advice prior to commencing transport if this will involve a prolonged flight.
- See the 'spinal cord injury' section for additional information.

## **Burn injury greater than 20% of body surface area**

- Transport the patient to a regional burn centre (Middlemore Hospital, Waikato Hospital, Hutt Hospital or Christchurch Hospital) if the burn injury is greater than 20% of body surface area, provided this is feasible and safe.
- Hutt Hospital is not a major trauma hospital and if there are signs or symptoms of major trauma in addition to the burn injury, the patient must be transported to a major trauma hospital.
- The patient must be transported to a major trauma hospital if they are not transported to a regional burn centre.
- See the 'burns' section for additional information.

## **Additional risk factors**

- Consider transporting the patient to a major trauma hospital if the patient has additional risk factors, but does not meet the criteria for having major trauma.
- Signs or symptoms include, but are not limited to:
  - Severe soft tissue injury, particularly if it involves the face.
  - Severe abdominal pain.
- High risk mechanisms of injury include, but are not limited to:
  - Ejection from a vehicle.
  - Fall greater than twice the patient's height.
- Patient risk factors include, but are not limited to:
  - Elderly.
  - Pregnancy.
  - Taking an oral anticoagulant.
  - Known bleeding disorder.

## **Determining the most appropriate major trauma hospital**

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

## **Patients that rapidly improve without treatment**

- A patient may initially meet criteria for major trauma but then rapidly improve without specific treatment.
- For example, a patient may have lost consciousness and then rapidly recovered, or had respiratory distress from an emotional cause that has rapidly improved.
- Provided the patient is very clearly improving and meets no other criteria for major trauma, clinical judgement should be used and transport may occur to a hospital which is not a major trauma hospital.

## **Staging at a medical facility**

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



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



## 4.3 Anaphylaxis

- Administer adrenaline if the patient is showing systemic signs of anaphylaxis:
  - a) Administer 0.5 mg IM for an adult.
  - b) See the paediatric drug dose tables for the IM dose for a child.
- Gain IV access.
- Administer 0.9% sodium chloride IV if the patient has signs of hypovolaemia or poor perfusion:
  - a) 1 litre for an adult.
  - b) 20 ml/kg for a child.
  - c) Repeat as required.
- Repeat the adrenaline IM every ten minutes if the patient is not improving, or every five minutes if the patient is deteriorating.
- Administer adrenaline IV if the patient is deteriorating despite adrenaline IM:

### **For an adult:**

- a) Administer an adrenaline infusion via an infusion pump. Start at a rate of 0.5 mg/hour and adjust the rate as required, or
- b) Place 1 mg of adrenaline into a 1 litre bag of 0.9% sodium chloride (1:1,000,000 solution):
  - Administer as an infusion. Start at 2 drops/second and adjust the rate as required, or
  - Administer a bolus of 0.01 mg adrenaline (10 ml) IV every 1-2 minutes as required.

### **For a child aged 5-14 years:**

- a) Administer an adrenaline infusion via an infusion pump. Start at a rate of 0.25 mg/hour and adjust the rate as required, or
- b) Place 1 mg of adrenaline into a 1 litre bag of 0.9% sodium chloride (1:1,000,000 solution):
  - Administer as an infusion. Start at 1 drop/second and adjust the rate as required, or
  - Administer IV boluses (see the paediatric drug dose tables) every 1-2 minutes as required.

### **For a child aged less than five years:**

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

## **Backup**

- Backup from a Paramedic or PRIME responder is usually sufficient as most patients improve 5-10 minutes after adrenaline IM and usually only require one dose.

- Backup from an ICP should be requested if the patient is peri-arrest or is not improving 5-10 minutes after one dose of adrenaline IM.

## Referral and transport

- All patients receiving treatment for anaphylaxis must be given a clear recommendation to be transported to a medical facility by ambulance.
- Transport should usually be to an ED, unless the patient:
  - a) Has previously had anaphylaxis, and
  - b) Has rapidly improved with a single dose of adrenaline IM, and
  - c) Is being taken to a primary care facility with the capacity to observe them for several hours.

## Additional information

### General principles

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

### Recognising anaphylaxis

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

## **Adrenaline administration**

- The most important priority is the early administration of adrenaline.
- The risk of death is raised in patients whose need for adrenaline (or repeat adrenaline) is under-recognised.
- Have a low threshold for administering adrenaline if anaphylaxis is suspected, even if it is not immediately life-threatening.
- Have a low threshold for repeat adrenaline if the patient is not improving.
- A dose of 0.5 mg adrenaline IM is appropriate for the majority of adults. Paramedics and ICPs may make a decision to reduce the dose, particularly if the patient is small, frail, or has ischaemic heart disease.
- When administering adrenaline IV, an IV infusion is preferred over IV boluses because this reduces the adverse effects of surges of adrenaline.

## **Cardiac arrest secondary to anaphylaxis**

- IV adrenaline has a high priority. See the 'cardiac arrest' section.

## **Angioedema**

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

## **Nebulised adrenaline**

- If the patient has swelling of the lips and/or tongue, stridor or bronchospasm in association with anaphylaxis, these are an indication for adrenaline IM.
- If the signs and/or symptoms are not improving following adrenaline administration this is an indication for further systemic adrenaline (IM or IV) and not nebulised adrenaline.

## **Additional treatment with antihistamines and/or steroids**

- Antihistamines and steroids have no role in the acute treatment of anaphylaxis.
- An oral antihistamine (for example loratadine) and an oral steroid (for example prednisone or prednisolone) may be administered following treatment for anaphylaxis if the patient has prominent itch and all of the systemic signs of anaphylaxis have completely resolved.

## 4.4 Burns

- Administer oxygen if the patient has suspected carbon monoxide poisoning as a result of clinically significant smoke inhalation. See the 'poisoning from gases' section for more information.
- Cool the burn for at least 20 minutes:
  - a) This should be at the scene unless there is an immediately life-threatening problem in the primary survey.
  - b) Remove all clothing (leaving underwear on) and decontaminate the patient if the burns are due to chemical exposure.
- Irrigate chemical burns to the eye for at least 30 minutes.
- Estimate burn depth and size after cooling.
- Cover burns with cling film after cooling.
- Gain IV access.
- Administer 0.9% sodium chloride IV if the patient has signs of hypovolaemia, poor perfusion, or the burn area is greater than 20%:
  - a) 1 litre for an adult.
  - b) 20 ml/kg for a child.
  - c) Administer further 0.9% sodium chloride if transport time is greater than one hour, or if required for poor perfusion.
- Administer nebulised bronchodilators (using the 'asthma' section) if bronchospasm is prominent.
- Administer nebulised adrenaline (using the 'stridor' section) if stridor is present.

### Backup

- Backup from an ICP or doctor able to perform RSI should be requested if the patient has airway burns or is unable to obey commands.
- Backup from a Paramedic or a PRIME responder should be requested if the patient has moderate to severe pain.

### Referral and transport

- The regional burn centres are in Middlemore Hospital, Waikato Hospital, Hutt Hospital and Christchurch Hospital.
- Transport the patient to a major trauma hospital if there is an immediately life threatening problem, for example severe airway obstruction.
- Transport the patient to a regional burn centre (the preferred destination if feasible and safe) or to a major trauma hospital, if the burn injury is greater than 20% of TBSA. Hutt Hospital is not a major trauma hospital and if there are signs or symptoms of major trauma in addition to the burn injury, the patient must be transported to a major trauma hospital.

- Transport the patient to a regional burn centre (the preferred destination if feasible and safe) or to a hospital with surgical facilities, if the burn injury is greater than 10% of TBSA in an adult or greater than 5% of TBSA in a child.
- Burns involving the face, hands or genitals may require treatment in a regional burn centre. However, provided the burn injury is less than 10% of TBSA in an adult or less than 5% of TBSA in a child, treatment is not usually time sensitive and the patient should usually be transported to the most appropriate hospital, and subsequently transferred if required.

## Additional information

### Airway burns

- Patients with suspected airway burns should be transported to a regional burn centre or a major trauma hospital without delay, unless staging occurs under the major trauma policy (see the ‘major trauma triage’ section). This is because airway swelling may require early intubation and ventilation.
- Suspect airway burns if the patient has:
  - Burn injury around or involving the lips, or
  - Loss of nasal hair, or
  - Visible swelling or burns in the mouth, or
  - A hoarse voice or stridor, or
  - Black sputum.

### Cooling, irrigating and dressing burns

- Burns are preferably cooled using cool (not ice cold) running water:
  - There is benefit in cooling the burn up to three hours post injury.
  - Beware of hypothermia during cooling, particularly if the patient is a small child or the burn is large.
  - It is acceptable to shorten the duration of cooling for burns greater than 40% if it risks causing clinically significant hypothermia.
  - Cool the burn but keep the patient warm.
- Chemical burns of the eye are potentially vision-threatening and irrigation must continue for at least 30 minutes. Chemical burns of the eye are not time critical in terms of transport to hospital and irrigation should occur at the scene whenever feasible, because it is irrigation that makes a difference to the outcome. The method of irrigation must ensure cross contamination of an uninjured eye is avoided.
- Dressing burns is not a priority but may make burns less painful. Cling film should be applied after cooling and may provide some analgesia.
- Burn gels provide analgesia but are not a substitute for 20 minutes of cool running water, provided this is available. If burn gels are used these should be applied after cooling is complete.

## Decontamination

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

## Estimating burn depth and size

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

## Electrical injury

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

## Fluid loss from burns

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

## 4.5 Crush injury

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

- If there is significant risk of asphyxiation, the weight must be released as soon as possible. In other circumstances, it is appropriate to delay release of the weight for up to 20 minutes while preparing for release syndrome.
- Request support at the scene from a medical specialist if there is an established protocol for this in the area.
- Place a tourniquet on the limb(s) if possible.
- Gain IV access (preferably in two sites) and administer a minimum of two litres of 0.9% sodium chloride. Administer further fluid as required.
- Monitor the cardiac rhythm continuously.
- Approximately ten minutes prior to release of the weight:
  - a) Administer continuous salbutamol nebulised, and
  - b) Administer 500 ml of 10% glucose IV as a bolus.
- As the weight is being released:
  - a) Administer 100 ml of 8.4% sodium bicarbonate IV over one minute, and
  - b) Administer a flush of 0.9% sodium chloride IV via a running line, and
  - c) Administer 6.8 mmol (1 g) of calcium chloride IV over one minute.
- Administer further doses of 8.4% sodium bicarbonate and calcium chloride if signs of hyperkalaemia (including dysrhythmia) occur.
- Administer 1 g of tranexamic acid IV provided the patient cannot be enrolled in the PATCH study.

### Additional information

#### Crush injury

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



## Release syndrome

- Release syndrome is a combination of severe shock, acidosis, hyperkalaemia (raised potassium levels) and dysrhythmia that occurs immediately following release of the weight, when severe crush injury has occurred.
- For release syndrome to occur a significant amount of tissue must be crushed (equivalent to at least an entire leg) and the weight must be in place for at least one hour.

## Should removal of the weight be deliberately delayed?

- Some references advocate that removal of the weight should be delayed while preparations are made for release syndrome. As a general rule the weight should be removed as soon as possible, noting that clinical judgment is required. For example:
  - If there is significant risk of asphyxiation the weight must be released as soon as possible.
  - If there is a clinically significant risk of release syndrome (and no significant risk of asphyxiation), it is worth delaying release of the weight for up to 20 minutes while preparation for release syndrome occurs.

## Crush syndrome

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

## Pathophysiology of crush injury and release syndrome

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

## Treatment

- Tourniquets:
  - Applying tourniquets is a balance of risk. Tourniquets help contain the toxic products within the crushed area and also help control bleeding, but in the absence of severe bleeding only have a role if applied prior to release of the weight.
  - If tourniquets have been applied, they should usually remain in place until the patient is in a clinical environment where life-threatening hyperkalaemia and/or severe bleeding can be treated. However, re-evaluate the need for tourniquets following release of the weight and consider releasing the tourniquets one at a time if the limb(s) do not appear badly injured and transport time to hospital is longer than 30 minutes.
- Several litres of 0.9% sodium chloride should be administered, even if the patient does not appear to be hypovolaemic. This is termed pre-loading. Pre-loading offers protection in three ways:
  - Increased intravascular volume helps dilute the released products.
  - Sodium ions help protect the cardiac cell membranes from the effects of the potassium.
  - Increased urine flow through the kidneys helps prevent myoglobin blocking the tubules.
- Salbutamol stimulates beta-2 receptors and causes potassium to move into cells, lowering the potassium concentration in blood.
- Glucose stimulates endogenous insulin production and causes potassium to move into cells, lowering the potassium concentration in blood.
- Calcium provides protection to cardiac cell membranes from potassium.
- Sodium bicarbonate provides protection in three ways:
  - Sodium ions help protect cardiac cell membranes from the effects of potassium.
  - The bicarbonate raises blood pH, causing potassium to move into cells which lowers the potassium concentration in blood.
  - The bicarbonate raises urinary pH which reduces myoglobin deposition in kidney tubules.
- Always ensure an adequate flush between administering calcium and sodium bicarbonate because precipitation will occur if they are combined.
- A medical specialist will bring additional skills to the scene. They can provide anaesthesia and may also be able to bring blood to the scene.
- If calcium and sodium bicarbonate cannot be delivered to the scene, all of the other treatments should still be provided.
- Amputation is only rarely required. If amputation is being considered outside the setting of a major incident, seek clinical advice whenever feasible.

## 4.6 Hypovolaemia from uncontrolled bleeding

This section is for hypovolaemia from:

- a) Penetrating truncal trauma, or
  - b) Leaking abdominal aortic aneurysm, or
  - c) Peripheral penetrating trauma where blood loss has not been controlled, or
  - d) Ectopic pregnancy.
- Compress external bleeding.
  - Apply a tourniquet if there is severe bleeding from a limb that is not controlled by direct pressure.
  - Do not remove penetrating objects from the head or truncal area.
  - Cover sucking chest wounds with a dressing.
  - Begin transport without delay, providing most treatments en route.
  - Keep the patient warm.
  - Gain IV access.
  - Administer tranexamic acid IV provided the patient cannot be enrolled in the PATCH study:
    - a) 1 g of tranexamic acid IV for an adult.
    - b) See the paediatric drug dose tables for a child.
  - Administer IV fluid if the patient has severe shock:
    - a) Arrange for blood to be administered if there is an established protocol for this in the area, or
    - b) Administer 500 ml of 0.9% sodium chloride for an adult or 10 ml/kg of 0.9% sodium chloride for a child.
    - c) Administer further fluid if the patient remains severely shocked.
  - Re-evaluate the need for a tourniquet after bleeding is controlled. Consider releasing the tourniquet if there is a focal bleeding point that can be controlled with direct pressure and transport time to hospital is over 30 minutes.

### Backup

- Backup must not delay rapid transport to hospital.
- Backup from an ICP must be requested if the patient has severe shock.
- Backup from an ICP or doctor able to administer blood should be requested if there is an established protocol for this in the area.
- Backup from a Paramedic or PRIME responder should be requested if backup from an ICP is not immediately available.

## Referral and transport

- The patient must be given a clear recommendation to be transported to an ED by ambulance.
- Transport a patient with trauma and shock direct to a major trauma hospital whenever this is feasible and safe.

## Additional information

### General principles

- The most important aspects of out-of-hospital treatment are to stop external bleeding and rapidly transport the patient to an appropriate major hospital, providing most treatments en route.
- Cover visible abdominal contents with cling film.
- There is no role for spinal immobilisation if the patient has penetrating trauma to the neck or torso.

### Defining severe shock

- Determining that the patient has severe shock requires clinical judgement because severe shock cannot be tightly defined. The overall clinical picture should be considered, taking into account the clinical scenario and the trend of the patient's heart rate, radial pulse strength, blood pressure, pulse pressure, peripheral capillary refill time and level of consciousness.
- Signs of severe shock include:
  - Increasing tachycardia.
  - Weak radial pulses (noting that the absence of a radial pulse does not equate to a specific blood pressure).
  - Prolonged capillary refill time.
  - A falling or unrecordable blood pressure.
  - Agitation, confusion or a falling level of consciousness (usually with preservation of the ability to obey commands).
  - A falling heart rate (a very late sign).
- It is not possible to define a blood pressure at which shock is severe. In young people, blood pressure may only begin to fall when shock is already severe and blood pressure varies with age, degree of fitness and medications.
- If a young patient's blood pressure is low or falling, it usually reflects a substantial loss of intravascular volume. In an elderly person with a reduced ability to compensate, a small loss of intravascular volume may result in a fall in blood pressure, even though shock is not severe.

- Some patients may not become tachycardic despite significant hypovolaemia. Examples include:
  - Patients taking beta-blockers.
  - End stage hypovolaemic shock with a falling heart rate.
  - Ectopic pregnancy (dilatation of the fallopian tube may cause vagal stimulation).
  - Miscarriage (dilatation of the cervix may cause vagal stimulation).

#### **IV fluid resuscitation for uncontrolled bleeding**

- Mortality rates from shock associated with uncontrolled bleeding appear to be reduced if the patient is deliberately allowed to be relatively hypovolaemic prior to surgical control of the bleeding.
- The rationale for low volume resuscitation is that the bleeding is usually from an artery and bleeding may be reduced when blood pressure is relatively low. Fluid resuscitation may result in an increase in blood pressure and dilution of clotting factors, both of which reduce the chance of clot formation and may increase blood loss.
- The threshold for 0.9% sodium chloride in this section is higher than in the 'hypovolaemia from controlled bleeding' section, in that it is only administered when there are signs of severe shock.
- When administering 0.9% sodium chloride, clinical judgement is required that balances the risk of death from hypovolaemic shock against the risk of making bleeding worse.
- If the time to surgical intervention is going to be greater than one hour or the patient is deteriorating, lower the threshold at which 0.9% sodium chloride is administered, administer higher volumes than described and arrange for blood to be administered if possible. Bleeding from solid organs (for example, lungs, liver, spleen or kidneys) following trauma has a pattern of bleeding that is usually relatively controlled. For this reason, blood loss from such organs is not treated using this section, but is treated using the 'hypovolaemia from controlled bleeding' section.

#### **Blood**

- Only call for blood if there is an established protocol in the area for blood to be delivered to the scene.
- Blood should be requested early if shock is severe.

#### **Tranexamic acid**

- The role of tranexamic acid is controversial. It reduces bleeding, but it is not yet clear that it improves outcomes.
- If the patient can be enrolled in the PATCH trial then this must occur and 'open label' tranexamic acid (tranexamic acid from ambulance kits) must not be administered.

- The administration of tranexamic acid is not a priority if the patient cannot be enrolled in the PATCH trial, but should occur if IV access is obtained.

## **Tourniquet application**

- Applying a tourniquet is a balance of risk. Tourniquets help control severe bleeding but can cause significant tissue ischaemia and damage (for example, to muscles and nerves) and should only be used when direct pressure is insufficient to control severe bleeding.
- When applying a tourniquet:
  - Remove clothing from the limb if possible.
  - Apply as distally as possible.
  - Do not apply over a joint.
  - Tighten until bleeding stops. The tourniquet must be tight enough to stop arterial flow.
  - Leave the wound exposed so that it can be observed for bleeding.
  - Record the time of application.
  - Reassess the tourniquet following treatment. It may need to be further tightened if blood pressure improves.
- If the tourniquet is applied to a forearm or lower leg, the presence of two bones may limit the pressure that can be applied to vessels. If bleeding continues despite the tourniquet being tightened maximally, place the tourniquet on the upper arm or thigh.
- The tourniquet needs to be very tight if applied over a thigh, particularly if the thigh is large. Occasionally a second tourniquet may be required proximal to the first tourniquet.
- Re-evaluate the need for a tourniquet after bleeding is controlled, IV access has been obtained and appropriate fluid resuscitation has been commenced.
- If the source of bleeding is a single lacerated artery, for example a lacerated brachial or radial artery, it is preferable that bleeding is controlled with direct pressure and then the tourniquet is released, particularly when transport time to hospital is over 30 minutes.
- If bleeding cannot be controlled with direct pressure the tourniquet should be reapplied.
- A tourniquet may be used to provide direct pressure over a dressing, for example directly over a lacerated brachial artery. In this setting the tourniquet needs to be tight enough to control bleeding and not necessarily tight enough to stop arterial flow.
- A conscious patient will usually require pain relief. If the patient is conscious and not in significant pain, it is likely that the tourniquet is not tight enough.

## **Sucking chest wounds**

- Place a colostomy bag over the wound if one is available. Colostomy bags usually stick well to skin, will reduce the amount of air sucked into the chest during inspiration and have a bag that helps collect blood.
- Place a standard dressing on the wound if a colostomy bag is not available or the wound is too large for a colostomy bag.
- Do not cover a sucking chest wound with a sealed dressing because this risks the development of tension pneumothorax.
- Do not spend time trying to seal a dressing on three sides in order to form a valve, as this is rarely effective.
- Remove the dressing if the patient develops signs of a tension pneumothorax.

## **Temperature**

- It is important to keep the patient warm because hypothermia worsens bleeding by contributing to coagulopathy.
- Remove wet clothing and dry the patient as soon as possible.
- Keep the patient covered with blankets whenever possible.
- Keep the interior of the ambulance as hot as possible. In particular, whenever feasible heat the interior of the ambulance before the patient is placed inside. This warms the physical environment, for example the stretcher, which acts as a 'heat sink' when cold.
- Utilise additional heating pads if available.
- Ambient temperature IV fluid contributes to hypothermia. Whenever possible IV fluid should be warmed using a dedicated warming device. These may be available (for example via an air ambulance service) and should be requested whenever feasible.
- Do not warm IV fluid in microwaves because this can result in unreliable fluid temperatures and/or may damage the plastic bag.
- Foil blankets are not useful for the majority of patients. Once in the ambulance, a hot environment is the most important factor and the presence of a foil blanket may be counterproductive as it reduces the amount of heat absorbed by the patient.

## **Bleeding from wounds**

- The best method of controlling external bleeding is firm, sustained and direct pressure over the bleeding point.
- If severe bleeding is present, the bleeding should be controlled by direct pressure before a dressing and/or bandage is applied.
- There is no benefit in raising a bleeding limb unless the bleeding is clearly venous and coming from near the hand or foot.

- If clinically significant external bleeding continues despite direct pressure and the wound is unsuitable for tourniquet application, consider the use of topical adrenaline:
  - Dilute adrenaline to ten times the volume (to 1:10,000) using 0.9% of sodium chloride. For example, dilute 2 mg of adrenaline to a total of 20 ml or dilute 5 mg of adrenaline to a total of 50 ml.
  - Flood the wound with this solution and continue to provide direct pressure.
  - If there is a significant wound cavity, pack the cavity with gauze soaked in 1:10,000 adrenaline solution and provide direct pressure over the cavity.

### **Penetrating objects**

- Penetrating objects should usually be removed from a limb as this will allow direct pressure to be applied. Clinical judgement should be used if the object is large (for example a knife) or appears to be near an artery.
- Do not remove penetrating objects from the head or truncal area (neck, axillae, chest, abdomen, pelvis or groin) because severe bleeding may occur that cannot be compressed.
- Provide pressure directly around the object if severe bleeding is present and it is not removed.





## 4.7 Hypovolaemia from controlled bleeding

This section is for hypovolaemia from:

- a) Blunt trauma, or
  - b) Peripheral blood loss that has been controlled, or
  - c) Gastrointestinal bleeding, or
  - d) Bleeding from another cause that does not clearly fit into another section.
- Keep the patient warm.
  - Gain IV access.
  - Administer 0.9% sodium chloride IV if the patient has signs of hypovolaemia or poor perfusion:
    - a) 500 ml IV for an adult.
    - b) 10 ml/kg IV for a child.
    - c) Repeat as required.
  - Administer tranexamic acid if IV fluid is administered for signs of hypovolaemia or poor perfusion, provided the patient cannot be enrolled in the PATCH study:
    - a) 1 g of tranexamic acid IV for an adult.
    - b) See the paediatric drug dose tables for a child.
  - Arrange for blood to be administered if shock is severe and there is an established protocol for this in the area.
  - Immobilise fractures. In particular, firmly splint the pelvis and tie the knees together if shock is associated with a possible pelvic fracture.

### Backup

- Backup from a Paramedic or PRIME responder must be requested if the patient has signs of hypovolaemia.
- Backup from an ICP must be requested if the patient has severe shock.

### Referral and transport

- The patient must be given a clear recommendation to be transported to an ED by ambulance if there are signs of hypovolaemia or poor perfusion.
- Transport a patient with trauma and shock direct to a major trauma hospital whenever this is feasible and safe.

## Additional information

### General principles

- Blood pressure alone is a poor guide to the severity of hypovolaemia and a poor guide to fluid therapy.
- Fluid therapy should be administered if there are signs of hypovolaemia even if the patient is not hypotensive.
- Fluid therapy should be titrated to signs of intravascular volume and perfusion. The trend of all of the following signs is an important guide to treatment:
  - Heart rate.
  - Pulse strength (noting that the absence of a palpable pulse does not equate to a specific blood pressure).
  - Capillary refill time.
  - Pulse pressure.
  - Blood pressure.
  - Level of consciousness.
- Some patients may not become tachycardic despite significant hypovolaemia. Examples include:
  - Patients taking beta-blockers.
  - End stage hypovolaemic shock with a falling heart rate.
  - Ectopic pregnancy (dilatation of the fallopian tube may cause vagal stimulation).
  - Miscarriage (dilatation of the cervix may cause vagal stimulation).
- Bleeding from solid organs (for example lung, liver, spleen or kidney) following trauma has a pattern of bleeding that is usually relatively controlled. For this reason, blood loss from such organs is treated using this section.

### Temperature

- It is important to keep the patient warm because hypothermia worsens bleeding by contributing to coagulopathy.
- Remove wet clothing and dry the patient as soon as possible.
- Keep the patient covered with blankets whenever possible.
- Keep the interior of the ambulance as hot as possible. In particular, whenever feasible heat the interior of the ambulance before the patient is placed inside. This warms the physical environment, for example the stretcher, which acts as a 'heat sink' when cold.
- Utilise additional heating pads if available.
- Ambient temperature IV fluid contributes to hypothermia. Whenever possible IV fluid should be warmed using a dedicated warming device. These may be available (for example via an air ambulance service) and should be requested whenever feasible.

- Do not warm IV fluid in microwaves because this can result in unreliable fluid temperatures and/or may damage the plastic bag.
- Foil blankets are not useful for the majority of patients. Once in the ambulance, a hot environment is the most important factor and the presence of a foil blanket may be counterproductive as it reduces the amount of heat absorbed by the patient.

### **Tranexamic acid**

- The role of tranexamic acid is controversial. It reduces bleeding, but it is not yet clear that it improves outcomes.
- If the patient can be enrolled in the PATCH trial then this must occur and 'open label' tranexamic acid (tranexamic acid from ambulance kits) must not be administered.
- The administration of tranexamic acid is not a priority if the patient cannot be enrolled in the PATCH trial, but should occur with the first dose of 0.9% sodium chloride.

### **Shock following blunt trauma**

- Shock following blunt trauma is usually caused by blood loss, but it is important to exclude tension pneumothorax.
- Occasionally shock following blunt trauma is caused by spinal cord injury, resulting in loss of sympathetic tone to peripheral blood vessels and/or the heart. See the 'spinal cord injury' section.
- When splinting a possibly fractured pelvis:
  - Do not spring the pelvis looking for instability.
  - It is difficult to determine that a pelvis is fractured by clinical examination. Assume that the pelvis is fractured if the patient has pain in the pelvic area, or is unable to report pain and has a suitable mechanism of injury.
  - Remove clothing prior to placing a splint whenever possible.
  - Firmly splint the pelvis using a transfer/lifting belt, a Sager strap/band or a specifically supplied pelvic splint.
  - The splint should be centred over the pubic bone (the base of the pubic hair area in an adult) and applied firmly. It should feel like a firmly fitting belt.
  - Do not use a sheet to wrap the pelvis unless this is the only option because a sheet can rarely be applied firmly enough.
  - Apply a pelvic splint prior to extrication if the patient appears severely injured and application is feasible. If it is not feasible to apply a splint prior to extrication, consider tying the patient's legs together and placing a splint on the stretcher, so the splint can be immediately applied after extrication.

## Blood

- Only call for blood if there is an established protocol in the area for blood to be delivered to the scene.
- Blood should be requested early if shock is severe.

## Bleeding from wounds

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



## 4.8 Hypovolaemia from fluid loss

This section is for hypovolaemia from fluid loss that does not clearly fit into another section, for example, from diarrhoea and vomiting.

- Gain IV access.
- Administer 0.9% sodium chloride IV if the patient has signs of hypovolaemia or poor perfusion:
  - a) 1 litre for an adult.
  - b) 20 ml/kg for a child.
  - c) Repeat as required.

### Backup

- Backup from a Paramedic or PRIME responder should be requested if the patient has signs of hypovolaemia or poor perfusion.
- Backup from an ICP should be requested if the patient has severe shock.

### Referral and transport

- The patient must be given a clear recommendation to be transported to an ED by ambulance if 0.9% sodium chloride IV is administered.
- Transport the patient to a hospital with intensive care facilities if shock is severe, whenever this is feasible and safe.

## Additional information

### General principles

- Blood pressure alone is a poor guide to the severity of hypovolaemia and a poor guide to fluid therapy.
- Fluid therapy should be administered if there are signs of hypovolaemia even if the patient is not hypotensive.
- Fluid therapy should be titrated to signs of intravascular volume and perfusion. The trend of all the following signs is an important guide to treatment:
  - Heart rate.
  - Pulse strength, noting that the absence of a palpable pulse does not equate to a specific blood pressure.
  - Capillary refill time.
  - Pulse pressure.
  - Blood pressure.
  - Level of consciousness.
- Some patients may not become tachycardic despite significant hypovolaemia, for example, patients taking beta-blockers.

## 4.9 Concussion and minor traumatic brain injury

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

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

### Referral and advice

- Assess the patient, including an assessment of the features contained within the flag table:
  - a) If one or more red flags are present the patient must be given a clear recommendation to be assessed by a doctor within two hours and should usually be given a clear recommendation to be transported to ED by ambulance.
  - b) If any orange flags are present (and no red flags) the patient should be given a clear recommendation to be seen in primary care (preferably by their own GP) within 48 hours. Clearly recommend the patient immediately stops activity/sport that might result in further brain injury.
  - c) If green flags are present (and no orange or red flags) the patient is usually suitable to be given a clear recommendation to continue with activity/sport. Clearly recommend the patient is seen in primary care (preferably by their own GP) if they develop symptoms of concussion. The patient may be administered paracetamol and/or ibuprofen if indicated.
  - d) Follow a local pathway if one is in place.



#### Red flags

- Loss of consciousness with the injury.
- Abnormal GCS.
- Seizure following the injury.
- Concussion is present and the patient is taking an anticoagulant or has a known bleeding disorder.
- Severe signs or symptoms of concussion are present.



### Orange flags - should be seen in primary care within 48 hours

- Headache.
- Nausea or vomiting.
- Amnesia or abnormal short term memory.
- Feeling groggy or hazy.
- Disorientated or has reduced attention.
- Abnormal coordination.
- Abnormal balance.
- Recent concussion episode.



### Green flags

- No signs or symptoms of concussion.

- Have a low threshold for recommending transport to an ED if the patient is taking an anticoagulant, has a bleeding disorder, or is elderly.
- If there are no signs or symptoms of concussion, the patient may be given a recommendation to continue with activity. Clinical judgement is required that takes into consideration the nature of the injury, because the onset of signs or symptoms of concussion may sometimes be delayed.
- The patient (or their guardian) and any accompanying adults must be given the concussion information sheet, along with an explanation of the advice within it, if transport by ambulance to a medical facility does not occur and any of the following are present:
  - a) There are signs or symptoms of concussion, or
  - b) The patient is thought to have had a significant injury, or
  - c) The patient is competent and refusing transport by ambulance, or
  - d) The patient is taking an anticoagulant or has a bleeding disorder.

## Additional information

### General principles

- If the patient has had loss of consciousness or has an abnormal GCS, they should receive a clear recommendation to be transported to an ED by ambulance because further assessment and observation is required in case subsequent intracranial bleeding develops.
- Clinical judgement is required when determining the patient has had loss of consciousness from the history given by bystanders. It is common for the patient to appear to be stunned for several seconds after a minor TBI and this is often reported by bystanders as being knocked out. This is not considered loss of consciousness unless there is a clear history of the patient being unconscious for a period of time that is in excess of a few seconds.

- The concussion assessment may be used for a child provided they are old enough to cooperate with having a history taken and being examined.
- The threshold for recommending transport to an ED must be lowered if the patient has alcohol and/or drug intoxication.

### **Referral and transport**

- Clinical judgement is required when determining whether a patient with one or more red flags is given a recommendation to be transported to an ED by ambulance, or to be seen in primary care.
  - Most patients should receive a recommendation to be transported to an ED by ambulance, particularly if the patient is living independently.
  - Being seen in primary care may be the best option if the patient is in an aged residential care facility, is very frail or has dementia.
- If the patient is being referred to primary care:
  - The patient’s anticipated clinical needs must be able to be safely met in primary care, and
  - A nurse or doctor within primary care must be contacted directly by ambulance personnel, and
  - A nurse or doctor must agree to see the patient, and
  - Safe transport (if required) must be available.

### **Concussion**

- Concussion is a form of TBI where no detectable injury is present on CT brain imaging, but the patient has signs or symptoms of altered brain function.
- Concussion can occur without loss of consciousness.
- The associated symptoms are often significant and may impair brain function for many months.
- Concussion is most often thought of as being associated with contact sports, but also commonly occurs with assaults, falls and minor road traffic crashes.
- Repeated concussion can have long-term effects and this is why medical assessment is required prior to resuming activities that risk further concussion.

### **Patients taking an anticoagulant or with a bleeding disorder**

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



## **The elderly**

- The elderly are at increased risk of intracranial bleeding, particularly subdural bleeding, following minor brain injury.
- Cerebral atrophy expands the subdural space and exposes cerebral bridging veins to an increased risk of rupture, even with minor injury such as a fall where the patient appears to be uninjured.
- Subdural bleeding may occur slowly over many days and the patient may present with subtle signs and/or symptoms such as a slight reduction in cognitive function.
- The elderly may not recognise the signs and/or symptoms of a brain injury, may not seek clinical help in a timely manner and are at increased risk of falling following a minor brain injury.
- There is no specific age at which a patient can be considered to be 'elderly' and clinical judgement is required. The risk of a subdural haemorrhage increases over the age of 65 years and the risk is increased further if the patient is frail.

## **Assessing short term memory**

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

## **Romberg's test**

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

## **The finger-nose test**

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

## 4.10 Severe traumatic brain injury

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

- Routinely administer oxygen.
- Ensure an open airway and adequate ventilation.
- Measure the blood glucose concentration and treat accordingly.
- Gain IV access.
- Administer 0.9% sodium chloride IV if there are signs of hypovolaemia or poor perfusion, or the systolic blood pressure is less than 120 mmHg in an adult, or less than the normal predicted systolic blood pressure in a child:
  - a) 1 litre for an adult.
  - b) 20 ml/kg for a child.
  - c) Administer one further bolus if required.
- Administer metaraminol IV in addition to 0.9% sodium chloride, if the systolic blood pressure is less than 120 mmHg in an adult, or less than the normal predicted systolic blood pressure in a child.

### **Metaraminol for an adult:**

- a) Administer via an infusion pump:
  - Administer an initial bolus of 0.5-1 mg metaraminol IV.
  - Start the infusion at 2 mg/hour and adjust the rate as required.
- b) Alternatively, administer a bolus of 0.5-1 mg metaraminol IV every 5-10 minutes as required.

### **Metaraminol for a child:**

- Administer a bolus of metaraminol IV (see the paediatric drug dose tables) every 5-10 minutes as required.
- Intubate using RSI if the patient has a GCS less than 10 with clinically significant compromise of their airway or ventilation. See the 'rapid sequence intubation' section.

## **Backup**

- Backup from an ICP or doctor able to perform RSI should be requested if the patient has:
  - A GCS less than or equal to 10, and
  - Clinically significant compromise of airway or ventilation.

## Referral and transport

- Transport the patient to a major trauma hospital whenever this is feasible and safe. See the 'major trauma triage' section.
- Transport the patient direct to a major trauma hospital with neurosurgical facilities whenever this is feasible and safe, if any of the following are present:
  - Intubated and ventilated.
  - Lateralising neurological signs.
  - Clinically obvious penetrating brain injury.

## Additional information

### General principles

- The goal of treating a patient with severe TBI is to:
  - Recognise severe TBI, and
  - Minimise or prevent secondary brain injury, and
  - Treat other life-threatening injuries if present, and
  - Transport the patient to the most appropriate major trauma hospital whenever this is feasible and safe.
- Secondary brain injury occurs when a further physiological insult occurs to the brain after the primary (initial) injury. Secondary brain injury increases mortality and worsens neurological recovery in survivors. Common causes of secondary brain injury include:
  - Hypoxia.
  - Hyperventilation.
  - Hypoventilation.
  - Hypotension.
- A patient with alcohol or drug intoxication who cannot obey commands following trauma should be presumed to have severe TBI until proven otherwise, even if it is highly suspected that alcohol or drug intoxication is the cause of the patient's altered level of consciousness.
- Hypoglycaemia can mimic severe TBI. A blood glucose concentration should always be measured.
- A brief seizure following severe TBI may occur, particularly in a child. These do not usually require treatment with medicines, but repeated or prolonged seizures should be treated using the 'seizures' section.
- Sedation increases the risk of secondary brain injury and must be avoided unless the patient's level of agitation is such that treatment and/or transport cannot be provided safely. If sedation is required, the preferred medicine is ketamine. See the 'agitated delirium' section.

## **Airway, oxygenation and ventilation**

- Oxygen is routinely administered to a patient with severe TBI to help prevent hypoxia, even if their SpO<sub>2</sub> is greater than or equal to 94%. The choice of administration device and flow rate is a pragmatic one, but for most patients a simple mask at 6 litres/minute is appropriate.
- Although there is a risk the patient may have a basal skull fracture, placement of a nasopharyngeal airway is not contraindicated if this is required to maintain an open airway, for example if there is trismus.
- Intubation without RSI may worsen outcomes by increasing secondary brain injury and increasing intracranial pressure. This is why intubation without RSI is restricted to patients with a GCS of 3 and ineffective breathing.
- Capnography is compulsory for all intubated patients. The target ETCO<sub>2</sub> for patients ventilated via an endotracheal tube is 30-35 mmHg. This is intended to ensure that arterial CO<sub>2</sub> levels are at the lower end of normal. See the 'intubation and ventilation' section.
- Do not hyperventilate a patient with TBI. Hyperventilation worsens the patient's outcome by causing cerebral vasoconstriction which decreases cerebral blood flow.

## **Cerebral blood flow and blood pressure**

- Cerebral blood flow is dependent on the cerebral perfusion pressure (CPP).
- CPP is determined by the mean arterial pressure (MAP) and the intracranial pressure (ICP) as per the formula:  $CPP = MAP - ICP$ .
- A reduction in CPP leads to cerebral ischaemia which worsens outcome in patients with severe TBI.
- ICP is commonly raised in patients with severe TBI and this is why maintaining a normal systolic blood pressure is important.

## **Skull fractures**

- The presence or absence of a skull fracture does not correlate with the severity of brain injury and significant time should not be spent assessing for the presence of a skull fracture.
- A skull fracture may be present without brain injury and severe brain injury may be present without a skull fracture.
- Most skull fractures cannot be diagnosed clinically and require imaging, for example a CT scan.
- Even if a compound skull fracture is clearly present, in the absence of severe TBI neurosurgery is not required urgently.
- Cerebrospinal fluid (CSF) may leak from the nose or ear following a basal skull fracture. The presence of a suspected CSF leak is not an indication for transport to a hospital with neurosurgical facilities as neurosurgery (if indicated) is usually scheduled months after the injury.

## Hospital destination and the possible need for neurosurgery

- Most patients with severe TBI do not require urgent neurosurgery. However, patients with any of the following clinical features have a high probability of requiring urgent neurosurgery and/or neuro-intensive care and should be transported to a major trauma hospital with neurosurgical facilities, whenever this is feasible and safe:
  - Intubated and ventilated. These patients usually require neuro-intensive care and may require urgent neurosurgery.
  - Lateralising neurological signs, for example unilateral pupil dilatation or unilateral weakness. These patients usually require urgent neurosurgery for extradural or subdural bleeding.
  - Clinically obvious penetrating brain injury. These patients usually require neurosurgery.
- The hospitals in New Zealand with neurosurgical facilities are:
  - Starship Hospital.
  - Auckland City Hospital.
  - Waikato Hospital.
  - Wellington Hospital.
  - Christchurch Hospital.
  - Dunedin Hospital.



## 4.11 Limb and/or soft tissue injuries

- Assess for the presence of fracture(s) and/or joint dislocation(s).
- Provide analgesia as per the 'analgesia' section.
- Fractures with significant displacement should be realigned as soon as possible, particularly if there is impaired perfusion or sensation distal to the injury, and this should occur out-of-hospital whenever this is feasible and safe.
- Consider relocating a dislocated joint. See the relevant section.

### Backup

- Backup from a Paramedic or PRIME responder should be requested if the patient has significant pain.
- Backup from an ICP should be requested if the patient is likely to require sedation or ketamine for dissociation.

### Referral and transport

- Transport the patient to a hospital with orthopaedic surgical facilities whenever this is feasible and safe, if the patient has any of the following:
  - a) A clearly obvious fracture of the shaft of the femur or tibia, or
  - b) A clearly obvious fracture of the neck of femur, or
  - c) A clearly obvious compound fracture, except those isolated to the tip of a digit, or
  - d) A dislocated or severely deformed wrist, elbow, knee or ankle joint, even if this has been relocated/realigned. See the 'other dislocations' section.
- The patient requires follow up with their GP if a dislocated shoulder is relocated. See the 'shoulder dislocation' section.
- The patient requires a non-urgent x-ray (usually in primary care) if a dislocated digit is relocated. See the 'digit dislocation' section.
- The patient requires assessment (usually in primary care) if a patella has been relocated and this is the first time it has been dislocated. See the 'patella dislocation' section.

## Additional information

### General principles

- A dislocated joint should be relocated/realigned as soon as possible because this will relieve pain, and the longer the joint is dislocated the higher is the risk that damage will be done to nerves, blood vessels and ligaments.
- The same principle applies to significantly displaced fractures which should be realigned as soon as possible. 'Significantly' cannot be tightly defined and requires clinical judgement.

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

## **Compound fractures**

- There is usually no role for prophylactic administration of intravenous antibiotics in the out-of-hospital setting. However, personnel should seek clinical advice if transport time is going to be greater than two hours.
- There is usually no significant role for irrigating a compound fracture in the out-of-hospital setting, as thorough irrigation, cleaning and/or debridement is required under anaesthesia.

- If the fracture is grossly contaminated, for example by grass or dirt, it is appropriate to irrigate the wound prior to placing a dressing, provided this does not significantly delay commencing transport. 0.9% sodium chloride is preferred, but water may be used provided it is clean. Several litres of fluid are usually required:
  - Use one litre bags of 0.9% sodium chloride with the corner cut from the bag, or
  - Use 0.9% sodium chloride placed in a clean jug/bowl, or
  - Use clean running water from a hose or clean jug/bowl.

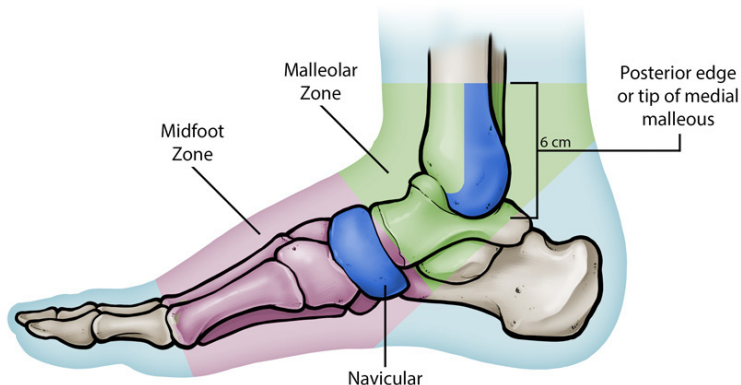
### **Providing sedation**

- If midazolam or ketamine is being administered:
  - Routinely administer oxygen and task one person to continually monitor the patient's SpO<sub>2</sub>, breathing and level of consciousness.
  - Have a manual ventilation bag and mask immediately available.
  - During midazolam administration the patient must be able to obey commands at all times.
  - During ketamine administration the aim is to achieve a dissociated state. This usually requires approximately 1 mg/kg of ketamine IV, up to a maximum of 100 mg.

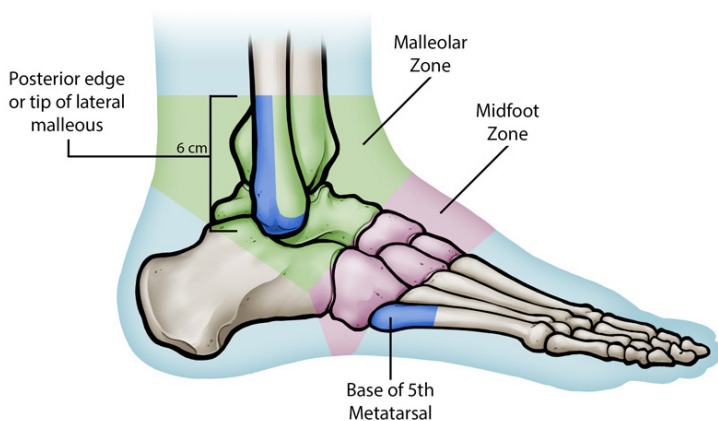
### **Ankle or foot injury and deciding if an x-ray is required**

- A patient should receive a recommendation to have an x-ray following an ankle or foot injury if any of the following from the Ottawa ankle/foot rules are present:
  - Bony tenderness along the distal 6 cm of the posterior edge of the tibia or tip of the medial malleolus.
  - Bony tenderness along the distal 6 cm of the posterior edge of the fibula or tip of the lateral malleolus.
  - Bony tenderness at the base of the 5<sup>th</sup> metatarsal.
  - Bony tenderness over the navicular bone.
  - Inability to weight bear for four steps, both immediately and when being assessed.
- Recommend an x-ray is not required if none of the clinical features above are present. Provide advice on pain relief and to seek further assessment in primary care if not improving over the next few days. Reassure the patient that even if a fracture is present, surgical repair (if indicated) is not urgent.
- Recommend an x-ray is required if any of the clinical features above are present. In the absence of severe pain and/or obvious displacement, most patients will be suitable to have an x-ray in primary care and most will not require transport by ambulance.
- The Ottawa ankle/foot rules may be used in a child, provided the child is old enough to cooperate with examination.





**Ottawa ankle/foot rules - medial view**

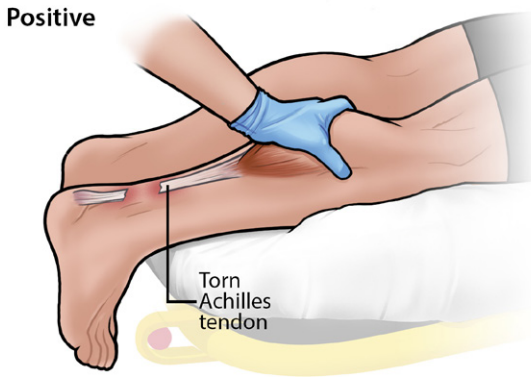


**Ottawa ankle/foot rules - lateral view**

### **Assessing for possible rupture of the Achilles tendon**

- Rupture of the Achilles tendon usually occurs during exercise, is usually associated with sudden onset of sharp pain behind the ankle and the patient may have felt a 'pop'. The pain associated with a complete rupture may not be severe.
- The ability to plantar flex (push down) the foot does not rule out a ruptured Achilles tendon.
- A gap may be visible or felt in the Achilles tendon with complete rupture, but lack of a gap does not rule out rupture.

- Perform a calf squeeze test:
  - Ask the patient to lie face down on a stretcher or bed, with their feet hanging off the end, and to relax.
  - Squeeze the unaffected calf muscle and observe the foot to plantar flex.
  - Squeeze the affected calf muscle and if the foot does not plantar flex the Achilles tendon is ruptured.
- Recommend the patient is seen by a specialist (for example a sports physician or orthopaedic specialist) to discuss operative versus non-operative management, if there are signs the tendon is ruptured. Provide advice on rest and pain relief as for soft tissue injury.
- Provide advice on rest and pain relief as for soft tissue injury if the Achilles tendon is not ruptured, and advise the patient to see a doctor or physiotherapist if not improving.



**Calf squeeze test**

## Soft tissue injury

- Most soft tissue injuries (sprains, strains, swelling and bruising) will improve regardless of the treatment provided. There are many opinions among health professionals on the treatment of soft tissue injury and there is no good evidence that any treatments significantly improve outcomes or significantly speed recovery.
- RICE (rest, ice, compression and elevation) treatment is commonly promoted for soft tissue injury and is a reasonable approach. Many references advise that heat and alcohol should be avoided but there is no good evidence to support this.
  - **Rest** is recommended for a day or two. After this, gentle mobilisation should occur provided this is not associated with worsening of symptoms. Prolonged rest delays recovery and increases loss of function. Recommend the patient regularly moves the affected area, for example gentle flexion and extension of the joint, and movement of fingers and toes.
  - **Ice** is recommended for significant pain. Ice (or a cold pack) should be applied for approximately 20 minutes and may be repeated approximately hourly. Do not apply ice or a cold pack directly to the skin as this may cause skin injury.
  - **Compression** is recommended for significant bruising or swelling, in the same way that we compress external bleeding.
  - **Elevation** is recommended for significant swelling for the first day or two, but should not interfere with gentle mobilisation and exercises as above.
- Patients who have significant loss of function or severe pain should be referred for further assessment, usually in primary care.
- Provide advice on analgesia. For example, paracetamol and/or an anti-inflammatory may be taken following the package instructions.
- Provide advice to see a health professional if symptoms are not improving within a few days, or earlier if symptoms are worsening.



## 4.12 Patella dislocation

- An attempt to relocate a dislocated patella should usually occur.
- Consider administering fentanyl IV.
- Consider administering methoxyflurane if fentanyl is unable to be administered.
- Grasp the patella and push it medially (inwards) while simultaneously straightening the knee.

### Backup

- Backup from a Paramedic or PRIME responder should be requested if the patient has significant pain.

### Referral and transport

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



## 4.13 Shoulder dislocation

- An attempt to relocate a dislocated shoulder may occur provided:
  - a) The patient has had a previous dislocation of the same joint, and
  - b) The shoulder is dislocated anteriorly, and
  - c) There is no clear evidence of acromioclavicular joint dislocation, and
  - d) There is no clear evidence of a fracture involving the humerus, and
  - e) The dislocation is a result of malpositioning and/or a relatively minor force.
- To attempt relocation of a dislocated shoulder:
  - a) Administer fentanyl IV.
  - b) Administer low dose midazolam IV if required, provided the patient can obey commands at all times.
  - c) Use either the Stimson or modified Kocher's technique.
  - d) A maximum of two attempts may be made.
  - e) Place the arm in a sling post relocation.
- Place the arm in the most comfortable position if relocation does not occur.

### Backup

- Backup from a Paramedic or PRIME responder should be requested if the patient has significant pain.
- Backup from an ICP should be requested if the patient is likely to require sedation or ketamine for dissociation.

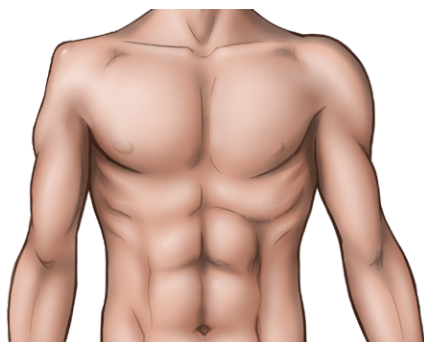
### Referral and transport

- The patient must receive a clear recommendation to be seen in an ED or in primary care if the shoulder does not relocate. Many primary care providers will not attempt to relocate a dislocated shoulder, and transport to primary care should only occur if staff at the facility have been contacted prior to commencing transport, and have agreed to see the patient.
- If the shoulder relocates:
  - a) Place the arm in a sling.
  - b) Recommend the patient keeps their arm in a sling, avoids using the arm unnecessarily, and sees their GP within 48 hours.
  - c) Provide advice on taking analgesia. Regular paracetamol and/or an anti-inflammatory (following advice on the packet instructions) is usually appropriate.
- A patient administered fentanyl and/or midazolam may be given a recommendation not to be transported to ED provided the patient:
  - a) Has a GCS of 15, and
  - b) Is in the care of a competent adult, and
  - c) Is instructed not to drive a vehicle or operate machinery for at least 24 hours.

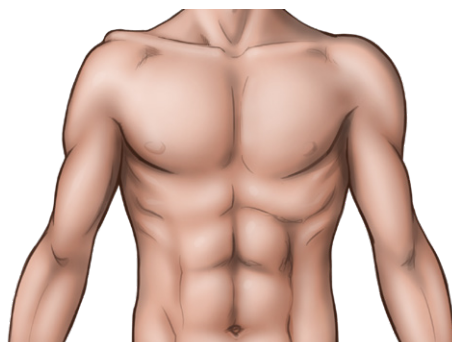
## Additional information

### General principles

- The shoulder joint is rendered relatively unstable by a shallow cup (the glenoid fossa) with reliance on muscles, ligaments and tendons for stability.
- Approximately 95% of dislocations are anterior. This typically produces a squared shoulder appearance.
- The shoulder must be examined to ensure that the deformity relates to the shoulder joint and not the acromioclavicular joint situated at the outer end of the clavicle.
- Shoulder relocation is usually indicated by:
  - A palpable or audible clunk, and
  - Relief of pain, and
  - Return of a normal shoulder shape, and
  - Return of normal (or near normal) motion of the shoulder joint.



**Squared shoulder appearance**



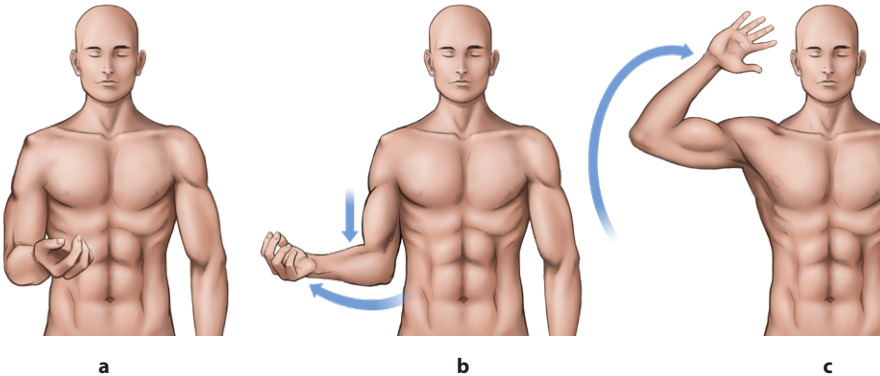
**Acromioclavicular joint dislocation**

- Complications are mainly associated with relocation of first dislocations, and dislocations that are associated with fractures or significant trauma.
  - It is not possible to define ‘significant trauma’ and clinical judgement is required.
  - The complications include displacing a fracture sustained at the time of injury or causing a fracture during relocation. This is the reason for only attempting relocation if the patient has an anterior dislocation of the shoulder in the setting of previous dislocation.
- Relaxation of muscles is one of the most important aspects of relocation. This requires reassurance, analgesia, sustained traction and patience.
- The shoulder should relocate with sustained traction and no force should be used during the manoeuvres described.

- Multiple techniques have been described for relocating a dislocated shoulder.
  - Most of them rely on adequate muscle relaxation and sustained traction.
  - If the patient has previously experienced successful relocation using a specific technique, it is acceptable to try this technique even if it is not one of the techniques described here.
  - If the first technique is not successful, do not attempt an alternative technique.

### The modified Kocher's technique

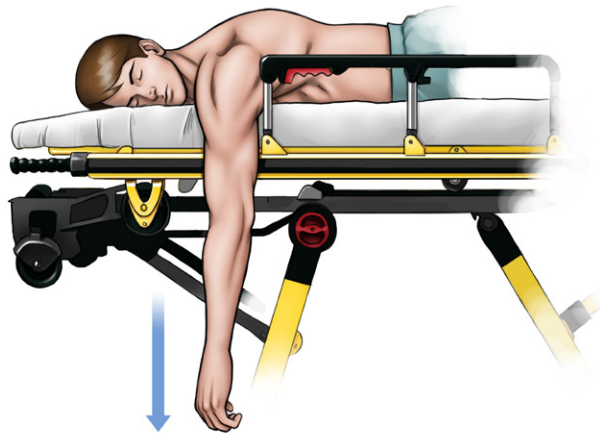
- Position the patient supine or sitting, with the arm by their side.
  - a) Bend the elbow to 90°.
  - b) Apply traction to the humerus and slowly externally rotate the arm until resistance is felt (usually approximately 45°).
  - c) Slowly abduct the arm, as if to scratch the back of the head with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



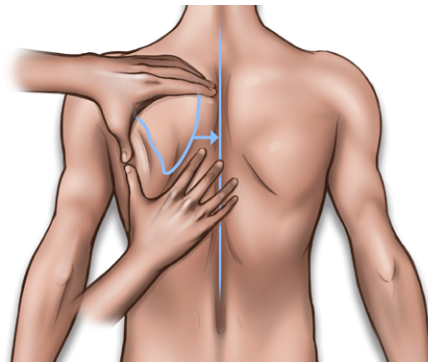
### The Stimson technique

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





**Stimson technique**



**Scapular rotation**

## **Providing sedation**

- If midazolam or ketamine is being administered:
  - Routinely administer oxygen and task one person to continually monitor the patient's SpO<sub>2</sub>, breathing and level of consciousness.
  - Have a manual ventilation bag and mask immediately available.
  - During midazolam administration the patient must be able to obey commands at all times.
  - During ketamine administration the aim is to achieve a dissociated state. This usually requires approximately 1 mg/kg of ketamine IV, up to a maximum of 100 mg.

## 4.14 Digit dislocation

- An attempt to relocate a dislocated digit (finger or toe) joint should usually occur.
- Examine and record the presence of sensation.
- Administer a digital ring block.
- Consider administering methoxyflurane but this is not usually required.
- Apply longitudinal traction until relocation occurs.
- Splint the digit post relocation.

### Backup

- Backup from a Paramedic or PRIME responder should be requested if the patient has significant pain.

### Referral and transport

- If the digit does not relocate, the patient must receive a clear recommendation to be seen in an ED or in primary care (preferably by their own GP), as soon as possible.
- If the digit relocates:
  - Splint the digit to the adjacent digits.
  - An x-ray is always required as there is a high association with fracture. This is non-urgent, and may occur within 24 hours provided there are no signs of a compound fracture, and the digit is aligned with normal distal perfusion.



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## 4.15 Other dislocations

This section is for dislocations of the wrist, elbow, knee, ankle or hip joint.

- An attempt to relocate/realign a dislocated or severely deformed wrist, elbow, knee or ankle joint should usually occur, particularly when there is impaired sensation or perfusion distal to the injury, unless time to hospital is less than 15 minutes.
  - a) Administer ketamine IV to achieve dissociation.
  - b) Provide sustained longitudinal traction of the limb with an assistant providing counter-traction above the injury site.
  - c) Splint the joint post relocation/realignment.
  - d) Place the limb in the most comfortable position if relocation/realignment does not occur.
- Do not attempt to relocate a dislocated hip without seeking clinical advice.

### Backup

- Backup from a Paramedic or PRIME responder should be requested if the patient has significant pain.
- Backup from an ICP should be requested if the patient is likely to require sedation or ketamine for dissociation.

### Referral and transport

- Transport the patient to a hospital with orthopaedic surgical facilities whenever this is feasible and safe, even if the joint has been relocated/realigned, because surgery is usually required.

## Additional information

### Wrist dislocation

- Wrist deformity is normally caused by a fracture rather than dislocation alone, but the out-of-hospital approach to both is the same.
- The wrist should be relocated/realigned urgently because it may be associated with damage to arteries or nerves.
- If relocation/realignment is indicated because of distal ischaemia but is not achieved, applying longitudinal traction is the best method for restoring circulation, if this is feasible.

## **Elbow dislocation**

- A dislocated elbow is an emergency because it may be associated with damage to the brachial artery or associated nerves.
- The elbow should be relocated/realigned urgently noting that relocation may be difficult because deep sedation is usually required.
- If relocation is indicated because of distal ischaemia but is not achieved, applying longitudinal traction is the best method for restoring circulation, if this is feasible.

## **Ankle dislocation**

- Dislocation may involve the subtalar joint or the ankle joint itself. The clinical appearance is similar for both types.
- Ankle dislocation is frequently accompanied by fractures. The presence or absence of fractures, including compound fractures, does not alter the need to relocate/realign the ankle if clinically indicated, and the technique is the same.
- Relocation will often correct with a 'clunk'. Dislocations with fractures may produce a grating sensation with no clear end point. If this occurs continue applying traction until normal alignment is achieved.
- If relocation occurs, splint the ankle and transport to an ED as an urgent x-ray is always required.
- If the ankle does not relocate, splint the ankle to reduce deformity as much as possible.

## **Knee dislocation**

- A dislocated knee is an emergency because it may be associated with damage to the popliteal artery or peroneal nerve.
- The knee should be relocated/realigned urgently noting that relocation may be difficult because deep sedation is usually required.
- If relocation is indicated because of distal ischaemia but is not achieved, applying longitudinal traction is the best method for restoring circulation, if this is feasible.

## **Hip dislocation**

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

## Providing sedation

- If midazolam or ketamine is being administered:
  - Routinely administer oxygen and task one person to continually monitor the patient's SpO<sub>2</sub>, breathing and level of consciousness.
  - Have a manual ventilation bag and mask immediately available.
  - During midazolam administration the patient must be able to obey commands at all times.
  - During ketamine administration the aim is to achieve a dissociated state. This usually requires approximately 1 mg/kg of ketamine IV, up to a maximum of 100 mg.



## 4.16 Spinal cord injury

This section is for patients with clinically significant signs and/or symptoms of acute spinal cord injury following trauma.

- Assess for the presence of other major injuries.
- Ensure the patient is appropriately immobilised, positioned, protected from pressure injury and kept warm.
- Gain IV access.
- Administer 0.9% sodium chloride IV if there are signs of hypovolaemia or poor perfusion, or the systolic blood pressure is less than 120 mmHg in an adult, or less than the normal predicted systolic blood pressure in a child:
  - a) 1 litre for an adult.
  - b) 20 ml/kg for a child.
  - c) Administer one further bolus if required.
- Administer metaraminol IV in addition to 0.9% sodium chloride, if the systolic blood pressure is less than 120 mmHg in an adult, or less than the normal predicted systolic blood pressure in a child.

### **Metaraminol for an adult:**

- a) Administer via an infusion pump:
  - Administer an initial bolus of 0.5-1 mg metaraminol IV.
  - Start the infusion at 2 mg/hour and adjust the rate as required.
- b) Alternatively, administer a bolus of 0.5-1 mg metaraminol IV every 5-10 minutes as required.

### **Metaraminol for a child:**

- Administer a bolus of metaraminol IV (see the paediatric drug dose tables) every 5-10 minutes as required.
- Consider administering adrenaline IV if the blood pressure is unresponsive to metaraminol or the patient is hypotensive and bradycardic.

### **Adrenaline for an adult:**

- a) Administer an adrenaline infusion via an infusion pump. Start at a rate of 0.5 mg/hour and adjust the rate as required, or
- b) Place 1 mg of adrenaline into a 1 litre bag of 0.9% sodium chloride (1:1,000,000 solution):
  - Administer as an infusion. Start at 2 drops/second and adjust the rate as required, or
  - Administer a bolus of 0.01 mg adrenaline (10 ml) IV every 1-2 minutes as required.

### **Adrenaline for a child aged 5-14 years:**

- a) Administer an adrenaline infusion via an infusion pump. Start at a rate of 0.25 mg/hour and adjust the rate as required, or
- b) Place 1 mg of adrenaline into a 1 litre bag of 0.9% sodium chloride (1:1,000,000 solution):
  - Administer as an infusion. Start at 1 drop/second and adjust the rate as required, or
  - Administer IV boluses (see the paediatric drug dose tables) every 1-2 minutes as required.

### **Adrenaline for a child aged less than five years:**

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

## **Referral and transport**

- Transport the patient direct to a spinal cord impairment (SCI) centre whenever this is feasible and safe.
- The SCI centres have the following catchment areas:
  - Middlemore Hospital: adults in the upper two-thirds of the North Island.
  - Christchurch Hospital: adults in the lower third of the North Island and in the South Island.
  - Starship Hospital: children in the North Island.
  - Christchurch Hospital: children in the South Island.
- The patient should be transported to a SCI centre if there are other signs of major trauma in addition to that of spinal cord injury, provided this is feasible and safe, as the SCI centres are also major trauma hospitals.
- If it is not feasible or safe to transport to a SCI centre, for example the patient has other major injuries and is deteriorating, the patient should be transported to the most appropriate major trauma hospital.
- Personnel must seek clinical advice prior to commencing transport if this will involve a prolonged flight.
- Provide as much notification prior to arrival as possible, ensuring that ED staff are aware that the patient is being transported acutely under the spinal cord injury destination policy and not as an inter-hospital transfer.

## **Additional information**

### **General principles**

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

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

- Clinically significant signs and/or symptoms of spinal cord injury require the patient to have one of the following:
  - Paraplegia.
  - Quadriplegia.
  - Clinically significant limb weakness.
  - Clinically significant loss of sensation.
- Clinical judgement must be used when determining a patient has clinically significant limb weakness or clinically significant loss of sensation, particularly if the SCI centre is a significant distance from the scene and the clinical signs/symptoms are not clear. A delay in transfer to a SCI centre may result in harm if the patient has spinal cord injury, but conversely it is important to avoid transporting patients that do not require it over a long distance to a SCI centre. Personnel must seek clinical advice if they are uncertain.

### **Mechanism of injury**

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



## **The adequacy of breathing**

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

## **Shock**

- Loss of sympathetic outflow from the spinal cord following spinal cord injury can cause neurogenic shock, and in this setting the patient is usually vasodilated below the site of injury.
- The sympathetic nervous supply to the heart leaves the spinal cord in the mid-thoracic area. Spinal cord injury above the mid-thoracic area may impair sympathetic nervous supply to the heart, resulting in an absence of tachycardia despite shock.
- It is preferable to transport the patient direct to a SCI centre. However, if the patient is deteriorating and it is possible that hypovolaemic shock is present, the patient should be transported to a major trauma hospital if transport time to a SCI centre is significantly longer than transport time to a major trauma hospital. Personnel must have a low threshold for seeking clinical advice.

## **Spinal cord blood flow and blood pressure**

- Spinal cord blood flow is dependent on the spinal cord perfusion pressure following spinal cord injury, in the same way that cerebral blood flow is dependent on cerebral perfusion pressure following TBI.
- A reduction in spinal cord perfusion pressure leads to spinal cord ischaemia which worsens outcome.
- The pressure around the spinal cord is commonly raised in patients with spinal cord injury and this is why maintaining a normal systolic blood pressure is important.
- Metaraminol is the preferred vasopressor unless the patient's blood pressure is unresponsive to metaraminol or the patient is hypotensive and bradycardic.

## **SCI centre catchment areas and transport destination**

- The patient should be transported to the catchment area SCI centre provided this is feasible and safe. This means that some patients will be flown to a SCI centre that is not the closest SCI centre to the scene. This is preferable to flying to the closest SCI centre because it is important to balance patient numbers between centres and this reduces secondary inter-hospital transfers.
- It will not always be feasible or safe to fly the patient to the catchment area SCI centre. For example, it is not always feasible or safe to fly an adult from the lower third of the North Island to Christchurch Hospital and in this setting consider flying the patient to Middlemore Hospital.

- The following factors should be taken into account when determining which SCI centre the patient is transported to:
  - The catchment area boundaries and the location of the scene.
  - The location and availability of helicopters.
  - The weather.
  - Where the patient lives.
- Personnel should seek clinical advice if they are uncertain which SCI centre the patient should be transported to.

## **Transport by air**

- If a helicopter flight will involve a significant flight time and/or involves overflying another major trauma hospital, it is essential that helicopter personnel re-evaluate the patient prior to flight, to ensure that it is safe for the patient to be flown to a SCI centre.
- If a helicopter is required but is not available within a reasonable time, or it is not feasible or safe (for example due to weather) to fly to a SCI centre, the patient should be transported to the most appropriate major trauma hospital. A reasonable time cannot be defined and requires clinical judgement.
- Seek clinical advice prior to commencing transport if this will involve a prolonged flight.
- It is not usually feasible to transport a patient by fixed wing aircraft. In very unusual circumstances a fixed wing aircraft may be used, but personnel must seek clinical advice prior to doing so.
- The patient must be removed from extrication devices and transported directly on the stretcher, unless the total time on the extrication device is going to be less than 30 minutes.
- Ensure the patient is kept warm.
- Urinary catheterisation is not usually required, but may occur if a transport time in excess of two hours is expected, personnel are trained to perform urinary catheterisation and this will not cause a significant delay in commencing transport.

## **Cervical spinal cord neuropraxia**

- Also sometimes called spinal shock and cervical cord concussion, this is temporary loss of motor and/or sensory function followed by recovery over a few minutes to a few hours.
- It is due to bruising and/or stretching of the cervical spinal cord and is often associated with hyperflexion or hyperextension of the neck.
- Most commonly the patient experiences immediate symptoms with any combination of the following: burning pain, numbness, tingling, weakness or paralysis. All four limbs are usually involved, but the patient may experience symptoms in only some limbs.

- Commonly the patient does not have a cervical fracture and may be completely symptom free following recovery from their symptoms.
- There is a high association between cervical cord neuropraxia and pre-existing cervical stenosis (narrowing of the cervical canal through which the spinal cord runs). If cervical stenosis is present this often requires urgent surgery.
- The symptoms of cervical neuropraxia may have resolved by the time ambulance personnel reach the scene:
  - The history must be recorded and passed on to medical staff, as this is likely to change the subsequent investigation of the patient.
  - The patient’s cervical spine should not be cleared clinically, even though the patient may not have any symptoms.
  - The patient should be transported by ambulance to an ED within a hospital that has CT scanning facilities, whenever this is feasible and safe.
- The patient does not need to be transported to a SCI centre, provided the signs and symptoms of cervical spinal cord neuropraxia have completely resolved.



## 4.17 Cervical spine immobilisation

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

### Referral and transport

- Transport the patient to an ED by ambulance if their cervical spine has not been cleared clinically.
- Most patients with a possible cervical spine injury will require radiological imaging and many will require a CT scan.
- The ED should preferably be within a hospital that has CT scanning facilities whenever this is feasible and safe, particularly when the patient has had a firm cervical collar placed.

## Additional information

### Clearing the cervical spine clinically

- The criteria described above may be used in a child, provided the child is old enough to cooperate with having a history taken and being examined.
- Begin by taking a history, does the patient have:
  - Neck pain?
  - Numbness or tingling anywhere?
  - Pain elsewhere?
- Examine the patient:
  - Feel for midline tenderness by palpating the posterior cervical spine from the skull to the prominence of the first thoracic vertebrae. Lateral muscle tenderness is not a sign of cervical spine injury.

- Assess for normal sensation to light touch in the limbs.
- Assess for normal movement of the limbs.
- Assess for signs of decreased alertness.
- A patient has a decreased level of alertness if any of the following are present:
  - A GCS less than 15.
  - Short term memory loss.
  - Clinical signs of intoxication.
  - Delayed or inappropriate response to external stimuli.
- Signs and symptoms of possible spinal cord injury are present if there is altered sensation or altered motor power (strength) in the limbs.
- Deciding if the patient has pain that might cause distraction from the pain of a cervical spine injury requires clinical judgement. To be considered distracting, the pain must be significant enough to prevent the patient from noticing that their neck is sore.
- Use additional caution when clearing the cervical spine clinically if the patient is not in apparent pain, but has an injury that would be expected to cause pain. Examples include long bone fractures and dislocations.
- A firm cervical collar or lanyard is not required if the cervical spine is cleared clinically.

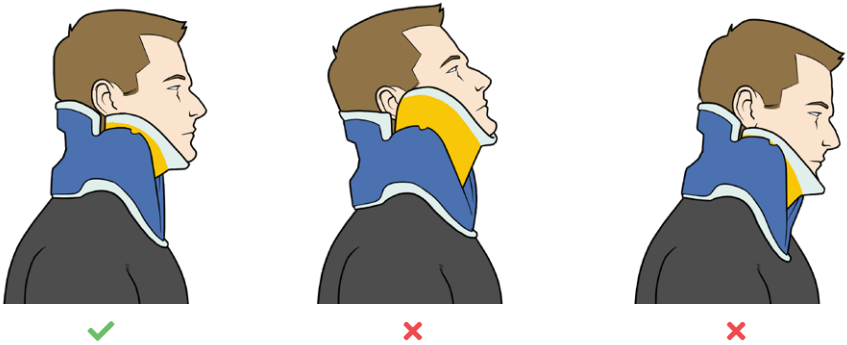
### **Factors that increase risk**

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

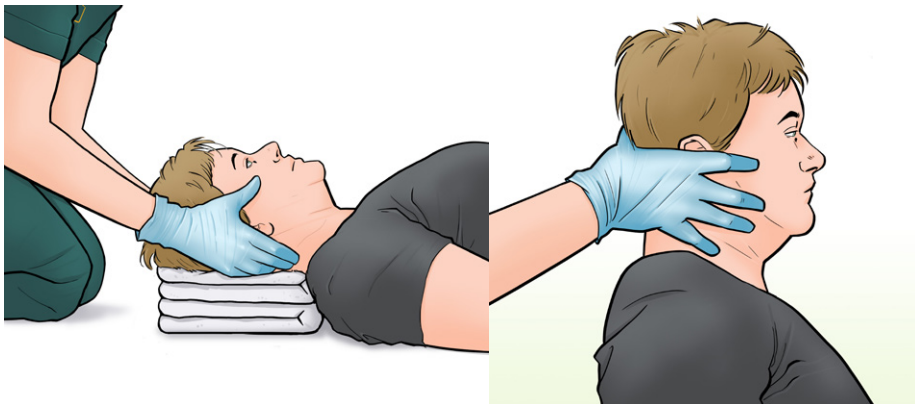
### **General principles of immobilisation and firm cervical collars**

- Abnormalities within the primary survey always take priority over the cervical spine.
- The patient should always be positioned with their spine in neutral alignment. If the patient's spine is not aligned, for example there is significant angulation, the spine must be aligned immediately.
- For most adults in the supine position, achieving neutral alignment will require 3-4 cm of flat pillow or 1-2 folded towels behind the head, noting that if pre-existing kyphosis is present the patient may require more than this. Conversely, small children may require padding under the thoracic spine to avoid neck flexion from their relatively large head.

- A firm cervical collar should not be routinely placed if the patient’s cervical spine cannot be cleared clinically. Deciding to place a firm cervical collar requires clinical judgement that balances the benefits and risks:
  - A firm cervical collar will limit movement of the cervical spine but there is no good evidence that this reduces the risk of secondary spinal cord injury.
  - A firm cervical collar may worsen neck pain, promote the development of pressure areas, make airway management more difficult and raise intracranial pressure.
- Always place a lanyard (labelled “cervical spine not cleared”) around the patient’s neck if their cervical spine has not been cleared clinically and a firm cervical collar has not been placed.



**Neutral alignment with a firm cervical collar**



**Manual stabilisation**

## **When a firm cervical collar should be placed**

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

## **If the patient is cooperative**

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

## **If the patient is uncooperative**

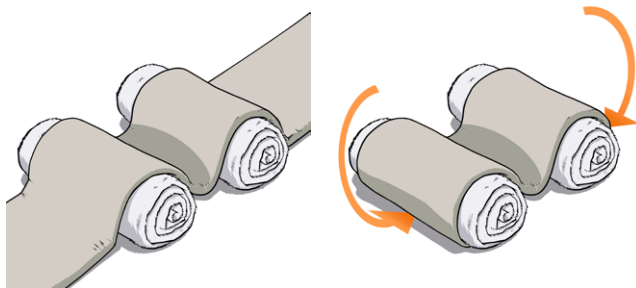
- Clinical judgement is required if the patient is uncooperative as placing a firm cervical collar may result in an increase in movement and/or agitation.
- Have a low threshold for not placing a firm cervical collar and consider providing manual stabilisation.
- Often the only realistic option is to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

## **If the patient is unconscious**

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

## Additional notes on immobilisation

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



Using rolled towels and a sheet as head blocks



## **Rigid boards, scoop stretchers and combi-carriers**

- Rigid boards are primarily sliding and extrication devices.
- Scoop stretchers and combi-carriers are primarily lifting and carrying devices.
- None of these devices have a role in providing immobilisation of the spine.
- All of these devices carry the risk of creating pressure injury if a patient is on one for longer than 30 minutes. If this is expected, the patient should be removed from the device prior to beginning transport whenever this is feasible and safe.
- If the patient is transported on such a device, it must be removed as soon as possible after arrival at hospital.

## **The Kendrick extrication device (KED)**

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

## **Allowing the patient to walk/mobilise**

- If the cervical spine has not been cleared clinically and the patient is conscious:
  - The patient should be placed supine on a stretcher with their spine in neutral alignment, as soon as this is feasible and safe.
  - It is acceptable to ask a cooperative patient to walk a few steps to a stretcher, provided they are instructed to keep their head and neck as still as possible.
  - Once on a stretcher the patient should not be asked to walk or to sit in a chair.
  - When transferring the patient from a stretcher to a bed, the preferred technique is to keep the patient supine and to use a sliding or lifting device, particularly when a firm cervical collar has been placed. However, it is acceptable to ask a cooperative patient to move themselves from a stretcher to an immediately adjacent bed, provided they are instructed to keep their head and neck as still as possible.

## **Cervical collars placed by other personnel**

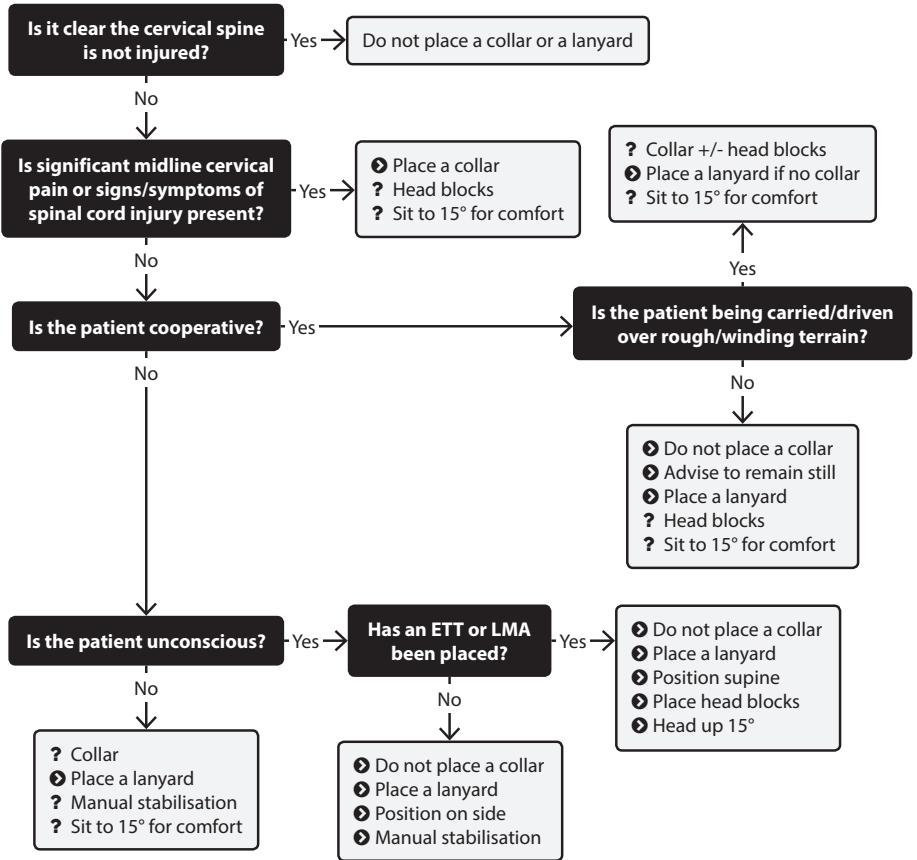
- Sometimes cervical collars (including soft cervical collars) have been placed by other healthcare providers prior to ambulance arrival.
- If a collar has been placed prior to ambulance arrival:
  - The collar should be removed if the patient's cervical spine can be cleared clinically.
  - The cervical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

## **Prophylaxis of nausea and vomiting**

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

See next page for flow chart 

## Cervical spine immobilisation summary



## 4.18 Tension pneumothorax

### **If the patient is spontaneously breathing and is not peri-arrest/in cardiac arrest**

- Decompress the affected side(s) using a specific chest decompression device.
  - a) The preferred site is the 5<sup>th</sup> intercostal space in the anterior axillary line.
  - b) Decompress in the 2<sup>nd</sup> intercostal space in the midclavicular line if the preferred site is not feasible.
- Decompress the affected side(s) using finger thoracostomy in the 5<sup>th</sup> intercostal space in the anterior axillary line, if a specific chest decompression device is not available or decompression with a device was not successful. Consider administering 1 mg/kg of ketamine IV (up to a maximum of 100 mg) prior to the procedure.

### **If the patient is ventilated or is peri-arrest/in cardiac arrest**

- Decompress the affected side(s) using finger thoracostomy in the 5<sup>th</sup> intercostal space in the anterior axillary line, ensuring your finger clearly reaches the pleura.
- Dress thoracostomy wounds using a colostomy bag or a standard dressing.

### **In addition**

- Gain IV access and administer 0.9% sodium chloride IV if the patient has signs of hypovolaemia or poor perfusion:
  - a) 500 ml IV for an adult.
  - b) 10 ml/kg IV for a child.
  - c) Repeat as required.

### **Backup**

- Backup from an ICP must be requested.
- Backup from a Paramedic or PRIME responder should be requested if backup from an ICP is not immediately available.

### **Referral and transport**

- Transport the patient to a major trauma hospital if the tension pneumothorax is secondary to trauma, whenever this is feasible and safe.
- Transport the patient to a hospital with intensive care facilities if the tension pneumothorax is spontaneous, whenever this is feasible and safe.
- Avoid transporting the patient higher than 300 metres above sea level provided this is feasible and safe.

## Additional information

### Pneumothorax

- Pneumothorax is the presence of air within the pleural space.
- Pneumothorax can occur under three circumstances:
  - Traumatic pneumothorax most commonly occurs following blunt trauma, noting that even in the setting of penetrating trauma a pneumothorax is not always present. Traumatic pneumothorax can be further broken down into open (where the chest wall is open to the outside), and closed (where the chest wall is intact and the pleural hole has been made by sudden compression of the chest like a Valsalva effect, or due to puncture by a fractured rib).
  - Primary spontaneous (idiopathic) pneumothorax occurs when the lung tissue is normal. The classic presentation is a tall young male with sudden onset of dyspnoea and pleuritic chest pain, often at the shoulder tip. It often occurs secondary to rupture of a congenital weakness (bleb) of the pleura.
  - Secondary spontaneous pneumothorax occurs secondary to abnormal lung tissue. The pleural rupture occurs as a consequence of lung disease, for example COPD, asthma or autoimmune lung disease.
- Pneumothorax without tension is common following trauma and rarely requires intervention in the out-of-hospital setting. Even in the setting of positive pressure ventilation, intervention is not usually required unless there are signs of significantly impaired oxygenation or ventilation, or tension pneumothorax is present.
- The signs and symptoms of pneumothorax can include:
  - Dyspnoea.
  - Chest pain.
  - Reduced air entry on the affected side.
  - Hyperresonant percussion note on the affected side.
  - Loss of lung sliding over the affected area on ultrasound.
  - Hypoxia. This is a late sign and usually only occurs when the pneumothorax is large.
- Subcutaneous emphysema is not a useful sign when diagnosing pneumothorax despite it being listed in some references. Subcutaneous emphysema is not a sign of pneumothorax, but is a sign that air has escaped the lungs and reached the skin via the mediastinum, usually from a proximal source such as a bronchi. Subcutaneous emphysema may be present in the absence of pneumothorax and conversely pneumothorax is commonly present without subcutaneous emphysema.

## Tension pneumothorax

- Tension pneumothorax is a cause of obstructive shock that occurs when a pneumothorax is under positive pressure that is high enough to impair venous return to the right heart.
- Tension pneumothorax occurs when the volume of air within the pleural space progressively increases with each inspiration, but is unable to escape during expiration because the pleural tear acts as a one-way valve. With each breath the pressure within the pleural space increases until it is higher than the venous pressure within the superior and inferior vena cava, resulting in a progressive fall in venous return to the right heart and cardiac arrest if not treated.
- Tension pneumothorax is uncommon and only occurs in a small subset of patients with pneumothorax, usually those that are receiving positive pressure ventilation.
- The signs and symptoms of tension pneumothorax include:
  - Progressively worsening shock. This is an important defining feature. If the patient does not have progressively worsening shock they do not have tension pneumothorax.
  - Progressively worsening dyspnoea.
  - Distended jugular veins. This occurs as a result of impaired venous return to the right heart. Very rarely, distended jugular veins may not be present if the patient has both tension pneumothorax and severe hypovolaemic shock.
  - Tracheal deviation away from the affected side. This is an extremely late sign as it requires very high pressure within the thorax and is rarely seen.

## Differential diagnosis

- Differentiating tension pneumothorax from other chest injuries is important because unnecessary chest decompression carries risks.
- The most common chest injuries that are misdiagnosed as tension pneumothorax are:
  - Pulmonary contusion in the presence of hypovolaemic shock. Pulmonary contusions are common and will cause reduced air entry and hypoxia. The jugular veins will be flat and the percussion note will usually be normal, but may be dull if the contusion is very severe.
  - Haemothorax in the presence of hypovolaemic shock. The jugular veins will be flat and the percussion note will be dull.
  - Pneumothorax in the presence of hypovolaemic shock. The jugular veins will be flat and the percussion note will be hyperresonant.

## Treatment

- Unnecessary chest decompression carries risks. However, untreated tension pneumothorax will cause death and the balance of risk is in favour of chest decompression if the diagnosis is clear, or the patient has signs consistent with tension pneumothorax and is progressively deteriorating with shock despite supportive treatment.
- IV fluid is usually helpful because most patients have coexisting bleeding, and raising venous pressure within the superior and inferior vena cava will produce a temporary improvement in venous return to the right heart.
- If a specific chest decompression device is available (for example a Turkel needle), this must be used in preference to an IV cannula because it is safer and more effective.
- Decompression in the 5<sup>th</sup> intercostal space in the anterior axillary line is safer and easier than decompression in the 2<sup>nd</sup> intercostal space in the midaxillary line because there is usually less distance to the pleura.
- Needle decompression is associated with the risks of:
  - Creation of a pneumothorax.
  - Haemorrhage (from vessel injury and of particular concern in the 2<sup>nd</sup> intercostal space).
  - Air embolism.
  - Failure to decompress the chest. Failure to reach the pleura is common with a needle technique, particularly if the chest wall is thick.
- Finger thoracostomy is usually more effective and safer than needle decompression, but:
  - Is more difficult than needle decompression in an awake patient, and
  - Is associated with an increased risk of infection, particularly empyema.
- With either technique it is vital to ensure that the pleura has been reached and it is worth taking extra time to be confident this has occurred.
- The most important sign of success following decompression is a sudden improvement in the severity of shock.
- It is possible for the tissues to close around a finger thoracostomy wound, particularly if the chest wall is thick, and thus a tension pneumothorax may recur following finger thoracostomy. Reopen the tract using a finger if the patient improves and then deteriorates again.
- Colostomy bags make an ideal dressing following finger thoracostomy because the bag will collect blood, they prevent significant amounts of air being sucked into the chest during inspiration if the patient is spontaneously breathing and they are easily removed if the tract needs to be reopened.
- Do not cover a thoracostomy wound with a sealed dressing because this risks the development of tension pneumothorax and do not spend time trying to seal a dressing on three sides in order to form a valve, as this is rarely effective.

## 4.19 Amputation

This section is for patients with complete or near-complete amputations of limbs, extremities or digits.

- Compress significant external bleeding and place a tourniquet if required.
- Recover the amputated part(s) provided it is feasible and safe to do so.
- Take a photo of the amputated part(s) if possible.
- Protect the amputated part(s) as soon as possible:
  - a) Wash the amputated part(s) using clean running water or 0.9% sodium chloride if severely contaminated, for example with dirt, but this is not a priority and significant time should not be taken to accomplish this.
  - b) Wrap in a clean damp towel or dressing.
  - c) Place into a clean (preferably sealed) plastic bag and place this into a second plastic bag.
  - d) Place a mixture of water and ice (icy slush) in the second (outer) plastic bag. It is acceptable to use cold packs and water if ice is not available.
  - e) Do not allow the part(s) to come into direct contact with ice, or into prolonged direct contact with fluid.

### Backup

- Backup from a Paramedic or PRIME responder should be requested if the patient has moderate to severe pain.
- Backup from an ICP should be requested if the patient has severe shock.

### Referral and transport

- If the patient has severe shock they must be transported to a major trauma hospital.
- Patients with amputated limbs, extremities or digits should be transported directly to a hospital with acute plastic surgical facilities whenever it is feasible and safe, provided:
  - a) Amputation is proximal to the distal inter-phalangeal joint, and
  - b) The amputated part(s) are available to be transported with the patient, and
  - c) The amputated part(s) are not severely crushed or mangled, and
  - d) The amputated part(s) have been cut and not avulsed (pulled) from the body, and
  - e) The patient can be transported to a hospital with acute plastic surgical facilities within four hours of injury.
- Provide as much notification prior to arrival in hospital as possible.
- Text or email a photo of the amputated part(s) to the receiving surgical team via the Clinical Desk, if possible.



- If it is not feasible or safe to transport the patient to a hospital with acute plastic surgical facilities, the patient should be transported to the most appropriate hospital, and subsequently referred to a hospital with acute plastic surgical facilities if required.
- Have a low threshold for seeking clinical advice, particularly if transport time to hospital will be prolonged.

## **Additional information**

### **General principles**

- Surgical reattachment of an amputation is usually only possible within four hours of the injury.
- Transporting the patient to a hospital that does not have acute plastic surgical facilities incurs a clinically significant delay that will reduce the chance of successful reattachment.
- The following hospitals have acute plastic surgical facilities:
  - Middlemore Hospital.
  - Waikato Hospital.
  - Hutt Hospital (see below).
  - Christchurch Hospital.
  - Dunedin Hospital.
- Hutt Hospital has acute plastic surgical facilities but is not a major trauma hospital. It is appropriate to transport a patient with an isolated amputation of a limb to Hutt Hospital if the limb is available for surgical reattachment, but if there are other major injuries or the patient has severe shock, the patient must be transported to a major trauma hospital.
- Surgical reattachment of an amputation is usually only feasible if the amputated part(s) have been cut from the body and are intact. However, parts of crushed, mangled or avulsed extremities may still be used by the surgical team as part of the surgical repair, and should be transported with the patient whenever feasible.
- Have a low threshold for seeking clinical advice if the patient has any of the following features, because they are unlikely to have their amputation successfully reattached:
  - Has peripheral vascular disease, or
  - Has diabetes, or
  - Is aged greater than 75 years.
- For isolated amputations of fingers or toes, digital ring blocks are the preferred form of analgesia.

## Tourniquet application

- Applying a tourniquet is a balance of risk.
  - Tourniquets help control severe bleeding but can cause significant tissue ischaemia and damage (for example to muscles and nerves) and should only be used when direct pressure is insufficient to control severe bleeding.
  - Applying a tourniquet will cause ischaemia of the limb distal to the tourniquet and this may compromise the success of surgical reattachment.
- When applying a tourniquet:
  - Remove clothing from the limb if possible.
  - Apply as distally as possible.
  - Do not apply over a joint.
  - Tighten until bleeding stops. The tourniquet must be tight enough to stop arterial flow.
  - Leave the wound exposed so that it can be observed for bleeding.
  - Record the time of application.
  - Reassess the tourniquet following treatment. It may need to be further tightened if blood pressure improves.
- If the tourniquet is applied to a forearm or lower leg, the presence of two bones may limit the pressure that can be applied to vessels. If bleeding continues despite the tourniquet being tightened maximally, place the tourniquet on the upper arm or thigh.
- The tourniquet needs to be very tight if applied over a thigh, particularly if the thigh is large. Occasionally a second tourniquet may be required proximal to the first tourniquet.
- Re-evaluate the need for a tourniquet after bleeding is controlled, IV access has been obtained and appropriate fluid resuscitation has been commenced.
  - If the source of bleeding is a single lacerated artery, for example a lacerated brachial or radial artery, it is preferable that bleeding is controlled with direct pressure and then the tourniquet is released, particularly when transport time to hospital is over 30 minutes.
  - If bleeding cannot be controlled with direct pressure the tourniquet should be reapplied.
- A tourniquet may be used to provide direct pressure over a dressing, for example directly over a lacerated brachial artery. In this setting the tourniquet needs to be tight enough to control bleeding and not necessarily tight enough to stop arterial flow.
- A conscious patient will usually require pain relief. If the patient is conscious and not in significant pain, it is likely that the tourniquet is not tight enough.

## 4.20 Eye injuries

This section is for patients with blunt or penetrating injuries that are isolated to the eye and/or the immediate tissues around the eye.

- Position the patient in a head up position, for example sitting at an approximately 45 degree angle.
- Irrigate chemical burns for at least 30 minutes.
- Apply pressure to external bleeding, but do not apply pressure to the globe if there is a possibility of a penetrating injury.
- Attempt to flush out a 'simple floating' foreign body (such an eyelash) using 0.9% sodium chloride.
- Examine and record the following:
  - a) The appearance of the eye and surrounding tissues. Consider taking a photograph using the ePRF tablet if there is an obvious abnormality.
  - b) Pupil size, shape and equality.
  - c) Pupil reactivity to light, including the consensual light reflex.
  - d) Eye movement, vertically and horizontally.
  - e) An approximate assessment of the vision in each eye.
- Administer ondansetron if the patient has an injury that appears to have penetrated the globe. See the 'nausea and/or vomiting' section for dosing.

### Backup

- Backup is rarely required, but backup from an Extended Care Paramedic (if easily available) may assist with diagnosis and treatment.

### Referral and transport

- The patient must be given a clear recommendation to be assessed in an ED (transport by ambulance will usually be required) if any of the following are present:
  - Injuries that appear to penetrate the globe or a mechanism of injury that suggests penetration is likely.
  - Lacerations involving the eyelid.
  - Deep and/or severe pain.
  - Hyphaema (bleeding into the anterior compartment).
  - Suspected retrobulbar haematoma.
  - Chemical injury.
  - New reduction in vision.
  - Abnormal pupillary light reflex.
  - Reduced ability to move the eye(s).
  - Swelling of the eyelids preventing full examination of the eye.

- The patient must be given a clear recommendation to be assessed in a primary care facility or in an ED if any of the following are present (transport by ambulance will usually not be required):
  - Suspected foreign body, provided it does not appear to have penetrated the globe.
  - The sensation of a foreign body persisting after removal.
  - Suspected corneal abrasion.
- The patient should be given a clear recommendation to remain in the community and seek follow up in primary care if they are concerned, if any of the following are present:
  - Subconjunctival haemorrhage with otherwise normal findings on examination.
  - Bruising of the soft tissues around the eye ('black eye'), with or without subconjunctival haemorrhage, with otherwise normal findings on examination.
- Have a lowered threshold for recommending the patient is assessed in an ED if you are uncertain of the severity of injury, or the patient is taking an anticoagulant.
- Avoid transporting the patient higher than 300 metres above sea level provided this is feasible and safe, if it is possible the globe has been penetrated.
- Most eye injuries do not require surgery but if required, it is rarely time critical. It is not necessary to routinely transport the patient to a hospital with facilities for eye surgery and the patient should usually be transported to the most appropriate ED or medical facility, and referred to an eye surgeon if required. However, transport to a hospital with facilities for eye surgery should occur if it is clear the globe has been penetrated, provided it is feasible and safe to do so, and the hospital has an ED.

## Additional information

### General principles

- Injuries to the eye often cause significant anxiety and/or distress in the patient, bystanders and treating personnel. It is important to adopt a calm and reassuring manner, without appearing to be overly relaxed or unconcerned.
- When taking a history always ask about the use of protective eyewear and have a lowered threshold for suspecting injury if it was not worn.
- Contact lenses should be removed whenever feasible, pending further assessment.
- Chemical burns of the eye are potentially vision-threatening and irrigation must continue for at least 30 minutes, Chemical burns of the eye are not time

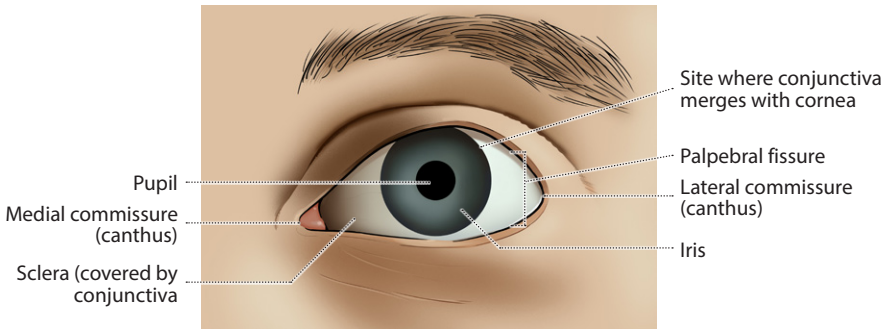
critical in terms of transport to hospital and irrigation should occur at the scene whenever feasible, because it is irrigation that makes a difference to the outcome. The method of irrigation must ensure cross contamination of an uninjured eye is avoided.

- Raised intraocular pressure may worsen outcome, particularly if the injury has penetrated the globe:
  - Placing the patient in a semi-sitting position lowers intraocular pressure.
  - Transporting the patient at altitude lowers the external pressure and increases the risk that intraocular contents may leak from the globe if there has been a penetrating injury.
  - Vomiting raises intraocular pressure and this is why ondansetron is routinely administered if the injury appears to have penetrated the globe.
- A combination of paracetamol and ibuprofen is recommended unless pain is severe. Do not apply lignocaine or ropivacaine topically to the eye because the solutions contain a preservative that may cause harm.
- Consider instructing the patient to keep both eyes closed if they are experiencing significant pain when blinking.
- Once the patient is in a medical facility:
  - The eye can be examined under magnification using a slit lamp, which is a significant aid to assessment and diagnosis.
  - Antibiotic ointment or drops are usually prescribed after any injury to the surface of the eye, including those from a foreign body.

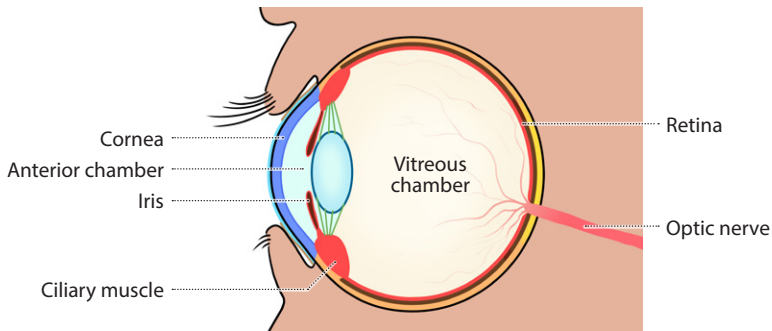
## **Examination and assessment**

- The best time to examine the eye is immediately after injury, before swelling impairs the ability to open the eyelids.
- When assessing the patient:
  - Inspect the eyelids and surrounding skin for bruising, swelling and/or lacerations.
  - Inspect the cornea, which should appear clear and without signs of laceration or abrasion.
  - Inspect the anterior chamber, which should appear clear.
  - Inspect the conjunctiva. Blood vessels run between the conjunctiva and the sclera and this is a common area for bleeding to occur.
  - Inspect the size, shape and equality of the pupils. Abnormality suggests an internal injury to the eye, but always ask about previous eye surgery or the use of pharmacological eye drops which commonly cause a large, abnormally shaped and/or unreactive pupil.
  - Assess pupil reactivity to light, including the consensual light reflex (the constriction of the pupil of one eye when light is shone in the other).
  - Assess eye movement in the vertical and horizontal plane by asking the patient to keep their head still and look at your finger while your finger moves.

- Assess vision in each eye by asking the patient to read text (for example from your pocket CPGs) with one eye covered, from approximately 60 cm using usual visual aids if available. Ask the patient if there is an acute change to their usual vision.



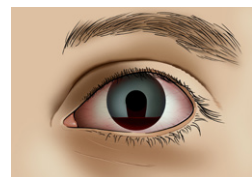
**Anterior view**



**Lateral view**

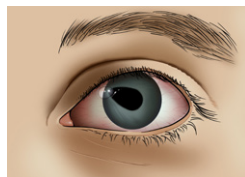
## Common injury patterns

- **Corneal abrasion** commonly occurs with a glancing blow to the eye. Corneal abrasions are not always clinically obvious and the diagnosis often requires the use of fluorescein (a dye) and a blue light to make it fluoresce. Assume the patient has a corneal abrasion if they have a mechanism of injury consistent with a glancing blow and pain during blinking.
- **Hyphaema** is bleeding within the anterior chamber and usually occurs after a direct blow to the eye. A layer of blood may be visible and the patient will usually have blurred vision which may be red-stained.
- **Foreign bodies** usually require removal under local anaesthesia in a medical facility. Foreign bodies are easily missed and personnel should assume a foreign body is present if the patient has persistent pain with blinking.



**Hyphaema**

- **Penetrating injury** is often obvious but may be subtle. If the pupil has developed a new tear drop shape, the tear drop often points in the direction of the injury.
- **Retrobulbar haematoma** occurs when there is bleeding behind the globe. This rapidly raises intraocular pressure and is immediately vision-threatening. The patient will usually have deep pain, proptosis (bulging) of the eye, reduced vision and a 'blood blister' like appearance of the conjunctiva. Urgent lateral canthotomy (a simple procedure that can be performed in ED) may be vision saving.



**Penetrating injury**

- **Retinal detachment** occurs when the retina detaches from the layer underneath. It is often associated with flashes of light and a 'curtain like' reduction in vision.

- **Subconjunctival haemorrhage** may appear spectacular, but does not extend over the cornea so vision is not affected. It resolves over several days and requires no active treatment or follow up provided the rest of the eye assessment is normal and the patient is not taking an anticoagulant. Subconjunctival haemorrhage often occurs spontaneously and may occur after rubbing the eye or sustaining a minor impact.



**Subconjunctival haemorrhage**

- **'Black eyes'** (for example from a punch) are infrequently associated with eye trauma because of the shielding effect of the facial bones. The bruising resolves over days and requires no active treatment or follow up provided the rest of the eye assessment is normal.
- **Capsicum spray** causes intense discomfort but does not cause harm. Flush the eyes (prolonged irrigation is not required) and advise the patient that with time the pain will settle.
- **Photokeratitis** occurs when the eyes are unprotected from exposure to high levels of ultraviolet light, for example as a result of light reflected from snow or ice, or light from an arc welder. Photokeratitis is also often referred to by a number of other terms including snow blindness, arc eye and welder's flash. Symptoms often arise several hours after exposure and commonly include pain, photophobia, lacrimation and blepharospasm (tight closure of the eyelids). Patients with photokeratitis do not usually require referral to a doctor and should be advised to protect their eyes from light, not wear contact lenses and take oral pain relief. Symptoms usually settle over 1-2 days and they should seek further clinical assessment if their symptoms are not improving.

## Dressings

- Dressing an eye injury is not always required, but ensure exposed eye surfaces are kept moist, for example by intermittently applying saline drops.
- All that is usually required is to tape the eyelid closed.
- If it is possible the globe has been penetrated and a dressing is going to be applied, always place an eye shield under the dressing to ensure that pressure is not placed on the eye, as external pressure may cause intraocular contents to leak from the globe.
- Do not try to make an eye shield from other objects (such as a polystyrene cup) as these may move under dressings and may place pressure on the globe. If an eye shield is not available and a covering is required (for example to avoid others being upset by seeing the wound), tape the eyelid closed and place a dressing loosely over the face, ensuring there is no pressure on the eye.
- If a dressing is applied directly over the eye, ensure the eyelid is closed under the dressing by taping the eyelid closed.





## 4.21 Wounds

This section is for patients with minor wounds including lacerations, abrasions and skin tears. See the 'limb and/or soft tissue injuries' section if the wound is more than minor, or is associated with a compound fracture. See the 'hypovolaemia from uncontrolled bleeding' section if the bleeding is severe.

- Compress external bleeding.
- Assess sensation, movement and blood supply in the area of (and distal to) the wound.
- Thoroughly irrigate the wound if it is visibly contaminated or was caused by a dirty object, ensuring all visible foreign material is removed.
- Close the wound or arrange for wound closure if this is required.
- Apply an appropriate dressing.

### Backup

- Consider requesting backup from an Extended Care Paramedic (ECP) if one is available, for wounds requiring closure:
  - Ambulance personnel at the scene should speak directly to the ECP to determine if it is appropriate for the ECP to close the wound.
  - Taking a photo and sending it to the ECP (with the patient's permission) may aid decision making.
  - Ambulance personnel do not need to remain on scene until the ECP arrives, provided the ECP accepts the referral and bleeding is adequately controlled.

### Referral and transport

- Provide a clear recommendation for the patient to be assessed in an ED if any of the following are present:
  - Severe or uncontrolled bleeding.
  - Penetrating injuries of unknown depth.
  - Significant tissue loss, tissue damage or crush injury.
  - Signs of ischaemia.
  - Loss of sensory or motor function.
  - Significant wound contamination or foreign material that is unable to be removed.
  - Signs of infection with systemic involvement.
  - Of cosmetic concern, for example involving the face.
  - Aged less than two years and requiring sutures or staples.
- Provide a clear recommendation for the patient to be assessed in a medical facility (preferably in primary care) if any of the following are present:
  - Requiring closure that cannot be achieved by ambulance personnel.

- Secondary to a bite.
- Signs of infection without systemic involvement.
- Tetanus immunisation is required.
- Have a low threshold for recommending the patient is seen in a medical facility if they have significant comorbidities or are immunosuppressed.
- Consider transport (if required) by private car provided bleeding and pain are adequately controlled.
- Provide advice for the patient to be followed up in primary care if immediate referral to ED or primary care is not required.

## **Additional information**

### **General principles**

- Wounds requiring closure (for example using sutures, staples or glue) should usually be closed within six hours of injury.
- Wounds that are less than 4 cm in length with edges that are easily brought together are usually suitable to be closed using wound tape/strips or glue.
- Wounds that are more than 4 cm in length or with edges that are not easily brought together usually require closure with sutures or staples.
- Wounds to the face, hands, feet, genitals, or over joints may require specialist treatment. Seek clinical advice if uncertain which hospital or primary care facility the patient should be assessed in.
- Wounds caused by a dirty object or that are visibly contaminated, require thorough decontamination via irrigation:
  - Several minutes of irrigation is usually required.
  - The volume of irrigating fluid is more important than the nature of the fluid, provided it is clean.
  - Clean running water or 0.9% sodium chloride may be used.
  - Have a low threshold for recommending the patient is seen in a medical facility if it is not clear the wound has been adequately decontaminated.

### **Tetanus-prone wounds and tetanus prophylaxis**

- Tetanus is a life-threatening disease caused by exotoxin released from the bacterium *Clostridium tetani*, which is commonly found in soil.
- Wounds are tetanus-prone if they are:
  - Contaminated, or
  - Caused by a dirty or rusty object.
- Clearly recommend that patients with a tetanus-prone wound are seen in a medical facility for repeat tetanus immunisation within 24 hours, if their immunisation status is unknown, or their last tetanus immunisation was more than five years ago.

## Skin tears

- Skin tears are wounds caused by a shearing force resulting in a separation of skin layers.
- Skin tears can be partial thickness (separation of the epidermis from the dermis) or full thickness (separation of both the epidermis and dermis from underlying structures).
- Skin tears are an important cause of morbidity in the elderly.
- As soon as possible attempt to realign the skin edges (for example using a gentle rolling technique) using a clean technique.
- The use of wound tape/strips should usually be avoided, but may be considered if it is difficult to retain the skin edges in place. Instruct the patient not to attempt to remove wound tape/strips if they are used,
- Provide a clear recommendation for the patient to be seen in a medical facility (preferably within primary care) as soon as possible, if the skin edges cannot be aligned or there are signs the skin flap is ischaemic.
- Apply an appropriate dressing:
  - Ensure the dressing immediately over the involved skin is 'non-stick'.
  - Apply an additional dressing that holds the non-stick dressing and underlying skin gently (but not tightly) in place. For example, use a bandage over a non-stick dressing.
  - If a dressing is stuck around the skin tear, consider drawing on the dressing (with an arrow) the direction in which it should be removed.
  - Provide advice to the patient and/or caregivers to keep the area dry.
  - Provide advice to be followed up in primary care, preferably by their own GP.

## Dressing minor wounds

- There is no evidence that any form of dressing is better than another, but the following principles are useful:
  - Covered wounds heal faster than non-covered wounds.
  - Wounds that are moist (but not wet) heal faster than wounds that are dry.
  - The wound should be clean before being dressed.
  - The skin edges should be dry and aligned before being dressed.
  - Whenever possible, the part of the dressing directly over the wound should be 'non-stick'. If a 'non-stick' dressing is not available and gauze is being used, this must be moistened prior to application.
- Large grazes can be difficult to dress. Advise the patient to keep the graze moist (for example, using petroleum jelly) if possible during healing.

## 5.1 Agitated delirium

This section is for patients aged greater than or equal to 12 years with agitation and delirium, when the level of agitation is posing a risk to safety. Do not use this section if the patient has agitation without delirium, or has delirium without agitation. Seek clinical advice if the patient is aged less than 12 years.

- Assess the patient for a reversible cause such as hypoglycaemia or hypoxia, provided this can be done safely. Move to the appropriate section if a clear cause is found.
- Determine the level of risk to safety (see additional information).

### Mild to moderate risk to safety

- Attempt verbal de-escalation and move sequentially through the steps below if the level of agitation continues to pose a risk to safety.
- Consider calling for police assistance.
- Provide safe restraint if required.
- Gain IV access if feasible and safe.
- Administer olanzapine provided agitated delirium is not due to poisoning with an antipsychotic medicine, and the patient will take an oral medicine:
  - a) 10 mg of olanzapine PO. Reduce the dose to 5 mg if the patient is frail.
  - b) The dose may be repeated once after 20 minutes.
- Administer droperidol if olanzapine is not administered or is ineffective:
  - a) 10 mg of droperidol IM/IV. Reduce the dose to 5 mg if the patient is frail.
  - b) The dose may be repeated once after 20 minutes.
- Administer midazolam if droperidol is unavailable or is ineffective:
  - a) 2-3 mg of midazolam IV every five minutes as required. Reduce the dose to 1-2 mg if the patient is frail, or
  - b) 10 mg of midazolam IM. Reduce the dose to 5 mg if the patient is frail.
  - c) The IM dose may be repeated once after 20 minutes.
- If the patient has an altered level of consciousness:
  - a) Position the patient on their side.
  - b) Provide safe restraint as required.
  - c) Administer oxygen and continually monitor the patient's airway, breathing, SpO<sub>2</sub> and level of consciousness.
  - d) Monitor heart rate, blood pressure and capillary refill time (particularly in restrained limbs) if possible.
  - e) Gain IV access if not already achieved.

## Severe to immediately life-threatening risk to safety

- Call for urgent police assistance and consider leaving the scene.
- Attempt verbal de-escalation and/or provide restraint only if it is safe to do so.
- Administer ketamine:
  - a) 1 mg/kg of ketamine IV (up to a maximum of 100 mg) every five minutes as required, or
  - b) 400 mg of ketamine IM if the patient weighs greater than 80 kg, or
  - c) 200 mg of ketamine IM if the patient weighs 80 kg or less.
  - d) The IM dose may be repeated once after 20 minutes.
- Seek clinical advice if the situation is not easily controlled.
- Once control has been obtained:
  - a) Position the patient on their side and provide safe restraint.
  - b) Administer oxygen and continually monitor the patient's airway, breathing, SpO<sub>2</sub> and level of consciousness.
  - c) Monitor heart rate, blood pressure and capillary refill time (particularly in restrained limbs) if possible.
  - d) Gain IV access if not already achieved.
  - e) Maintain a sedated state by administering 1-2 mg of midazolam IV every 5 minutes as required.
  - f) Administer additional ketamine IV if a severe or immediately life-threatening risk to safety persists.
  - g) Request police escort during transport.

## Backup

- Backup from a Paramedic or PRIME responder should be requested.
- Backup from an ICP must be requested if there is a severe to life-threatening risk to safety. Backup from a Paramedic or PRIME responder should be requested if backup from an ICP is not immediately available.
- Backup from an ICP or doctor able to perform RSI should be requested if there is a severe to life-threatening risk to safety that is not easily controlled.

## Referral and transport

- The patient must be transported to an ED by ambulance if droperidol, midazolam or ketamine has been administered.
- The patient must be transported to an ED by ambulance if olanzapine has been administered, unless:
  - a) The patient has a known mental health problem, and
  - b) The patient's agitation improves and they are safe, and
  - c) The patient is with a competent adult who can remain with them, and
  - d) Mental health personnel are contacted directly by personnel at the scene and agree to assess the patient.

## Additional information

### General principles

- Agitated delirium is also known as acute severe behavioural disturbance, and excited delirium syndrome when there is marked physiological derangement.
- To have agitation the patient must have an abnormal increase in motor activity. For example: trying to climb off the stretcher or actively resisting assessment, treatment and/or transport. Anxiety and/or signs of mental distress alone are not enough to define the patient as being agitated.
- To have delirium the patient must have signs of an abnormal state of mind. For example: confusion, delusions or significantly abnormal behaviour.
- Agitated delirium is an emergency. The combination of behavioural disturbance, agitation, hyperactivity and physiological excitation/stress may be life-threatening. In addition, the provision of treatment may involve the risk of harm to the patient and/or personnel.
- It is important to rule out reversible causes, but sometimes this cannot be safely achieved without controlling the patient's agitation prior to assessment.
- Agitated delirium may be caused by drugs, infection, metabolic disorders (such as hypoglycaemia and hyponatraemia), liver failure, mental health disorders, dementia and drug withdrawal (particularly alcohol). In New Zealand the most common cause is recreational drug ingestion, particularly methamphetamines, cathinones and synthetic cannabinoids.

### Verbal de-escalation

- Verbal de-escalation is often under-utilised.
- Provided there is not an immediate risk to life, verbal de-escalation must be attempted before providing sedation and/or restraint.
- Friends and/or family members may be helpful, but ask them to desist if they are making the situation worse.
- The key aspects to successful verbal de-escalation are:
  - Allow sufficient time. 15-20 minutes may be required.
  - Maintain a safe distance between you and the patient.
  - Have only one person verbally engage the patient.
  - Introduce yourself, state you are there to help and provide reassurance.
  - Use a calm voice and adopt a non-threatening stance. Sit if it is feasible and safe to do so.
  - Use short sentences and keep messages simple. Repetition is essential as the patient will usually have a short attention span.
  - Minimise the number of people in the immediate vicinity.
  - Limit unnecessary noise and distractions. For example, limit radio noise.
  - Actively listen to the patient and try to gain an understanding of their concerns.

- Try to establish rapport and offer choices if appropriate. For example, offer a drink or a cigarette.
- Avoid provocative statements. For example, do not say “if you don’t calm down we will have to sedate you”.
- Once rapport has been established, offer medicine if appropriate. For example, “I see you are very uncomfortable, would you like some medication to help?”

## Determining the level of risk to safety

- Determining the level of risk to safety requires clinical judgement that takes into account the risk to the patient and to personnel.

Mild to moderate risk to safety	Severe to immediately life-threatening risk to safety
<p>Signs include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• Verbally aggressive</li> <li>• Actions not involving immediate risk of serious harm to personnel, for example pushing or grabbing.</li> <li>• Pulling at equipment</li> <li>• Trying to climb off the stretcher</li> <li>• Agitation preventing control of moderate external bleeding</li> </ul>	<p>Signs include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• Dangerous physical aggression</li> <li>• Wielding a weapon</li> <li>• Actions involving immediate risk of serious harm to personnel, for example punching or kicking</li> <li>• Destruction of physical surroundings</li> <li>• Trying to get out of a moving ambulance</li> <li>• Agitation preventing control of severe or life-threatening external bleeding</li> </ul>

## Providing restraint

- Restraint must only be provided when necessary as restraint often increases the level of agitation.
- Restraint carries risks that must be balanced against the risks of not appropriately assessing, treating or transporting the patient.
- Use the minimum amount of restraint required to ensure safety, using a tiered approach that matches the level of restraint to the risk to safety. For example:
  - For agitation causing a mild to moderate risk to safety the patient may only require guidance with a hand on their arm/shoulder/back, or may require someone to hold their hands.
  - For agitation causing a severe to immediately life-threatening risk to safety the patient is likely to require their limbs to be restrained.
- All forms of physical restraint must be recorded on the ePRF.

- Never restrain the patient face down and never restrain the patient with weight on their neck, chest, back or abdomen, as these risk causing respiratory arrest (positional asphyxia).
- There is a high risk of injury to the patient and/or personnel if the patient has severe agitation. In this setting it is vital that there is a planned and coordinated team approach to simultaneous provision of safe sedation and restraint.

## **Involving police**

- Assistance from police is not routinely required but should be requested if there is:
  - Significant risk of injury to the patient, personnel or bystanders, or
  - The patient has agitation causing a severe to immediately life-threatening risk to safety, or
  - More than minimal restraint is required.
- Police do not have the legal authority to restrain a patient on their own property, unless there is immediate danger to people, including immediate danger as a result of being unable to treat the patient.
- Police do not have the legal authority to restrain a patient in a public space, unless there is immediate danger to people (as above), or the patient is considered to be 'disturbing the peace'.
- In rare circumstances where an immediate threat to life exists, it may be appropriate for a taser to be used by police to gain initial control, so that sedation and restraint can be safely provided. In this setting there must be an explicit discussion with police regarding the risks of using a taser, noting that these predominantly relate to the risk of injury associated with the fall following deployment of the taser.

## **Providing sedation**

- Sedation is sometimes referred to as 'chemical restraint' but use of this term is discouraged.
- Sedation carries risks that must be balanced against the risks of not appropriately assessing, treating or transporting the patient.
- Use the minimum amount of sedation required to ensure safety, using a tiered approach that matches the choice and dose of sedative medicine to the level of risk posed to safety.
- The safest approach is usually to provide restraint and sedation, because sedation minimises the amount of restraint required and vice versa.
- When administering droperidol:
  - The IM route is as effective as the IV route.
  - IV administration may occur if IV access is already in place, but IM administration should not be delayed while IV access is obtained.



- When administering midazolam:
  - The preferred route is IV, but this route is often not feasible initially and IM administration should not be delayed while IV access is obtained.
  - No maximum IV dose has been described because the balance of risk is in favour of continuing to administer midazolam if the patient remains agitated.
- When administering ketamine:
  - Ketamine should not be administered to patients with dementia unless all other options have been exhausted.
  - The goal is to produce a state of dissociation so that the patient can be safely restrained, and IV access obtained.
  - IV access should be obtained whenever possible and IV midazolam administered as the ketamine effect wears off, with the aim of transporting the patient in a sedated state.
  - If IV access cannot be obtained, IM midazolam should be administered using the doses described under mild to moderate risk to safety, in anticipation of the ketamine effect wearing off.
- Uncontrolled severe agitation carries a risk of precipitating cardiac arrest. For this reason, sedation must be administered if the patient is severely agitated, even if they have been successfully physically restrained.



## 5.2 Hyperglycaemia

This section is for patients with hyperglycaemia and suspected diabetic ketoacidosis (DKA) or suspected hyperosmolar non-ketosis (HONK).

- Gain IV access.
- Administer 0.9% sodium chloride IV if the patient has signs of hypovolaemia or poor perfusion:
  - a) 1 litre for an adult over one hour.
  - b) 20 ml/kg for a child over one hour.
  - c) Repeat as required.

### Backup

- Backup from a Paramedic or PRIME responder should be requested if the patient has signs of hypovolaemia or poor perfusion.
- Backup from an ICP should be requested if the patient has severe shock.

### Referral and transport

- The patient must be given a clear recommendation to be transported to an ED by ambulance if DKA or HONK is suspected.

## Additional information

### Diabetic ketoacidosis

- DKA develops in patients with type one diabetes who receive insufficient insulin, leading to clinically significant hyperglycaemia.
- Patients with DKA have:
  - Hyperglycaemia with a blood glucose concentration that is usually greater than 20 mmol/litre.
  - Hypovolaemia from a combination of osmotic diuresis secondary to hyperglycaemia, reduced oral intake and vomiting.
  - Acidosis from metabolism of fatty acids to ketones. The most common sign of this is tachypnoea. The patient's breath may have a fruity smell from ketones.
- The patient may have non-specific abdominal pain.
- There is no role for transport to a GP unless it is for backup en route to hospital.
- There is no role for out-of-hospital administration of insulin because rapid falls in glucose risk causing cerebral oedema.
- Hyperventilation is a normal physiological response to metabolic acidosis and the patient should not be coached to lower their respiratory rate.

## Hyperglycaemia without acidosis

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

## Patients with diabetes who are unwell

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

## IV fluid and hyperglycaemia

- Rapid boluses of IV fluid are avoided if the cause of hypovolaemia is hyperglycaemia, unless the patient has severe shock. This is because rapid boluses of IV fluid may contribute to cerebral oedema:
  - Rapid boluses of fluid may cause a rapid fall in glucose (by dilution) and this causes a rapid fall in osmolality. A rapid fall in osmolality causes water to shift into the brain and this may cause cerebral oedema.
  - Children and young adults are most at risk of the adverse effects from cerebral oedema because they do not have cerebral atrophy.



## 5.3 Hypoglycaemia

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

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

### Referral and transport

- The patient may receive treatment for hypoglycaemia and be given a clear recommendation that transport by ambulance to a medical facility is not required, provided all of the following criteria are met:
  - a) It is an isolated single episode, and
  - b) It is not due to overdose (including accidental) of insulin or oral hypoglycaemics, and
  - c) It is not complicated by seizure or clinically significant injury, and
  - d) The patient recovers fully and can mobilise normally, and
  - e) The blood glucose concentration is greater than 3.5 mmol/litre, ten (or more) minutes after glucagon or the last glucose administration, and
  - f) A competent adult can stay with the patient for the next four hours, and
  - g) The patient eats a meal (preferably with complex carbohydrates), and
  - h) The patient is given the hypoglycaemia information sheet, which is explained to them and the accompanying adult.
- The patient must be given a clear recommendation to have their treatment reviewed (for example by their GP or diabetes service personnel). If the patient is aged less than or equal to 18 years or has been recently diagnosed with diabetes, this review must occur within 24 hours.

## Additional information

### Causes of hypoglycaemia

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

### Measuring blood glucose concentration

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

### Treating hypoglycaemia with oral glucose

- Oral glucose is best administered as a simple carbohydrate that is rapidly absorbed.
  - Examples include 10% glucose (100 ml contains 10 g of glucose), glucose tablets or gel, sugar dissolved in water, 'non-diet' jam or similar glucose containing spreads and 'non-diet' soft drinks.
  - 10-20 g of glucose is approximately half a cup of 'non-diet' fruit juice or soft drink, one tablespoon of sugar, one tablespoon of honey or six squares of chocolate.
  - Most oral glucose gels contain 10-20 g of glucose per dose and can be administered to all patients, regardless of age.
  - Document oral glucose as the approximate number of grams of oral glucose administered, or a description of the food ingested.
- Hypoglycaemia may occur several hours later as glucose is metabolised. This is why the instructions within the information sheet are important and why a meal must be eaten. The meal should preferably contain a complex carbohydrate such as brown rice, whole grain bread, porridge or beans.
- Glucose gel may be spread on the gums, tongue and inside of the cheeks of a baby or small child.

## Treating hypoglycaemia with glucagon

Glucagon will be ineffective if the patient has depleted glycogen stores. Examples include if the patient does not have diabetes, is a young child, has sepsis, or has not eaten food for more than 12 hours. In this setting glucagon will not be harmful, but the focus must be on administration of glucose.

## Hypoglycaemia in children aged less than five years

- Hypoglycaemia in children aged less than five years is most commonly due to:
  - An illness in combination with no food intake and depleted glycogen stores, or
  - Severe sepsis, or
  - Poisoning with oral hypoglycaemic medicines.
- Although metabolic disorders can cause hypoglycaemia in young children, this is rare. Do not delay treatment of hypoglycaemia in young children pending diagnostic tests, other than measuring a capillary glucose concentration. Although some references advocate delaying treatment until a blood sample is taken for analysis of possible metabolic disorders, treatment always takes priority over blood tests in this setting.
- Children not known to have diabetes are usually malnourished or glycogen depleted for another reason, and glucagon is unlikely to be effective.



## 5.4 Poisoning from gases

This section is for poisoning following exposure to gases, solvents, smoke and/or fumes.

- Ensure scene safety.
- Measure the blood glucose concentration if the patient has diabetes or an altered level of consciousness, and treat accordingly.
- Assess for symptoms of carbon monoxide (CO) poisoning.
- Measure the carboxy-haemoglobin level if suitable equipment is available.
- Administer oxygen via a reservoir mask at 10 litres/minute if:
  - a) CO poisoning is suspected and the patient is symptomatic, or
  - b) The carboxy-haemoglobin level is greater than 10%.
- Administer nebulised bronchodilators if clinical signs of bronchospasm are prominent.

### Backup

- Backup from a Paramedic or PRIME responder should be requested if the patient has significantly abnormal vital signs.
- Backup from an ICP or doctor able to perform RSI should be requested if the patient has:
  - a) A GCS less than 10 with poor airway and/or poor breathing, or
  - b) Agitation causing a severe to immediately life-threatening risk to safety, that is not easily controlled.

### Referral and transport

- The patient must receive a clear recommendation to be transported to an ED by ambulance if CO poisoning is suspected, their vital signs are significantly abnormal, or bronchospasm requires more than one dose of nebulised bronchodilators.
- The patient should usually receive a clear recommendation that transport to an ED following exposure to solvents and/or fumes is not required, even if they are symptomatic, provided there are no signs of abnormal physiology.
- The patient requires a mental health assessment if they have attempted suicide. See the 'attempted and/or threatened suicide' section for more information.

## Additional information

### **Carbon monoxide (CO) poisoning**

- CO poisoning occurs when there is significant exposure to CO, resulting in CO binding to the haemoglobin molecule and displacing oxygen.
- CO poisoning may occur as a suicide attempt or following accidental exposure in an enclosed space, for example exposure to vehicle exhaust fumes, gas heaters/BBQs, burning charcoal and/or smoke.
- CO poisoning usually causes (in order of worsening severity of poisoning): headache, nausea, vomiting, chest tightness, shortness of breath, tachycardia, confusion, falling level of consciousness, dysrhythmias and cardiac arrest. Although some references describe the patient developing a cherry red skin colour, this is rarely seen.
- Measure the carboxy-haemoglobin level using a CO-oximeter if one is available.
- The patient must receive a clear recommendation to be assessed in an ED if CO poisoning is suspected and:
  - The patient is symptomatic, or
  - The carboxy-haemoglobin level is greater than 10%.
- Measurement of SpO<sub>2</sub> via pulse oximetry is unreliable if the patient has CO poisoning.

### **Solvents and/or fumes**

- Exposure to solvents and/or fumes commonly causes a combination of the following: headache, nausea, vomiting, dizziness, shortness of breath and irritation of the eyes, nose, mouth or throat.
- The symptoms will usually resolve over 1-2 hours provided the patient is removed from the source.
- The presence of symptoms does not necessarily indicate exposure to a toxic level and is not an indication to routinely recommend transport to an ED.
- The possibility of CO poisoning should be reasonably ruled out and the patient should receive a recommendation that transport to ED is not required unless there are objective signs of abnormal physiology. Examples of abnormal physiology include an SpO<sub>2</sub> less than 94% breathing air, persisting clinical signs of bronchospasm despite one dose of nebulised bronchodilators and clinical signs of pulmonary oedema.



## Chlorine gas

- Chlorine is commonly used throughout New Zealand in industry and home swimming/spa pools.
- When chlorine comes into contact with mucous membranes, hydrochloric acid is formed resulting in local irritation/inflammation.
- Patients commonly experience a burning sensation in the eyes, nose, mouth or throat, coughing, chest tightness, shortness of breath and nausea. If the exposure is severe the patient may develop signs of pulmonary oedema.
- Mucous membranes should be liberally flushed using water, for example from a shower.
- The symptoms will usually resolve over 1-2 hours provided the patient is removed from the source.
- The presence of symptoms does not indicate exposure to a toxic level and is not an indication to routinely recommend transport to an ED, unless there are signs of abnormal physiology. Examples of abnormal physiology include an SpO<sub>2</sub> less than 94% breathing air, persisting clinical signs of bronchospasm despite one dose of nebulised bronchodilators and clinical signs of pulmonary oedema.

## Decontamination

- Decontamination prior to transport is only required if there are chemicals on the patient's skin or clothing:
  - Clothing should be removed, leaving underwear on, and the patient decontaminated using water.
  - The most appropriate form of decontamination is a shower, including a domestic shower, of approximately three minutes' duration.
  - Decontamination using a fire service decontamination unit is acceptable, provided one is immediately available. However, decontamination should not be delayed while waiting for one to arrive.
- Off gassing (where the patient exhales dangerous levels of a gas) has never been documented to occur. All cases of apparent off gassing were caused by chemicals on the patient's clothes and this is why clothing contaminated with chemicals must be removed prior to transport.



## 5.5 Poisoning from medicines

This section is for poisoning from medicines, or when the cause of poisoning is unknown.

- Measure the blood glucose concentration if the patient has diabetes or an altered level of consciousness, and treat accordingly.
- Administer naloxone if opiate poisoning is suspected and the patient has a significantly impaired level of consciousness, or significantly impaired breathing:
  - a) 0.1-0.4 mg of naloxone IV every five minutes for an adult, or
  - b) 0.8 mg of naloxone IM every ten minutes for an adult.
  - c) See the paediatric drug dose tables for a child.
- Administer 0.9% sodium chloride IV if the patient has signs of hypovolaemia or poor perfusion:
  - a) 1 litre IV for an adult.
  - b) 20 ml/kg IV for a child.
  - c) Repeat as required.
- Administer 0.9% sodium chloride IV if cyclic antidepressant poisoning is suspected and the patient has tachycardia, QRS prolongation or an altered level of consciousness:
  - a) 2-3 litres IV for an adult.
  - b) 40-60 ml/kg IV for a child.
- If 8.4% sodium bicarbonate is immediately available or can be delivered to the scene within ten minutes, in addition to 0.9% sodium chloride, administer:
  - a) 100 ml IV over 5-10 minutes for an adult.
  - b) 2 ml/kg IV over 5-10 minutes for a child.

### Backup

- Backup from a Paramedic or PRIME responder should be requested if the patient has abnormal vital signs.
- Backup from an ICP or doctor able to perform RSI should be requested if the patient has:
  - a) A GCS less than 10 with poor airway and/or poor breathing, or
  - b) Agitation causing a severe to immediately life-threatening risk to safety, that is not easily controlled.

### Referral and transport

- The patient must receive a clear recommendation to be transported to an ED if they have abnormal vital signs or the medicine/dose taken is potentially harmful. See the 'patient competency' section for more information if the poisoning is a suicide attempt and the patient declines the recommendation.

- The patient requires a mental health assessment if they have attempted suicide. This does not routinely require transport to an ED and assessment should occur in the community provided:
  - a) The poisoning is clearly not harmful, and
  - b) An appointment can be made directly with a mental health team, and
  - c) The patient can be observed by a competent adult until assessment occurs.
  - d) See the 'attempted and/or threatened suicide' section for more information.

## Additional information

### General principles

- An altered level of consciousness following poisoning from medicines is usually caused by benzodiazepines, antidepressants, antipsychotics, opiates, sedatives or a combination of these.
- The treatment of poisoning is rarely medicine specific and is focused on:
  - Supporting airway, breathing and circulation.
  - Treating agitation if it is impairing the ability to safely provide treatment and/or transport. See the 'agitated delirium' section for more information.
  - Ensuring the patient receives appropriate additional assessment and/or follow up.
- The New Zealand National Poisons Centre can be contacted on 0800 764766 for information if the name of the medicine is known, but ambulance personnel do not know what the effects might be. However, use the Clinical Desk for advice regarding treatment or interventions and not the Poisons Centre.

### Naloxone

- Naloxone is not indicated in the treatment of poisoning associated with an altered level of consciousness unless opiate poisoning is strongly suspected.
- Even when opiate poisoning is suspected, naloxone only has a role when there is clinically significant impairment of consciousness or breathing.
- Naloxone administration may be associated with seizures, hypertension, pulmonary oedema or severe agitation. The goal is to administer the minimum amount of naloxone required to produce an adequate improvement in the patient's level of consciousness and/or breathing.
- There is no evidence to support the commonly held view that adequate oxygenation prior to naloxone administration reduces the severity of agitation following naloxone administration. However, treatment of severe hypoxia takes precedence over the administration of naloxone.

## Police

- Assistance from police is not routinely required but should be requested if there is:
  - Significant risk of injury to the patient, personnel or bystanders, or
  - The patient has agitation causing a severe to immediately life-threatening risk to safety, or
  - More than minimal restraint is required.
- Police do not have the legal authority to restrain a patient on their own property, unless there is immediate danger to the patient, personnel or bystanders, including as a result of being unable to treat the patient.
- Police do not have the legal authority to restrain a patient in a public space, unless there is immediate danger (as above) or the patient is considered to be 'disturbing the peace'.

## Paracetamol poisoning

- Significant paracetamol poisoning may cause acute liver failure, but this is treatable provided treatment occurs early.
- A patient with significant paracetamol poisoning is commonly asymptomatic in the first 6-12 hours and then usually develops nausea, vomiting and non-specific abdominal pain.
- A patient with suspected paracetamol poisoning requires transport to an ED, even if asymptomatic and regardless of the apparent dose taken, because the described dose is often incorrect.

## Cyclic antidepressant poisoning

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

## Serotonin syndrome

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

## Beta-blocker poisoning

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

## Colchicine poisoning

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



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## 5.6 Poisoning from recreational drugs

This section is for poisoning from recreational drugs including alcohol.

- Measure the blood glucose concentration if the patient has diabetes or an altered level of consciousness, and treat accordingly.
- Administer naloxone if opiate poisoning is suspected and the patient has a significantly impaired level of consciousness, or significantly impaired breathing:
  - a) 0.1-0.4 mg of naloxone IV every five minutes as required for an adult, or
  - b) 0.8 mg of naloxone IM every ten minutes as required for an adult.
  - c) See the paediatric drug dose tables for a child.
- Administer 0.9% sodium chloride IV if the patient has signs of hypovolaemia or poor perfusion:
  - a) 1 litre IV for an adult.
  - b) 20 ml/kg IV for a child.
  - c) Repeat as required.

### Backup

- Backup from a Paramedic or PRIME responder should be requested if the patient has significantly abnormal vital signs.
- Backup from an ICP or doctor able to perform RSI should be requested if the patient has:
  - a) A GCS less than 10 with poor airway and/or poor breathing, or
  - b) Agitation causing a severe to immediately life-threatening risk to safety, that is not easily controlled.

### Referral and transport

- The patient must be given a clear recommendation to be transported to an ED if they have significantly abnormal vital signs.
- Clinical judgement is required taking into account the social circumstances and the nature of the drug, but most patients should usually receive a recommendation that transport to an ED is not required, provided all the following are met:
  - a) They are able to obey commands, and
  - b) They do not have significantly abnormal vital signs, and
  - c) There is no history, signs or symptoms of acute traumatic brain injury, and
  - d) Hypoglycaemia has been excluded, and
  - e) They can mobilise safely, and
  - f) They are in a safe situation, for example are with a competent adult.
- Clinical judgement is required when determining an intoxicated patient is safe to be taken into the care of police. For this to occur the patient must meet all the criteria listed above and must not have agitated delirium. If the patient

has agitated delirium this must be treated as a health problem and not as a criminal problem. See the 'agitated delirium' section for more information.

- Clinical judgement is required if the patient has had a seizure, particularly following ingestion of chemicals commonly referred to as synthetic cannabinoids. It is usually appropriate to manage the patient without transport to an ED if the patient has stopped seizing and has recovered to be able to mobilise safely.
- The patient does not require a mental health assessment unless they have attempted suicide.

## **Additional information**

### **General principles**

- The treatment of poisoning from recreational drugs is not drug specific and is focused on:
  - Supporting airway, breathing and circulation.
  - Treating agitation if it is impairing the ability to safely provide treatment and/or transport. See the 'agitated delirium' section for more information.
  - Ensuring the patient is safe and receives appropriate additional assessment if required.
- 0.9% sodium chloride IV does not speed recovery from alcohol poisoning and is not indicated unless there are signs of hypovolaemia, poor perfusion or dehydration.
- The New Zealand National Poisons Centre can be contacted on 0800 764766 for information if the name of the drug is known, but ambulance personnel do not know what the effects might be. However, use the Clinical Desk for advice regarding treatment or interventions and not the Poisons Centre.
- Do not transport drugs or vomit to hospital to help identify the drug.

### **Naloxone**

- Naloxone is not indicated in the treatment of poisoning associated with an altered level of consciousness unless opiate poisoning is strongly suspected.
- Even when opiate poisoning is suspected, naloxone only has a role when there is clinically significant impairment of consciousness or breathing.
- Naloxone administration may be associated with seizures, hypertension, pulmonary oedema or severe agitation. The goal is to administer the minimum amount of naloxone required to produce an adequate improvement in the patient's level of consciousness and/or breathing.
- There is no evidence to support the commonly held view that adequate oxygenation prior to naloxone administration reduces the severity of agitation following naloxone administration. However, treatment of severe hypoxia takes precedence over the administration of naloxone.

## Treatment of alcohol and/or recreational drug poisoning at events

- At large events, specific facilities and staff may be organised to manage and treat patients with alcohol and/or recreational drug poisoning. In the absence of significant complications, such as severe airway obstruction, these patients are usually suitable for treatment at such facilities.
- Patients with an altered level of consciousness may be adequately managed provided their airway, breathing and circulation are adequate and they are closely monitored.
- Clinical judgement is required when deciding if a patient should be transported to an ED. In general, transport to an ED should occur if the patient:
  - Has signs or symptoms consistent with TBI, or
  - Has unequal pupils, or
  - Tolerates an airway adjunct, or
  - Has hypoglycaemia that does not respond to treatment, or
  - Has very abnormal physiology (for example poor airway, poor breathing, signs of shock, or moderate to severe hypothermia).
- Some patients with gamma hydroxybutyrate (GHB) poisoning will tolerate an airway adjunct for 20-30 minutes and then rapidly improve. In the absence of other reasons for transport, such patients are suitable for treatment at the facility provided a doctor or ICP is present.
- Patients must be observed regularly. In general, half hourly observations of respiratory rate, SpO<sub>2</sub>, heart rate and GCS are appropriate.
- Most patients will improve with time. There are no specific treatments for alcohol poisoning, but some treatments may be provided without transporting the patient to an ED:
  - 0.9% sodium chloride IV for signs of hypovolaemia, poor perfusion or dehydration.
  - Antiemetics for nausea and/or vomiting.
  - Glucose IV for hypoglycaemia. Alcohol impairs gluconeogenesis and may occasionally cause hypoglycaemia, particularly in children and adolescents. A patient may be treated for hypoglycaemia and not transported to ED provided only one dose of 10% glucose is required and the non-transport criteria within the hypoglycaemia section are followed.
- The patient may be discharged once they are obeying commands and able to mobilise safely. Prior to discharge they should receive advice (preferably written) on safe alcohol and/or recreational drug consumption.



## Specific recreational drugs

- Recreational drugs are often taken in combination (particularly with alcohol) producing uncertain and compounding effects.
- Common recreational drugs include:
  - **Gamma hydroxybutyrate (GHB)** may cause the patient to be deeply unconscious with a poor airway, poor breathing and intermittent apnoea. Commonly the patient requires assisted ventilation and improves rapidly after 20-30 minutes. The patient may take longer to improve if another sedative (for example alcohol) has also been ingested.
  - **Ecstasy** may cause an altered level of consciousness, seizures and hyperthermia.
  - **Ketamine** may cause hallucinations or an altered level of consciousness.
  - **Amphetamines and methamphetamines** may cause severe hypertension, tachycardia and disturbed behaviour. The latter may be severe and may be associated with violence or attempted suicide.
  - **Cathinones** (for example mephedrone) are amphetamine-like. They may cause hypertension, tachycardia, hallucinations, paranoia, panic attacks and disturbed behaviour. The latter may be severe.
  - **Cannabis and cannabinoids** may cause mental dissociation, anxiety, tachycardia, palpitations, chest pain, nausea and vomiting.
  - **Synthetic cannabinoids** is a broad term used to describe a mixture of synthetic chemicals that are usually added to dried plant material enabling them to be smoked. Many of the chemicals have no relationship to cannabis and/or cannabinoids and for this reason the term 'synthetics' is used by some. These drugs may cause altered level of consciousness, seizures, agitation and cardiac arrest.
  - **Cocaine** may cause severe hypertension, tachycardia, intracranial haemorrhage, coronary artery spasm and myocardial ischaemia.

## Seizures following recreational drug use

- Seizures following recreational drug use are common, particularly with the chemicals commonly referred to as synthetic cannabinoids.
- The seizures are usually self-limiting and commonly the patient will refuse assessment and/or transport.
- Clinical judgement must be used as forcibly initiating assessment and/or transport often requires a combination of significant restraint and/or sedation, which may be more life-threatening than the effects of the recreational drug.
- It is usually appropriate to manage the patient without transport to an ED if the patient has stopped seizing and has recovered to be able to mobilise safely. Advice on providing supervision until the patient has fully recovered should be provided to family and/or friends whenever feasible.

## Police

- Assistance from police is not routinely required but should be requested if there is:
  - Significant risk of injury to the patient, personnel or bystanders, or
  - The patient has agitation causing a severe to immediately life-threatening risk to safety, or
  - More than minimal restraint is required.
- Police do not have the legal authority to restrain a patient on their own property, unless there is immediate danger to the patient, personnel or bystanders, including as a result of being unable to treat the patient.
- Police do not have the legal authority to restrain a patient in a public space, unless there is immediate danger (as above) or the patient is considered to be 'disturbing the peace'.



## 5.7 Poisoning from miscellaneous causes

This section is for patients with poisoning from miscellaneous causes including swallowed objects, that do not fit into another section.

- Measure the blood glucose concentration if the patient has diabetes or an altered level of consciousness, and treat accordingly.
- Administer 0.9% sodium chloride IV if the patient has signs of hypovolaemia or poor perfusion:
  - a) 1 litre IV for an adult.
  - b) 20 ml/kg IV for a child.
  - c) Repeat as required.

### Backup

- Backup from a Paramedic or PRIME responder should be requested if the patient has abnormal vital signs.
- Backup from an ICP or doctor able to perform RSI should be requested if the patient has:
  - a) A GCS less than 10 with poor airway and/or poor breathing, or
  - b) Agitation causing a severe to immediately life-threatening risk to safety, that is not easily controlled.

### Referral and transport

- The patient must receive a clear recommendation to be transported to an ED if they have abnormal vital signs or the poison is potentially harmful. See the 'patient competency' section for more information if the poisoning is a suicide attempt and the patient declines the recommendation.
- A clear recommendation must be made to be assessed in an ED if the swallowed object is potentially dangerous, such as a battery, a magnet (especially if there is more than one) or a sharp object such as a pin:
  - This is the case even if the patient is asymptomatic.
  - Transport to a hospital with surgical facilities is preferred. However, transport to a hospital without surgical facilities may occur, because surgical referral and intervention is not usually time critical.
  - Batteries and in particular button (or disc) batteries can cause severe injury to the oesophagus or bowel and may need to be surgically removed. If a battery of the same size is available it should also be taken to the ED.
  - Patients that have swallowed button batteries are time sensitive and should be assessed in an ED without significant delay, noting that transport by ambulance may not be required.
  - Button batteries can be mistaken for coins. If the patient is thought to have swallowed a coin, but it is possible it is a button battery, the patient should be treated as if a battery has been swallowed.

- A clear recommendation may be made to remain in the community if the patient is asymptomatic and there is clear evidence that the swallowed object is not dangerous, for example a button or marble. In this setting the patient or parent/caregiver should be advised that the object will most likely pass through the bowel and that medical advice should be sought if symptoms develop.
- The patient requires a mental health assessment if they have attempted suicide. This does not routinely require transport to an ED and assessment should occur in the community provided:
  - The poisoning is clearly not harmful, and
  - An appointment can be made directly with a mental health team, and
  - The patient can be observed by a competent adult until assessment occurs.
  - See the 'attempted and/or threatened suicide' section for more information.

## Additional information

### General principles

- The treatment of poisoning is rarely poison specific and is focused on:
  - Supporting airway, breathing and circulation.
  - Treating agitation if it is impairing the ability to safely provide treatment and/or transport. See the 'agitated delirium' section for more information.
  - Ensuring the patient receives appropriate additional assessment and/or follow up.
- The New Zealand National Poisons Centre can be contacted on 0800 764766 for information if the name of the poison is known, but ambulance personnel do not know what the effects might be. However, use the Clinical Desk for advice regarding treatment or interventions and not the Poisons Centre.
- Do not induce vomiting as this may cause oesophageal injury.
- There is no role for the transport of chemicals or vomit to hospital to help identify the poison.

### Acid or alkali ingestion

- Ingestion of strong acid or alkali may cause significant injury to the oesophagus. This is particularly the case with alkaline products such as dishwashing powders and bleach.
- Some inflammation of the oropharynx is common but significant injury and/or swelling of the oropharynx is uncommon.
- Encourage sips of water provided the patient's airway and swallow are normal and this does not induce vomiting.
- Have a low threshold for administering ondansetron IV.

## Organophosphate poisoning

- Organophosphate (OP) poisoning occurs most commonly with deliberate ingestion of insecticides containing an OP. It is possible for OP poisoning to occur following skin contact with chemicals containing an OP, but this requires very significant exposure.
- Organophosphates inhibit the activity of the enzyme cholinesterase. This causes acetylcholine (ACh) to build up at neural and neuromuscular junctions. The build-up of ACh causes:
  - Salivation.
  - Lacrimation.
  - Defaecation and vomiting.
  - Urination.
  - Bradycardia.
  - Bronchoconstriction and bronchial secretions.
  - Muscle twitching and muscle weakness.
- Treatment is support of the patient's airway, breathing and circulation, in addition to treatment with atropine. Atropine will reverse most of the effects of the ACh:
  - An appropriate initial dose for an adult is 1.2 mg IV which should be repeated every five minutes until there are signs of adequate atropinisation.
  - Repeated and escalating doses may be required.
  - It is likely that additional atropine will need to be delivered to the treating crew.
- Adequate atropinisation will be indicated by:
  - Resolution of bradycardia.
  - Drying of secretions.
  - Resolution of wheeze.
- Adequate protection for staff is achieved by wearing gloves and overalls or a gown, unless the patient is in a confined space with an aerosolised OP.
- Decontamination prior to transport is not required if the patient has ingested an OP. The patient's vomit will contain OP and normal PPE should be worn to prevent contact with vomit.
- Decontamination prior to transport is required if there are OP chemicals on the patient's skin or clothing:
  - Clothing should be removed, leaving underwear on, and the patient decontaminated using water.
  - The most appropriate form of decontamination is a shower, including a domestic shower, of approximately three minutes' duration.
  - Decontamination using a fire service decontamination unit is acceptable, provided one is immediately available. However, decontamination should not be delayed while waiting for one to arrive.

- Off gassing (where the patient exhales dangerous levels of OP) has never been documented to occur. All cases of apparent off gassing were caused by OP on the patient's clothes and this is why clothing must be removed prior to transport.

## **Cyanide poisoning**

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

- Amyl nitrite. This usually comes in capsule form which is designed to be crushed into a tissue or hand. The gas released from the contents is inhaled. Amyl nitrite causes the haemoglobin molecule to change to methaemoglobin and this binds cyanide. Amyl nitrite also causes skin flushing and hypotension.
- Sodium thiosulfate. This speeds metabolism of cyanide and is administered IV.
- Cyanide poisoning following exposure to smoke is clinically indistinguishable from CO poisoning. Treatment is supportive. No specific PPE other than normal body fluid protection is required. If cyanide poisoning is suspected the patient should be transported to ED without trying to obtain specific cyanide antidotes.

### **Paraquat poisoning**

- Paraquat is a herbicide that is extremely poisonous, with a high mortality rate. As little as 20-40 ml may be fatal. There are no effective treatments once it is absorbed.
- Patients with possible paraquat poisoning must be transported to an ED without delay, even if asymptomatic because specific gut decontamination techniques may be required urgently.
- No specific PPE (other than normal body fluid precautions) or decontamination is required if paraquat has been ingested. In the unlikely event that paraquat is present on the patient's skin or clothing, decontamination should occur in the same way as described for organophosphates.
- Oxygen administration is controversial in patients with paraquat poisoning:
  - Part of the lung damage from paraquat is due to oxygen free radicals and the concentration of these is increased by exposure to high levels of oxygen.
  - In experimental models, animals with paraquat poisoning had worse outcomes when exposed to high levels of oxygen. On this basis many treatment guidelines recommend that supplemental oxygen be avoided.
  - However, there is no evidence to support this in humans and there are many case reports of patients with hypoxia associated with paraquat poisoning being treated with supplemental oxygen and surviving.
  - Oxygen should be administered if the SpO<sub>2</sub> is below 94% on air.




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## 5.8 Seizures

- Measure the blood glucose concentration and treat accordingly.
- Administer midazolam if the seizure is generalised and continues for longer than five minutes, or the patient has status epilepticus.
- Administer midazolam IV:
  - a) 5 mg of midazolam IV for an adult. Reduce the dose to 3 mg if the patient is frail.
  - b) See the paediatric drug dose tables for a child.
  - c) This may be repeated once after five minutes.
- Administer midazolam IM if IV access has not already been obtained:
  - a) 10 mg of midazolam IM for an adult. Reduce the dose to 5 mg if the patient is frail.
  - b) See the paediatric drug dose tables for a child.
  - c) This may be repeated once after ten minutes
- Administer valproate IV over 1-2 minutes, preferably via a running line, if the seizure continues or recurs after two parenteral doses of midazolam:
  - a) 1200 mg of valproate for an adult.
  - b) See the paediatric drug dose tables for a child.
- Some patients have pre-prescribed medicines to be administered via the rectal, nasal or buccal route. All personnel may administer such medicines, even if not within their delegated scope of practice, provided they have been prescribed for that patient and the seizure continues for longer than five minutes, or the patient has status epilepticus.

### Backup

- Backup from a Paramedic or PRIME responder should be requested if midazolam is indicated.
- Backup from an ICP must be requested if more than one dose of midazolam is administered.
- Backup from an ICP or doctor able to perform RSI must be requested if there is severe airway obstruction or status epilepticus.

### Referral and transport

- The patient must receive a clear recommendation to be transported to an ED by ambulance if this is the first time they have had a seizure, unless the cause is clearly recreational drug use and the patient has recovered to be able to mobilise safely.
- The patient may receive a clear recommendation not to be transported to a medical facility by ambulance, even if midazolam has been administered, provided the patient:
  - a) Has known epilepsy with no significant change in their usual pattern of



- seizures, or has recreational drug poisoning, and
  - b) Has not been injured, and
  - c) Has recovered to a safe postictal state, and
  - d) Can be left in the care of a competent adult, and
  - e) Has received a maximum of one dose of parenteral midazolam by ambulance personnel, and
  - f) Is instructed to see their GP within 72 hours for a review of their treatment.
- If transport is required, this should usually be to an ED, but could be to primary care if the patient is rapidly improving and is well known to staff at that facility.
  - The patient should be transported to a hospital with intensive care facilities if they have status epilepticus, whenever this is feasible and safe.

## **Additional information**

### **Treating seizures with the patient's medication**

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

### **Treating seizures with midazolam**

- The preferred route is IV, but do not delay administration IM while IV access is obtained because the evidence is that midazolam by the IM route is as effective as IV route.
- Always round the weight of children up to the nearest 10 kg.
- Midazolam IV may take 2-3 minutes to stop the seizure.
- A brief period of apnoea is common following successful treatment with midazolam IV.
- The maximum number of doses of midazolam administered by ambulance personnel is two by any route if the patient does not stop seizing. For example, two IV doses, one IM dose and one IV dose, or two IM doses. This maximum of two doses may be administered in addition to any benzodiazepine that has already been administered prior to ambulance arrival.
- There is no maximum number of midazolam doses if the seizures stop with midazolam administration and the patient has normal/purposeful movement between seizures. Examples of normal/purposeful movement include localising to pain, sitting up, rolling over and pulling on an oxygen mask.
- Wait ten minutes before administering midazolam IV after IM administration. This is to allow adequate time for the IM dose to be absorbed.

## Status epilepticus

- The definition of status epilepticus is evolving.
- Many references define status epilepticus as a seizure lasting longer than 30 minutes despite treatment, or multiple seizures occurring when the patient remains unconscious between seizures. However, increasingly many clinicians advocate that seizures persisting beyond 10-15 minutes despite treatment should be considered status epilepticus.
- Our definition of status epilepticus is:
  - Seizures that persist despite two doses of parenteral midazolam from clinical personnel, or
  - Three or more seizures with failure of the patient to have normal or purposeful movement between seizures.
- Regardless of the definition used, the key aspects are that:
  - Prolonged and uncontrolled seizures alter brain receptor activity, making pharmacological control of seizures more difficult. The longer the seizures persist before being controlled, the more difficult control becomes.
  - Status epilepticus is life-threatening because it is commonly associated with hypoxia, hypercarbia, metabolic acidosis (lactate is produced during vigorous skeletal muscle activity), hyperthermia (as a result of prolonged muscle activity) and aspiration.
  - RSI may be required.
  - General anaesthesia and admission to an intensive care unit is often required.

## Following the seizure

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

## The postictal state

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

## Types of seizures

- Seizures may be classified as generalised (grand mal) or partial (focal or localised). Partial seizures may be simple (where the patient retains awareness of their surroundings) or complex (where the patient loses awareness of their surroundings).
- A patient having partial seizures may present without obvious convulsions or motor activity and may be able to obey commands and interact during seizure activity. The patient may present with any combination of the following:
  - Habitual repetitive movements (automatisms).
  - Sensory symptoms including visual or auditory hallucinations.
  - Emotional outbursts or unusual feelings, such as feeling like they are outside their body.
  - Blank gaze.
- The most common cause of partial seizures is temporal lobe epilepsy.
- Partial seizures may respond to midazolam and/or valproate. If the seizure lasts longer than five minutes and is causing distress, it is appropriate to treat the seizures with anticonvulsants.

## Non-epileptic seizures (pseudo-seizures or psychogenic seizures)

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

## Seizures following recreational drug use

- Seizures following recreational drug use are common, particularly with the chemicals commonly referred to as synthetic cannabinoids.
- The seizures are usually self-limiting and commonly the patient will refuse assessment and/or transport.
- Clinical judgement must be used as forcibly initiating assessment and/or

transport often requires a combination of significant restraint and/or sedation, which may be more life-threatening than the effects of the recreational drug.

- It is usually appropriate to manage the patient without transport to an ED if the patient has stopped seizing and has recovered to be able to mobilise safely. Advice on providing supervision until the patient has fully recovered should be provided to family and/or friends whenever feasible.

### **Febrile seizures in children**

- Febrile seizures are associated with a rapid temperature rise, rather than any specific temperature and usually occur in children aged less than six years.
- The most common cause of febrile seizures is a viral illness.
- Fever associated with infection usually confers some benefit to the patient and does not cause harm provided it is less than 40°C. For this reason rapid and/or aggressive cooling is not indicated unless the temperature is higher than 40°C. Unless this is the case, cool slowly by uncovering the child.

### **Seizures during pregnancy**

- Seizures during pregnancy can occur as a result of pre-eclampsia.
- Eclampsia occurs when a patient with pre-eclampsia has one or more generalised seizures.
- Magnesium may have a role in the treatment of eclampsia. Seek clinical advice.



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## 6.1 Assessing for sepsis

### General principles

- Sepsis is present when a microorganism invades a normally sterile part of the body, resulting in an immune response producing systemic signs and/or symptoms.
- The infecting microorganism is usually a bacterium, but may be a virus, a fungus or a parasite.
- Sepsis is usually isolated to a specific organ, for example the skin, urinary tract or lungs, but the immune response to sepsis affects all organs in the body.
- Sepsis has a significant mortality rate and early recognition with treatment improves outcomes.
- There are no criteria that can be used to tightly define the presence or absence of sepsis and the overall clinical picture must be taken into account.

### Risk factors for developing sepsis

- The following factors place the patient at increased risk of developing sepsis:
  - Aged less than one year or greater than 75 years.
  - Treated with chemotherapy within the last four weeks.
  - Known neutropenia.
  - Taking immune suppressing medicines, for example steroids.
  - Diabetes.
  - An indwelling venous line or catheter.
  - Surgery or an invasive procedure within the last four weeks.
  - A breach of skin integrity, for example wounds or blisters.
  - IV drug misuse within the last four weeks.
  - Birth, termination of pregnancy or miscarriage in the last four weeks.
- A patient with one or more risk factors may not have sepsis and conversely a patient without risk factors may develop sepsis. However, the presence of risk factors should heighten awareness of the possibility of sepsis and cause personnel to assess the patient with additional attention to detail.

### Assessment of the patient

- When assessing the patient:
  - Take a history from the patient and their family or carers, including frequency of urination.
  - Examine the patient looking for a site of infection.
  - Measure/assess and record the patient's respiratory rate, SpO<sub>2</sub>, heart rate, blood pressure, capillary refill time, temperature, blood glucose concentration, level of consciousness and mental status.

- Always consider sepsis a possibility if a patient is unwell without an obvious cause and take into account that the patient may have non-specific signs or symptoms, especially early in the course of sepsis.
- Assess the patient with additional attention to detail if they cannot provide a clear history, for example if they do not speak English or cannot communicate clearly.
- The following signs and symptoms indicate that sepsis may be present:
  - Abnormal temperature.
  - Tachypnoea.
  - Tachycardia.
  - New onset of poor peripheral perfusion/mottling of skin.
  - Lowered blood pressure or narrowing of pulse pressure.
  - Signs of abnormal vasodilatation.
  - New onset of an altered mental status.
  - Decreased frequency of urination.
  - Aching muscles and/or joints.
  - Rigors.
- Assess mental status by assessing how alert the patient is, their level of interaction (for example when taking a history), their memory (for example address and current political party in government), and their orientation (for example to time, place and person). See the 'assessing mental status' section.

### **Interpreting vital signs**

- Although fever is commonly associated with sepsis, the presence or absence of fever is not always a useful diagnostic sign:
  - Sepsis can be present without fever.
  - Temperature can vary over time.
  - The measured temperature can differ between sites at the same time, for example the temperature at the tympanic site may differ from the temperature at the axillary site.
  - Tympanic thermometers may be unreliable in small children if the probe will not adequately fit their external auditory meatus and an axillary measurement is preferred if a child is under six months of age.
  - A fall in temperature is a very important sign in that it is often associated with low cardiac output.
  - Fever may not be due to sepsis. For example a deep venous thrombosis can cause fever.
- Interpret the respiratory rate in the overall context of the patient:
  - Consider the normal range for the patient's age.
  - Tachypnoea is a subtle but important sign that the patient is unwell.

- Interpret the heart rate in the overall context of the patient:
  - Consider the normal range for the patient’s age.
  - Baseline heart rate is usually reduced in young and/or fit adults.
  - New onset of tachydysrhythmia (particularly atrial fibrillation) is common in the elderly with sepsis.
  - Tachycardia may not be present if the patient is taking a beta-blocker.
  - Fever will cause tachycardia but severe tachycardia should not be attributed to fever alone.
- Interpret the blood pressure in the overall context of the patient:
  - Consider the normal range for the patient’s age.
  - Compare the blood pressure to the patient’s usual blood pressure if this is known.
  - A patient with pre-existing hypertension may have a significant fall in blood pressure without developing hypotension.
  - A normal blood pressure does not rule out sepsis, particularly in children and young adults.
  - Take a lying/sitting blood pressure and a standing blood pressure if this is feasible and safe. Postural hypotension is an important sign the patient may have sepsis.
- Interpret mental status in the overall context of the patient:
  - Compare the patient’s current mental status to their known usual state.
  - Changes in mental status may be subtle and a history of an acute change from family and/or carers is important.
  - A change in mental status may present as irritability, altered behaviour or agitation, particularly in young children and those with pre-existing intellectual impairment.
- Rigors indicate that bacteria may be present in the blood.





## 6.2 Sepsis

This section is for patients with a provisional diagnosis of sepsis. See the 'meningococcal septicaemia' section if this is suspected. If the patient is aged less than 12 years, provide supportive treatment and seek clinical advice regarding antibiotic administration if the child is very unwell, and transport time to hospital is prolonged.

- Measure/assess and record the patient's respiratory rate, SpO<sub>2</sub>, heart rate, blood pressure, temperature, capillary refill time, blood glucose concentration, level of consciousness and mental status.
- Assess for the presence of risk factors (see the risk factor tables).
- Gain IV access if there are signs of hypovolaemia, poor perfusion, or one or more high risk factors are present.
- Administer antibiotics only if one or more high risk factors are present, the patient is aged greater than or equal to 12 years and time to hospital is greater than 30 minutes:
  - a) Administer amoxicillin/clavulanic acid if the site of sepsis appears to be the soft tissues, a joint or the chest.
  - b) Administer amoxicillin/clavulanic acid and gentamicin if the site of sepsis appears to be the urinary tract, the abdomen or the site is unknown.
  - c) See later for dosing.
- Administer 0.9% sodium chloride IV if there are signs of hypovolaemia or poor perfusion:
  - a) 1 litre for an adult.
  - b) 20 ml/kg for a child.
  - c) Repeat as required.

## Sepsis risk factors for patients aged greater than or equal to 12 years

### High risk factors

- **History or CNS examination**
  - Objective evidence of new onset of an altered mental status.
  - Known neutropenia.
- **Respiratory**
  - Respiratory rate  $\geq 25$ /minute.
  - New need for oxygen via reservoir mask to maintain SpO<sub>2</sub> > 92% (or more than 88% in known COPD).
- **Blood pressure**
  - Systolic blood pressure  $\leq 90$  mmHg.
  - Systolic blood pressure > 40 mmHg below known normal.
- **Circulation and hydration**
  - Heart rate > 130/minute.
  - Not passed urine in the last 18 hours.
  - If catheterised, passing < 0.5 ml/kg of urine per hour.
- **Skin**
  - Mottled or ashen appearance.
  - Cyanosis of skin, lips or tongue.
  - Petechiae or purpura.

### Medium risk factors

- **History or CNS examination**
  - History from family/caregivers of new onset of an altered mental status.
  - History of acute deterioration of functional ability.
  - Impaired immune system (illness or drugs including oral steroids).
  - Trauma, surgery or invasive procedures in the last six weeks.
- **Respiratory**
  - Respiratory rate 21-24/minute.
- **Blood pressure**
  - Systolic blood pressure 91-100 mmHg.
- **Circulation and hydration**
  - Heart rate 91-130/minute
  - New onset dysrhythmia.
  - Not passed urine in the last 12-18 hours.
  - If catheterised, passing 0.5-1 ml/kg of urine per hour.
- **Temperature**
  - Tympanic temperature < 36°C.
- **Skin**
  - Signs of potential infection, including redness, swelling or discharge at surgical site or breakdown of wound.

## Low risk factors

- **History or CNS examination**
  - Normal mental status.
- **Respiratory**
  - Respiratory rate  $\leq$  20/minute.
- **Blood pressure**
  - Systolic blood pressure  $>$  100 mmHg.
- **Circulation and hydration**
  - Heart rate  $\leq$  90/minute.
  - Passed urine in the last 12 hours.
  - If catheterised, passing  $>$  1 ml/kg of urine per hour.

## Antibiotic dosing

- 1.2 g of amoxicillin/clavulanic acid IV.
- Gentamicin dosing:
  - a) 400 mg if weight is greater than 80 kg.
  - b) 320 mg if weight is 60-80 kg.
  - c) 240 mg IV if weight is less than 60 kg.

## Treatment of hypotension

- Administer metaraminol IV if despite two doses of 0.9% sodium chloride, the systolic blood pressure is less than 100 mmHg in an adult, or significantly less than the normal predicted systolic blood pressure in a child.

### Metaraminol for an adult:

- a) Administer via an infusion pump:
  - Administer an initial bolus of 0.5-1 mg metaraminol IV.
  - Start the infusion at 2 mg/hour and adjust the rate as required.
- b) Alternatively, administer a bolus of 0.5-1 mg metaraminol IV every 5-10 minutes as required.

### Metaraminol for a child:

- Administer a bolus of metaraminol IV (see the paediatric drug dose tables) every 5-10 minutes as required.
- Consider administering adrenaline IV if the blood pressure is unresponsive to metaraminol, or the patient is hypotensive and bradycardic.

### Adrenaline for an adult:

- a) Administer an adrenaline infusion via an infusion pump. Start at a rate of 0.5 mg/hour and adjust the rate as required, or
- b) Place 1 mg of adrenaline into a 1 litre bag of 0.9% sodium chloride (1:1,000,000 solution):

- Administer as an infusion. Start at 2 drops/second and adjust the rate as required, or
- Administer a bolus of 0.01 mg adrenaline (10 ml) IV every 1-2 minutes as required.

**Adrenaline for a child aged 5-14 years:**

- a) Administer an adrenaline infusion via an infusion pump. Start at a rate of 0.25 mg/hour and adjust the rate as required, or
- b) Place 1 mg of adrenaline into a 1 litre bag of 0.9% sodium chloride (1:1,000,000 solution):
  - Administer as an infusion. Start at 1 drop/second and adjust the rate as required, or
  - Administer IV boluses (see the paediatric drug dose tables) every 1-2 minutes as required.

**Adrenaline for a child aged less than five years:**

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

**Backup**

- Backup from a Paramedic or PRIME responder should be requested if 0.9% sodium chloride IV is indicated.
- Backup from an ICP should be requested if the patient has hypotension that is not rapidly responding to 0.9% sodium chloride IV.

**Referral and transport**

- A patient with one or more high risk factors, or with two or more moderate risk factors, must be given a clear recommendation to be:
  - Transported to an ED by ambulance, or
  - Seen within two hours in primary care (preferably by their own GP).
- Patients with only one moderate risk factor (and no high risk factors) are usually suitable to be given a clear recommendation to be seen in primary care (preferably by their own GP), within six hours.
- Patients with only low risk factors (and no high risk factors or moderate risk factors) are usually suitable to be given a clear recommendation to be seen in primary care (preferably by their own GP) within 24 hours.

## **Additional information**

### **Referral and transport**

- Clinical judgement is required when determining whether patients with one or more high risk factors, or with two or more moderate risk factors, are given a recommendation to be transported to an ED by ambulance, or a recommendation to be seen in primary care.
  - Most patients should receive a recommendation to be transported to an ED by ambulance, particularly if the patient is living independently.
  - Being seen in primary care may be the best option if the patient is in an aged residential care facility or is frail.
- If the patient is being referred to primary care within six hours:
  - Primary care staff must be contacted directly by ambulance personnel and an appointment confirmed before leaving the scene.
  - Safe transport for the patient (if required) must be available or organised.

### **Withdrawing blood for culture**

- Blood culture bottles are not carried because they have a very short shelf life and some hospital personnel will not process blood culture bottles that have been filled by ambulance personnel.
- Administering antibiotics without taking blood for culture is a balance of risk:
  - Not taking blood for culture increases the risk of not making a microbiological diagnosis, and this alters the choice and duration of subsequent antibiotic treatment.
  - Delaying antibiotic administration increases the risk of deterioration and this increases morbidity and mortality, particularly if the transport time to hospital is prolonged.
  - For these reasons, antibiotics are only administered if the patient is aged greater than or equal to 12 years, has a provisional diagnosis of sepsis, has one or more high risk factors, and the time to hospital is longer than 30 minutes.
  - Time to hospital is defined as the time from gaining IV access to handover in ED.

## 6.3 Meningococcal septicaemia

This section is for patients with a clinical diagnosis of meningococcal septicaemia.

- Gain IV access and administer ceftriaxone:
  - a) Administer 2 g IV for an adult.
  - b) See the paediatric drug dose tables for a child.
  - c) Administer the dose IM if IV access cannot be immediately obtained.
- Administer 0.9% sodium chloride IV if there are signs of hypovolaemia or poor perfusion:
  - a) 1 litre for an adult.
  - b) 20 ml/kg for a child.
  - c) Repeat as required.
- Measure the blood glucose concentration and treat accordingly.
- Gain IV access in a second site if possible.
- Administer metaraminol IV if despite two doses of 0.9% sodium chloride, the systolic blood pressure is less than 100 mmHg in an adult, or significantly less than the normal predicted systolic blood pressure in a child.

### **Metaraminol for an adult:**

- a) Administer via an infusion pump:
  - Administer an initial bolus of 0.5-1 mg metaraminol IV.
  - Start the infusion at 2 mg/hour and adjust the rate as required.
- b) Alternatively, administer a bolus of 0.5-1 mg metaraminol IV every 5-10 minutes as required.

### **Metaraminol for a child:**

- Administer a bolus of metaraminol IV (see the paediatric drug dose tables) every 5-10 minutes as required.
- Consider administering adrenaline IV if the blood pressure is unresponsive to metaraminol or the patient is hypotensive and bradycardic.

### **Adrenaline for an adult:**

- a) Administer an adrenaline infusion via an infusion pump. Start at a rate of 0.5 mg/hour and adjust the rate as required, or
- b) Place 1 mg of adrenaline into a 1 litre bag of 0.9% sodium chloride (1:1,000,000 solution):
  - Administer as an infusion. Start at 2 drops/second and adjust the rate as required, or
  - Administer a bolus of 0.01 mg adrenaline (10 ml) IV every 1-2 minutes as required.

### **Adrenaline for a child aged 5-14 years:**

- a) Administer an adrenaline infusion via an infusion pump. Start at a rate of 0.25 mg/hour and adjust the rate as required, or
- b) Place 1 mg of adrenaline into a 1 litre bag of 0.9% sodium chloride (1:1,000,000 solution):
  - Administer as an infusion. Start at 1 drop/second and adjust the rate as required, or
  - Administer IV boluses (see the paediatric drug dose tables) every 1-2 minutes as required.

### **Adrenaline for a child aged less than five years:**

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

## **Backup**

- Backup must be requested from an ICP.
- Backup from a Paramedic or PRIME responder must be requested if backup from an ICP is not immediately available.

## **Referral and transport**

- The patient must be transported to an ED by ambulance.
- Transport the patient to a hospital with intensive care facilities whenever this is feasible and safe.

## **Additional information**

### **General principles**

- Meningococcal septicaemia is an infection within blood from the bacterium *Neisseria meningitidis*. It is uncommon and has a high mortality rate.
- Meningococcal septicaemia is time critical in terms of commencing treatment and antibiotics should be administered out-of-hospital whenever possible.
- Patients with meningococcal septicaemia in the early stages of infection commonly have non-specific influenza-like symptoms. Antibiotics are not indicated unless there are clear clinical signs of meningococcal septicaemia such as petechiae or purpura (see below).
- Meningococcal septicaemia commonly triggers disseminated intravascular coagulation (DIC).
  - DIC causes a combination of bleeding and clotting within small blood vessels throughout the body.
  - DIC occurs in all organs but can be seen in the skin as small spots. The spots are not like a rash and will not blanch if they are pressed on.

- Petechiae are small spots about the size of the tip of a pen. They are due to bleeding from small capillaries in the skin. They can be seen anywhere and the patient should be examined fully to exclude them. They usually develop and/or progress over time and if the diagnosis is being considered, the patient's skin should be re-examined every 10-15 minutes looking for new petechiae.
- Purpura are larger spots that look like small bruises. They result from a combination of bleeding and ischaemia of the skin. They are usually very obvious.
- DIC is usually associated with signs of severe shock.
- As meningococcal bacteria die they release a substance called endotoxin. The body's immune response to endotoxin can cause profound worsening of shock following antibiotic administration. Be prepared to treat this with further 0.9% sodium chloride IV, metaraminol IV, and adrenaline IV if required. It is rare for significant amounts of endotoxin to be released from other bacteria.
- Hypoglycaemia is common in patients with meningococcal septicaemia. Have a low threshold for re-measuring the blood glucose concentration if transport time is prolonged or the patient has a falling level of consciousness.

## **Meningitis**

- Meningitis is a completely different disease to meningococcal septicaemia. It is relatively common and has a low mortality rate.
- Meningitis is inflammation of the meninges of the brain. The most common cause is infection.
- The infection is most commonly viral, but may be bacterial. *Neisseria meningitidis* is only one of many bacteria that can cause bacterial meningitis.
- The patient will usually present with headache and signs of infection. They may have nausea, a stiff neck and photophobia.
- Meningitis is not usually time critical in terms of commencing antibiotic treatment and administration of an antibiotic is rarely indicated in the out-of-hospital setting.
- Rarely, the patient may benefit from antibiotic administration if they have an altered level of consciousness and transport time to hospital is greater than 60 minutes. In this setting personnel should seek clinical advice.

## **Advice to personnel following exposure to a patient with suspected meningococcal infection**

- Meningococcal bacteria are present in the oro/nasopharynx in approximately 10% of the asymptomatic population and are spread between people via oro/nasopharyngeal droplets.
- The risk of infection in personnel following treatment and/or transport of a patient with meningococcal disease is low and no different from the rest of the population, unless personnel have had close contact with the patient.



- Close contact with the patient is defined as any of the following:
  - Living in the same house.
  - Sharing eating or drinking utensils.
  - Contact resulting in transmission of oro/nasopharyngeal droplets between the patient and personnel. For example, mouth to mouth ventilation or the patient coughing or sneezing directly into the face of personnel not wearing a surgical mask.
- Personnel who have not had close contact with the patient do not require antibiotic prophylaxis.
- Personnel who have had close contact with the patient:
  - Are at slightly increased risk of subsequent meningococcal infection than the rest of the population.
  - Should notify their service via the usual reporting process.
  - Should notify public health, for example via the local 0800 number, including the name and NHI of the patient. Public health staff will contact personnel to discuss antibiotic prophylaxis.
- Antibiotic prophylaxis is not time critical and can be commenced several days following exposure. The decision to take antibiotic prophylaxis requires discussion on the balance of risk.
- Personnel should seek clinical advice via the Clinical Desk if they require urgent advice.



## 6.4 Cellulitis

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

- Assess the patient, including an assessment of the features contained within the flag table.
- If no red flags are present, the patient should be given a clear recommendation to be seen in primary care (preferably by their own GP) within 12 hours.
- If the patient is not being directly referred (or transported) to a medical facility, consider administering a single dose of amoxicillin/clavulanic acid IV if it is possible there may be a delay in the patient seeing a doctor:
  - a) 1.2 g IV for an adult.
  - b) Wait a minimum of 20 minutes before leaving, to ensure there are no signs or symptoms of severe allergy.



### Red flags

- Signs of shock.
- Severe pain, oedema or blistering.
- Skin necrosis.
- Inability to mobilise.
- Rigors.
- Neutropenia.
- Chemotherapy within the last four weeks.
- Temperature > 40°C.
- An associated abscess.
- Involves > 5% of body surface area.
- Rapidly spreading.
- Involves the face, hands or genitals.
- Diabetes on insulin.
- Significant lymphangitis.
- A hot or painful joint.
- Associated with a bite wound.
- Frail, elderly or significant comorbidities.
- New onset of an altered mental status.

## Additional information

### General principles

- Cellulitis is most common in the lower leg.
- Mark the outer margins with a pen to provide a baseline for later clinical reference, noting that the cellulitis will usually extend outside the marked area for the first 1-2 days following the initiation of treatment.
- Rigors indicate that bacteria may be present in the blood.
- Neutropenia is a low neutrophil white blood cell count. Neutropenia usually occurs post chemotherapy and the patient will usually know if they are neutropenic.
- Chemotherapy includes any form of IV or oral chemotherapy for cancer treatment.
- 'Rapidly' spreading cannot be tightly defined and requires clinical judgement.
- Significant lymphangitis is present if there is red tracking or severe pain in the area of the lymph drainage/lymph nodes of the limb.
- A hot or painful joint indicates the possibility of septic arthritis (an infected joint) and this requires treatment in a hospital.
- If the patient is not being referred directly or transported to a medical facility, and amoxicillin/clavulanic acid IV has been administered, remove the IV line prior to leaving the scene.
- Do not administer amoxicillin/clavulanic acid IM if IV access cannot be obtained.

### Referral and transport

- There are no orange or green flags for cellulitis because in the absence of red flags the patient still needs to be seen by a doctor.
- Have a lowered threshold for recommending transport to an ED if the patient is a child.
- Provide advice if the patient is not being transported to a medical facility:
  - Keep the limb elevated if possible.
  - Take paracetamol and/or ibuprofen for analgesia.
  - Call an ambulance if signs of severe systemic illness (for example feeling faint, severe nausea, severe vomiting or rigors) develop or the patient becomes unable to mobilise.

## 6.5 Chest infection

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

- Assess the patient, including an assessment of the features contained within the flag table. See the 'making recommendations using the flag tables' section.



### Red flags

- Signs of shock.
- Tachypnoea.
- New onset of an altered mental status.
- SpO<sub>2</sub> < 94% on air (unless normal for the patient).
- Inability to mobilise normally.
- Severe pleuritic chest pain.
- Rigors.
- Neutropenia.
- Chemotherapy within the last four weeks.
- Temperature > 40°C.



### Orange flags - should be seen in primary care within 24 hours

- Temperature 38-40°C.
- Mild to moderate pleuritic chest pain.
- Aged ≥ 65 years.
- COPD.
- Purulent sputum.
- Immunocompromised (for example on steroids or immunotherapy).



### Green flags

- Temperature less than 38°C.
- Productive cough but sputum not purulent.
- Aged ≤ 64 years.
- Normal vital signs.
- Normal mobility.



## 6.6 Influenza

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

- Protect yourself from droplets.
- Have the patient wear a surgical mask if this is feasible.
- Assess the patient, including an assessment of the features contained within the flag table. See the 'making recommendations using the flag tables' section.



### Red flags

- Signs of shock.
- Tachypnoea.
- New onset of an altered mental status.
- SpO<sub>2</sub> < 94% on air (unless normal for the patient).
- Inability to mobilise normally.
- Severe pleuritic chest pain.
- Rigors.
- Neutropenia.
- Chemotherapy within the last four weeks.
- Temperature > 40°C.



### Orange flags - should be seen in primary care within 24 hours

- Aged ≥ 65 years.
- Pregnant.
- Immunocompromised (for example on steroids or immunotherapy).
- Ischaemic heart disease.
- COPD.
- Diabetes.
- Severe obesity.
- Purulent sputum.



### Green flags

- Productive cough but sputum not purulent.
- Aged ≤ 64 years.
- Normal vital signs.
- Normal mobility.

## Additional information

- Consider an alternative diagnosis if the patient has any of the following:
  - Absence of fever, or
  - Tachycardia that is inconsistent with influenza, or
  - Prolonged peripheral capillary refill time, or
  - Mottling, or
  - Absence of respiratory or throat symptoms, or
  - Rigors, or
  - Inability to mobilise normally.
- Include an assessment for signs of meningococcal septicaemia, which in the very early phase may be indistinguishable from influenza.
- Influenza is generally seasonal (usually winter and spring months in New Zealand) and the prevalence in the community at any given time needs to be considered before making a provisional diagnosis of influenza.
- The patient will most commonly present with:
  - Non-specific symptoms (for example muscle aches, fatigue, malaise and headache), and
  - Respiratory symptoms (for example cough, sore throat and chest discomfort), and
  - Fever with a temperature greater than 38°C.
- If more than two orange flags are present, have a lowered threshold for recommending the patient is assessed in an ED.
- Rigors indicate that bacteria may be present in the blood.
- Neutropenia is a low neutrophil white blood cell count. Neutropenia usually occurs post chemotherapy and the patient will usually know if they are neutropenic.
- Chemotherapy includes any form of IV or oral chemotherapy for cancer treatment.
- In order for patients with diabetes to meet the criteria for an orange flag, they must be receiving treatment with insulin or an oral hypoglycaemic.
- If the patient is not transported an influenza information sheet should be given to them and appropriate advice provided.



## 6.7 Lower urinary tract infection (UTI)

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

- Assess the patient, including an assessment of the features contained within the flag table. See the 'making recommendations using the flag tables' section.



### Red flags

- Signs of shock.
- Flank/loin pain.
- Severe pain.
- Significant haematuria.
- Urinary retention.
- Inability to mobilise normally.
- Rigors.
- Neutropenia.
- Chemotherapy within the last four weeks.
- Temperature > 40°C.
- New onset of an altered mental status.



### Orange flags - should be seen in primary care within 24 hours

- Dysuria.
- Temperature 38-40°C.
- Moderate pain.
- Male.
- Aged < 15 years.
- Aged ≥ 65 years.
- Pregnancy.
- Immunocompromised (for example on steroids or immunotherapy).



### Green flags

- Aged 15-64 years.
- Normal vital signs.
- Normal mobility.
- Temperature < 38°C.
- Mild pain.



## Additional information

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

## 6.8 Sore throat

- Assess the patient, including an assessment of the features contained within the flag table. See the 'making recommendations using the flag tables' section.



### Red flags

- Signs of airway compromise.
- Signs of shock.
- Severe pain.
- Drooling or severe difficulty swallowing.
- Abnormal speech.
- Rigors.
- Neutropenia.
- Chemotherapy within the last four weeks.
- Temperature > 40°C.



### Orange flags - should be seen in primary care within 24 hours

- Onset over less than a day.
- Temperature 38-40°C.
- Moderate pain.
- Aged < 15 years.
- Aged 16-45 years with any of the following features:
  - a) Māori or Pacific People, or
  - b) Live in a low socioeconomic area of the North Island, or
  - c) Have a past history or family history of rheumatic fever.



### Green flags

- Mild pain.
- Temperature < 38°C.

## Additional information

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



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## 6.9 Infectious disease precautions

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

ESBL – extended spectrum beta-lactamase producing organism.

MRSA – methicillin resistant staphylococcus aureus.

MRO – multi-resistant organism.

VRE – vancomycin resistant enterococci.

## PPE levels

Level of PPE	Level of PPE required
Standard	<ul style="list-style-type: none"><li>• Gloves for anticipated contact with body fluids.</li><li>• Change contaminated gloves as soon as possible.</li><li>• Eye protection for anticipated body fluid splash.</li><li>• Consider overalls/gown and/or an apron for significant body fluid exposure.</li><li>• Hand washing and drying or alcohol hand rub, before and after patient contact.</li></ul>
Contact	<ul style="list-style-type: none"><li>• Standard level PPE plus gloves and overalls/gown for direct contact with the patient or their immediate surroundings.</li></ul>
Droplet	<ul style="list-style-type: none"><li>• Standard level PPE plus a surgical mask for the patient and personnel.</li><li>• Consider overalls/gown if within two metres of the patient if the patient is coughing significantly and unable to wear a mask.</li><li>• N95 mask for personnel within two metres of the patient during procedures that may aerosolise droplets. For example when nebulising medicines.</li></ul>
Airborne	<ul style="list-style-type: none"><li>• Standard PPE plus an N95 mask for the patient and personnel.</li><li>• Wear overalls/gown and/or an apron for direct contact if the patient has norovirus or chicken pox.</li></ul>



## Vehicle cleaning and disinfection

Level of cleaning and disinfection	Minimum actions
Standard	<ul style="list-style-type: none"> <li>• Open all vehicle doors for ten minutes with nobody in the vehicle, if the infectious disease was airborne.</li> <li>• Wear gloves.</li> <li>• Decontaminate and disinfect surfaces contaminated with body fluid:               <ol style="list-style-type: none"> <li>a) Decontaminate using a cleaning solution, removing all visible soiling.</li> <li>b) Wipe with a disinfectant and allow to dry.</li> </ol> </li> <li>• Remove used linen.</li> <li>• Wipe down the stretcher and all surfaces touched by the patient with disinfectant and allow to dry.</li> <li>• Wipe down all surfaces in the back of the vehicle touched by personnel (such as the monitor) with an approved disinfectant wipe and allow to dry.</li> <li>• Clean the floor if visibly dirty.</li> <li>• Replace linen.</li> <li>• Wash and dry hands.</li> <li>• Once disinfected surfaces are dry, the vehicle may be used for other patients.</li> </ul>
Additional	<ul style="list-style-type: none"> <li>• Standard level cleaning and disinfection plus:               <ol style="list-style-type: none"> <li>a) Wear gloves and overalls/gown and/or an apron.</li> <li>b) Wipe down all interior surfaces (including in the front of the vehicle) that the patient or personnel may have touched, with disinfectant and allow to dry.</li> <li>c) Clean the floor.</li> </ol> </li> <li>• Once disinfected surfaces are dry, the vehicle may be used for other patients.</li> </ul>



# 7.1 Special considerations in young children

## Initial assessment

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

**Activity**  
Movement, interaction, tone

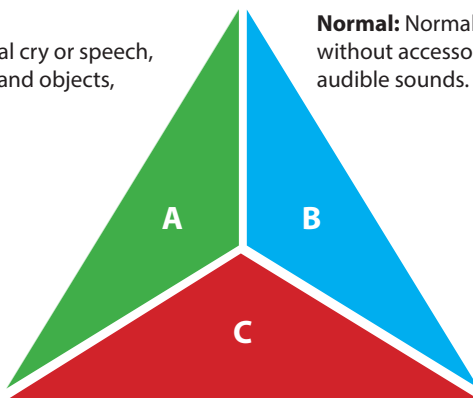
**Abnormal:** Inactive, lethargic, abnormal or absent cry or speech, failure to interact with people or objects, floppy.

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

**Breathing**  
Respiratory rate, work of breathing

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

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



**Circulation**  
Heart rate, perfusion

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

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

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

## **Communication**

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

## **Interaction and activity**

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



## The respiratory system

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

## The cardiovascular system

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

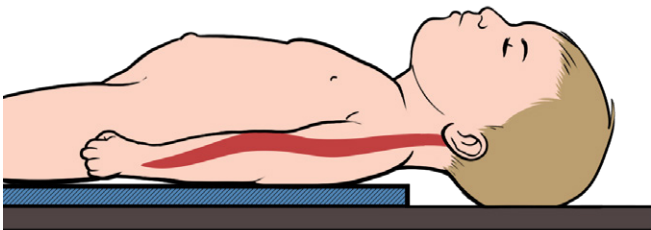
- The signs of shock in children are:
  - Tachycardia.
  - Tachypnoea.
  - Vasoconstriction with prolonged capillary refill time. This will also often produce mottled skin.
  - Reduced activity and interaction.
- Although children have a higher blood volume per kilogram, they have a lower total blood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

### Traumatic brain injury (TBI)

- Children have a large and heavy head relative to their body size and are more prone to TBI than adults.
- When unconscious, the upper airway tends to get obstructed by a relatively large, flaccid tongue, or kinked because of neck 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.
- When a small child requires cervical spine immobilisation, to achieve neutral alignment they may require padding under the thoracic spine to avoid neck flexion from their relatively large head.



**Thoracic padding in a small child**

## 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.
- Tympanic thermometers may be unreliable in small children if the probe will not adequately fit their external auditory meatus and an axillary measurement is preferred if a child is under six months of age.
- Temperature should be interpreted and managed in the context of the patient's age, illness and clinical picture, noting that infants may not be able to generate an elevated temperature in response to infection.

## Neonates

- There should be a very low threshold for transport to a medical facility by ambulance for neonates.
- Consideration must be given to the larger clinical picture (for example, anxious parents, poor feeding, dry nappies and change in behaviour) rather than relying on vital signs.
- Have a low threshold for seeking clinical advice.



## 7.2 Paediatric equipment and drug doses

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

<b>Estimated weight (kg)</b>	
Under 1 year old	5
1 - 10 years	(Age in years + 4) x 2
11 - 14 years	Age in years x 3
<b>Cuffed endotracheal tube (ETT) size (mm)</b>	
Newborn to 1 year	3 - 4
1 year and over	(Age in years ÷ 4) + 3.5
<b>Endotracheal tube length at lips (cm)</b>	
Newborn	6 + weight in kg
Under 1 year	ETT size x 3
1 year and over	(Age in years ÷ 2) + 12
<b>Defibrillation energy</b>	
Initial and subsequent	5 J/kg

### Paediatric drug doses

- The following pages contain tables of paediatric drug doses. They are based on rounding the child's weight up to 5, 10, 20, 30 or 40 kg. For example, a child known or estimated to weigh between 11 and 20 kg receives a dose based on 20 kg, and a child known or estimated to weigh between 31 and 40 kg receives a dose based on 40 kg.
- Children have a higher proportion of body water than adults and require higher doses of most drugs per kg, to achieve the same effect.
- Children weighing more than 40 kg can usually be administered adult doses, but clinical judgement must be used if the dose may be potentially harmful, for example when administering paracetamol. If there is any doubt, a paediatric dose should be administered.
- The tables do not incorporate all administration information and should be read in conjunction with the information within the 'medicines' section of the comprehensive edition.

- The tables indicate the calculated dose of each drug for a given rounded weight, the concentration of drug that should be drawn up, and the volume that should be administered from that solution.
- Drug doses for rapid sequence intubation (RSI) are not contained within these tables, but are contained within the RSI section.
- Some of the doses within the tables differ slightly from the internationally recommended dose. This is to ensure a practical approach, and to help reduce administration errors. For example, the usual recommended defibrillation energy for a child is 4 J/kg, but this energy level is not available for the weight ranges within the following tables on most defibrillators used within the ambulance sector in New Zealand, and for this reason 5 J/kg is used. Where there are differences between the dose in the tables and the internationally recommended dose, these differences are not clinically significant.

## Drug dilution and administration

<b>1</b>	<p><b>Adrenaline IV 1:10,000 (0.1 mg/ml)</b></p> <ul style="list-style-type: none"> <li>• Draw up 1 ml of adrenaline from a 1 mg/ml ampoule.</li> <li>• Dilute to a total volume of 10 ml using 0.9% sodium chloride.</li> <li>• Administer the volume from the tables as an IV bolus.</li> </ul>
<b>2</b>	<p><b>Adrenaline IV 1:1,000,000 (0.001 mg/ml)</b></p> <ul style="list-style-type: none"> <li>• Use a 1 litre bag of 0.9% sodium chloride.</li> <li>• Add 1 ml of adrenaline from a 1 mg/ml ampoule.</li> <li>• Shake well and label.</li> <li>• Administer the volume from the tables as an IV bolus.</li> <li>• An IV infusion may be administered if aged 5 years or older.</li> </ul>
<b>3</b>	<p><b>Ceftriaxone IV 200 mg/ml</b></p> <ul style="list-style-type: none"> <li>• Add approximately 4ml of 0.9% sodium chloride to a 2 g ampoule of ceftriaxone powder and shake until dissolved.</li> <li>• Draw up the contents of the ampoule.</li> <li>• Dilute to a total volume of 10 ml using 0.9% sodium chloride.</li> <li>• Discard unrequired drug and administer the volume from the tables as a slow IV push over 1-2 minutes, preferably into a running line.</li> </ul>
<b>4</b>	<p><b>Ceftriaxone IM 400 mg/ml</b></p> <ul style="list-style-type: none"> <li>• Add 4 ml of 0.9% sodium chloride to a 2 g ampoule of ceftriaxone powder and shake until dissolved. The total volume will be 5 ml.</li> <li>• Draw up 2.5 ml in each of two syringes.</li> <li>• Discard unrequired drug volume and administer one syringe into each lateral thigh. If this site is not suitable use each lateral upper arm.</li> </ul>

5	<p><b>Fentanyl IV 10 mcg/ml (weight rounded up to 30 kg or more)</b></p> <ul style="list-style-type: none"> <li>• Draw up 2 ml of fentanyl from a 100 mcg/2 ml ampoule.</li> <li>• Dilute to a total volume of 10 ml using 0.9% sodium chloride.</li> <li>• Administer the volume from the tables as an IV bolus.</li> </ul>
6	<p><b>Fentanyl IV 1 mcg/ml (weight rounded up to 20 kg or less)</b></p> <ul style="list-style-type: none"> <li>• Use a 100 ml bag of 5% glucose.</li> <li>• Add 2 ml of fentanyl from a 100 mcg/2 ml ampoule.</li> <li>• Shake well and label.</li> <li>• Administer the volume from the tables as an IV bolus.</li> </ul>
7	<p><b>Fentanyl and ketamine IV for post intubation sedation</b></p> <ul style="list-style-type: none"> <li>• Draw up 200 mcg of fentanyl (two 100 mcg/2 ml ampoules) and 200 mg of ketamine (one 200 mg/2 ml ampoule), in the same syringe.</li> <li>• Dilute to a total volume of 20 ml. This solution contains 10 mcg/ml of fentanyl and 10 mg/ml of ketamine.</li> <li>• Administer the volume from the tables as an IV bolus.</li> </ul>
8	<p><b>Fentanyl and midazolam IV for post intubation sedation</b></p> <ul style="list-style-type: none"> <li>• Draw up 100 mcg of fentanyl (one 100 mcg/2 ml ampoule) and 10 mg of midazolam (2 ml from a 15 mg/3 ml ampoule), in the same syringe.</li> <li>• Dilute to total volume of 10 ml. This solution contains 10 mcg/ml of fentanyl and 1 mg/ml of midazolam.</li> <li>• Administer the volume from the tables as an IV bolus.</li> </ul>
9	<p><b>Ketamine IV for analgesia 1 mg/ml</b></p> <ul style="list-style-type: none"> <li>• Draw up 1 ml of ketamine from a 200 mg/2 ml ampoule.</li> <li>• Place into a 100 ml bag of 5% glucose. This solution contains 1 mg/ml.</li> <li>• Draw up the volume from the tables and dilute this further to a total volume of 20 ml using 0.9% sodium chloride.</li> <li>• Administer IV over approximately 15 minutes.</li> </ul>
10	<p><b>Ketamine IV for dissociation 10 mg/ml</b></p> <ul style="list-style-type: none"> <li>• Draw up 1 ml of ketamine from a 200 mg/2 ml ampoule.</li> <li>• Dilute to a total volume of 10 ml using 0.9% sodium chloride.</li> <li>• Administer the volume from the tables as an IV bolus.</li> </ul>
11	<p><b>Magnesium IV 1 mmol/ml</b></p> <ul style="list-style-type: none"> <li>• Draw up 5 ml of magnesium from a 10 mmol/5 ml ampoule.</li> <li>• Dilute to a total volume of 10 ml using 0.9% sodium chloride.</li> <li>• Discard unrequired drug and administer the volume from the tables IV over approximately 15 minutes, preferably into a running line.</li> </ul>

<b>12</b>	<b>Metaraminol IV 0.1 mg/ml</b> <ul style="list-style-type: none"><li>• Use a 100 ml bag of 5% glucose and withdraw 10 ml from the bag.</li><li>• Add 10 ml from a pre-filled syringe of 10 mg/10 ml metaraminol.</li><li>• Shake well and label.</li><li>• Administer the volume from the tables as an IV bolus.</li></ul>
<b>13</b>	<b>Midazolam IV 1 mg/ml</b> <ul style="list-style-type: none"><li>• Draw up 1 ml of midazolam from a 15 mg/3 ml ampoule.</li><li>• Dilute to a total volume of 5 ml using 0.9% sodium chloride.</li><li>• Discard unrequired drug and administer the volume from the tables as an IV bolus.</li></ul>
<b>14</b>	<b>Naloxone IV 0.1 mg/ml</b> <ul style="list-style-type: none"><li>• Draw up 1 ml of naloxone from a 0.4 mg/ml ampoule.</li><li>• Dilute to a total volume of 4 ml using 0.9% sodium chloride.</li><li>• Administer the volume from the tables as an IV bolus.</li></ul>
<b>15</b>	<b>Valproate IV 100 mg/ml</b> <ul style="list-style-type: none"><li>• Add 4 ml of 0.9% sodium chloride to each 400 mg ampoule of valproate powder and shake until dissolved. This will give a 100 mg/ml solution.</li><li>• Draw up the volume from the tables and dilute this further to a total volume of 10-20 ml using 0.9% sodium chloride.</li><li>• Administer as a slow IV push over 1-2 minutes, preferably into a running line.</li></ul>



## 5 kg / less than 1 year

	Dose	Volume	6
<b>Cardiac arrest</b>			
Adrenaline IV	0.05 mg	0.5 ml (1:10,000)	1
Amiodarone IV	25 mg	0.5 ml (undiluted)	
Manual defibrillation	25	Joules	
LMA	Size 1 (< 5 kg)	Cuff inflation 4 ml	
ETT (cuffed)	Size 3	9 cm length at lips	
<b>Other drugs</b>			
Adrenaline IV (not cardiac arrest)	0.001 mg	1 ml (1:1,000,000)	2
Adrenaline IM	0.05 mg	0.5 ml (1:10,000)	1
Adrenaline IN (epistaxis)	-	-	
Ceftriaxone IV	300 mg	1.5 ml (200 mg/ml)	3
Ceftriaxone IM	300 mg	0.75 ml (400 mg/ml)	4
Fentanyl IV (analgesia)	1-5 mcg	1-5 ml (1 mcg/ml)	6
Fentanyl IM	5 mcg	0.1 ml (undiluted)	
Fentanyl IN (first dose)	10 mcg	0.2 ml (undiluted)	
Fentanyl IN (subsequent doses)	5 mcg	0.1 ml (undiluted)	
Fentanyl/ketamine IV (post intubation)	5 mcg/5 mg	0.5 ml	7
Fentanyl/midazolam IV (post intubation)	2.5 mcg/0.25 mg	0.25 ml	8
Glucagon IM	0.5 mg	0.5 ml (undiluted)	
10% glucose IV	2 ml/kg	10 ml	
Ibuprofen liquid PO	50 mg	2.5 ml (20 mg/ml)	
Ibuprofen tablet PO	-	-	
Ketamine IV (analgesia)	-	-	
Ketamine IV (dissociation)	-	-	
Ketamine IM/PO (analgesia)	-	-	
Ketamine IM (dissociation)	-	-	
1% lignocaine IO	5 mg	0.5 ml (undiluted)	
1% lignocaine SC	15 mg (max)	1.5 ml (max)	
Loratadine PO	-	-	





# 10 kg / 1 year

	Dose	Volume	6
<b>Cardiac arrest</b>			
Adrenaline IV	0.1 mg	1 ml (1:10,000)	1
Amiodarone IV	50 mg	1 ml (undiluted)	
Manual defibrillation	50	Joules	
LMA	Size 2 (10-20 kg)	Cuff inflation 10 ml	
ETT (cuffed)	Size 3 or 4	12 cm length at lips	
<b>Other drugs</b>			
Adrenaline IV (not cardiac arrest)	0.002 mg	2 ml (1:1,000,000)	2
Adrenaline IM	0.1 mg	0.1 ml (undiluted)	
Adrenaline IN (epistaxis)	-	-	
Ceftriaxone IV	500 mg	2.5 ml (200 mg/ml)	3
Ceftriaxone IM	500 mg	1.25 ml (400 mg/ml)	4
Fentanyl IV (analgesia)	2-10 mcg	2-10 ml (1 mcg/ml)	6
Fentanyl IM	10 mcg	0.2 ml (undiluted)	
Fentanyl IN (first dose)	20 mcg	0.4 ml (undiluted)	
Fentanyl IN (subsequent doses)	10 mcg	0.2 ml (undiluted)	
Fentanyl/ketamine IV (post intubation)	10 mcg/10 mg	1 ml	7
Fentanyl/midazolam IV (post intubation)	5 mcg/0.5 mg	0.5 ml	8
Glucagon IM	0.5 mg	0.5 ml (undiluted)	
10% glucose IV	2 ml/kg	20 ml	
Ibuprofen liquid PO	100 mg	5 ml (20 mg/ml)	
Ibuprofen tablet PO	100 mg	½ tablet	
Ketamine IV (analgesia)	2.5 mg	2.5 ml (1 mg/ml)	9
Ketamine IV (dissociation)	10 mg	1 ml (10 mg/ml)	10
Ketamine IM/PO (analgesia)	5 mg	0.05 ml (undiluted)	
Ketamine IM (dissociation)	20 mg	0.2 ml (undiluted)	
1% lignocaine IO	10 mg	1 ml (undiluted)	
1% lignocaine SC	30 mg (max)	3 ml (max)	
Loratadine PO	5 mg	½ tablet	



## 20 kg / 2-5 years

	Dose	Volume	6
<b>Cardiac arrest</b>			
Adrenaline IV	0.2 mg	2 ml (1:10,000)	1
Amiodarone IV	100 mg	2 ml (undiluted)	
Manual defibrillation	100	Joules	
LMA	Size 2 (10-20 kg)	Cuff inflation 10 ml	
ETT (cuffed)	Size 4 or 5	15 cm length at lips	
<b>Other drugs</b>			
Adrenaline IV (not cardiac arrest)	0.004 mg	4 ml (1:1,000,000)	2
Adrenaline IM	0.2 mg	0.2 ml (undiluted)	
Adrenaline IN (epistaxis)	0.1 mg	1 ml (1:10,000)	1
Ceftriaxone IV	1 g	5 ml (200 mg/ml)	3
Ceftriaxone IM	1 g	2.5 ml (400 mg/ml)	4
Fentanyl IV (analgesia)	5-20 mcg	5-20 ml (1 mcg/ml)	6
Fentanyl IM	20 mcg	0.4 ml (undiluted)	
Fentanyl IN (first dose)	40 mcg	0.8 ml (undiluted)	
Fentanyl IN (subsequent doses)	20 mcg	0.4 ml (undiluted)	
Fentanyl/ketamine IV (post intubation)	20 mcg/20 mg	2 ml	7
Fentanyl/midazolam IV (post intubation)	10 mcg/1 mg	1 ml	8
Glucagon IM	1 mg	1 ml (undiluted)	
10% glucose IV	2 ml/kg	40 ml	
Ibuprofen liquid PO	150 mg	7.5 ml (20 mg/ml)	
Ibuprofen tablet PO	100 mg	½ tablet	
Ketamine IV (analgesia)	5 mg	5 ml (1 mg/ml)	9
Ketamine IV (dissociation)	20 mg	2 ml (10 mg/ml)	10
Ketamine IM/PO (analgesia)	10 mg	0.1 ml (undiluted)	
Ketamine IM (dissociation)	40 mg	0.4 ml (undiluted)	
1% lignocaine IO	20 mg	2 ml (undiluted)	
1% lignocaine SC	60 mg (max)	6 ml (max)	
Loratadine PO	5 mg	½ tablet	



## 30 kg / 6-10 years

	Dose	Volume	6
<b>Cardiac arrest</b>			
Adrenaline IV	0.3 mg	3 ml (1:10,000)	1
Amiodarone IV	150 mg	3 ml (undiluted)	
Manual defibrillation	150	Joules	
LMA	Size 3 (30-50 kg)	Cuff inflation 20 ml	
ETT (cuffed)	Size 5 or 6	17 cm length at lips	
<b>Other drugs</b>			
Adrenaline IV (not cardiac arrest)	0.006 mg	6 ml (1:1,000,000)	2
Adrenaline IM	0.3 mg	0.3 ml (undiluted)	
Adrenaline IN (epistaxis)	0.1 mg	1 ml (1:10,000)	1
Ceftriaxone IV	1.5 g	7.5 ml (200 mg/ml)	3
Ceftriaxone IM	1.5 g	3.75 ml (400 mg/ml)	4
Fentanyl IV (analgesia)	10-30 mcg	1-3 ml (10 mcg/ml)	5
Fentanyl IM	30 mcg	0.6 ml (undiluted)	
Fentanyl IN (first dose)	60 mcg	1.2 ml (undiluted)	
Fentanyl IN (subsequent doses)	30 mcg	0.6 ml (undiluted)	
Fentanyl/ketamine IV (post intubation)	30 mcg/30 mg	3 ml	7
Fentanyl/midazolam IV (post intubation)	15 mcg/1.5 mg	1.5 ml	8
Glucagon IM	1 mg	1 ml (undiluted)	
10% glucose IV	2 ml/kg	60 ml	
Ibuprofen liquid PO	200 mg	10 ml (20 mg/ml)	
Ibuprofen tablet PO	200 mg	1 tablet	
Ketamine IV (analgesia)	8 mg	8 ml (1 mg/ml)	9
Ketamine IV (dissociation)	30 mg	3 ml (10 mg/ml)	10
Ketamine IM/PO (analgesia)	15 mg	0.15 ml (undiluted)	
Ketamine IM (dissociation)	60 mg	0.6 ml (undiluted)	
1% lignocaine IO	30 mg	3 ml (undiluted)	
1% lignocaine SC	90 mg (max)	9 ml (max)	
Loratadine PO	5 mg	½ tablet	



## 40 kg / 11-13 years

	Dose	Volume	6
<b>Cardiac arrest</b>			
Adrenaline IV	0.4 mg	4 ml (1:10,000)	1
Amiodarone IV	200 mg	4 ml (undiluted)	
Manual defibrillation	200	Joules	
LMA	Size 3 (30-50 kg)	Cuff inflation 20 ml	
ETT (cuffed)	Size 6 or 7	19 cm length at lips	
<b>Other drugs</b>			
Adrenaline IV (not cardiac arrest)	0.008 mg	8 ml (1:1,000,000)	2
Adrenaline IM	0.4 mg	0.4 ml (undiluted)	
Adrenaline IN (epistaxis)	0.2 mg	2 ml (1:10,000)	1
Ceftriaxone IV	2 g	10 ml (200 mg/ml)	3
Ceftriaxone IM	2 g	5 ml (400 mg/ml)	4
Fentanyl IV (analgesia)	10-40 mcg	1-4 ml (10 mcg/ml)	5
Fentanyl IM	40 mcg	0.8 ml (undiluted)	
Fentanyl IN (first dose)	80 mcg	1.6 ml (undiluted)	
Fentanyl IN (subsequent doses)	40 mcg	0.8 ml (undiluted)	
Fentanyl/ketamine IV (post intubation)	40 mcg/40 mg	4 ml	7
Fentanyl/midazolam IV (post intubation)	20 mcg/2 mg	2 ml	8
Glucagon IM	1 mg	1 ml (undiluted)	
10% glucose IV	2 ml/kg	80 ml	
Ibuprofen liquid PO	300 mg	15 ml (20 mg/ml)	
Ibuprofen tablet PO	300 mg	1 ½ tablets	
Ketamine IV (analgesia)	10 mg	10 ml (1 mg/ml)	9
Ketamine IV (dissociation)	40 mg	4 ml (10 mg/ml)	10
Ketamine IM/PO (analgesia)	20 mg	0.2 ml (undiluted)	
Ketamine IM (dissociation)	80 mg	0.8 ml (undiluted)	
1% lignocaine IO	40 mg	4 ml (undiluted)	
1% lignocaine SC	120 mg (max)	12 ml (max)	
Loratadine PO	10 mg	1 tablet	





## Paediatric vital signs

Age	Heart rate	Respiratory rate	Blood pressure (systolic)	Blood volume (ml/kg)
Newborn	120-180	30-60	60-90	85-90
1-11 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

## Infant Glasgow Coma Scale

<b>Best eye opening</b>	
Spontaneously	4
To voice or touch	3
To pain or pressure	2
None	1
<b>Best verbal response</b>	
Smiles, babbles, coos	5
Cries normally	4
Cries only to pain or pressure	3
Moans or grunts	2
None	1
<b>Best motor response</b>	
Normal spontaneous movement	6
Localises or has purposeful movement	5
Withdraws from pain or normal flexion	4
Abnormal (spastic) flexion	3
Extension or rigid	2
None	1



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## 7.3 Neonatal resuscitation

This section is for the resuscitation of babies immediately following birth.

### Initial actions

- Always clarify who is the team leader. If a lead maternity carer (LMC) is present, they are the team leader and are directing the treatment unless this responsibility is formally handed over to ambulance personnel.
- Place the baby skin to skin with the mother.
- Provide external stimulation while drying the baby.
- Maximise the external temperature and place a hat on the baby if possible.
- Continue to provide stimulation via rubbing/drying if breathing or activity is abnormal.
- Establish continual heart rate and SpO<sub>2</sub> monitoring if breathing or activity remain abnormal.
- Move to the appropriate section below at approximately one minute.

### If breathing is adequate and the heart rate is greater than or equal to 100/minute

- Do not provide ventilation.
- Clamp and cut the cord at 2-3 minutes.
- Move to the appropriate section if there is a sustained change in heart rate.
- Administer oxygen only if required to maintain a normal SpO<sub>2</sub>.

### If breathing is inadequate or the heart rate is 60-100/minute

- Clamp and cut the cord immediately if this is required to enable ventilation.
- Ventilate at a rate of 60/minute, using PEEP set to 5 cmH<sub>2</sub>O, initially without added oxygen.
- Continue to ventilate and add oxygen at 10 litres/minute if the heart rate fails to rise above 100/minute after two minutes.
- Move to the appropriate section if there is a sustained change in heart rate.

### If the heart rate is less than 60/minute

- Clamp and cut the cord immediately if this is required to enable CPR.
- Start CPR at a ratio of 3:1.
- Focus on ventilation with PEEP set to 5 cmH<sub>2</sub>O and added oxygen at 10 litres/minute.
- Place an LMA.
- Consider placing an ETT.
- Gain IV access.

- Administer adrenaline IV every four minutes:
  - a) 0.01 mg (0.1 ml of 1:10,000) for gestation less than or equal to 26 weeks.
  - b) 0.025 mg (0.25 ml of 1:10,000) for gestation 27-37 weeks.
  - c) 0.05 mg (0.5 ml of 1:10,000) for gestation greater than or equal to 38 weeks.
- Move to the appropriate section if there is a sustained change in heart rate.

### **In addition**

- Continue to actively focus on keeping the baby warm, for example utilise heating pads if available.
- Titrate oxygen flow to an SpO<sub>2</sub> of 90-95% ten or more minutes after birth.
- Measure the blood glucose concentration if the baby's activity is not normal, but this is not a priority if resuscitation is required. Administer glucose if the blood glucose concentration is less than 2.5 mmol/litre:
  - a) Spread glucose gel on the gums, tongue and inside of the cheeks and repeat this every 5-10 minutes as required.
  - b) Administer 10 ml of 10% glucose IV if the blood glucose concentration does not rise 20 minutes after oral glucose.
  - c) Repeat the glucose measurement every ten minutes and administer further glucose as required until the glucose concentration is greater than or equal to 2.5 mmol/litre.
- Normal SpO<sub>2</sub> post birth:
  - 60-70% at 1 minute.
  - 65-85% at 2 minutes.
  - 70-90% at 3 minutes.
  - 75-90% at 4 minutes.
  - 80-90% at 5 minutes.
  - 85-90% at 10 minutes.
  - 90-95% at more than 10 minutes.

### **Backup**

- Backup from an ICP and/or LMC must be requested if ventilation is required at any stage.
- Backup from a Paramedic or PRIME responder must be requested if an ICP and/or LMC is not immediately available.

### **Referral and transport**

- Transport to a hospital with neonatal facilities if the baby has required intervention at any stage, or has abnormal vital signs, whenever feasible and safe.
- It is the responsibility of ambulance personnel to ensure all ambulance occupants are safely restrained during transport.

## Additional information

### General principles

- Assessment and interventions are based primarily on the baby's activity, breathing, heart rate and SpO<sub>2</sub>.
- Resuscitation of a neonate is focused primarily on supporting ventilation.
- A crying and/or active baby requires no specific intervention. Place skin to skin with the mother and dry the baby provided neither is requiring resuscitation. Place a hat on the baby if one is available, cover them both with a warm blanket and observe the baby's activity and breathing.
- It is normal for the peripheries of the baby to remain blue for several hours after birth.
- The heart rate is best monitored via ECG leads which may be placed on the back.
- Pulse oximetry should be monitored using the right hand whenever possible because a patent ductus arteriosus may produce falsely low measurements in the left hand and feet. Place the probe over several digits if the probe is too large for a single digit.
- Preventing heat loss is vital as hypothermia worsens outcomes:
  - The torso and limbs of a premature baby requiring resuscitation should be immediately wrapped in plastic without being dried and placed in a hot environment as soon as possible.
  - A term baby should be dried and resuscitated in a hot environment if possible.
  - A hat should be placed on the baby if one is available.
  - The interior of the ambulance should be made as hot as possible.
- Mother and baby must be safely restrained during transport.

### Oxygen administration, suctioning and ventilation

- Routine oxygen administration during neonatal resuscitation appears to make outcomes worse. This is why oxygen is reserved for deterioration despite initial ventilation.
- Suctioning the mouth and nose before the body is delivered is not required, even if meconium is present. If ventilation is required, this takes priority over suctioning meconium unless meconium is clearly occluding the airway.
- Ventilation via an LMA is preferred to ventilation via an ETT because intubation with an ETT has a high failure rate, unless the person performing the intubation is very experienced. However, if ventilation or CPR is required for more than ten minutes an ETT may be placed provided intubation is able to be quickly performed.

## **Intravascular access, adrenaline and 0.9% sodium chloride**

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

## **Clamping and cutting the umbilical cord**

- Delaying clamping and cutting the cord until 2-3 minutes after birth appears to improve the outcome for the baby.
- There is no urgency to clamp and cut the cord provided neither the baby nor the mother are requiring resuscitation.
- Clamp and cut the cord at least 5 cm from the baby as this facilitates access to the cord vessels for later cannulation if required.

## **Hypoglycaemia**

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

## **The role of hospital-based neonatal teams**

- There is usually no role for requesting a neonatal team to attend a scene that is not a birthing unit.
- There may be a role for a neonatal team to attend a birthing unit, noting that this decision will be made by a neonatologist in consultation with the LMC and the team may take significant time to reach the scene.
- The decision to utilise a neonatal team is usually a trade-off between time to skilled intervention and the availability of dedicated equipment during transfer:
  - If the baby is requiring ventilation or CPR, it is usually faster to transport the baby to a neonatal team than to transport a neonatal team to the scene.
  - If the baby requires specific equipment for transfer, it is usually preferable to wait at the scene for a neonatal team with dedicated equipment.

## Starting and stopping resuscitation

- A resuscitation attempt should always be started unless an LMC directs ambulance personnel not to.
- Resuscitation should usually occur at the scene because the quality of resuscitation is compromised during transport. However, resuscitation en route to hospital may be appropriate if transport time is short and an ICP or LMC cannot reach the scene quickly. What constitutes a short transport time cannot be tightly defined and requires clinical judgement taking into account the time to reach hospital and the time for backup to arrive.
- If the LMC is not present to make the decision, personnel must seek clinical advice whenever possible.
- Resuscitation attempts should usually be stopped if the baby is in asystole for more than ten minutes.



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## 8.1 Antepartum haemorrhage

This section is for patients with vaginal bleeding occurring after 20 weeks gestation and prior to birth.

- Commence transport as soon as possible, providing most treatments en route.
- Tilt the patient 30° to their left to prevent supine hypotension.
- Seek help from an LMC if possible, provided this does not delay transport.
- Gain IV access.
- Administer 0.9% sodium chloride IV if the patient has signs of hypovolaemia or poor perfusion:
  - a) Administer 500 ml of 0.9% sodium chloride IV.
  - b) Repeat as required.
- Administer 1 g of tranexamic acid if IV fluid is administered for signs of hypovolaemia or poor perfusion.
- Arrange for blood to be administered if shock is severe and there is an established protocol in the area for blood to be delivered to the scene.

### Backup

- Backup from a Paramedic or PRIME responder must be requested if the patient has signs of hypovolaemia or poor perfusion.
- Backup from an ICP must be requested if shock is severe.

### Referral and transport

- The patient must be transported to an ED by ambulance.
- Transport the patient direct to a hospital with obstetric facilities whenever feasible and safe, providing early notification if signs of hypovolaemia or poor perfusion are present.

## Additional information on APH

### General principles

- APH usually presents with vaginal blood loss, which must be considered to be APH until proven otherwise.
- Placental abruption usually causes abdominal pain without significant vaginal blood loss.
- Placenta praevia usually causes vaginal blood loss without significant abdominal pain.
- There is no difference in the treatment of placental abruption and placenta praevia in the out-of-hospital setting.

- It is uncommon for APH to cause a threat to life for the mother but it is common for APH to cause a threat to life for the baby.

## **IV fluid administration for APH**

- The threshold for IV fluid administration in APH is lower than in the postpartum haemorrhage section. This is because APH has a pattern of bleeding that is more likely to be relatively controlled in comparison, and in APH shock carries an additional risk to the baby.
- Pregnant women have an expanded blood volume and can lose more than one litre of blood without showing signs of shock. If a pregnant patient has signs of shock, it is by definition severe.
- A fall in blood pressure is a very late sign and will only occur if shock is very severe.
- 0.9% sodium chloride should be titrated to signs of intravascular volume and perfusion. The trend of all of the following signs is an important guide to treatment:
  - Heart rate.
  - Pulse strength.
  - Capillary refill time.
  - Pulse pressure.
  - Blood pressure.
  - Level of consciousness.

## **Temperature**

- It is important to keep the patient warm because hypothermia worsens bleeding by contributing to coagulopathy.
- Keep the patient covered with blankets whenever possible.
- Keep the interior of the ambulance as hot as possible. In particular, whenever feasible heat the interior of the ambulance before the patient is placed inside. This warms the physical environment, for example the stretcher, which acts as a 'heat sink' when cold.
- Utilise additional heating pads if available.
- Ambient temperature IV fluid contributes to hypothermia. Whenever feasible IV fluid should be warmed using a dedicated warming device. These may be available (for example via an air ambulance service) and should be requested whenever feasible.
- Do not warm IV fluid in microwaves because this can result in unreliable fluid temperatures and/or may damage the plastic bag.
- Foil blankets are not useful for the majority of patients. Once in the ambulance, a hot environment is the most important factor and the presence of a foil blanket may be counterproductive as it reduces the amount of heat absorbed by the patient.

## Blood

- Only call for blood if there is an established protocol in the area for blood to be delivered to the scene.
- Blood should be requested early if shock is severe.

## Tranexamic acid

- The role of tranexamic acid is controversial. It reduces bleeding, but it is not yet clear that it improves outcomes.
- The administration of tranexamic acid is not a priority but should occur with the first dose of 0.9% sodium chloride.



## 8.2 Postpartum haemorrhage

Use this section for patients with vaginal bleeding in excess of 500 ml within 24 hours of birth.

- Commence transport as soon as possible, providing most treatments en route.
- Place pressure on any compressible bleeding.
- Seek help from an LMC if possible, provided this does not delay transport.
- Administer 10 units of oxytocin IM into the lateral thigh. If multiple babies are present, delay administration until after birth of the last baby.
- If the placenta has not delivered and an LMC is not available, seek urgent clinical advice regarding controlled cord traction to help deliver the placenta.
- Gain IV access.
- Administer 1 g of tranexamic acid IV.
- Administer IV fluid if there are signs of shock:
  - a) Arrange for blood to be administered if there is an established protocol in the area for blood to be delivered to the scene.
  - b) Administer 500 ml of 0.9% sodium chloride IV if blood is not immediately available.
  - c) Administer further boluses of 0.9% sodium chloride IV as required.
- Feel for the uterus at approximately umbilical level and massage it firmly.
- Perform bimanual compression of the uterus if bleeding is severe and the patient is deteriorating.
- Administer adrenaline if shock is very severe, appears disproportionate to the severity of blood loss, and is unresponsive to 2-3 litres of 0.9% sodium chloride or blood:
  - a) Place 1 mg of adrenaline into a 1 litre bag of 0.9% sodium chloride.
  - b) Administer this as an IV infusion. Start at 2 drops/second and adjust the rate to the patient's condition, or
  - c) Administer 0.01 mg (10 ml of 1:1,000,000) IV every 1-2 minutes as required.

### Backup

- Backup from an ICP must be requested if there are signs of shock.
- Backup from a Paramedic or a PRIME responder must be requested if an ICP is not immediately available.

### Referral and transport

- The patient must be transported to an ED by ambulance.
- Transport the patient direct to a hospital with obstetric facilities whenever feasible and safe, providing early notification.

## Additional information

### General principles

- Postpartum haemorrhage (PPH) commonly causes an immediate threat to the life of the mother.
- PPH is most commonly due to uterine atony and/or a retained placenta.
- It is difficult to estimate the volume of blood loss in PPH. Blood loss is usually spread over several locations (for example in the bed, on the floor or in the toilet), may be mixed with amniotic fluid and may be concealed (for example intrauterine or intra-abdominal bleeding).
- The most important aspects of out-of-hospital treatment are to rapidly transport to an appropriate hospital and stop compressible bleeding, providing most treatments en route.
- If oxytocin has already been administered as part of routine treatment after birth, an additional 10 units of oxytocin should be administered in the setting of PPH and this may require meeting another vehicle.
- Secondary PPH occurs between 24 hours and six weeks after delivery. Oxytocin should be administered if the blood loss is estimated to be greater than or equal to 500 ml, even though the role for oxytocin in secondary PPH is unclear.

### IV fluid administration for PPH

- The views of healthcare providers differ on the best approach to IV fluid resuscitation in the setting of PPH. LMCs usually utilise the principles within the 'hypovolaemia from controlled bleeding' section, which is acceptable if an LMC is present and is the team leader.
- The threshold for IV fluid administration in PPH is slightly higher than in the APH section. This is because PPH has a pattern of bleeding that is more likely to be uncontrolled in comparison and in APH severe shock carries an additional risk to the baby.
- Pregnant women have an expanded blood volume and can lose more than one litre of blood without showing signs of shock. If a recently pregnant patient has signs of shock, it is by definition severe.
- A fall in blood pressure is a very late sign and will only occur if shock is very severe.
- The uterus has a high blood supply and bleeding associated with PPH can be massive and rapid. If blood loss appears substantial and/or the patient is deteriorating, it is appropriate to commence rapid administration of 0.9% sodium chloride, in addition to requesting blood (if available) while simultaneously commencing transport.

## Temperature

- It is important to keep the patient warm because hypothermia worsens bleeding by contributing to coagulopathy.
- Keep the patient covered with blankets whenever possible.
- Keep the interior of the ambulance as hot as possible. In particular, whenever feasible heat the interior of the ambulance before the patient is placed inside. This warms the physical environment, for example the stretcher, which acts as a 'heat sink' when cold.
- Utilise additional heating pads if available.
- Ambient temperature IV fluid contributes to hypothermia. Whenever feasible IV fluid should be warmed using a dedicated warming device. These may be available (for example via an air ambulance service) and should be requested whenever feasible.
- Do not warm IV fluid in microwaves because this can result in unreliable fluid temperatures and/or may damage the plastic bag.
- Foil blankets are not useful for the majority of patients. Once in the ambulance, a hot environment is the most important factor and the presence of a foil blanket may be counterproductive as it reduces the amount of heat absorbed by the patient.

## Blood

- Only call for blood if there is an established protocol in the area for blood to be delivered to the scene.
- Blood should be requested early if shock is present.

## Tranexamic acid

- The role of tranexamic acid is controversial. It reduces bleeding, but it is not yet clear that it improves outcomes.
- Tranexamic acid should be administered if IV access is obtained.

## Amniotic fluid embolism

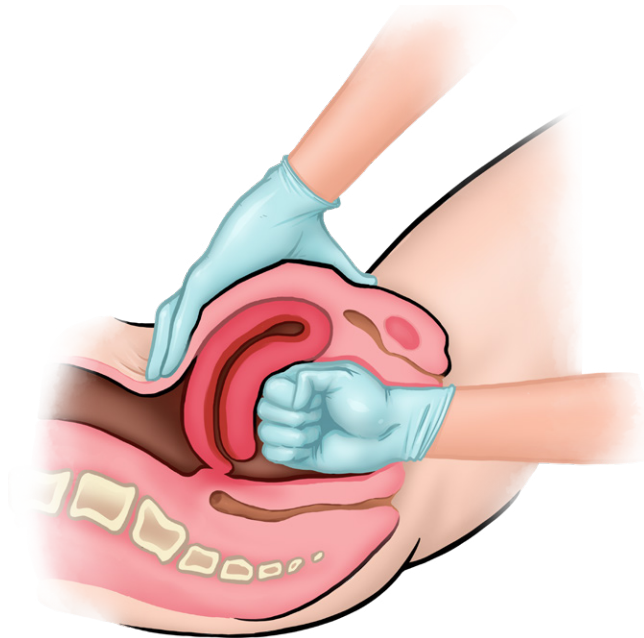
- Amniotic fluid embolism is rare.
- Amniotic fluid embolism occurs when amniotic fluid enters the maternal circulation, causing a severe inflammatory response that has a high mortality rate.
- Signs and symptoms include tachypnoea, hypoxia and shock.
- If shock is disproportionate to blood loss and unresponsive to IV fluid resuscitation, amniotic fluid embolism should be considered a possibility and adrenaline IV (preferably by infusion) should be administered.

## Manual nipple stimulation

- Although there is no good evidence, the general view is that manual nipple stimulation provides no useful additional release of endogenous oxytocin and thus has no role in the treatment of PPH.

## Bimanual compression of the uterus

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



**Bimanual compression of the uterus**



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## 8.3 Pregnancy and birth

### General principles

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

### Vaginal examination

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

### Spontaneous miscarriage

- Provide a clear recommendation to a patient with miscarriage occurring during the first trimester that immediate referral or transport to hospital is not required unless:
  - Pain is severe, or
  - The nature or location of the pain is different to that of menstrual pain, or
  - Bleeding is significantly more than a heavy menstrual period.
- Contact the LMC if possible.
- Provide a clear recommendation that the patient is assessed in hospital, preferably one with obstetric facilities, if miscarriage occurs after the first trimester.
- If referral to hospital is not required and the LMC cannot be contacted, recommend the patient is reviewed by their LMC or GP within 24 hours.



## **Pregnancy and abdominal or pelvic injury**

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

## **Supine hypotension**

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

## **Pre-labour rupture of membranes**

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

## **Pre-term labour**

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

## **Birth**

- Imminent birth following normal labour is not a valid reason to travel under lights.
- Pull to the side of the road if birth is imminent during transport.
- Support the patient to adopt the position she prefers.
- Support the baby's head and shoulders as they appear, without applying traction, and document the time of birth.
- Place the baby skin to skin with the mother and initiate drying.

- Ensure a warm environment and continue to keep the baby skin to skin with the mother provided neither requires immediate resuscitation. Place a hat on the baby if one is available and cover mother and baby with a warm blanket. Continually observe the baby's activity and breathing.
- Clamp and cut the cord 5 cm from the baby 2-3 minutes after birth, unless this is required earlier to facilitate resuscitation.
- Administer 10 units of oxytocin IM into the mother's lateral thigh. If multiple babies are present delay administration until after birth of the last baby. Routine administration of oxytocin is controversial, but appears to reduce the incidence of postpartum haemorrhage.
- Allow the placenta to deliver spontaneously, without applying traction, and document the time of placental birth. This usually occurs within 60 minutes. Place the placenta in a plastic bag.
- Following delivery of the placenta, feel for the uterus at approximately umbilical level and rub it using a circular motion until it feels firm.

## Shoulder dystocia

- Shoulder dystocia (when the baby's head appears but birth does not occur after two contractions with pushing) is a life-threatening emergency for the baby.
- Utilise the mnemonic HELPER and move sequentially through the steps below if birth does not occur:
  - **Help.** Call for immediate help from an LMC, doctor or ICP.
  - **Evaluate the need for episiotomy.** This is not within delegated scopes of practice and personnel must seek urgent clinical advice if this is thought to be required.
  - **Legs up.** Ask the patient to grab her knees, pull them to her chest and push as hard as she can with the next two contractions.
  - **Pressure.** With the legs still up (as above), 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.
  - **Enter manoeuvres.** This refers to internal rotation manoeuvres that are not within delegated scopes of practice and personnel must seek urgent clinical advice if these are thought to be required.
  - **Remove the posterior arm.** Place the fingers of your hand into the posterior aspect of the vagina (adjacent to the anus), feel for the posterior arm and manipulate it until the arm is able to be pulled through the vagina.
  - **Roll.** Ask the patient to move on to her hands and knees and push as hard as she can with the next two contractions.
- If the above actions fail, seek urgent clinical advice and transport urgently. If possible position the mother tilted to the left with pillows/blankets under her pelvis, so that her head is below her pelvis.

## **If the cord is wrapped around the neck**

- This is quite common and is not an emergency.
- If the cord is loose and is easy to slip over the baby's head, then do so. If you cannot easily slip it over the head, allow birth to continue.

## **Prolapsed umbilical cord**

- This is when the umbilical cord appears in the vagina ahead of the baby.
- This is a life-threatening emergency for the baby. It risks the baby having poor blood supply from an obstructed cord and requires urgent delivery.
- Seek immediate help from an LMC if possible.
- Instruct the patient not to push.
- If possible position the mother tilted to the left with pillows/blankets under her pelvis, so that her head is below her pelvis. This is designed to take the weight of the baby off the cord and delay delivery until an LMC is available.
- Transport urgently to a hospital with obstetric facilities.
- Encourage delivery to occur if the baby appears at the vaginal opening or the patient wants to push.

## **Breech delivery**

- This is when the baby is coming out feet or buttocks first.
- This is a life-threatening emergency for the baby. It risks the baby having poor blood supply from an obstructed cord and requires urgent delivery.
- Seek immediate help from an LMC if possible.
- Instruct the patient not to push.
- If possible, position the mother tilted to the left with pillows/blankets under her pelvis, so that her head is below her pelvis. This is designed to take the weight of the baby off the cord and delay delivery until an LMC is available.
- Transport urgently to a hospital with obstetric facilities.
- Encourage delivery to occur if the baby appears at the vaginal opening or the patient wants to push.

## **Retained placenta**

- This is when the placenta has not been delivered within 60 minutes of the baby.
- Transport to a hospital with obstetric facilities without unnecessary delay and seek help from an LMC if possible.
- Gain IV access and be prepared to treat postpartum haemorrhage.

## Pre-eclampsia

- Pre-eclampsia is variable in both clinical presentation and severity, and can affect multiple organ systems. Signs and symptoms can include:
  - Renal insufficiency. For example, a decreased glomerular filtration rate, proteinuria, increased serum creatinine and increased uric acid levels.
  - Liver dysfunction. For example, nausea and vomiting and epigastric or abdominal pain.
  - Cardiovascular dysfunction. For example, hypertension, haemolysis, vascular endothelial leak (causing oedema) and decreased plasma volume.
  - Neurological symptoms. For example, headache, visual disturbance, hyperreflexia and cerebral haemorrhage.
- The aetiology of pre-eclampsia is not well understood, but is thought to be caused by poor placental implantation and/or abnormalities of placental vessels. This leads to placental hypoperfusion, a systemic inflammatory response, and foetal growth restriction.
- The diagnostic criteria for pre-eclampsia are:
  - A systolic blood pressure of greater than 140 mmHg, and/or a diastolic blood pressure of greater than 90 mmHg, and
  - More than 20 weeks gestation, and
  - Proteinuria (protein in the urine).
- If pre-eclampsia is suspected, contact the LMC directly and arrange for urgent assessment to occur.
- Magnesium may have a role in the treatment of severe pre-eclampsia. Seek clinical advice.

## Eclampsia

- Eclampsia occurs when a patient with pre-eclampsia has one or more generalised seizures.
- These seizures are thought to occur as a result of acute severe intracranial hypertension, where the cerebrovascular autoregulatory mechanisms are unable to compensate.
- Eclampsia poses a significant threat to both the life of the baby and the life of the mother.
- Treat as per the 'seizures' section.
- Magnesium may have a role in the treatment of eclampsia. Seek clinical advice.
- Transport the patient to a hospital with obstetric and intensive care facilities, whenever feasible and safe.

# 9.1 The principles of intubation and ventilation

## The risks

- The risks associated with intubation and ventilation include:
  - Hypoxia and hypercarbia during laryngoscopy, and
  - Raised intracranial pressure during laryngoscopy, and
  - Unrecognised oesophageal intubation, and
  - Inadvertent hyperventilation post intubation, and
  - Reduced cardiac output as a result of raised intrathoracic pressure reducing venous return to the heart, and
  - Interruption of chest compressions during cardiac arrest, and
  - Reduced blood flow during CPR (as a result of raised intrathoracic pressure) if ventilation rates are greater than 10 breaths/minute. Note: this risk exists with supraglottic airway devices too.

## The benefits

- The benefits associated with intubation and ventilation include:
  - Securing the airway, and
  - Protecting the lungs from aspiration of vomit, and
  - Controlling CO<sub>2</sub> levels by controlling ventilation, and
  - Improving oxygenation by allowing the administration of PEEP via an ETT, and
  - Allowing continuous chest compressions to occur (if CPR is in progress), without interruptions for ventilation.

## The balance of risks and benefits

- For the majority of unconscious patients not in cardiac arrest, the risks of intubation without rapid sequence intubation (RSI) outweigh the benefits.
- Intubation and ventilation without RSI must only occur if the patient has a GCS of 3 and ineffective breathing.

## Intubation and ventilation during cardiac arrest

- For the majority of patients in primary cardiac arrest, intubation and ventilation are not a priority during the initial phase of resuscitation.
- If the cardiac arrest is secondary to respiratory failure (for example following drowning) intubation should be performed early if adequate ventilation is not being achieved via an LMA.
- Chest compressions should be continuous (without interruptions for ventilation) if an LMA is in place and ventilation appears adequate.
- The LMA should be replaced with an ETT if there is significant vomiting or ventilation via the LMA is inadequate, provided this does not cause an unnecessary pause in chest compressions.





## 9.3 Rapid sequence intubation (RSI)

- RSI is indicated for a patient with:
  - a) A GCS less than or equal to 10, and
  - b) Clinically significant compromise of airway or ventilation.
- RSI is contraindicated if:
  - a) Capnography is unavailable, or
  - b) A dedicated suitable assistant is unavailable.
- RSI with suxamethonium is contraindicated if:
  - a) There is a history (or family history) of malignant hyperthermia, or
  - b) The patient has pre-existing paraplegia or quadriplegia, or
  - c) The patient has a muscle disorder with long-term weakness, or
  - d) Hyperkalaemia is strongly suspected.
- Use caution performing RSI if:
  - a) The intubation is predicted to be difficult, or
  - b) Transport time to hospital is less than 15 minutes, or
  - c) The underlying condition is likely to rapidly improve, or
  - d) The patient is aged less than five years or greater than 75 years, or
  - e) The patient has severe comorbidities.

### RSI procedure

- Administer fentanyl IV over approximately one minute.
- Utilise the RSI checklist.
- Administer metaraminol IV if there are signs of shock.
  - a) 0.5-1 mg metaraminol IV for an adult.
  - b) Consider a metaraminol infusion.
  - c) See the paediatric drug dose tables if the patient is a child.
- Administer ketamine.
- Administer neuromuscular blockade:
  - a) Rocuronium IV, or
  - b) Suxamethonium IV.
- Consider providing approximately five ventilations prior to laryngoscopy, particularly if oxygenation is abnormal or intubation is predicted to be difficult.
- Intubate and immediately confirm ETT position with waveform capnography over the first 4-6 breaths.
- Routinely administer rocuronium if suxamethonium was administered for the RSI, provided the  $\text{ETCO}_2$  is greater than 5 mmHg.
- Utilise the post intubation checklist.
- Routinely administer ongoing sedation, analgesia, neuromuscular blockade and vasopressor using the 'post intubation' section.



## Adult RSI drug doses

	< 70 kg	70-90 kg	> 90 kg
Fentanyl*	120 mcg	150 mcg	200 mcg
Ketamine	120 mg	150 mg	200 mg
Rocuronium	150 mg	150 mg	200 mg
Suxamethonium	150 mg	150 mg	200 mg

\* Halve the dose of fentanyl if there are signs of shock or the patient is frail.

## Paediatric RSI drug doses

	10 kg	20 kg	30 kg	40 kg
Fentanyl*	20 mcg	40 mcg	60 mcg	80 mcg
Ketamine	20 mg	40 mg	60 mg	80 mg
Rocuronium	20 mg	40 mg	60 mg	80 mg
Suxamethonium	20 mg	40 mg	60 mg	80 mg

\* Halve the dose of fentanyl if there are signs of shock.

## Additional information

### General principles

- The primary goal of performing RSI is to improve patient outcomes by securing the airway, treating hypoxia and controlling ventilation to prevent hypercarbia. This is particularly important in patients who are unconscious post cardiac arrest or have severe TBI, because secondary brain injury worsens long-term outcomes.
- The decision to perform RSI must take into account all of the factors contributing to the balance of risk for each patient.
- Patient preparation and attention to detail are important factors to ensuring that the RSI is performed in a way that ensures the benefits outweigh the risks and this is why only selected ICPs are endorsed to perform RSI.
- Personnel calling for backup from an ICP endorsed to perform RSI must take into account how long it will take for backup to arrive. In order to be appropriately utilised, such backup must arrive at least 15 minutes faster than the patient can be transported to an appropriate hospital.
- Whenever feasible, a second ICP should be utilised as the dedicated assistant.
- Oxygen via nasal prongs at 15 litres/minute during laryngoscopy significantly prolongs the time to desaturation:
  - If two oxygen sources are available, oxygen should be administered via the manual ventilation bag/mask in addition to oxygen via nasal prongs.

- If only one oxygen source is available, consider shifting the oxygen tubing from the manual ventilation bag to the nasal prongs during laryngoscopy, noting that the oxygen tubing will need to be reconnected to the manual ventilation bag following intubation or following a failed intubation.
- The onset of adequate neuromuscular blockade may be delayed if cardiac output is very low. Consider increasing the dose of suxamethonium to approximately 3 mg/kg, up to a maximum of 200 mg.

## **Cautions**

- It usually takes approximately 15-20 minutes to prepare the patient, brief the team and safely perform RSI and this is why a transport time of less than 15 minutes is a caution. However, transport time is only one aspect of the total time it takes for a patient to reach hospital and time to intervention is more important than time to hospital.
- If the patient has a cause of unconsciousness that is likely to rapidly improve (examples include hypoglycaemia, a postictal state and poisoning with CO, GHB or opiates), RSI is unlikely to improve their clinical outcome.
- Whenever feasible, clinical advice should be sought prior to RSI in patients with severe comorbidities that significantly reduce their life expectancy, because RSI is unlikely to improve their clinical outcome.

## **The choice of neuromuscular blocker**

- Choosing to perform RSI using either rocuronium or suxamethonium requires clinical judgement that balances the risks and benefits.
- When performing RSI using rocuronium as the neuromuscular blocker:
  - The contraindications associated with using suxamethonium are removed.
  - The time to adequate neuromuscular blockade is increased by approximately one minute, in comparison to suxamethonium.
  - The patient will be neuromuscularly blocked for approximately 60 minutes if a failed intubation occurs. This may be considered an advantage because the conditions for securing ventilation (via bag/mask ventilation, laryngeal mask airway or surgical airway) are usually optimised if the patient is not moving.
- Choosing suxamethonium increases the number of contraindications, but results in a much shorter time to return of neuromuscular function if a failed intubation occurs.
- The balance of risk is usually in favour of performing RSI using rocuronium as the neuromuscular blocker, unless the clinical scenario is one where the patient is considered at high risk of a failed intubation.

## Delayed sequence intubation

- Delayed sequence intubation is a term used to describe the administration of sedation prior to RSI.
- Delayed sequence intubation is indicated if the patient meets criteria for RSI, but is agitated and/or combative to a level that is preventing safe preparation prior to RSI:
  - Administer sufficient ketamine (usually 0.5-1 mg/kg IV) to gain control of the agitation.
  - Once control is gained, ensure adequate pre-oxygenation and preparation.
  - Perform RSI and consider reducing the dose of ketamine, taking into account the dose of medicines already administered.

## Truncated RSI

- Rarely, a patient may be deteriorating with airway obstruction so rapidly that there is a high risk of death prior to performing RSI, and a truncated approach to RSI (also called crash intubation or crash RSI) should be considered:
  - Task one person to provide as much pre-oxygenation as possible.
  - Truncate the checklist to ensure that IV access is secure and the equipment to perform and confirm intubation is available and checked.
  - Administer a neuromuscular blocker alone if the patient has a GCS of 3.
  - Administer ketamine and a neuromuscular blocker if the patient has a GCS greater than 3.

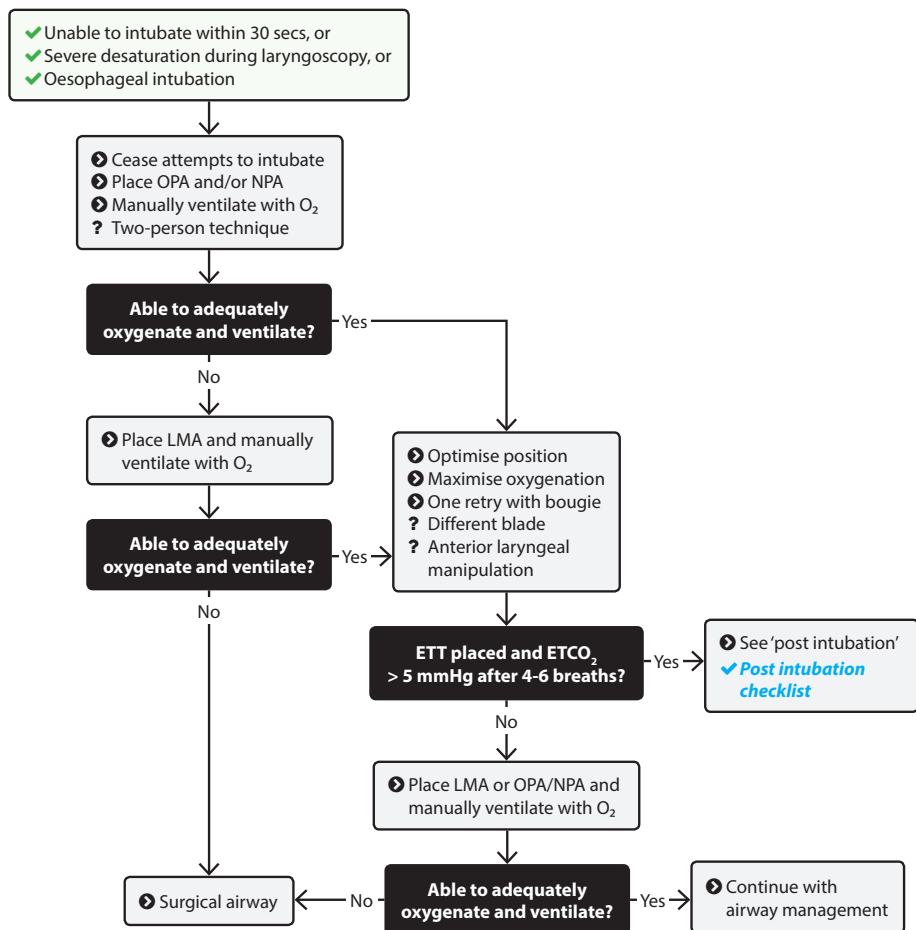


## 9.4 RSI checklist

- Roles assigned and team briefed:
  - a) Airway.
  - b) Airway assistant.
  - c) Drugs and monitoring.
- Patient prepared:
  - a) Pre-oxygenation. Nasal prongs in place.
  - b) Position optimised.
  - c) IV access patent. Running line attached.
  - d) 0.9% sodium chloride IV bolus if indicated.
- Monitoring attached and visible:
  - a) Baseline vital signs.
  - b) Pulse oximetry and capnography.
- Equipment checked and ready:
  - a) Manual ventilation bag with PEEP valve set to minimum 5 cmH<sub>2</sub>O.
  - b) Oropharyngeal airway.
  - c) Laryngoscope.
  - d) ETT. Cuff checked. Syringe containing 5 ml of air.
  - e) ETT holder in place.
  - f) Suction checked and in position.
  - g) Bougie.
  - h) LMA and surgical airway equipment out.
- Drugs drawn up, labelled and doses confirmed:
  - a) Metaraminol.
  - b) Fentanyl.
  - c) Ketamine.
  - d) Neuromuscular blocker.
  - e) Post intubation sedation
  - f) Rocuronium.
  - g) Consider atropine.
- Failed intubation plan communicated.



## 9.5 Failed intubation drill



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## 9.6 Post intubation

- Use this section if:
  - a) The patient has been intubated with an ETT, and
  - b) ETT placement has been confirmed by capnography.
- If the patient has been intubated during cardiac arrest, this section should only be used if sustained ROSC occurs.
- Ventilate to a target  $\text{ETCO}_2$  of:
  - a) 30-35 mmHg if the primary clinical problem is severe TBI.
  - b) 35-45 mmHg if the primary clinical problem is not severe TBI.
- Administer sedation and analgesia in combination with neuromuscular blockade if the patient has been intubated:
  - a) Following RSI, or
  - b) Without RSI and shows clinically significant signs of movement. Avoid neuromuscular blockade in an adult with a very poor prognosis, whenever feasible and safe.
- Administer fentanyl and midazolam if the patient does not have signs of shock:
  - a) Draw up 100 mcg of fentanyl in combination with 10 mg of midazolam in a 10 ml syringe. Dilute with 0.9% sodium chloride to a total of 10 ml. This solution contains 10 mcg/ml of fentanyl and 1 mg/ml of midazolam.
  - b) For an adult administer 1-2 ml of this solution IV (1-2 mg of midazolam and 10-20 mcg of fentanyl) every 5-15 minutes, titrating the dose and frequency to the clinical signs of the patient's level of sedation.
  - c) For a child administer the volume described in the paediatric drug dose tables IV every 5-15 minutes, titrating the dose and frequency to the clinical signs of the patient's level of sedation.
- Administer fentanyl and ketamine if the patient has signs of shock:
  - a) Draw up 200 mcg of fentanyl in combination with 200 mg of ketamine. Dilute with 0.9% sodium chloride to a total of 20 ml. This solution contains 10 mcg/ml of fentanyl and 10 mg/ml of ketamine.
  - b) For an adult administer 5 ml of this solution IV (50 mcg of fentanyl and 50 mg of ketamine) every 15-30 minutes, titrating the frequency to the clinical signs of the patient's level of sedation.
  - c) For a child administer the volume described in the paediatric drug dose tables IV every 15-30 minutes, titrating the frequency to the clinical signs of the patient's level of sedation.
- Administer rocuronium unless neuromuscular blockade is being withheld in an adult with a very poor prognosis:
  - a) 100 mg IV for an adult weighing greater than 80 kg.
  - b) 50 mg IV for an adult weighing 50-80 kg.
  - c) See the paediatric drug dose tables for a child.
  - d) Repeat as required.

- Administer 0.9% sodium chloride IV if there are signs of hypovolaemia or poor perfusion, or the patient is hypotensive:
  - a) 1 litre for an adult.
  - b) 20 ml/kg for a child.
  - c) Administer one further bolus if required.
- Administer metaraminol IV in addition to 0.9% sodium chloride, if the patient remains hypotensive.

**Metaraminol for an adult:**

- a) Administer via an infusion pump:
  - Administer an initial bolus of 0.5-1 mg metaraminol IV.
  - Start the infusion at 2 mg/hour and adjust the rate as required.
- b) Alternatively, administer a bolus of 0.5-1 mg metaraminol IV every 5-10 minutes as required.

**Metaraminol for a child:**

- Administer a bolus of metaraminol IV (see the paediatric drug dose tables) every 5-10 minutes as required.
- Consider administering adrenaline IV if the blood pressure is unresponsive to metaraminol or the patient is hypotensive and bradycardic.

**Adrenaline for an adult:**

- a) Administer an adrenaline infusion via an infusion pump. Start at a rate of 0.5 mg/hour and adjust the rate as required, or
- b) Place 1 mg of adrenaline into a 1 litre bag of 0.9% sodium chloride (1:1,000,000 solution):
  - Administer as an infusion. Start at 2 drops/second and adjust the rate as required, or
  - Administer a bolus of 0.01 mg adrenaline (10 ml) IV every 1-2 minutes as required.

**Adrenaline for a child aged 5-14 years:**

- a) Administer an adrenaline infusion via an infusion pump. Start at a rate of 0.25 mg/hour and adjust the rate as required, or
- b) Place 1 mg of adrenaline into a 1 litre bag of 0.9% sodium chloride (1:1,000,000 solution):
  - Administer as an infusion. Start at 1 drop/second and adjust the rate as required, or
  - Administer IV boluses (see the paediatric drug dose tables) every 1-2 minutes as required.

**Adrenaline for a child aged less than five years:**

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

## Post intubation checklist

- Confirm placement with capnography. Note the  $\text{ETCO}_2$  level and waveform.
- Examine for signs of bronchial intubation and adjust the ETT depth if required.
- Secure the ETT and note the length at lips.
- Measure vital signs.
- Administer sedation and analgesia in combination with neuromuscular blockade if required.
- Check the oxygen supply.
- Check the ETT cuff. Ensure the minimum amount of air required to provide a seal.
- Ensure a manual ventilation bag is immediately available if a mechanical ventilator is being used.

## Additional information

### $\text{ETCO}_2$

- $\text{ETCO}_2$  is inversely proportional to ventilation when cardiac output is near normal.
- The target  $\text{ETCO}_2$  ranges are:
  - 30-35 mmHg if the primary clinical problem is severe TBI. This will usually result in the arterial  $\text{pCO}_2$  being at the lower end of the normal range.
  - 35-45 mmHg if the primary clinical problem is not severe TBI. This will usually result in the arterial  $\text{pCO}_2$  being in, or just above the normal range.
- The  $\text{ETCO}_2$  will usually be above the target range immediately following intubation. Aim to reach the target over 5-10 minutes because rapid reductions in  $\text{ETCO}_2$  may cause cerebral vasoconstriction.
- A patient with life-threatening bronchospasm will usually have a very high  $\text{ETCO}_2$ . In this setting targeting an  $\text{ETCO}_2$  of 35-45 mmHg risks causing a reduced cardiac output from dynamic hyperinflation (or air trapping). Ventilate the patient with a respiratory rate of approximately six breaths/minute and allow the  $\text{ETCO}_2$  to be high.
- $\text{ETCO}_2$  is proportional to blood flow when cardiac output is very low and the most common clinical setting is cardiac arrest. Typically  $\text{ETCO}_2$  will be 15-25 mmHg during cardiac arrest with CPR in progress.
- In some patients (particularly those with clinically important aspiration) the  $\text{ETCO}_2$  will remain high despite increasing ventilation. If the  $\text{ETCO}_2$  remains high despite a ventilation rate of 20-30 breaths/minute, do not increase the ventilation any further and allow the  $\text{ETCO}_2$  to remain high.



## **The decision to administer sedation, analgesia and neuromuscular blockade if the patient has been intubated without RSI**

- Sedation and analgesia in combination with neuromuscular blockade are not required if the patient remains GCS 3 and does not show signs of clinically significant movement.
- Unnecessary sedation and analgesia carries a risk of hypotension.
- Unnecessary sedation and analgesia in combination with neuromuscular blockade carries a risk of impairing clinical assessment of CNS function after arrival at hospital, and this may have implications for clinical decisions regarding treatment.
- Conversely, patient movement incurs risk. This is particularly the case while the patient is being extricated from the scene and/or transported, often with limited numbers of personnel. Examples include:
  - Patient movement that may displace the ETT.
  - Coughing or gagging on the ETT which may raise ICP, particularly in patients with TBI.
  - Shivering. Shivering raises oxygen consumption as well as raising body temperature and is of particular concern if the patient is post cardiac arrest.
  - Spontaneous breathing that interferes with adequate oxygenation or ventilation. This is particularly a problem if the patient has severe impairment of oxygenation or very poor pulmonary compliance, for example from aspiration pneumonitis.
- The administration of sedation and analgesia in combination with neuromuscular blockade requires clinical judgement which balances the risks against the benefits. The decision must take into account the anticipated clinical course of the patient and whether or not the movement is clinically significant or unsafe, noting that sedation and analgesia in combination with neuromuscular blockade should not be delayed until movement is so severe that the patient is at risk. For example:
  - A child should usually receive sedation and analgesia in combination with neuromuscular blockade.
  - An adult who has had a witnessed cardiac arrest with VF or VT as the first rhythm should usually receive sedation and analgesia in combination with neuromuscular blockade.
  - An adult with a very poor prognosis (for example, severe comorbidities, or requiring long-term aged residential care) should usually have sedation and analgesia administered but neuromuscular blockade withheld. This is because the patient is unlikely to benefit from admission to an intensive care unit and may be extubated in the ED.

## **Ensuring that adequate sedation and analgesia is administered**

- If neuromuscular blockade is administered, sedation and analgesia must be administered to ensure that:
  - ICP is minimised (particularly if the primary clinical problem is severe TBI).
  - The patient is not awake and aware that they are unable to move. This may occur if the patient recovers awareness after neuromuscular blockade is administered. Causes of unconsciousness that rapidly improve, such as GHB poisoning, place the patient at particular risk of this.
- When administering sedation and analgesia:
  - Use doses at the lower end of the described ranges if the patient is small, frail, or cardiovascularly unstable.
  - Titrate the dose and frequency of administration to the clinical signs of the patient's level of sedation. Increase the dose and frequency of administration if the patient has hypertension and tachycardia, or shows signs of tears. Decrease the dose and frequency of administration if the patient has hypotension.

## **Ensuring a safe ETT cuff seal**

- The cuff of the ETT is designed to ensure a seal within the trachea. This seal prevents air leaking out of the trachea during positive pressure ventilation and reduces the risk of aspiration of pharyngeal contents into the lungs.
- It is very easy to generate a high pressure within the ETT cuff and this may cause tracheal injury by impairing the blood supply to the tracheal mucosa. Tracheal injury may lead to tracheal stenosis and this may cause significant morbidity.
- Most adult patients only require 3-5 ml of air in the ETT cuff to ensure an adequate seal and using a 5 ml syringe to inflate the cuff reduces the risk of creating a high cuff pressure.
- As soon as feasible, the cuff should be checked to ensure that the minimum amount of air is present in order to provide a seal. Remove air from the cuff until a small leak is heard during positive pressure ventilation and then add 1-2 ml of air until the leak cannot be heard.
- The air within the cuff will expand at altitude:
  - This is not usually clinically significant if the flight is at usual helicopter altitude and is less than 30 minutes in duration.
  - If the flight is at high altitude or longer than 30 minutes in duration, consider removing small amounts of air to control cuff pressure and re-inflate the cuff as altitude decreases.

## 9.7 Mechanical ventilation

### Introduction

- Mechanical ventilation is not described within delegated scopes of practice, but it may only be used by ICPs who have been trained and authorised to operate the ventilator available.
- Mechanical ventilators are present in many of the air ambulances in New Zealand, noting there are multiple different types. This section provides generic instructions and does not replace training in the use of a mechanical ventilator.
- Sustained ventilation via a manual ventilation bag is challenging and this is compounded when the patient is being moved and/or when multiple clinical tasks are required. The advantages of mechanical ventilation include:
  - Consistent ventilation at selected settings.
  - Reduced risk of inadvertent hyperventilation, resulting in reduced risk of lowered cerebral blood flow as a result of cerebral vasoconstriction.
  - The logistic advantages of freeing personnel for other clinical tasks.

### Ventilator modes

- There are multiple ventilation modes with different names and abbreviations used to describe them. However, the ventilation modes can be broadly categorised as:
  - Volume controlled. In this mode the delivered tidal volume is set and the peak airway pressure is dependent on lung compliance.
  - Pressure controlled. In this mode the delivered airway pressure is set and the tidal volume delivered is dependent on lung compliance.
  - Synchronised. In this mode the patient is able to take spontaneous breaths between ventilator delivered breaths. For most patients in the out-of-hospital setting this is not a useful mode.
  - Non-synchronised (often called controlled or mandatory). In this mode the patient is unable to take spontaneous breaths between ventilator delivered breaths.
- A volume controlled mode is recommended for most patients.

### Common ventilator settings

- Tidal volume:
  - A tidal volume of approximately 7 ml/kg of lean body weight is usually appropriate for most patients.
  - From a practical perspective, the tidal volume should be proportional to the patient's height rather than weight, as height correlates best with lung volume. For example, a tall patient should have a higher tidal volume than a short patient with the same weight.

- Relief airway pressure:
  - This is often referred to as the maximum pressure or P max and is the airway pressure that the ventilator will not exceed.
  - If the peak airway pressure reaches the relief airway pressure, the ventilator will stop delivering positive pressure and alarm.
  - The relief airway pressure is a safety setting. It helps prevent damage to the lungs from excessive pressure.
  - The relief pressure should be set at 40 cmH<sub>2</sub>O (or mbar) for adults and children.
  - The pressure may need to be set higher in patients with obesity or stiff lungs (for example following aspiration), but should not exceed 45 cmH<sub>2</sub>O without seeking clinical advice.
- Ventilation frequency:
  - This should be set as close as possible to the normal respiratory rate for the patient's age.
  - For an adult this will usually be 12-14/minute. Faster rates will be required in children.
  - Beware using a mechanical ventilator if the patient has severe bronchospasm. Even with a low respiratory rate, the risk of dynamic hyperinflation (air trapping) is high and manual ventilation is usually the safest option.
- Inspiratory expiratory ratio:
  - The proportion of time that each ventilation cycle is in the inspiratory phase compared with the expiratory phase is called the inspiratory expiratory ratio (I:E ratio).
  - An I:E ratio of 1:2 is appropriate for most patients. This means that one-third of the time will be in inspiration and two-thirds of the time in expiration.
  - If bronchospasm is present, the I:E ratio can be increased to 1:4 or 1:5 to allow a longer expiratory time to reduce the risk of dynamic hyperinflation.
- Fraction of inspired oxygen:
  - The fraction of inspired oxygen (FiO<sub>2</sub>) is the percentage of inspired oxygen expressed as a fraction. For example, 60% oxygen is an FiO<sub>2</sub> of 0.6.
  - Most ventilators allow the FiO<sub>2</sub> to be adjusted.
  - It is usually appropriate to commence ventilation on an FiO<sub>2</sub> of 1.0, but provided pulse oximetry is reliable this should be reduced to minimise the FiO<sub>2</sub>. This reduces the risk of harm from high oxygen concentrations at a tissue level and conserves the oxygen supply.

## Commencing mechanical ventilation checklist

- Ensure the patient is adequately sedated and neuromuscularly blocked.
- Connect an oxygen source to the ventilator and check the oxygen supply.
- Connect the ventilator to an electrical supply if required.
- Connect the ventilator circuit/tubing if not already in place.
- Test the ventilator and circuit/tubing.
- Select the ventilation mode.
- Set the initial tidal volume:
  - a) 600 ml for a tall adult.
  - b) 500 ml for an adult of average height.
  - c) 7 ml/kg (rounded off to the nearest 10 kg) for a child.
- Set the initial ventilation rate:
  - a) 14/minute for an adult.
  - b) 16/minute for a child greater than or equal to 30 kg.
  - c) 20/minute for a child under 30 kg.
- Set the maximum inspiratory pressure to 40 cmH<sub>2</sub>O.
- Set the I:E ratio to 1:2.
- Set the FiO<sub>2</sub>, usually commencing on 1.0 (100% oxygen).
- Set the PEEP.
- Turn the ventilator on and connect the circuit/tubing to the patient.
- Check ventilation, oxygenation, monitoring and vital signs.
- Ensure the tubing is secured.

## Troubleshooting: general

- If at any time troubleshooting does not quickly resolve the problem, cease mechanical ventilation and commence manual ventilation.
- The **DOPES** mnemonic is one systematic approach to troubleshooting.
- **Displacement** of the ETT. Consider the possibility of inadvertent extubation, oesophageal placement or endobronchial intubation.
  - a) Check the ETCO<sub>2</sub> level and waveform.
  - b) Examine the chest for endobronchial intubation.
  - c) Adjust the ETT length at the lips if required.
- **Obstruction** of the ETT or circuit/tubing. Consider the possibility the ETT is obstructed (for example by secretions or kinking) or the circuit is obstructed.
  - a) Check the ETT is not kinked.
  - b) Check the patient is not biting the ETT.
  - c) Check the circuit/tubing is not kinked.
  - d) Check the ETT is not blocked by passing a suction catheter or bougie down the ETT.

- **Pneumothorax.** Consider the possibility of pneumothorax.
  - a) Examine the chest.
  - b) Check for high peak inspiratory pressures.
  - c) Decompress the chest if tension pneumothorax is suspected, preferably by finger thoracostomy.
  - d) Consider other causes of abnormal lung function, for example pulmonary oedema, bronchospasm and aspiration.
- **Equipment.** Consider the possibility of an equipment problem.
  - a) Check the ventilator and the settings.
  - b) Check the circuit/tubing, ensuring all connections are secure.
  - c) Check the oxygen and power supply.
- **Stacked breaths.** Consider the possibility of dynamic hyperinflation (air trapping). Disconnect the ventilator for 20-30 seconds to allow full expiration.

### **Troubleshooting: falling ETCO<sub>2</sub>**

- Reduce the ventilation rate and adjust every 5-10 minutes as required.
- If ETCO<sub>2</sub> continues to fall, consider the possibility this is due to falling cardiac output.

### **Troubleshooting: rising ETCO<sub>2</sub>**

- Increase the ventilation rate and adjust every 5-10 minutes as required.
- In some patients (particularly those with clinically important aspiration) the ETCO<sub>2</sub> will remain high despite increasing ventilation. If the ETCO<sub>2</sub> remains high despite a ventilation rate of 20-30 breaths/minute, do not increase the ventilation any further and allow the ETCO<sub>2</sub> to remain high.

### **Troubleshooting: falling SpO<sub>2</sub>**

- Increase the FiO<sub>2</sub>.
- Check the ventilator and circuit/tubing for leaks.
- Increase the PEEP.
- Examine for signs of endobronchial intubation.
- Examine for signs of pneumothorax.
- Consider the possibility of a monitoring error.

### **Troubleshooting: high airway pressures**

- Ensure the patient is adequately sedated and neuromuscularly blocked.
- Examine for signs of endobronchial intubation.
- Examine for signs of bronchospasm.
- Check the ETT and circuit/tubing for signs of obstruction.
- Reduce the tidal volume.
- Increase the relief airway pressure to 45 cmH<sub>2</sub>O.

# 10.1 Mental health conditions

## Introduction

- Mental health encompasses a wide range of conditions, and it is not the role of ambulance personnel to diagnose patients in this setting. It is however, important to have an understanding of the characteristics of mental health conditions that are commonly encountered in the out-of-hospital setting.
- Patients with particular mental health conditions are more commonly encountered in the out-of-hospital setting than others because:
  - There is a high incidence of the condition within the population (for example depression), or
  - The nature of the condition (for example schizophrenia) places the individual at increased risk of illness, injury or an acute deterioration in their mental health condition, requiring urgent assessment and/or treatment from a health professional.

## Assessment, treatment and referral

- The fundamental aspects of assessment and making decisions regarding treatment and/or referral for patients with a mental health condition are the same as for any other patient, with the addition of these important principles:
  - Assess the patient in a quiet and non-threatening environment whenever this is feasible.
  - Always assess and document the patient's mental status.
  - Assess and examine the patient carefully because physical illness (for example sepsis) or injury often co-exist with an acute deterioration in a mental health condition.
  - Involve family members and/or caregivers in assessment and decisions, whenever this is feasible.
  - Patients with a mental health condition are over-represented in mortality rates in several areas. A patient's mental health history and current mental status must be taken into consideration when making transport and/or referral decisions.
  - Seek advice from healthcare personnel that know the patient well, whenever this is feasible.
  - Further assessment and/or treatment from mental health personnel should occur in the community whenever this is feasible, provided it is clear that assessment and/or treatment in an ED is not required for a physical illness or injury.
  - Additional attention to safety is required if the patient has hallucinations, severe agitation or very abnormal behaviour.

## **Depression**

- Depression is the most commonly diagnosed mental health condition in New Zealand.
- Depression is characterised by signs and symptoms including, but not limited to:
  - Persistent negative mood.
  - Decreased satisfaction or pleasure from engaging in activities.
  - Insomnia or hypersomnia.
  - Feelings of hopelessness or worthlessness.
  - Inability to concentrate.
  - Agitation.
  - Suicidal ideation.
- Patients who have depression are at an increased risk of suicide, or attempted suicide.

## **Anxiety disorders**

- Anxiety disorders are common in New Zealand, with generalised anxiety disorder being the most frequently diagnosed.
- Each anxiety disorder has specific diagnostic criteria, but common features include:
  - A symptom duration of at least six months, and
  - A disproportionate fear or sympathetic nervous system response relative to the danger posed, and
  - Maladaptive behaviour to avoid the source of anxiety.

## **Bipolar disorder**

- Bipolar disorder is a mood disorder, characterised by symptoms of depression that are punctuated by manic episodes.
- Manic episodes are commonly accompanied by signs and symptoms such as grandiosity, insomnia, flight of ideas, inattention, increased psychomotor activity, and excessive engagement in risky or unrestrained behaviours that are likely to have adverse outcomes.
- Patients with bipolar disorder are at increased risk of suicide, or attempting suicide.

## **Personality disorders**

- Personality disorders are common, with borderline personality disorder being the most frequently diagnosed.
- Personality disorders are usually characterised by unstable moods and emotions, abnormal behaviour and impaired social relationships.
- Patients with a personality disorder are at increased risk of non-suicidal self-harm, suicide, attempted suicide and threatened suicide.



- Patients with a personality disorder may be intensely concerned with abandonment, and the perception of this impending loss or rejection can result in significant alterations to the patient's self-image, affect and behaviour.
- It is important to communicate with these patients in an optimistic manner, to encourage coping skills and to establish clear boundaries.

### **Schizophrenia and schizoaffective disorder**

- Schizophrenia is a psychotic disorder characterised by disturbances in the patient's perceptions, thoughts, behaviour and affect that last for at least six months. Signs and symptoms include, but are not limited to:
  - Hallucinations.
  - Delusions.
  - Disorganised thoughts and speech.
  - Abnormal behaviour.
  - Catatonia (a state of immobility and stupor).
  - Negative symptoms (for example, apathy and decreased emotional expressiveness).
- Schizoaffective disorder is characterised by schizophrenia with the addition of major mood abnormalities, for example depression or mania.
- These disorders are usually accompanied by major social and occupational dysfunction, and ambulance personnel are often requested at a point of acute deterioration.



## 10.2 Assessing mental status

This section provides a guide to assessing mental status. The GCS is a very basic assessment of the level of consciousness and many patients with abnormal mental status will have a normal GCS. Abnormal mental status often only becomes obvious when a comprehensive assessment of mental status is undertaken. The BATOMI mnemonic provides a useful structure for an assessment of mental status.

### The BATOMI mnemonic

- **B**ehaviour.
- **A**ffect, appearance and mood.
- **T**hought and talk.
- **O**rientation.
- **M**emory.
- **I**ntellect and insight.

### Behaviour

- Assess for signs of abnormal behaviour, for example:
  - Lack of eye contact.
  - Abnormal body language and/or posture.
  - Abnormal movement, for example restlessness, tremor or repetitive movement (such as lip smacking).

### Affect, appearance and mood

- Assess the patient's affect (observable behaviour that represents the expression of emotion). Examples of abnormal affect include:
  - Blunted affect: a significant reduction in the intensity of emotional expression.
  - Flat affect: the absence of signs of emotional expression.
  - Inappropriate/incongruent affect: the expression of emotion that does not match the content of what is being said or thought.
  - Labile affect: abnormal sudden rapid shifts in emotions or emotional expression.
- Assess the patient's appearance. For example, assess if they are dressed appropriately and if they maintain appropriate personal hygiene.
- Assess for signs of abnormal mood.

## Thought and talk

- Assess the patient's thoughts and the expression of their thoughts.  
For example:
  - Ideation. In particular, note if the patient's ideas are abnormal and/or may be harmful, for example suicidal ideation.
  - Confusion. For example, assess whether the patient comprehends their current situation.
  - Delusions (fixed and false beliefs). For example, grandiose delusions, paranoid delusions or persecutory delusions.
- Assess the tone, flow, rate, volume and content of the patient's speech.
- Assess for the presence of hallucinations (false or distorted sensory perceptions).

## Orientation

- Assess the patient's orientation to person, place and time.

## Memory

- Assess the patient's short term memory by asking them to remember three random objects or words. After approximately one minute, ask the patient to recall the objects or words.
- Assess the patient's long-term memory by asking 2-3 questions that are easily verified. For example:
  - What is your address?
  - What political party is in power at the moment?

## Intellect and insight

- Assess the patient's intellect by noting their cognitive ability and comprehension of information.
- Assess the patient's insight by noting whether they can understand their situation and act appropriately.

## Additional information

### General principles

- Document the aspects of mental status on the ePRF, but do not refer directly to BATOMI as a title. This is because most hospital personnel are familiar with the individual aspects of BATOMI, but not the actual title.

### Delusions and hallucinations

- Delusions are defined as false beliefs that remain fixed despite what almost everyone else believes, and despite what usually constitutes incontrovertible evidence to the contrary. Take note of delusions as part of the mental status assessment.
- Hallucinations are defined as sensory perceptions that occur in the absence of external stimulation of the sensory organ. They are most common in patients with schizophrenia or other psychotic disorders.
  - The majority of hallucinations experienced by patients are auditory (for example hearing voices), but hallucinations can also be visual, tactile (touch), olfactory (smell), gustatory (taste), and kinaesthetic (bodily or movement sense).
  - Do not deny the patient’s experience, but suggest your own perceptions. For example, “I can’t see or hear what you are experiencing, but I believe that it’s very real for you”.
  - Talk to the patient about what they are experiencing, reassure them that they are safe, and ask whether there is anything you can do to help.
  - It may be difficult for the patient to concentrate on what you are saying because their hallucinations are distracting. Without being condescending, ensure you speak clearly and keep your sentences simple.



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## 10.3 Attempted and/or threatened suicide

- Prevent imminent suicide provided this is feasible and safe.
- Assess the patient for injury and/or poisoning requiring transport to a medical facility.
- Directly refer the patient for an urgent mental health assessment if the patient is not transported to a medical facility and:
  - a) Suicide has been attempted, or
  - b) A threat of suicide appears genuine.
- Mental health assessment may occur in the community provided:
  - a) An appointment is made directly with a mental health team, and
  - b) The patient can be observed and supported by a competent adult until mental health assessment occurs.
- Follow a local pathway if one is in place.

### Additional information

#### Attempted suicide

- All patients that have attempted suicide require an urgent mental health assessment.
- Mental health assessment will occur in hospital if the patient requires transport to an ED. However, it is not always necessary to transport a patient to an ED to obtain a mental health assessment.
- All DHBs have mental health teams that provide assessment in the community. The contact numbers for DHB community mental health teams are on the Ministry of Health website and all personnel should know how to contact a DHB community mental health team in their area.
- Community mental health teams receive multiple requests for help, have to prioritise their responses and may not be able to respond immediately to a referral. Provided the patient is not in imminent danger and a competent adult can remain with them until assessment occurs, it is not necessary for ambulance personnel to remain with the patient until the mental health team arrive.

#### Threatened suicide

- Determining that a threat of suicide appears 'genuine' requires clinical judgement. For the threat to be considered genuine the patient must be considered to be at risk of attempting suicide.
- A person may express brief thoughts/threats of suicide, for example during an argument or at a time of intense grief, and these should not be routinely considered genuine. However, if other risk factors are present (noting these

are not diagnostic in isolation), the thoughts/threats should be considered genuine and a referral for a mental health assessment should occur. Examples of risk factors include:

- Depression.
  - Previous history of suicide attempt.
  - Access to a firearm.
  - Social isolation.
  - Alcohol/drug use.
- Personnel should seek clinical advice if uncertain.

### **Non-suicidal self-harm**

- Non-suicidal self-harm occurs when a patient deliberately injures their body, but is not intending to die. Examples include cutting or burning skin, and biting.
- Non-suicidal self-harm is common and it is important to differentiate between non-suicidal self-harm and attempting suicide.
- See the 'non-suicidal self-harm' section.

### **Calling for assistance from police**

- Police are not routinely required to assist with the management of a patient that has attempted suicide, including when treatment and/or transport is being provided against their will.
- Assistance from police should be requested if:
  - There is significant risk of injury to the patient, personnel or bystanders, or
  - The patient has agitation causing a severe to immediately life-threatening risk to safety, or
  - More than minimal restraint is required.
- Police do not have the legal authority to restrain a patient on their own property, unless there is immediate danger to people, including immediate danger as a result of being unable to treat the patient.
- Police do not have the legal authority to restrain a patient in a public space, unless there is immediate danger to people (as above), or the patient is considered to be 'disturbing the peace'.
- Minimal restraint cannot be tightly defined and requires clinical judgement. Examples of minimal restraint include:
  - Guiding a patient with a hand on their arm, shoulder or back.
  - Holding a patient's hand(s).
  - Guiding a patient on to a stretcher or into an ambulance.

## **The Mental Health (Compulsory Assessment and Treatment) Act 1992**

- The Mental Health Act describes the process for the assessment and treatment, including compulsory treatment if necessary, of patients with mental health disorders.
- Registered medical practitioners, registered nurses and police have legal authority within the Mental Health Act to detain patients with mental health disorders, but ambulance personnel do not. However, ambulance personnel do have legal authority within the Crimes Act.
- A duly authorised officer (DAO) is a person with specific powers and responsibilities under the Mental Health Act. These powers include the ability to force a patient to undergo an assessment that may lead to a compulsory treatment order. DAOs are appointed and are usually mental health nurses.
- When asking for an assessment by a mental health team, personnel do not need to specifically request a DAO.

## **The Crimes Act 1961**

- The Crimes Act describes the legal authority of anyone to use reasonable force in order to prevent suicide, or an act that is likely to cause immediate and/or serious injury to a person.
- What constitutes reasonable force is not defined within the Act.
- Personnel can use reasonable force, including providing restraint and administering sedation, if required in order to treat and/or transport a patient they believe is at significant risk of immediate and/or serious injury.
- Personnel will not be judged on whether or not they complied with the wording in a specific Act, but will be judged on whether or not they acted in the best interest of the patient, and whether or not their actions were reasonable in the circumstances.



## 10.4 Non-suicidal self-harm

- Assess the patient for injury and/or poisoning requiring transport to a medical facility.
- Assess the patient to rule out a suicide attempt. See the 'attempted and/or threatened suicide' section if suicide has been attempted, or a threat of suicide appears genuine.
- Ensure appropriate support and follow up if the patient is not transported to a medical facility.

### Additional information

#### General principles

- Non-suicidal self-harm occurs when a patient deliberately injures their body, but is not intending to die. Examples include cutting or burning skin.
- It is important to differentiate between non-suicidal self-harm and attempting suicide. Although the methods used to engage in non-suicidal self-harm sometimes overlap with those of suicide attempts (for example, cutting the wrists), non-suicidal self-harm is distinct from suicide attempts in that these patients do not intend for their actions to be lethal.
- Patients often harm themselves repeatedly in one session, creating multiple injuries in the same area of the body. This is often a repeated behaviour and can result in extensive scarring.
- The motivations to engage in non-suicidal self-harm are unclear, but may be:
  - To distract themselves when they are experiencing pressing, unavoidable, and overwhelming negative thoughts and/or emotions.
  - To experience something physical when they are otherwise feeling dissociated or 'numb'.
  - To express themselves or communicate strong emotions that they cannot otherwise articulate.
  - As a form of self-punishment for perceived faults.
  - As a plea for help.

#### Patient support and follow up

- Clinical judgement is required, but a patient who has engaged in non-suicidal self-harm does not routinely require referral for a mental health assessment.
- A patient who has engaged in non-suicidal self-harm requires support (for example from a competent adult) and follow up (for example in primary care).
- Have a low threshold for seeking clinical advice if uncertain.
- Provide the patient and/or their support people with a telephone support number or text support number, such as Lifeline or Helpline.



## 10.5 Psychological wellness

This section is for personnel to help them pro-actively support their psychological wellness and that of their colleagues. It is based on the MANERS psychological first aid tool developed by the Victorian Ambulance Service and is designed to be used as an adjunct to other forms of psychological support.

### The MANERS psychological first aid tool

- **Minimise** exposure.
- **Acknowledge** the event.
- **Normalise** reactions.
- **Educate** as required.
- **Review**, restore or refer.
- **Self-care**.

### Minimise exposure

- Minimise exposure to distressing situations. For example, if a person is psychologically distressed speak to them and their manager about the possibility of taking time away from work.
- Move the person to a place of calm and safety if they are distressed. This may not always be immediately possible during an incident, but if a person is distressed remove them from the situation as soon as possible and have someone be with them.

### Acknowledge the event

- Talk openly if an incident was potentially distressing.
- Ask the person if they are OK.
- Allow the person to talk about how they have been affected, but respect people who do not want to talk about it.
- Ensure conversations are sensitive, respectful and confidential.
- Be prepared to listen without trying to provide solutions.

### Normalise reactions

- Reassure the person it is normal to be affected.
- Recognise that individual people are affected differently and that this is normal.
- Acknowledge the person's feelings without being judgemental.

### Educate as required

- Talk about the MANERS psychological first aid tool.
- Talk about what helps you.

- Encourage techniques that promote psychological wellness.
- Ensure the person knows the support services available through their service and externally.

**Review, restore or refer**

- Encourage the person to return to normal duties when ready.
- Arrange a follow-up phone call or visit to check on how they are doing.
- Refer the person to support services if required, for example peer support or professional assistance.

**Self-care**

- Maintain a healthy lifestyle ensuring adequate sleep, exercise, nutrition and leisure activity.
- Encourage a culture of openly talking about how we are feeling.
- Identify your own barriers to psychological wellness and develop a proactive approach to ensuring you are well.
- Develop skills that improve communication and help deal with conflict.
- Access peer support and/or professional support as required.

**At the end of each shift**

- Pause briefly at the end of each shift (preferably with your crew) and think about or discuss:
  - What was the best thing we did for a patient or family today?
  - What is something we did today that we could do better next time?
  - What are we going to do when we get home to help maintain our psychological wellness?



# 11.1 Drowning

## If the patient is in cardiac arrest

- In addition to usual treatment, prioritise the ventilation aspect of CPR and use a CPR ratio of 15:2 unless an ETT is in place.
- Intubate with an ETT if ROSC is not achieved in the first few minutes.
- IV drugs have a very low priority.

## If the patient is not in cardiac arrest

- Assess for signs or symptoms of aspiration.
- Assess for signs of injury.
- Assess for signs or symptoms of hypothermia.

## Referral and transport

- Clearly recommend that the patient is transported to ED by ambulance if:
  - a) There was loss of consciousness associated with the drowning, or
  - b) There are signs or symptoms of aspiration, for example tachypnoea, crackles in the lungs on auscultation, persistent coughing, shortness of breath or an SpO<sub>2</sub> less than 94% on air, or
  - c) There are signs of injury requiring transport to ED, or
  - d) The patient has moderate to severe hypothermia.
- If the patient is not transported to an ED, clearly recommend they seek medical advice at an ED if respiratory symptoms develop within the next few days.

## Additional information

### General principles

- Drowning occurs when a patient has impaired lung function as a result of aspiration following immersion or submersion in liquid.
- Following drowning, the patient may or may not have a cardiac arrest and may or may not survive, but if the patient has abnormal lung function then the patient has drowned.
- The literature contains a number of imprecise and unhelpful terms. Do not use any of the following terms: near drowning, wet drowning, dry drowning, salt water drowning, fresh water drowning, silent drowning or secondary drowning.
- Always consider the possibility that a medical event (for example, hypoglycaemia or a seizure) may have occurred prior to drowning.

## Cardiac arrest

- The key to surviving cardiac arrest secondary to drowning is rapid rescue and early CPR, with a focus on ventilation. The rapidity of the rescue is more important than the means by which rescue occurs, but the safety of rescuers must be maintained.
- A resuscitation attempt should be commenced unless there are very clear signs the patient is dead.
- There is no role for ventilation or CPR while the patient is still in the water.
- It is common for significant amounts of frothy fluid to be coming from the mouth and/or nose. Do not interrupt ventilation to remove or suction fluid as this is usually ineffective (fluid will continue to be produced) and interruptions to ventilation are harmful.
- Beware misdiagnosing severe bradycardia as asystole, especially in children.
- Adequate ventilation is often only achieved via an ETT because the lungs may contain significant volumes of liquid.
- Adequate ventilation may not be achieved via an LMA because of the high pressures required to achieve ventilation if the lungs contain liquid. If ventilation is not clearly achieved via an LMA, consider providing ventilation via a manual ventilation bag and mask using a two-person technique.
- Survivors tend to come from the group of patients that get ROSC within 10-15 minutes, usually with good CPR (with a focus on ventilation).
- In most patients it will be appropriate to continue resuscitation attempts for approximately 40 minutes, but it is appropriate to cease resuscitation attempts earlier than this if the rhythm has been asystole for more than ten minutes.
- Although there are case reports of patients surviving resuscitation attempts of several hours in duration, the patients were usually small children that had drowned in water containing ice and the overall mortality rate was very high. Even in winter, water temperatures in New Zealand are not cold enough to provide significant cerebral protection and therefore the duration of resuscitation should not be influenced by the temperature of the water the patient drowned in. Personnel should seek clinical advice if they are uncertain.

## General principles of treatment

- Liquid damages the endothelial lining of the lung and this may result in the development of significant amounts of pulmonary oedema.
  - Do not attempt to remove or suction fluid as this is usually ineffective (fluid will continue to be produced) and removing the oxygen mask increases the likelihood of hypoxia.
  - CPAP or PEEP is usually helpful.
  - The patient may be hypovolaemic (the pulmonary oedema fluid has come from the circulation) and may require 0.9% sodium chloride IV.
  - There is no role for treatment with GTN.

- Consider the possibility of cervical spine injury, but in the absence of trauma this is rare following drowning and is not an initial priority.
- The patient's stomach often contains significant amounts of water but there is usually no role for draining the stomach.
- There is no role for positioning the patient to try to achieve postural drainage of the lungs.
- Although there are significant electrolyte differences between salt water and fresh water, there are usually no clinically significant physiological differences between drowning in salt water and drowning in fresh water.
- Lung function may deteriorate several hours after aspiration, even if at the time lung function appears normal.



## 11.2 SCUBA diving emergencies

- Position the patient flat.
- Administer oxygen via a reservoir mask.
- Gain IV access.
- Administer 0.9% sodium chloride IV if there are signs of hypovolaemia or poor perfusion:
  - a) 1 litre for an adult.
  - b) 20 ml/kg for a child.
  - c) Administer one further bolus if required.

### Referral and transport

- Transport the patient to North Shore Hospital ED or Christchurch Hospital ED, provided the diagnosis of decompression sickness or arterial gas embolism is clear, and it is feasible and safe to do so. Seek clinical advice if there is uncertainty or transport will be prolonged.
- Do not transport directly to a recompression facility.
- Transport the patient to the nearest appropriate ED if the diagnosis is not clear.
- Avoid transporting the patient higher than 300 metres above sea level provided this is feasible and safe.
- Transport the patient's dive computer with them if this is available.

## Additional information

### General principles

- The most common SCUBA diving emergency is decompression sickness or 'the bends'. This occurs when gases (predominantly nitrogen) that are dissolved in body fluids expand to form bubbles.
- When a person has been SCUBA diving at depth, the increased ambient pressure results in an increase in the volume of gases dissolved in body fluids. As the diver ascends, these dissolved gases come out of body fluids and are exhaled via the lungs. If the volume of dissolved gases is high and/or the ascent is rapid, the gases leaving body fluids can form bubbles in the same way that occurs when a carbonated drink is opened.
- The patient should be positioned flat because this limits the number of bubbles that reach the brain.

## Signs and symptoms of decompression sickness

- The patient may have any combination of the following:
  - Joint pain, particularly in large joints.
  - Headache.
  - Visual disturbance.
  - Itching skin or a feeling of ‘insects crawling on the skin’.
  - Altered peripheral sensation or motor power.
  - Confusion.
  - Reduced level of consciousness.
  - Chest pain.
  - Shortness of breath.
- Although symptoms usually develop within one hour of SCUBA diving, they may be delayed until up to 24 hours later, and decompression sickness must be considered a possibility in any patient with unexplained symptoms occurring within 24 hours of SCUBA diving.

## Arterial gas embolism

- Arterial gas embolism occurs when gas bubbles directly enter arteries.
- The arterial bubbles usually come from a lung that has been damaged by expansion of gas during ascent.
- A patient with arterial gas embolism will most commonly develop sudden loss of consciousness or stroke-like symptoms, during or immediately after ascent.
- The treatment of a patient with arterial gas embolism is the same as the treatment of a patient with decompression sickness.

## Referral and transport

- Decompression sickness and arterial gas embolism may be made worse by transport at altitude. This is because the decreased ambient pressure causes gas bubbles to enlarge.
- The patient must not be transported direct to a recompression facility because assessment in an ED is required prior to referral to a recompression facility.
- Recompression facilities are only available in Auckland and Christchurch. This is why transport via North Shore Hospital ED or Christchurch Hospital ED is preferred, provided the diagnosis of decompression sickness or arterial gas embolism is clear.

## Signs of spinal cord impairment

- Decompression sickness may cause signs and symptoms of spinal cord impairment.
- Treat the patient using this section and not the ‘spinal cord injury’ section if the patient has signs or symptoms of spinal cord impairment following SCUBA diving and has not had a traumatic injury.

## 11.3 Hyperthermia

This section is for patients with hyperthermia following environmental exposure and/or exertion. If the patient is febrile due to another cause (for example sepsis or poisoning), see the appropriate section and utilise the cooling principles within this section if their temperature is greater than 40°C.

- Transfer the patient into a cool environment as soon as possible.
- Assess the patient, measure vital signs and acquire a 12 lead ECG.
- Measure the blood glucose concentration and treat accordingly.
- Determine the severity of hyperthermia.

### Mild to moderate hyperthermia

- Cool the patient:
  - a) Remove excess clothing.
  - b) Apply cool water to the head and skin.
  - c) Ensure airflow over the patient, utilising a fan if available.
  - d) Provide a cool drink if feasible.
- Gain IV access and administer 0.9% sodium chloride IV if the patient has moderate hyperthermia and is not responding to initial treatment:
  - a) 1 litre for an adult.
  - b) 20 ml/kg for a child.
  - c) Repeat as required.
- Measure the patient's temperature every 15-30 minutes until it is consistently below 38°C.

### Severe hyperthermia

- Keep the patient supine and continually monitor the cardiac rhythm.
- Urgently commence cooling:
  - a) Remove all clothing down to underwear.
  - b) Apply cool water to the head and skin.
  - c) Ensure airflow over the patient, utilising a fan if available.
  - d) Apply ice or ice packs in the axillae and groins.
- Gain IV access and administer 0.9% sodium chloride IV:
  - a) 1-2 litres for an adult.
  - b) 20-40 ml/kg for a child.
  - c) Repeat as required.
- Commence transport as soon as possible, continuing cooling en route.
- Treat seizures as per the 'seizures' section.
- Measure the patient's temperature every 15-30 minutes.



## Backup

- Backup from a Paramedic or PRIME responder should be requested if the patient has moderate hyperthermia that is not responding to initial treatment.
- Backup from an ICP must be requested if the patient has severe hyperthermia.
- Backup from an ICP or doctor able to perform RSI should be requested if the patient has a persistent motor score of less than 6 and is not rapidly improving.

## Referral and transport

- Most patients with mild to moderate hyperthermia should be treated in the community without transport to an ED, provided:
  - a) The patient is cooled to below 38°C, and
  - b) The patient has normal vital signs and can mobilise normally following cooling, and
  - c) An underlying medical condition (for example, sepsis) contributing to hyperthermia is ruled out, and
  - d) A maximum of one dose of 0.9% sodium chloride has been administered.
- The patient must be transported to an ED by ambulance if severe hyperthermia is present. If there is a choice of hospital destination, transport a patient with severe hyperthermia to a hospital with intensive care facilities, provided this is feasible and safe.

## Additional information

### General principles

- Hyperthermia is defined as a core body temperature of greater than 38°C.
- Hyperthermia is caused by inadequate thermoregulation in response to excessive exposure to heat, excessive heat production or impaired heat loss, and usually occurs when exertion is combined with exposure to high ambient temperatures.
- The body utilises two main mechanisms to eliminate heat: sweating (causing evaporative heat loss) and vasodilation (increasing heat loss through the skin).
- When core body temperature exceeds 40°C proteins within the body may denature, resulting in severe cellular and organ dysfunction which may be life-threatening.
- Hyperthermia is distinct from fever which occurs when there is a physiological increase in the temperature 'set point'. However, when fever is very severe (for example greater than 40°C), the physiological effects are the same.
- The term 'heat exhaustion' is sometimes used to describe mild to moderate hyperthermia and the term 'heat stroke' is sometimes used to describe severe hyperthermia. However, use of these terms is discouraged because they are imprecise and have varying meaning.

## Determining the severity of hyperthermia

- Signs and symptoms of mild hyperthermia (38-39°C) include sweating, tachycardia and tachypnoea.
- Signs and symptoms of moderate hyperthermia (39-40°C) include sweating, tachycardia, tachypnoea, lethargy, feeling faint, nausea and vomiting, muscle cramping, disorientation and headache.
- Signs and symptoms of severe hyperthermia (greater than 40°C) include altered level of consciousness, confusion, absence of sweating, dry and hot skin, signs of shock, dysrhythmias and seizures.

## Summary table (not all clinical features need to be present)

Mild hyperthermia	Moderate hyperthermia	Severe hyperthermia
<ul style="list-style-type: none"><li>• 38-39°C</li><li>• Sweating</li><li>• Tachycardia</li><li>• Tachypnoea</li></ul>	<ul style="list-style-type: none"><li>• 39-40°C</li><li>• Sweating</li><li>• Tachycardia</li><li>• Tachypnoea</li><li>• Lethargy</li><li>• Feeling faint</li><li>• Nausea and vomiting</li><li>• Muscle cramping</li><li>• Disorientation</li><li>• Headache</li></ul>	<ul style="list-style-type: none"><li>• &gt; 40°C</li><li>• Altered level of consciousness</li><li>• Confusion</li><li>• Absence of sweating</li><li>• Dry and hot skin</li><li>• Signs of shock</li><li>• Dysrhythmias</li><li>• Seizures</li></ul>

## Factors that increase the risk of hyperthermia

- Extremes of age. The elderly and young children have impaired thermoregulatory mechanisms.
- Pre-existing medical conditions can increase the vulnerability to high ambient temperatures, including diabetes, hyperthyroidism, peripheral vascular disease, ischaemic heart disease and heart failure.
- Medications can cause increased heat production (for example thyroxine and cyclic antidepressants), decrease thirst (for example ACE inhibitors), decrease sweating (for example antihistamines, anticholinergics and beta blockers), or increase fluid loss (for example diuretics).
- Length and/or intensity of exposure. Hyperthermia is more likely to develop with an increase in both length and intensity of exposure to exertion and/or a hot environment.
- Humidity. When humidity is high, sweat will not evaporate as easily from the skin and heat loss is reduced.
- Strenuous activity combined with high ambient temperatures. This is a feature that is common amongst firefighters and endurance athletes.

## The pathophysiology of severe hyperthermia

- Dehydration from excessive sweating in combination with peripheral vasodilation can lead to hypovolaemia.
- Sodium and other electrolytes are lost through sweating which can lead to electrolyte abnormalities, particularly if sweat loss is severe and only water is consumed during prolonged exercise. The electrolyte abnormality of greatest concern is hyponatraemia which may be associated with seizures. Seek urgent clinical advice if hyponatremia is suspected as specific treatment (for example with sodium bicarbonate) may be required.
- Rhabdomyolysis (muscle breakdown) may occur.
  - Muscle cells are particularly prone to heat injury and as they die cellular proteins (including myoglobin), acid and potassium are released.
  - Release of acid into the circulation will interfere with normal cellular function, particularly in the heart.
  - Release of potassium from muscle cell death interferes with normal cardiac conduction and may cause dysrhythmias.
  - Release of myoglobin blocks kidney tubules and may cause renal failure.
- Neurological dysfunction including seizures may occur. This is predominantly due to a direct effect of the temperature damaging the brain.
- Dysrhythmias may occur. Electrolyte abnormalities (particularly hyperkalaemia) will interfere with normal cardiac conduction and may cause dysrhythmias.
- Coagulopathy may occur. The high temperature denatures proteins and this may disrupt normal coagulation mechanisms, leading to disseminated intravascular coagulation (DIC).

## Assessment and treatment

- Some tympanic thermometers may not be able to measure temperatures above 41°C. It is important to focus on the patient's clinical presentation rather than trying to obtain an accurate reading.
- Avoid inducing shivering during cooling as this will increase heat production.
- Avoid inducing severe vasoconstriction during the cooling process as this will reduce the amount of heat lost through the skin.
- Do not apply ice or ice packs directly to skin as this may cause skin injury.
- Patients with severe hyperthermia should be positioned supine to maximise venous return and help maintain cardiac output.
- Hypoglycaemia may occur, particularly in the setting of severe hyperthermia.
- Agitation is common, particularly in the setting of severe hyperthermia. Treat pain with fentanyl IV and have a low threshold for administering low doses of midazolam IV.

## 11.4 Hypothermia

This section is for patients with hypothermia secondary to environmental exposure.

- Transfer the patient into a warm and dry environment as soon as possible and/or reduce environmental exposure.
- Remove wet clothing and ensure the patient is dry.
- If there is going to be a delay in getting the patient to a warm and dry environment, wrap them (still in their wet clothes) in a vapour barrier with external insulation and with a heat source (for example a heating pad/pack) against the torso, if possible.
- Assess the patient, measure vital signs and assess the cardiac rhythm.
- Measure the blood glucose concentration and treat accordingly.
- Determine the severity of hypothermia.

### Mild hypothermia

- Actively warm the patient:
  - a) Place in a warm environment and dress in warm clothes.
  - b) Provide a warm drink (preferably containing sugar) and warm food, provided the patient can safely swallow.
- Encourage gentle exercise provided this is safe.
- Measure the patient's temperature every 15-30 minutes until it is consistently above 35°C.

### Moderate to severe hypothermia

- Place in a warm environment.
- Keep the patient supine and minimise unnecessary movement.
- Continually monitor the cardiac rhythm.
- Prevent further cooling by wrapping the patient in a 'hypothermia wrap' with a heat source (for example a heating pad/pack) against the torso, if possible.
- Gain IV access but avoid IV fluid administration unless signs of severe hypovolaemic shock are clearly present. If IV fluid is administered, ensure this is warmed using a dedicated warming device if possible.
- Commence transport.
- Measure the patient's temperature every 15-30 minutes.

## Cardiac arrest

- Commence CPR if it is safe and feasible to do so, while the patient is further assessed:
  - **If the initial rhythm is VF or VT:** continue treatment and CPR, even if the rhythm deteriorates into asystole with defibrillation, providing a maximum of three shocks if the rhythm continues to be VF or VT.
  - **If the patient is in PEA or has severe bradycardia:** continue treatment but stop chest compressions and ventilate at a rate of six breaths/minute.
  - **If the initial rhythm is asystole:** stop treatment and stop CPR. Note that the patient may have severe bradycardia and a one minute period of observation of the cardiac rhythm is required before asystole can be confirmed. See below if the patient has been in an avalanche.
- Continue with treatment and CPR if the patient has been in an avalanche, unless:
  - a) The chest is incompressible, or
  - b) There are visible injuries incompatible with life, or
  - c) The rhythm is asystole and the airway was completely occluded by snow/ice at the time of extrication.
- If the patient remains in cardiac arrest after ten minutes of resuscitation, seek clinical advice (if possible) on the appropriateness of transport to hospital with CPR en route.
  - a) Do not transport to hospital with CPR en route without clinical advice to do so, as the patient will need prolonged active warming and cardiovascular support such as cardiopulmonary bypass or extracorporeal membrane oxygenation (ECMO), and these will require significant advance warning and prior arrangements to be made with hospital specialists.
  - b) Do not transport to hospital with CPR en route unless it is feasible and safe to do so.
  - c) Do not provide further defibrillation and do not administer further adrenaline IV or amiodarone IV.
  - d) Focus on high performance CPR with a ventilation rate of 6 breaths/minute and utilise mechanical CPR if it is available.
  - e) Have the following additional information available if the patient has been in an avalanche:
    - The known or estimated time buried.
    - The core temperature if this is able to be measured.
    - Whether an air pocket was present in front of the face when extricated.
    - Whether the airway was completely occluded by snow/ice at the time of extrication.

## Backup

- Backup from a Paramedic or PRIME responder must be requested if the patient has moderate hypothermia.
- Backup from an ICP must be requested if the patient has:
  - a) Severe hypothermia, or
  - b) Poor airway or poor breathing, or
  - c) Dysrhythmia.

## Referral and transport

- Most patients with mild hypothermia should be treated in the community without transport to an ED, provided:
  - The patient is rewarmed to above 35°C, and
  - The patient has normal vital signs and can mobilise normally following warming, and
  - An underlying medical condition (for example sepsis) contributing to hypothermia is ruled out.
- The patient must be transported to an ED by ambulance if moderate to severe hypothermia is present. If there is a choice of hospital destination, transport a patient with severe hypothermia to a hospital with intensive care facilities, provided this is feasible and safe.

## Additional information

### General principles

- Hypothermia is defined as a core body temperature of less than 35°C. It is usually due to excessive exposure to a cold environment.
- Hypothermia worsens outcomes if the patient is injured.
- Other conditions that alter a patient's ability to move (for example sepsis, stroke, hypoglycaemia, intoxication or injuries) may contribute to the development of hypothermia.
- Tympanic and digital thermometers are unreliable when the patient is hypothermic, and it is important to focus on the patient's clinical presentation when determining the severity of hypothermia, rather than relying on the measured temperature.
- Hypoglycaemia may occur in patients with hypothermia, due to depletion of blood glucose and glycogen stores following prolonged shivering.
- Patients with severe hypothermia are also at risk of developing hyperkalaemia, coagulopathy, disseminated intravascular coagulation (DIC), thromboembolism and rhabdomyolysis.

## Determining the severity of hypothermia

- Signs and symptoms of mild hypothermia (32-35°C) include shivering, increased muscle tone, tachycardia, hypertension, tachypnoea, poor coordination, lethargy and confusion.
- Signs and symptoms of moderate hypothermia (28-32°C) include absence of shivering, muscle rigidity, altered level of consciousness, bradycardia, hypotension and bradypnoea.
- Signs and symptoms of severe hypothermia (less than 28°C) include unconsciousness, severe bradycardia, severe bradypnoea (breathing may not be clinically detectable), severe shock (circulation may not be clinically detectable), unreactive pupils and cardiac arrest.
- ECG changes can occur with hypothermia including: prolongation of the PR, QRS and QT intervals, and the presence of an Osborn (or J) wave. However, no ECG changes correlate well with a specific severity of hypothermia.

### Summary table (not all clinical features need to be present)

Mild hypothermia	Moderate hypothermia	Severe hypothermia
<ul style="list-style-type: none"><li>• 32-35°C</li><li>• Shivering</li><li>• Increased muscle tone</li><li>• Tachycardia</li><li>• Hypertension</li><li>• Tachypnoea</li><li>• Poor coordination</li><li>• Lethargy</li><li>• Confusion</li></ul>	<ul style="list-style-type: none"><li>• 28-32°C</li><li>• Absence of shivering</li><li>• Muscle rigidity</li><li>• Altered level of consciousness</li><li>• Bradycardia</li><li>• Hypotension</li><li>• Bradypnoea</li></ul>	<ul style="list-style-type: none"><li>• &lt; 28°C</li><li>• Unconscious</li><li>• Severe bradycardia</li><li>• Severe bradypnoea</li><li>• Severe shock</li><li>• Unreactive pupils</li><li>• Cardiac arrest</li></ul>

## The physiological response to heat loss

- Exposure to cold causes reflex compensatory mechanisms in the body to:
  - Conserve heat through vasoconstriction (restricting blood flow to the peripheries) and piloerection (trapping warm air near the skin), and
  - Generate heat through increased cellular metabolism and shivering.
- As the body temperature falls, the body loses its ability to compensate for heat loss, causing a progressive slowing in cellular metabolism, enzyme activity, neural conduction and cardiac activity.
- As the body temperature continues to fall cellular metabolism also falls, further reducing heat production and resulting in a vicious cycle of falling temperature, falling metabolism and falling heat production.

- When core temperature drops below 32°C the tubular reabsorption ability within the kidneys is adversely affected, resulting in polyuria ('cold diuresis'). This is similar to the diuresis that occurs with severe hyperglycaemia and will contribute to hypovolaemia.

### **Patients at increased risk of hypothermia**

- Patients are at increased risk of hypothermia if they have an impaired ability to conserve and/or generate body heat, reduced physiological reserve, conditions that increase heat loss, or an inability to remove themselves from the cold environment.
- Patients at increased risk include those that are elderly, frail, intellectually impaired, children, immobile, intoxicated, malnourished or injured.
- Patients that develop hypothermia in New Zealand are predominantly from two groups:
  - Those that are immobile and exposed to a cold environment in their home. For example, elderly patients with a fractured neck of femur who lie on a cold floor for a prolonged period.
  - Those that are exposed to adverse weather during recreational or occupational activity. For example, in the bush or mountains.

### **Warming**

- Passive warming (for example the use of blankets) is only useful when the patient has a temperature over 35°C.
- Active warming is required when the patient has a temperature below 35°C.
- It is vital to remove wet clothing, dry the patient and place them in a warm environment, provided this is feasible and safe. If this is not feasible and safe, completely wrapping the patient in a 'hypothermia wrap' including a vapour barrier with external insulation, will trap moisture against the patient and help with warming, particularly if a heat source (for example a heating pad/pack) is placed against the patient's torso, within the vapour barrier.
- Do not place a heat source directly against the skin as this may cause injury.
- Ideally three layers and a heat source are used to create a 'hypothermia wrap':
  - Place a heat source, for example a heating pack/pad (these are often carried by rescue organisations and helicopter services) against the patient's torso.
  - Wrap the patient in a vapour barrier, for example using a commercially available rescue wrap/sack (these are often carried by rescue organisations and helicopter services) or multiple foil blankets. This reduces evaporative heat loss.
  - Insulate around the vapour barrier, for example using a sleeping bag or blankets.
  - Wrap the patient and the previously described layers in a further layer, for example a tarpaulin or sheet of plastic.



- Place a hat on the patient if one is available, provided the patient is not in cardiac arrest.
- Keep the interior of the ambulance as hot as possible. In particular, heat the interior of the ambulance before the patient is placed inside. This warms the physical environment, for example the stretcher, which acts as a 'heat sink' when cold.
- Eating food, provided the patient can safely swallow, generates heat from the increase in metabolism that occurs as food is digested.

### **Additional treatment considerations for moderate to severe hypothermia**

- It is not feasible to provide sufficient heat to warm a patient with moderate to severe hypothermia in the out-of-hospital setting. The goal is to prevent further heat loss and transport the patient to a hospital with the facilities to provide appropriate and safe warming.
- Vasodilation may lead to a worsening of hypothermia as a result of cold blood returning to the patient's core. This is why it is important to focus on warming the torso (and not the extremities) and is why IV fluid is avoided unless the patient clearly has severe hypovolaemic shock. Even if IV fluid is warmed, it may make hypothermia worse by increasing blood supply to cold peripheries.
- Whenever feasible IV fluid should be warmed using a dedicated warming device. These may be available (for example via a helicopter service) and should be requested whenever feasible.
- Do not warm IV fluid in microwaves because this can result in unreliable fluid temperatures and/or may damage the plastic bag.
- Impaired cellular metabolism may impair the response to treatment. For example the patient may not respond to pacing, synchronised cardioversion or defibrillation.
- The risk of precipitating a dysrhythmia (particularly ventricular fibrillation) during patient movement is controversial. It is not clear from the literature that it is patient movement that causes the dysrhythmia, or if it is secondary to the change in temperature that usually coincides with the patient being moved. Moving the patient should not be unnecessarily delayed but avoid excessive and/or unnecessary movement, for example moving from a supine to a sitting position, whenever this is feasible and safe.
- Keep the patient flat to maximise venous return and help maintain cardiac output.

## Cardiac arrest

- Cardiac arrest secondary to hypothermia in New Zealand is uncommon and usually the circumstance is that a patient dies and their body cools after death. It is important to try to differentiate cardiac arrest secondary to hypothermia, from the circumstance where a patient has died and then cooled after death, particularly if the patient is elderly and/or frail.
- Because the metabolic rate drops significantly with severe hypothermia, it is possible for patients to survive prolonged cardiac arrest secondary to hypothermia.
- Survival following cardiac arrest secondary to severe hypothermia usually requires the patient to be transported to a hospital with the facilities to provide cardiopulmonary bypass or ECMO, while the patient is warmed.
- Do not place a hat on the patient as it is advantageous for the brain to be cold.
- Resuscitate the patient in a warm environment if possible, because this will help prevent further heat loss. However, do not try to provide additional warming because this will not result in a significant increase in body temperature and will impair resuscitation.
- CPR is not recommended if the patient is in PEA or has severe bradycardia because:
  - The patient is likely to have cardiac output that cannot be detected clinically, and
  - CPR may precipitate ventricular fibrillation, and
  - CPR complicates extrication and transport, and
  - CPR exposes personnel to additional risks during transport if mechanical CPR is not available.
- It is appropriate to provide intermittent manual chest compressions if required, for example while carrying the patient on a stretcher.
- Provide intermittent manual chest compressions, for example five minutes on and five minutes off, if there are insufficient personnel to perform continuous chest compressions.
- Provide a low ventilation rate of 6 breaths/minute because the metabolic rate will be very low and higher ventilation rates may compromise venous return to the heart.
- Attach and utilise capnography if an LMA or ETT is placed. A trace should be obtained if placement is correct, but the expected  $\text{ETCO}_2$  will be much lower than usual because of a low metabolic rate.

## 12.1 Autonomic dysreflexia

This section is for patients with chronic spinal cord impairment and autonomic dysreflexia.

- Look for a cause of stimulation and resolve if possible.
- If the patient remains symptomatic with a systolic BP greater than 180 mmHg, commence treatment as below and move sequentially through the steps if the BP remains uncontrolled:
  - a) Sit the patient up with their legs dependent if feasible and safe.
  - b) Administer 0.4-0.8 mg of GTN SL every 3-5 minutes, provided the heart rate is greater than 40/minute and less than 150/minute.
  - c) Apply a TTS 10 GTN patch or commence a GTN infusion IV, using the heart rate contraindications above, if hypertension is not rapidly controlled with GTN SL. If a GTN infusion is commenced, titrate this to a systolic BP of 150-170 mmHg.
  - d) Administer labetalol or metoprolol IV provided the heart rate is greater than 60/minute:
    - Administer 10 mg of labetalol IV over 1-2 minutes. This may be repeated every ten minutes to a maximum of 50 mg, or
    - Administer 2.5 mg of metoprolol IV over 1-2 minutes. This may be repeated every ten minutes to a maximum of 10 mg.
  - e) Remove the GTN patch if the systolic BP falls below 100 mmHg.
- Seek clinical advice if the BP is difficult to control.

### Backup

- Backup from an ICP should be requested if hypertension is not controlled despite GTN SL and a GTN patch.

### Referral and transport

- The patient should receive a clear recommendation that transport to a medical facility is not required if the cause has been identified and resolved, the systolic BP is controlled to below 180 mmHg with GTN SL alone, and the patient becomes asymptomatic.
- The patient must receive a recommendation to be transported to a medical facility by ambulance if a clear cause cannot be identified and resolved, a GTN patch is applied, labetalol or metoprolol is administered, or the patient remains symptomatic. The medical facility should usually be an ED, but may be a primary care facility:
  - a) Particularly if the patient is well known to staff at that facility, and
  - b) Staff at the facility are contacted prior to arrival and agree to accept the patient.

## Additional information

### General principles

- Autonomic dysreflexia (also known as autonomic hyperreflexia) is a term used to describe abnormal stimulation of the autonomic nervous system in patients with chronic spinal cord impairment. Autonomic dysreflexia usually occurs in association with significant stimulation below the level of the cord injury.
- It is not entirely clear how and why autonomic dysreflexia occurs. The most common theory is that:
  - Significant stimulation below the level of the spinal cord injury results in an increase in pain-like impulses within sensory nerves going to the spinal cord. The sensory nerves are intact and capable of transmitting pain impulses, even though the patient cannot feel them.
  - The pain-like impulses cannot be transmitted to the brain because the spinal cord is damaged. This results in stimulation of the sympathetic nervous system below the level of the spinal cord injury.
  - Stimulation of the sympathetic nervous system causes vasoconstriction below the level of the spinal cord injury and this causes hypertension.
  - Hypertension triggers reflex parasympathetic stimulation, causing bradycardia and vasodilation above the level of the spinal cord injury.

### Stimuli

- The most common forms of stimuli are:
  - Bladder distension, for example from a blocked urinary catheter. If the urinary catheter is blocked and cannot be unblocked, it needs to be replaced urgently.
  - Bowel distension, for example from severe constipation or bowel obstruction. Ask when the patient last passed a bowel motion. If constipation is thought likely and a caregiver present, they may be able to administer an enema or disimpact the bowel.
- Other forms of stimuli include:
  - Acute injury, for example fractures or burns. If this is present administer fentanyl IV, even if the patient cannot feel pain.
  - Labour. This is well recognised and most pregnant women with chronic spinal cord impairment will be electively admitted to hospital for caesarean section under anaesthesia.
  - Other sources of pain or infection, for example pressure areas.

## Signs and symptoms (not all need to be present)

- The patient will have chronic spinal cord impairment and:
  - Hypertension. This may be life-threatening. If hypertension is not present then the patient does not have autonomic dysreflexia.
  - Anxiety. This may be severe.
  - Headache. This occurs as a result of the hypertension.
  - Signs of vasoconstriction (such as mottling) below the level of the spinal cord injury. This may not always be clinically obvious.
  - Bradycardia. This occurs as a reflex cardiovascular response to hypertension.
  - Signs of vasodilation (such as flushing) above the level of the spinal cord injury. This may not always be clinically obvious.
  - Tachycardia. Rarely the patient can be tachycardic if there is significant stimulation of the sympathetic nervous system at a brain level.

## GTN infusion

- A GTN infusion may only be administered by ICPs with:
  - Specific training on GTN administration via an IV infusion, and
  - Written service guidelines for infusion dilution and pump set up, and
  - A written standing order.



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## 12.2 Blocked urinary catheter

Use this section for patients with blocked urinary catheters including suprapubic catheters, provided the patient has not had surgery on their renal tract or prostate in the last four weeks.

- Check that the:
  - a) Drainage bag is not full, and
  - b) Drainage bag is below pubic height, and
  - c) Tubing is not kinked or blocked, and
  - d) Tubing does not contain a one way valve that has been incorrectly inserted facing the wrong way.
- Examine the patient for signs of sepsis. Recommend transport to a medical facility without further intervention if clinically significant signs of sepsis are present.
- Arrange for the catheter to be replaced within the next few hours if an appropriately trained person is available.
- Flush the catheter using a clean technique if it cannot be replaced within the next few hours:
  - a) Draw up 50-100 ml of 0.9% sodium chloride or sterile water using a catheter tip syringe. Warm this under a tap if possible.
  - b) Detach the drainage tubing from the catheter and attach the syringe.
  - c) Flush the catheter firmly over 5-10 seconds. Some discomfort is expected but stop if there is severe pain.
  - d) Remove (if possible) the fluid using the syringe.
  - e) Re-attach the drainage tubing and ensure urine is flowing into the drainage bag.

### Referral and transport

- If the problem was resolved by flushing the catheter, arrange for the catheter to be replaced as soon as possible, preferably within the community. Advise the patient to drink plenty of fluid to help maintain a good urine flow.
- If the problem was not resolved the patient should be given a clear recommendation to be transported to a medical facility to have the catheter replaced. Clinical judgement is required regarding the mode of transport and transport by private vehicle may be appropriate, provided this will not cause significant delay.

## Additional information

- The preferred approach is to have the catheter replaced, provided this is feasible. This may be available via a local pathway such as a district nursing service or specifically trained ambulance personnel.
- Even if the catheter is unblocked, the catheter should subsequently be replaced as soon as possible.
- Personnel may replace a urethral or suprapubic catheter, provided they have been formally trained and authorised to do so and have the appropriate equipment. Personnel who are uncertain if they are authorised must seek clinical advice.
- Flushing a urinary catheter requires a clean, but not sterile technique. Perform hand hygiene before putting on gloves. Minimise contact between gloved hands and non-sterile surfaces. Do not contaminate the end of the catheter syringe with non-sterile surfaces prior to connecting it to the catheter. The end of the catheter and the drainage tubing do not require cleaning with an alcohol swab.
- It is very common for sediment to be visible in the urine. This does not mean that a urinary tract infection is present.
- It is very common for the urine to appear slightly pink and contain small blood clots following a catheter flush and this does not require specific treatment or advice. If there are large blood clots or there is red urine, the patient should be given a clear recommendation to be transported to a medical facility by ambulance.
- If there are signs of clinically significant sepsis, flushing the catheter may precipitate severe sepsis and this is why transport should be recommended in this setting.
- It is common for the catheter to be flushed, but for the fluid not to return when the syringe is aspirated. This is not of concern if urine subsequently flows into the drainage bag. If urine does not flow the catheter is still blocked.



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## 12.3 Epistaxis

### Mild bleeding

- Firmly compress the fleshy part of the nose for 15 minutes.
- If the bleeding is not controlled administer adrenaline IN as below.

### Moderate or severe bleeding

- Instruct the patient to blow their nose to clear all blood clots.
- Administer adrenaline IN into each bleeding nostril using a mucosal atomising device, and firmly compress the fleshy part of the nose for 15 minutes:
  - a) Administer 0.2 mg of adrenaline (2 ml of 1:10,000) per bleeding nostril for a patient aged 12 years or over.
  - b) Administer 0.1 mg of adrenaline (1 ml of 1:10,000) per bleeding nostril for a child aged 5-11 years.
  - c) Seek clinical advice if the patient is a child aged less than five years.
- If the bleeding does not stop or recurs, a second dose of adrenaline IN may be administered after 20 minutes.

### Severe bleeding that remains uncontrolled

- Place a nasal tamponade device if one is available.
- If a nasal tamponade device is not available, place an ETT with the middle of the cuff approximately 3-4 cm into each bleeding nostril for an adult, and approximately 2-3 cm for a child:
  - a) Clinical judgement is required when choosing the size of a cuffed ETT to use. Most adults will require a size 5 or 6 ETT and most children will need an ETT several sizes smaller than would be used for intubation.
  - b) Inflate the cuff with 2-3 ml of air.
  - c) Remove the ETT if bleeding remains uncontrolled.
- Administer tranexamic acid IV:
  - a) Administer 1 g of tranexamic acid IV for an adult.
  - b) See the paediatric drug dose tables for a child.

### Backup

- Call for backup from an ICP if bleeding requires an ETT to be placed.

### Referral and transport

- If the bleeding is mild and:
  - **Stops completely**, no follow up is required unless the patient is taking an anticoagulant or is hypertensive. If the patient is taking an anticoagulant, or their systolic blood pressure is greater than 180 mmHg and/or their diastolic blood pressure is greater than 110 mmHg, their treatment must be reviewed in primary care (preferably by their own GP) within 24 hours.



- **Does not stop**, the patient should be seen by a doctor within a few hours. This could be in primary care unless the patient is taking an anticoagulant, in which case the patient should be seen in an ED.
- If the bleeding is moderate to severe and:
  - **Stops following adrenaline**, the patient must be seen by a doctor within a few hours. This is particularly important if the patient is taking an anticoagulant and transport to an ED by ambulance will usually be required.
  - **Does not stop**, the patient must be transported to ED by ambulance.
- If the patient is not transported by ambulance, provide advice to avoid hot showers, hot drinks or blowing their nose for as long as possible after the bleeding has been controlled.

## Additional information

- Anticoagulants do not include antiplatelet agents such as aspirin, clopidogrel or ticagrelor.
- Patients with hypertension are at increased risk of recurrent epistaxis, but hypertension should not be specifically treated by ambulance personnel without seeking clinical advice.
- Bleeding may be from the anterior part of the nose. In this setting bleeding is commonly:
  - Coming from capillaries.
  - Secondary to minor trauma or a dry mucosa.
  - Mild.
  - Controlled by anterior pressure.
- Bleeding may be from the posterior part of the nose. In this setting bleeding is more commonly:
  - Coming from a single artery or vein (resembling a varicose vein in the nose).
  - Seen in elderly patients, particularly those with hypertension or taking an anticoagulant.
  - Moderate or severe.
  - Not controlled by anterior pressure and may require cauterisation, tamponade or nasal packing.
- Bleeding is occasionally life-threatening and this occurs most commonly in elderly patients taking an anticoagulant. The patient may require 0.9% sodium chloride IV for hypovolaemia in addition to the above treatments.



## 12.5 Nausea and/or vomiting

- Administer ondansetron if nausea and/or vomiting is clinically significant:
  - a) Administer 8 mg of ondansetron IV once for an adult.
  - b) Administer 4 mg of ondansetron IM for an adult, if IV access cannot be obtained.
  - c) The IM dose may be repeated once after 20 minutes if required.
  - d) See the paediatric drug dose tables for a child.
- One IV dose may be administered in addition to one IM dose, if clinically significant nausea and/or vomiting persists, and IV access is subsequently obtained. For example, in this setting a maximum total dose of 12 mg may be administered to an adult.

### Backup

- If an EMT is present there is usually no role for backup to be requested solely for ondansetron IV.

### Referral and transport

- A patient may be administered ondansetron and be given a clear recommendation that immediate referral to a medical facility is not required, provided the patient:
  - Appears to have a minor clinical problem, and
  - Has no other significant symptoms, and
  - Has normal vital signs.

## Additional information

- The IV route is preferred.
- Prophylactic administration of ondansetron is not routinely required. Consider administering ondansetron if the nature of the patient's injuries and transport position are such that vomiting would be particularly problematic.
- Ondansetron should not be administered for vomiting associated with an altered level of consciousness because it is rarely effective in this setting.



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## 12.6 Stroke

Use this section for adults with signs and/or symptoms of a stroke. Seek clinical advice if the patient is a child.

- Measure the blood glucose concentration and treat accordingly. Do not treat the patient as having a stroke if the patient is hypoglycaemic or has received treatment for hypoglycaemia, even if there are signs or symptoms of stroke.
- Do not treat the patient as having a stroke if the patient has had a seizure, even if there are signs or symptoms of stroke.
- Assess the patient using the FAST test.
- Perform an additional assessment using the PASTA tool if the FAST test indicates acute stroke, and the PASTA tool is formally included in the stroke pathway for that geographical area.
- Designate the patient as status two, gain IV access and transport to a designated stroke hospital without delay, as per the local stroke pathway, if signs or symptoms of a stroke are present and:
  - a) The patient will arrive in a designated stroke hospital within four hours of the time of symptom onset, or
  - b) Transport is occurring to Auckland City Hospital, Wellington Regional Hospital or Christchurch Hospital and the patient will arrive within six hours of the time of symptom onset.
- Alert hospital staff early if the stroke pathway is being followed and provide the following information:
  - FAST results, and
  - PASTA tool results (if applicable), and
  - Time of symptom onset, and
  - NHI number.

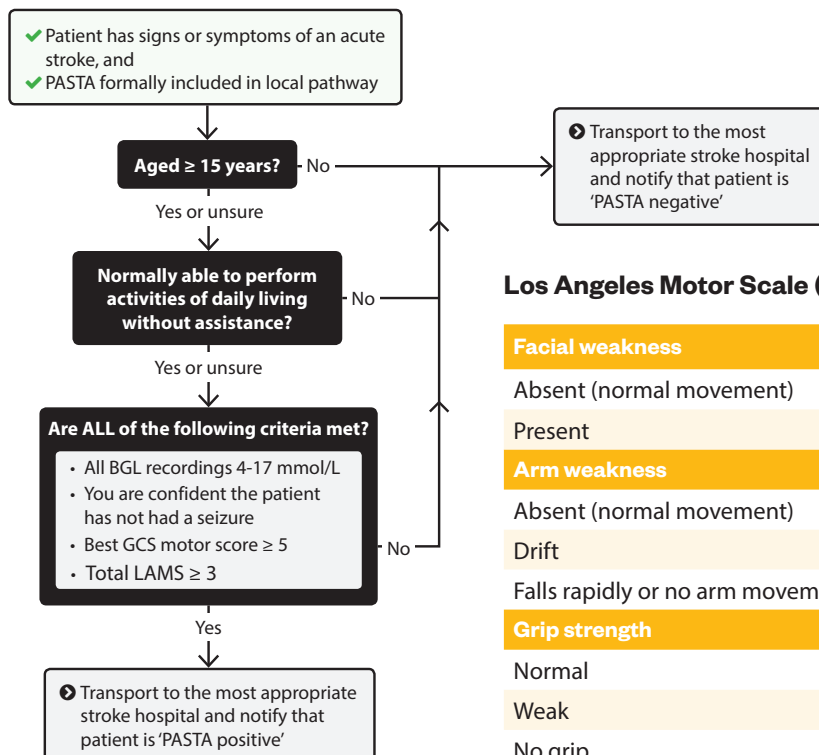
### Referral and transport

- Provide a clear recommendation for the patient to be transported to an ED by ambulance if there are signs or symptoms of an acute stroke.
- Transport the patient to a designated stroke hospital without delay if they are within the time window (as above) for reperfusion therapy.
- Transport the patient to the most appropriate hospital (this may not be a designated stroke hospital) if the patient is clearly outside the time window for reperfusion therapy. Personnel should seek clinical advice if they are uncertain.
- Transport a relative with the patient whenever this is feasible and safe as the relative may be required to help with consent for reperfusion therapy.
- Provide a handover while the patient is on the ambulance stretcher and convey the patient direct to the CT scanner if asked to do so, provided this is not associated with significant delay.

## The FAST test

<b>Face</b>	Look for new onset of unilateral facial weakness. Ask the patient to smile and show all of their teeth/gums.
<b>Arm</b>	Look for new onset of unilateral arm weakness. Ask the patient to raise their arms to 90° from the body, with their palms facing upward, close their eyes and keep their arms raised. Look for inability to raise one arm or for one arm that drifts downward.
<b>Speech</b>	Look for new onset of abnormal speech. Ask the patient to repeat a sentence and listen for slurring of words. Ask the patient to name several common objects shown to them and observe any difficulty or inability to name them.
<b>Time</b>	Note the time of onset. This is normally recorded as the time that the patient was last seen or known to be symptom-free. If the patient has woken up with the symptoms, record the time that the patient was last seen or known to be awake and symptom-free, as well as the time of waking.

## Pre-hospital acute stroke triage and assessment (PASTA)



### Los Angeles Motor Scale (LAMS)

#### Facial weakness

Absent (normal movement)	0
Present	1

#### Arm weakness

Absent (normal movement)	0
Drift	1
Falls rapidly or no arm movement	2

#### Grip strength

Normal	0
Weak	1
No grip	2

## Additional information

### General principles

- A patient is having a stroke until proven otherwise if there are new abnormalities as detected by the FAST test.
- Hypoglycaemia can cause signs and symptoms that mimic a stroke and these may persist for many hours following treatment. Treat the patient using the 'hypoglycaemia' section and not this section if the patient is hypoglycaemic, or has received treatment for hypoglycaemia.
- Seizures can cause signs and symptoms that mimic a stroke, particularly during the postictal phase and these may persist for many hours following the seizure. Treat the patient using the 'seizures' section and not this section if the patient has had a seizure.
- A patient with a stroke will have signs and symptoms that relate to the part of the brain that has lost blood supply. Most commonly these include any combination of:
  - Unilateral face weakness.
  - Unilateral arm weakness.
  - Unilateral leg weakness.
  - Speech disturbance.
  - Visual disturbance.
- The FAST test detects approximately 85% of patients with an ischaemic stroke, and in particular will not usually detect stroke affecting the cerebellum.
- Observing the patient walking (provided this is feasible and safe) may detect new onset of abnormal balance. Performing the finger-nose test (see the 'concussion and minor TBI' section) may detect new onset of abnormal coordination. A new onset of abnormal balance or abnormal coordination may indicate a stroke affecting the cerebellum.

### The PASTA tool

- The PASTA tool is designed to help select patients that are most likely to receive reperfusion therapy.
- Only use the PASTA tool if it has been formally introduced into a local stroke pathway within that geographical area.

### Reperfusion therapy

- The earlier reperfusion therapy is provided for ischaemic stroke, the more likely the patient is to make a good recovery.
- Delays to reperfusion therapy worsen outcomes and ambulance personnel have an important role in identifying patients with stroke, minimising time on scene, minimising transport time, transporting patients to the most appropriate hospital and ensuring timely notification prior to arrival.

- Two forms of reperfusion therapy are available in New Zealand:
  - Fibrinolytic therapy is available at all designated stroke hospitals.
  - Stroke clot retrieval is available at Auckland City Hospital, Wellington Regional Hospital and Christchurch Hospital.

### **Ischaemic stroke and time to fibrinolytic treatment**

- A patient with an ischaemic stroke who can be transported to a designated stroke hospital within four hours of the time of symptom onset, is a potential candidate for fibrinolytic treatment. However, fibrinolytic treatment is only suitable for approximately 20% of patients with an acute ischaemic stroke.
- The earlier fibrinolytic treatment is provided, the more likely the patient is to recover from their stroke. However, fibrinolytic treatment must be provided within four and a half hours from the time of symptom onset. If the patient is arriving at a designated stroke hospital at four hours from the time of symptom onset, hospital personnel have only 30 minutes to perform a CT scan, make a diagnosis and initiate treatment.
- IV access should be obtained, noting that multiple attempts should not occur because of the subsequent risk of bleeding if fibrinolytic treatment is administered.
- Transport under lights is not routinely required, but should be considered if a clinically significant time saving will occur.
- A patient who cannot be transported to a designated stroke hospital within four hours of the time of symptom onset is usually not a candidate for fibrinolytic treatment. However, transport should not be delayed because the use of CT perfusion imaging means that some of these patients are still suitable to receive fibrinolytic treatment or stroke clot retrieval.

### **Ischaemic stroke and time to stroke clot retrieval (SCR)**

- Stroke clot retrieval (SCR) is also known as endovascular clot retrieval (ECR), percutaneous stroke intervention (PSI) and thrombectomy.
- SCR is a procedure where the occluded cerebral artery is accessed and the clot removed, thus re-establishing blood flow.
- SCR is a very effective treatment for ischaemic stroke. The potential 'treatment window' for SCR from time of symptom onset is much longer than with fibrinolytic therapy, and is up to 24 hours in selected patients.
- Do not bypass a designated stroke hospital to transport a patient direct to a hospital with SCR facilities, unless this is a formal part of a local stroke pathway.

## Transport mode

- Transport to hospital should usually be by road, as only a small number of patients will benefit from transport by helicopter. However, the possibility of transport by helicopter should be considered if:
  - The patient is independent and without severe comorbidities, and
  - The diagnosis is clear, and
  - The patient has severe weakness, and
  - The patient will clearly reach a designated stroke hospital within four hours of the onset of symptoms, and
  - Helicopter transport will clearly save more than 30 minutes compared with road transport.
- Severe comorbidities are chronic diseases that significantly limit a patient's life expectancy. Examples include severe COPD, severe heart failure, metastatic cancer with weight loss and living in an aged residential care facility.

## Haemorrhagic stroke

- A patient with a haemorrhagic stroke will present very similarly to a patient with an ischaemic stroke, but in addition will usually have a sudden onset of headache, an altered or falling level of consciousness and vomiting.
- It is not possible to confidently distinguish between an ischaemic stroke and a haemorrhagic stroke without a CT scan.
- Even if haemorrhagic stroke is suspected, the stroke pathway should still be followed.





## 12.7 Transient ischaemic attack

- Assess the patient using the FAST test.
- Treat using the 'stroke' section if the patient has any signs or symptoms of stroke that persist.
- Treat as a transient ischaemic attack (TIA) only if all signs and symptoms have completely resolved.

### Referral and transport

- The patient must be seen by a doctor and this should usually be in an ED. Transport by ambulance may not be required if the patient has access to private transport and this will not be unnecessarily delayed.
- The patient may be seen in primary care (preferably by their own GP) provided primary care staff are spoken to by ambulance personnel and an appointment is confirmed for the same day.

### Additional information

- To have a TIA the patient must have signs or symptoms of a stroke that have completely resolved.
- A patient who has had a TIA is at increased risk of subsequently developing a stroke and this is why the patient must be assessed by a doctor on the same day.
- A patient with a TIA needs a series of investigations that usually includes radiology and this is why most patients should be assessed in an ED.
- The ABCD2 score is a means of assessing the risk of a patient subsequently developing a stroke following a TIA. However, all patients with a TIA require an assessment regardless of their ABCD2 score, and for this reason the ABCD2 score does not have a significant role in the out-of-hospital setting.



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## 12.8 Inter-hospital transfer for stroke clot retrieval (SCR)

Only ICPs may use this section for the inter-hospital transfer of adult patients for stroke clot retrieval (SCR). Seek clinical advice if the patient is a child.

- Receive a handover from hospital staff and commence transport without delay.
- Ensure you are supplied with an ampoule of hydrocortisone and promethazine by hospital staff, unless this is already available to ambulance personnel.
- If applicable, ensure the alteplase infusion is still running and continue this until it is complete.
- Monitor and record vital signs including GCS every ten minutes.
- Examine the patient regularly for signs of angioedema.
- Phone the receiving clinician approximately 30 minutes prior to arrival, update them on the patient's condition (including any treatment provided en route), and confirm where in the hospital the patient is expected.
- Seek clinical advice for any significant changes in patient condition that are not easily managed.

### Treatment of hypertension

- If the systolic BP is greater than 180 mmHg or the diastolic BP is greater than 110 mmHg commence treatment as below and move sequentially through the steps if the BP remains uncontrolled:
  - a) Monitor and record the BP every five minutes.
  - b) Apply a TTS 10 GTN patch or commence a GTN infusion IV, provided the heart rate is greater than 40/minute and less than 150/minute. If a GTN infusion is commenced, titrate this to a systolic BP of 150-170 mmHg.
  - c) Administer labetalol or metoprolol IV provided the heart rate is greater than 60/minute:
    - Administer 10 mg of labetalol IV over 1-2 minutes. This may be repeated every ten minutes to a maximum of 50 mg, or
    - Administer 2.5 mg of metoprolol IV over 1-2 minutes. This may be repeated every ten minutes to a maximum of 10 mg.
  - d) Remove the GTN patch if the systolic BP falls below 140 mmHg.
- Seek clinical advice if the BP is difficult to control.

## Stopping the alteplase infusion

- Stop the alteplase infusion and seek clinical advice if:
  - The systolic BP is greater than 200 mmHg, or
  - The diastolic BP is greater than 120 mmHg, or
  - There are signs of intracranial haemorrhage (for example sudden onset of headache, fall in GCS by more than two points, or sudden worsening of stroke signs), or
  - There are signs of severe bleeding, or
  - The patient develops angioedema.

## Treatment of angioedema

- Stop the alteplase infusion.
- Administer 100 mg of hydrocortisone IV.
- Administer 12.5 mg of promethazine IV.
- Administer 5 mg of adrenaline nebulised if there is stridor or concern about airway compromise.

## Additional information

### Introduction

- Stroke clot retrieval (SCR) is a procedure where the occluded cerebral artery is accessed and the clot removed, thus re-establishing blood flow.
- SCR is also known as percutaneous stroke intervention (PSI), endovascular clot retrieval (ECR) and thrombectomy.
- SCR is a very effective treatment for stroke, particularly if a large clot is blocking a proximal artery, because fibrinolytic therapy in this setting often fails to achieve reperfusion.
- The earlier SCR occurs the better is the patient's outcome. The potential 'treatment window' for clot retrieval from time of symptom onset is much longer than with fibrinolytic therapy, and is up to 24 hours in selected patients.
- For a patient to be selected for SCR, a CT scan is required which shows a proximal occlusion and fibrinolytic therapy will usually be commenced while arrangements are being made for SCR to occur.
- The role of the ICP in inter-hospital transfer is to ensure rapid and safe transfer, while being prepared to treat any complications that may occur.
- Most patients requiring inter-hospital transfer for SCR are suitable to be escorted by a suitably trained ICP. Personnel should seek clinical advice prior to commencing transfer if they believe an ICU retrieval team is required, for example if the patient is unconscious, ventilated or requires ventilation.

## **Transfer mode**

- The fastest transfer mode should be used provided this is feasible and safe, with the most appropriate mode usually being determined by transport time.
- Transfer by road ambulance will usually be the most appropriate mode if the transport time by road between hospitals is less than 60 minutes.
- Transfer by helicopter will usually be the most appropriate mode if the transport time by road between hospitals is more than 60 minutes.
- Transfer by plane should be rare and personnel must not provide transfer by plane unless they have been trained to do so.

## **Patient handover at the referring hospital**

- Receive a handover from personnel at the referring hospital, including:
  - The history and any relevant additional information, for example allergies.
  - Current therapy including whether an alteplase infusion is running and if so, the total dose to be administered, the rate of infusion and whether additional bag/syringe changes are required en route.
  - The patient's vital signs.
  - The name and phone number of the receiving clinician.
  - Any relevant medical records.
- Minimise delays during handover, patient preparation and leaving the hospital. Personnel should aim to leave the hospital within 15 minutes of arrival.
- Do not insert additional IV lines unless absolutely necessary.

## **Fibrinolytic therapy**

- The most commonly used drug is alteplase and this requires an IV infusion.
  - Ideally the infusion should be set up prior to leaving the referring hospital so that no additional changing of bags or syringes is required en route.
  - Ensure the rate of infusion is known in case the infusion has to be stopped and restarted during transfer.
- In some settings tenecteplase may be used (usually in the setting of a clinical trial) and this is administered as a single IV bolus prior to commencing transport.

## **Hypertension**

- Hypertension increases the risk of intracranial haemorrhage, particularly when fibrinolytic therapy has been administered.
- Do not use GTN SL in this setting because it may be associated with a rapid fall in BP which may worsen brain ischaemia.
- A significant fall in blood pressure may worsen brain ischaemia, and this is why the systolic blood pressure at which a GTN patch is removed is higher than in other sections.

## Angioedema

- Angioedema is an uncommon complication of fibrinolytic therapy, but may occur in approximately 1% of patients, particularly those treated with alteplase.
- Angioedema may occur during or up to two hours after the infusion, and may be hemilingual.
- Do not administer adrenaline IM because it has no useful role in treating angioedema and risks haemorrhage following fibrinolytic therapy.
- Do not administer adrenaline IV unless there are convincing signs of anaphylaxis, because adrenaline via the IV route has no role in treating angioedema and risks causing hypertension which increases the risk of intracranial haemorrhage following fibrinolytic therapy.
- It is rare for angioedema to cause life-threatening airway obstruction, but if this occurs it should be treated using the same approach as in other patients, noting that:
  - Intubation with RSI must be approached with extreme caution, as intubation is likely to be difficult.
  - A surgical approach to the airway is likely to be associated with significant bleeding.

## On arrival at the SCR centre

- Meet the SCR team at the arranged location.
- Provide a handover and help convey the patient to the interventional suite on the ambulance stretcher unless instructed otherwise.

## GTN infusion

- A GTN infusion may only be administered by ICPs with:
  - Specific training on GTN administration via an IV infusion, and
  - Written service guidelines for infusion dilution and pump set up, and
  - A written standing order.



## 12.9 Special considerations in the elderly

### Introduction

- There is no age at which a patient can be automatically considered to be elderly. Each patient must be considered individually and their chronological age considered separately from their level of physical ability, comorbidities and physiological reserve (the combination of the latter three is often referred to as biological age or physiological age). However, patients aged greater than or equal to 75 years usually require a more considered and/or altered approach than younger patients and this is often reflected in the guidance within these CPGs.
- The general principles of assessment and making decisions and/or recommendations regarding treatment and/or referral are unchanged in elderly patients in comparison to younger patients. However, it is important to have an understanding of the important differences in the elderly and to always take these into account.
- The elderly are more likely to have reduced physiological reserve, frailty, comorbidities, and to be taking multiple medicines (polypharmacy). The combination of these factors means that the clinical needs of the elderly are usually more complex as they age.

### Assessment

- Assessment may be challenging because of barriers to communication, the presence of comorbidities and polypharmacy.
- Communication may be more difficult because the patient may have reduced hearing and/or vision, or pre-existing conditions that reduce comprehension (such as receptive dysphasia or dementia). Strategies that can enhance communication include:
  - Speak slowly and clearly, but avoid being patronising.
  - Allow sufficient time for the patient to comprehend and answer questions.
  - Check that sensory aids are functional.
  - Reduce unnecessary background noise.
  - Place light sources behind the patient if possible.
- Always consider the influence of the patient's comorbidities:
  - Comorbidities may impair physiological reserve. For example, heart failure impairs the cardiovascular response to sepsis.
  - The signs and symptoms of a chronic disorder may mask the signs and symptoms of an acute disorder. For example, it may be more difficult to recognise respiratory infection in a patient with COPD and chronic production of sputum.
  - Treatment of a chronic disorder may mask the signs and symptoms of an acute disorder. For example, a patient taking a beta-blocker may not develop a tachycardia.

- Polypharmacy adds to the complexity. A detailed history is necessary to confirm compliance with medicines and the presence of self-medication, for example taking over the counter medicines or taking medicines previously prescribed for another condition ('left over' medicines). Patients accessing multiple different health providers are at higher risk of polypharmacy than those who have coordinated care through one lead provider.
- The elderly are more likely to have an atypical presentation. For example, they are more likely to have an atypical presentation of myocardial ischaemia.
- The elderly are more likely to under-report symptoms.
- Always take a history from family members and caregivers in addition to taking a history from the patient, as they are the most likely to notice subtle changes, for example changes in mental status.

### **Physiological changes of ageing**

- Ageing results in physiological changes that occur in addition to the physiological changes associated with comorbidities. The physiological changes associated with ageing involve a general slowing of body processes and a reduction in physiological reserve, resulting in reduced ability to compensate during times of increased demand, for example during sepsis.
- The respiratory system changes include reduced respiratory muscle strength, increased thoracic cage stiffness, loss of alveolar structure (with less area for gas exchange) and a reduction in functional residual capacity, resulting in a lowering of SpO<sub>2</sub>.
- The cardiovascular system changes include reduced pacemaker cells, stiffening of arterial walls, reduced baroreceptor sensitivity, reduced maximum heart rate, reduced stroke volume and a reduction in cardiac output.
- The nervous system changes include slowing of nerve conduction and reflexes. Brain size decreases allowing for more movement and stretching of bridging veins, with increased risk of cerebral bleeding (particularly subdural bleeding). The signs and symptoms of subdural bleeding may be subtle because of the increased intracranial free space.
- The renal system changes include reduced renal blood flow and function. This impairs excretion of waste products and medicines that are excreted renally.
- The hepatic system changes include a reduction in metabolic enzyme activity that prolongs the metabolism and clearance of most drugs.
- The musculoskeletal system changes include reduced muscle and bone mass, reduced flexibility and function, and loss of calcium in bones that increases the risk of fractures.
- The skin changes include skin becomes thinner and drier, has less elasticity and loses collagen. Sweat gland activity decreases and reduces the ability to thermoregulate in a hot environment.

- The metabolic changes include a reduction in body mass and the speed of physiological processes, resulting in a reduction in metabolic rate and heat production, increasing the risk of developing hypothermia in a cold environment.

## **Decisions and recommendations regarding treatment and/or referral**

- Decisions and recommendations regarding treatment and/or referral may be challenging because of the presence of reduced physiological reserve, comorbidities and polypharmacy.
- The elderly have a lowered percentage of body mass that is water and this reduces the volume of distribution of most medicines. As a result, the same dose of a medicine will usually have a greater effect (because of less dilution) than in a younger patient. Consider reducing the dose of medicines, particularly if the patient is frail, and whenever feasible administer IV medicines in low doses that are titrated to effect.
- There is some evidence that the elderly are less likely to receive pain relief than younger patients. Pain in the elderly may be masked by challenges with communication, reduced physiological response to pain, reduced cognition and a misconception that the elderly are stoic.
- Treatment decisions are often complicated by uncertainty regarding what ceiling (or maximum level) of treatment and/or intervention is appropriate, particularly if the patient is frail or has dementia. Always take into account all available information, including the patient's known wishes (for example in an advance directive) and information from health personnel that know the patient well. Seek clinical advice if uncertain.
- Have a lowered threshold for recommending the elderly are transported to a medical facility. However, there is good evidence that they are at increased risk of harm when admitted to hospital, particularly if they have dementia or are frail. These patients are preferably treated in the community by primary care personnel, particularly if they are in an aged residential care facility, whenever this is feasible and safe. In this setting direct communication with a doctor or nurse who accepts the referral should occur whenever possible.
- The elderly are at increased risk of falling, but falling is not a natural aspect of ageing. If the patient does not require transport to a medical facility ambulance personnel have an important role in ensuring the patient is referred to a falls prevention service. See the 'falls' section.



## Dementia

- Dementia is a term for a broad category of diseases resulting in a long-term reduction in cognition, intellect and memory.
- The elderly are at increased risk of dementia, but dementia is not a natural aspect of ageing.
- The presence of dementia adds additional complexity when assessing the elderly and making decisions and/or recommendations regarding treatment and/or referral.
- Dementia is commonly associated with behavioural and psychiatric symptoms, including:
  - Physical aggression.
  - Loud vocalisation.
  - Agitation.
  - Wandering.
  - Anxiety.
  - Hallucinations.
  - Delusions.
- Acute worsening of the behavioural and psychiatric symptoms associated with dementia is a common cause for ambulance personnel to be called. The usual principles of assessment and making decisions and/or recommendations regarding treatment and/or referral apply, with an additional focus on:
  - Assessing for a treatable underlying cause, for example sepsis.
  - Assessing for an injury causing pain. Have a lowered threshold for administering pain relief, but avoid tramadol because drugs with anticholinergic activity may make confusion worse.
  - Assessing for a contribution from medicines with anticholinergic activity.
- Avoid sedation whenever it is feasible and safe to do so, because sedation may be associated with long-term worsening of the behavioural and psychiatric symptoms of dementia, and is associated with an increased risk of mortality. If sedation is required to ensure safety, the preferred medicines (in order) are: olanzapine, droperidol and midazolam. Ketamine must be reserved for when safety is severely compromised and ketamine administration to patients with dementia should be rare.
- Patients with dementia often suffer from a significant worsening of their behavioural and psychiatric symptoms when admitted to hospital. Patients with dementia are preferably treated in the community by primary care personnel, particularly if they are in an aged residential care facility, whenever this is feasible and safe. In this setting direct communication with a doctor or nurse who accepts the referral should occur whenever possible.

## 12.10 Obesity

### General principles

- Obesity increases the risk of associated comorbidities.
- Patients with obesity have an increased risk of mortality and morbidity for the same level of illness or injury, in comparison to non-obese patients.
- Have a lowered threshold for recommending the patient is assessed in a medical facility if the patient is obese.
- Obesity is associated with psychological problems including poor self-esteem and depression.

### Pathophysiological effects of obesity

- Total lung capacity and functional residual capacity (FRC) are reduced, causing the patient to desaturate faster than a non-obese patient.
- Work of breathing is raised due to the weight of the chest wall and abdominal contents. In particular, the work of breathing may be very high in the supine position, which should be avoided whenever possible.
- There is an increased risk of:
  - a) Obstructive sleep apnoea.
  - b) Chronic hypercarbia from obesity hypoventilation syndrome.
  - c) Hypertension.
  - d) Ischaemic heart disease.
  - e) Type two diabetes.
  - f) Osteoarthritis.
  - g) Acute infection, particularly soft tissue infection.

### Assessment

- Assessment is more difficult, but despite this obese patients require more careful assessment and greater attention to detail than non-obese patients.
- It is more difficult to auscultate heart and breath sounds.
- It is more difficult to examine the abdomen.
- 12 lead ECG acquisition is more difficult due to difficulty locating anatomical landmarks for lead placement. Flattening or inversion of the T wave may be due to obesity, but should not be attributed to obesity alone.
- Pulse oximetry may be unreliable due to excessive tissue thickness. Consider placing the probe on a little finger, little toe or an earlobe.
- Blood pressure measurement may be inaccurate due to the blood pressure cuff not being the correct size. Use the correct sized cuff if available or use the patient's forearm to measure the BP, noting that this technique may result in higher readings than those taken on the upper arm.

## Treatment

- Airway management is more difficult and a two-person bag/mask technique should be considered.
- Intubation is more difficult:
  - a) Consider ramping the patient by elevating their upper body to align their ears with their sternal notch.
  - b) Use a video laryngoscope if one is available.
  - c) Routinely use a bougie and anterior laryngeal manipulation.
- Mechanical ventilation is more difficult:
  - a) Increase the peak inspiratory pressure if necessary.
  - b) Consider increasing the PEEP to 10 cmH<sub>2</sub>O.
  - c) Consider raising the upper body to aid ventilation.
- Finger thoracostomy is more difficult, due to the challenge of identifying landmarks and the thickness of the chest wall. Consider making a longer than usual incision and be assertive with dissection.
- IV cannulation is more difficult. Have a lowered threshold for gaining IO access.
- The patient is at higher risk of respiratory depression with opiates.
- The patient is at higher risk of hypercarbia with oxygen administration.



**Ramping**

## Transport

- Ensure the patient's weight does not exceed the stretcher capacity.
- Call for a specific bariatric vehicle and/or stretcher if this is available.
- Call for extra personnel, including Fire personnel if required.
- Ambulance personnel may request lifting assistance from Fire personnel for obese patients requiring transport to a medical facility, when there is no other reasonable alternative. A patient status must be provided and personnel must not request assistance for patients being returned home or for pre-planned inter-facility transfers.
- Transport the patient sitting up whenever possible.
- Restrain the patient as per normal. If the patient cannot wear a seatbelt, consider other forms of restraint. The driver must also ensure that the nature of their driving is modified to keep the patient as safe as possible during transport.
- If the patient has a CPAP or BiPAP machine, ensure this is transported with the patient whenever feasible.
- Provide advanced warning of arrival at the medical facility.
- If the patient is morbidly obese, it may be unsafe for them to be transported by air and whenever feasible this should be discussed with Air Desk personnel when making the request.

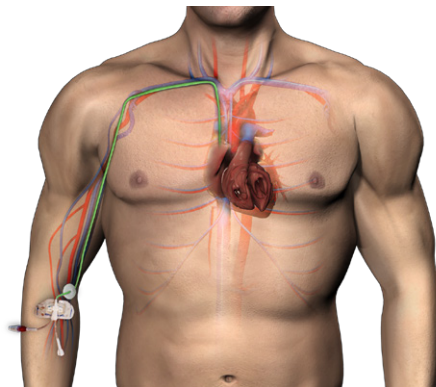


## 12.11 Patients with existing vascular access

This section describes when existing vascular access may be used by personnel at Paramedic and ICP level.

### Peripherally inserted central catheters (PICC)

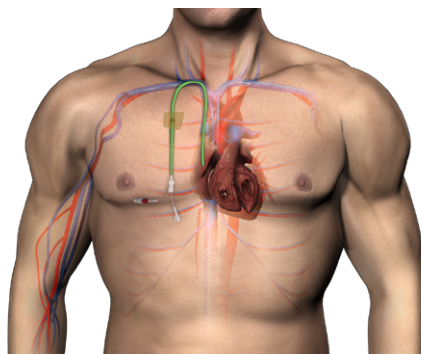
- These are often referred to as PICC (pronounced 'pick') lines.
- PICC lines are approximately 80 cm long and are placed via a vein in the antecubital fossa, with the tip sited in a central vein within the thorax.
- PICC lines usually have one or two lumens.
- PICC lines are usually used for medium term (weeks to months) vascular access for antibiotic or intravenous nutrition (IVN) administration in the community.
- If a patient has an existing PICC line, IV access should be obtained in another limb whenever feasible. If this is not feasible, IV cannulae must not be placed in the same antecubital fossa as a PICC line because this risks damage to the line.
- PICC lines may be used for medicine or fluid administration if immediate IV treatment is required and alternative IV access cannot be obtained:
  - a) Wear clean (but not sterile) gloves.
  - b) The luer plug may need to be changed if the existing one is not compatible with equipment carried by ambulance personnel.
  - c) Clean the luer plug with an alcohol swab for fifteen seconds.
  - d) Administer medicines or fluids as usual followed by a minimum of a 10 ml flush.
  - e) Do not disconnect an infusion unless this is absolutely necessary.
  - f) If an infusion is disconnected do not reconnect it.



PICC line

## Tunnelled central lines

- These are often referred to as Hickman or Groshong lines.
- Tunnelled central lines are approximately 40 cm long and are placed via a vein (usually the internal or external jugular), with the distal tip sited in a central vein within the thorax and the proximal end tunnelled to emerge from the skin in the subclavian region.
- Tunnelled central lines usually have one or two lumens.
- Tunnelled central lines are usually used for long-term (months to years) vascular access for administration of treatments such as chemotherapy, IVN or dialysis.
- Using a tunnelled line in the out-of-hospital setting increases the risk of infecting the line. The consequences of this are high and for this reason tunnelled lines may only be used for medicine or fluid administration if a patient has an immediately life-threatening condition and alternative IV access cannot be obtained.
- If the line is being used for dialysis:
  - It may contain a concentrated solution of anticoagulant to prevent blood clotting in the line. In this setting the line is usually labelled, but always assume that anticoagulant is present.
  - 5 ml of blood should be withdrawn and discarded to remove the anticoagulant before using the line.
  - If blood cannot be withdrawn, try another lumen.
  - If blood still cannot be withdrawn, consider using the lumen noting that it is possible the patient may get a bolus of anticoagulant. The anticoagulant dose will be small and is unlikely to be detrimental.
- The rest of the principles of using a tunnelled central line are the same as those for using a PICC line.



**Tunnelled central line**

## Central lines

- All lines that have their tip in a central vein are central lines, however the term is usually used to describe standard central lines. These are approximately 15 cm long and are usually placed via an internal jugular or subclavian vein, with the distal tip sited in a central vein within the thorax. The skin insertion site is situated immediately over the entry site to the vein.
- Very occasionally central lines may be placed via a femoral vein.
- Central lines usually have one to three lumens.
- It is unusual for a patient in the community to have a central line, but when present it is most likely a form of dialysis access.
- The principles of using a central line are the same as those for using a tunnelled line.



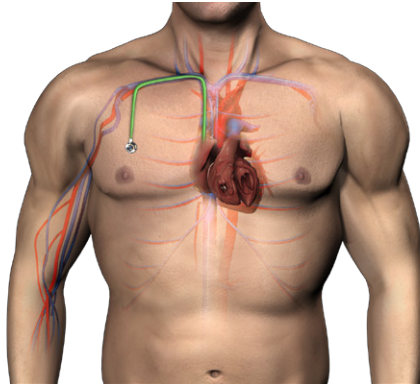
Central line

## Dialysis fistulae

- These are surgically created connections between an artery and a vein.
- Dialysis fistulae are used for vascular access for dialysis and have a high flow of blood through them.
- Dialysis fistulae are usually situated in the arm but are occasionally in the leg.
- Do not gain IV access in the same limb as a fistula, unless IV access cannot be obtained elsewhere and medicine or fluid administration is required for an immediately life-threatening condition. In this setting, gain IV access as far from the fistula as possible, noting that if the IV access is proximal to the fistula there may be arterial flow within the vein.
- Do not measure blood pressure in the same limb as a fistula because the result will be altered.
- Do not attempt to establish vascular access in a fistula, even in a life-threatening emergency because the risk of intra-arterial injection and/or permanent damage is very high.

## Portacath lines

- These are lines that are placed via a vein (usually a jugular or subclavian vein) with the tip sited in a central vein within the thorax and the end placed surgically under closed skin. On the end is a port which is accessed using a specifically designed needle inserted through the overlying skin. The port is usually located in the subclavian area or upper arm.
- Portacath lines are usually used for long-term vascular access for chemotherapy.
- The principles of using a portacath line are the same as those for using a tunnelled central line, noting that:
  - The specifically designed needle must be available.
  - The port must only be accessed by people trained to do so.
  - An anticoagulant may be present.



**Portacath line**



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## 13.1 Making recommendations using the flag tables

Use this section in conjunction with the relevant flag tables to make referral and transport recommendations.

- Assess the patient, including an assessment of the features contained within the relevant flag tables:
  - a) If one or more red flags are present the patient must be given a clear recommendation to be assessed by a doctor within two hours, and should usually be given a clear recommendation to be transported to ED by ambulance.
  - b) If any orange flags are present (and no red flags) the patient should be given a clear recommendation to be seen in primary care (preferably by their own GP) within the timeframe specified in the relevant section.
  - c) If green flags are present (and no orange or red flags) the patient is usually suitable to be given a clear recommendation to remain in the community with self-care. Advise that the patient is seen in primary care (preferably by their own GP) if their symptoms fail to improve. The patient may be administered paracetamol and/or ibuprofen if indicated.
- Follow a local pathway if one is in place.

### Referral and transport

- Clinical judgement is required when determining whether a patient with one or more red flags is given a recommendation to be transported to ED by ambulance, or to be seen in primary care.
  - Most patients should receive a recommendation to be transported to an ED by ambulance, particularly if the patient is living independently.
  - Being seen in primary care may be the best option if the patient is in an aged residential care facility, is very frail or has dementia.
- If the patient has one or more red flags and is being referred to primary care:
  - The patient's anticipated clinical needs must be able to be safely met in primary care, and
  - A nurse or doctor within primary care must be contacted directly by ambulance personnel, and
  - A nurse or doctor must agree to see the patient, and
  - Safe transport (if required) must be available.
- The timeframes for the patient to be seen/assessed in each section are a maximum. Clinical judgement is required and patients may need to be seen earlier than described.

## 13.2 Abdominal pain

Use this section to help determine which patients with abdominal pain require referral to a medical facility and if so, to which type of facility.

- Assess the patient, including an assessment of the features contained within the flag table. See the 'making recommendations using the flag tables' section.



### Red flags

- Severe pain.
- Abnormal vital signs.
- Pain radiating to the back.
- Loin or flank pain.
- Temperature > 40°C.
- Rigors.
- Female aged 14-50 years and last menstrual period (LMP) more than four weeks ago.
- Pregnant.
- Abdominal tenderness on palpation.
- Pain made worse by movement.
- Indigestion or epigastric pain.
- Persistent or recurrent vomiting.
- Aged < 5 years.
- Aged ≥ 65 years.
- Immunocompromised (for example on steroids or immunotherapy).



### Orange flags - should be seen in primary care within 12 hours

- Dysuria.
- Frequency or urgency of urination.
- Recent unplanned weight loss.
- Haematuria.
- Temperature 38-40°C but other vital signs normal.
- New onset of constipation in the elderly.



### Green flags

- Diarrhoea and vomiting with normal vital signs.
- Pain associated with menstruation.
- Recurrent constipation.

## Additional information

### General principles

- A patient with abdominal pain who calls an ambulance should usually be assessed in an ED, unless there is an obvious benign cause such as urinary tract infection, menstruation or recurrent constipation.
- There are multiple conditions that can cause abdominal pain. The distribution of nerve supply to abdominal organs is such that pain from them may be non-specific, difficult to localise and may mimic the pain from other causes in terms of location, sensation and radiation.

### Red flags

- Abdominal pain radiating to the spine or flank may result from conditions such as pancreatitis, gastric or duodenal ulceration, cholecystitis, pyelonephritis, or a leaking abdominal aortic aneurysm.
- An abdominal aortic aneurysm is usually asymptomatic prior to leaking. Although many references describe a pulsating mass, this may not be palpable. A leaking abdominal aortic aneurysm usually presents with abdominal pain that radiates to the back and signs of shock.
- Rigors indicate that bacteria may be present in the blood.
- A female aged 14-50 years whose last menstrual period was more than four weeks ago may have an ectopic pregnancy.
- Perforated bowel (for example from cancer, diverticular disease or ulceration) usually presents with non-specific abdominal pain for 1-2 days followed by signs of peritonitis (abdominal tenderness with pain made worse by movement).
- All patients with upper abdominal (epigastric) pain should have a 12 lead ECG acquired, noting that a normal ECG does not rule out myocardial ischaemia.



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## 13.3 Falls

Use this section to help determine which patients following a fall require referral to a medical facility and if so, to which type of facility. Use the 'syncope' section if the patient appears to have had a fall as a result of loss of consciousness.

- Assess the patient, including an assessment of the features contained within the flag table. See the 'making recommendations using the flag tables' section.
- In addition, perform a falls risk assessment if the patient is aged greater than or equal to 65 years, is living independently, and is not being transported to an ED by ambulance. Gain consent and refer the patient to a falls prevention service if any abnormalities are found. Alternatively, refer the patient to their GP if a falls referral pathway is not available.



### Red flags

- Clinically significant injury.
- Clinically significant pain.
- Abnormal vital signs.
- Signs of stroke.
- Seizure without a history of epilepsy.
- Headache.
- New onset of visual disturbance.
- Unable to mobilise.
- Unstable medical condition contributing to the fall.



### Orange flags - should be seen in primary care within 24 hours

- More than one fall in the last week.
- Postural hypotension.
- Seizure with a history of epilepsy.
- Recent change in medication.
- Minor injury requiring non-urgent treatment.
- New reduction in mobility but able to weight bear.



### Green flags

- Minor soft tissue injury not requiring medical treatment.
- Able to mobilise in a manner that is normal for the patient.

## Additional information

### General principles

- A patient that has fallen without a clear mechanical cause, for example a trip or slip, requires a thorough history and clinical examination to rule out a cause for collapse.
- A patient that has fallen always requires an assessment to rule out injury, even if they appear to be uninjured.
- Do not use the term 'lift assist' when referring to a patient that has fallen as this term should only be used when a crew is assisting another crew to lift a patient.
- Falling is not a natural part of aging and all patients aged greater than or equal to 65 years who have fallen require an assessment that considers referral to a falls prevention service.
- Have a raised index for suspicion of injury if the patient:
  - Has fallen a significant height, for example greater than one metre or five stairs in an adult, or
  - Is taking an anticoagulant or has a known bleeding disorder.
- Always take into account the patient's comorbidities and social circumstances.
- Examples of unstable medical conditions contributing to the fall include diabetes with poor glucose control and poorly controlled Parkinson's disease. Clinical judgement is required when determining that a medical condition requires review in an ED or review by the patient's GP.
- Clinical judgement must be used to determine when a patient with orange flags should be seen by a doctor. The 24 hour timeframe is a maximum and many patients should be seen sooner than this, for example if soft tissue injury is present.
- Postural hypotension is present if there is a fall of greater than 20 mmHg in the systolic BP or greater than 10 mmHg in the diastolic BP when standing.

### Falls risk assessment

- Falls are a common cause of injury and loss of independence in older patients.
- Ambulance personnel have an important role in referring older patients at risk of a fall to a falls referral pathway, as this reduces the risk of further falls and injury.
- Referral to a falls referral pathway is not required if the patient is living in an aged residential care facility because the facility personnel are required to manage this. Patients living in an independent unit (for example a villa) in the same complex as an aged residential care facility are designated as living independently.

- Ask the patient the following questions:
  - Have you slipped, tripped or fallen in the last year?
  - Do you need to use your hands to get out of a chair?
  - Are there any activities you've stopped doing because you are afraid of falling?
- Perform Romberg's test.
- Perform a timed up and go test.
- Refer the patient to a falls referral pathway if:
  - The patient answered 'yes' to any of the questions, or
  - Romberg's test is abnormal, or
  - The timed up and go test is abnormal, or
  - Personnel consider the patient is at risk of falling.
- Examine the environment for hazards which may contribute to the risk of falling. Examples include rugs, mats, cords and poor footwear. Eliminate these hazards with the patient's permission if feasible.

### **Romberg's test**

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

### **Timed up and go test**

- Seat the patient in a chair and mark a location three metres away. The patient should wear their regular footwear and use any regular walking aids.
- Give the patient the following instructions. "When I say go I want you to stand up, walk to the line, turn around, walk back and sit down again".
- Begin timing on the word go and stop when the patient sits back down.
- The timed up and go test is abnormal if the time is longer than 12 seconds.
- During the timed up and go test observe the patient's posture, gait and balance. Record any obvious abnormalities.

### **Referring the patient to a falls prevention service**

- All DHBs in New Zealand have a falls prevention service offering follow up and support, which may include:
  - Access to strength and balance programmes.
  - The provision of mobility aids.
  - Vision testing.
  - Medication review.

- To refer a patient to a falls prevention service via ePRF, follow the instructions in the ePRF on local falls referral pathways.
- Include as much information in the ePRF as possible, enabling the falls prevention service to offer the patient the most appropriate support. For example:
  - The patient’s contact details, including their phone number.
  - The answers to the falls risk questions.
  - Whether the patient uses a mobility aid.
  - Whether the patient requires assistance with their activities of daily living, for example showering.
  - Whether the patient can leave their home unassisted.
  - The results of Romberg’s test and the timed up and go test.



## 13.4 Fever in patients aged under five years

Use this section to help determine which children aged less than five years with fever (temperature greater than 38°C associated with illness) require referral to a medical facility and if so, to which type of medical facility.

- Clearly recommend that all children aged less than 12 months with a fever are transported to an ED by ambulance.
- For children aged greater than or equal to 12 months, assess the child and utilise the paediatric assessment triangle. Include an assessment of features contained within the flag table. See the 'making recommendations using the flag tables' section.



### Red flags

- **Colour:**
  - Pale or ashen.
  - Mottled.
  - Cyanosed.
- **Activity:**
  - No response to social cues.
  - Difficult to rouse or does not stay awake when roused.
  - Weak cry.
  - Exhaustion.
- **Respiratory:**
  - Grunting.
  - Respiratory rate > 50/minute.
  - Moderate or severe chest indrawing.
  - SpO<sub>2</sub> < 94% on air.
- **Circulation and hydration:**
  - Reduced skin turgor.
  - Severe tachycardia.
  - Peripheral capillary refill time > three seconds.
  - Bradycardia (an extremely late sign).
- **Other:**
  - Temperature > 40°C.
  - Neutropenia.
  - Chemotherapy within the last four weeks.
  - Pain in a single joint or a single muscle area.
  - Rigors.
  - Petechiae or purpura.
  - Neck stiffness.
  - Focal neurological signs.
  - Significant concern regarding neglect or non-accidental injury.





## Orange flags - should be seen in primary care within six hours

- **Colour:** pallor reported by caregiver (but not seen by personnel).
- **Activity:**
  - Not responding to social cues normally.
  - Wakes only after physical stimulation.
  - Decreased activity.
  - Poor feeding.
- **Respiratory:**
  - Nasal flaring.
  - Respiratory rate 40-50/minute.
  - Mild indrawing.
  - Crackles audible on auscultation.
  - SpO<sub>2</sub> 94-95% on air.
- **Circulation and hydration:**
  - Dry mucous membranes.
  - Tachycardia.
  - Peripheral capillary refill time 2-3 seconds.
  - Reduced urinary output or frequency.
- **Other:**
  - Sore throat.
  - Illness for longer than five days.
  - Non-weight bearing or not mobilising appropriately.
  - Immunocompromised (for example on steroids).
  - Help from a healthcare provider has been sought more than once within 24 hours.



## Green flags

- **Colour:** normal colour of skin, lips and tongue.
- **Activity:**
  - Responds normally to social cues.
  - Wakes easily and stays awake.
  - Strong/normal cry or not crying.
- **Respiratory:**
  - Normal respiratory rate.
  - No signs of indrawing.
  - SpO<sub>2</sub> ≥ 96% on air.
- **Circulation and hydration:**
  - Normal skin and eyes.
  - Moist mucous membranes.
  - Normal heart rate.
  - Peripheral capillary refill time < two seconds.

## Additional information

### General principles

- Children can be challenging to assess and treat. The combination of parental anxiety and uncertainty from personnel with regard to their clinical decisions can complicate simple clinical conditions. Objectively utilising the flags will help overcome some of these issues.
- Tympanic thermometers may be unreliable in small children if the probe will not adequately fit their external auditory meatus and an axillary measurement is preferred if a child is under six months of age.
- Any temperature measurement greater than 40°C must result in a clear recommendation for the patient to be transported to ED by ambulance, even if the temperature subsequently falls.
- Advise the parents or guardians to see their GP if the child fails to improve. The patient may be administered paracetamol and/or ibuprofen if indicated.
- Infants may not generate an elevated temperature in response to infection.
- Fever in children is most commonly caused by a viral infection.
- The threshold for transport to an ED must be lowered in children with coexisting chronic diseases such as respiratory disease.
- The threshold for transport to an ED must be lowered if help from a healthcare provider has been sought more than once within 24 hours.
- Rigors indicate that bacteria may be present in the blood.
- Neutropenia is a low neutrophil white blood cell count. Neutropenia usually occurs post chemotherapy and the parents will usually know their child is neutropenic.
- Chemotherapy includes any form of IV or oral chemotherapy for cancer treatment.
- Septic arthritis may present with pain in a single joint.
- Myositis and fasciitis may present with tenderness in a single muscle area.
- Meningitis may present with drowsiness, headache and/or neck stiffness. Neck stiffness does not usually occur below the age of one year.
- Petechiae or purpura commonly occur with meningococcal septicaemia.
- Parents are often very concerned and may wish for their child to be transported by ambulance, despite a recommendation to the contrary. In this setting transport by ambulance should occur if no other reasonable transport option is available.
- An apparent improvement following the administration of antipyretics (such as paracetamol and/or ibuprofen) may be due to masking of symptoms and does not rule out a serious infection.



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## 13.5 Fever in patients aged five years and over

Use this section to help determine which patients aged greater than or equal to five years with fever (temperature greater than 38°C associated with illness) require referral to a medical facility and if so, to which type of facility.

- Assess the patient, including an assessment of the features contained within the flag table. See the 'making recommendations using the flag tables' section.



### Red flags

- Significantly abnormal vital signs.
- Pain or tenderness in the flank or back.
- Rigors.
- Neutropenia.
- Chemotherapy within four weeks.
- Abdominal pain with tenderness on palpation.
- Pain in a single joint or a single muscle area.
- Severe muscle tenderness.
- Temperature > 40°C.
- Drowsiness.
- Severe or worsening headache.
- Neck stiffness.
- Petechiae or purpura.



### Orange flags - should be seen in primary care within 12 hours

- Cellulitis.
- Immunocompromised (for example on steroids or immunotherapy).
- Frequency or urgency of urination.
- Sore throat.
- Cough productive of purulent sputum.
- Pleuritic chest pain.
- Help from a healthcare provider has been sought more than once within 24 hours.



### Green flags

- Influenza with normal vital signs and normal mobility.

## Additional information

### General principles

- The threshold for transport to an ED must be lowered if the patient has coexisting chronic disease such as renal disease, cardiac disease or diabetes.
- The threshold for transport to an ED must be lowered if help from a healthcare provider has been sought more than once within 24 hours.

### Red flags

- Fever usually causes an increase in the heart rate and respiratory rate and clinical judgement must be used when determining that the patient's vital signs are significantly abnormal.
- Any temperature measurement greater than 40°C must result in a clear recommendation for the patient to be transported to ED by ambulance, even if the temperature subsequently falls.
- Pyelonephritis may present with pain or tenderness in the flank or back.
- Rigors indicate that bacteria may be present in the blood.
- Neutropenia is a low neutrophil white blood cell count. Neutropenia usually occurs post chemotherapy and the patient will usually know they are neutropenic.
- Chemotherapy includes any form of IV or oral chemotherapy for cancer treatment.
- A patient with abdominal pain and tenderness on palpation requires a surgical review.
- Septic arthritis may present with pain in a single joint.
- Myositis and fasciitis may present with tenderness in a single muscle area.
- Meningitis may present with drowsiness, headache and/or neck stiffness.
- Severe muscle tenderness may occur with meningococcal septicaemia, myositis or fasciitis.
- Petechiae or purpura commonly occur with meningococcal septicaemia.



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## 13.6 Headache

Use this section to help determine which patients with headache require referral to a medical facility and if so, to which type of facility.

- Assess the patient, including an assessment of the features contained within the flag table. See the 'making recommendations using the flag tables' section.



### Red flags

- Headache or neck pain following neck manipulation.
- Neck pain or neck stiffness.
- Sudden onset of severe headache.
- Temperature > 38°C (in the absence of influenza symptoms).
- Persistent vomiting.
- Focal neurological signs.
- Altered level of consciousness, including a history of altered level of consciousness with the onset of the headache.
- New onset of an altered mental status.
- Worsening headache following recent trauma to the head.
- Taking an anticoagulant or has a known bleeding disorder.
- Signs of temporal arteritis.
- Hypertension during pregnancy.
- Previous history of intracranial bleeding.
- Family history of cerebral vascular abnormalities.
- Onset during sexual activity or exercise.
- Headache associated with seizure.



### Orange flags - should be seen in primary care within 12 hours

- Symptoms associated with sinusitis.
- Migraine with symptoms different to usual.



### Green flags

- Symptoms associated with influenza.
- Known migraine with usual symptoms.
- Normal vital signs, normal assessment using the FAST test and able to walk normally.

## Additional information

### General principles

- It is unusual for a patient with headache to call for an ambulance and the patient should usually be assessed in an ED, unless there is an obvious benign cause such as a migraine, influenza, sinusitis, caffeine withdrawal, nicotine withdrawal or a hangover.
- A patient with green flags (and no orange or red flags) may remain in the community and be administered a single dose of any combination of paracetamol, ibuprofen, tramadol or ondansetron.

### Migraines

- Migraines are recurrent severe headaches. They usually come on over an hour or two and last for several hours.
- Migraines may be preceded by transient neurological symptoms (an aura) such as visual changes (for example altered vision, spots or flickers) and/or sensory changes such as pins and needles.
- The pain is usually unilateral (but may be bilateral), throbbing, made worse by activity, associated with nausea and vomiting and may be associated with sensitivity to light and noise.
- There is no good evidence that administration of 0.9% sodium chloride IV is effective in treating migraines, however there is evidence that it is useful if the patient has dehydration. A patient with known migraines and typical symptoms may be administered 0.9% sodium chloride IV for signs of dehydration (up to a maximum of 1 litre for an adult and 20 ml/kg for a child), without being transported to a medical facility.
- Some patients with migraines call for an ambulance and request opiate pain relief. Opiates are strongly discouraged in this setting and should not be administered.

### Cluster headaches

- Cluster headaches are recurrent, unilateral headaches centred around one eye or the temporal area. They are often associated with watering of the eye and/or congestion/running of the nose.
- Cluster headaches may be severe and will usually spontaneously resolve. Patients may experience multiple headaches in a short period of time, followed by a period of no headaches, hence the term 'cluster'.
- The cause of cluster headaches is not known, but abnormal vasodilatation of cerebral blood vessels is thought to be involved.
- A short period of inhalation of high concentration oxygen may resolve the headache. The theory is that this causes cerebral vasoconstriction and thus relieves the pain.

- If the provisional diagnosis is cluster headache and there are no red flags, administer 15 litres/minute of oxygen via a reservoir mask for 15-20 minutes and reassess:
  - Recommend self-care and subsequent follow up by their GP if the headache resolves.
  - Recommend the patient is seen by a doctor (preferably in primary care and preferably by their own GP) if their headache does not resolve.

## Red flags

- Subarachnoid haemorrhage may present with sudden onset of severe headache (thunderclap headache) and/or headache associated with neck stiffness.
- Vertebral artery dissection may present with sudden onset of neck pain and/or headache which may follow injury or neck manipulation.
- Meningitis may present with headache, fever, neck stiffness, photophobia, nausea and vomiting. The symptoms of meningitis are similar to those of migraine, except that the pain from migraine:
  - Usually comes on over an hour or two, whereas the pain from meningitis usually comes on more slowly.
  - Is usually throbbing, whereas the pain from meningitis is usually more constant.
  - Usually lasts only for a few hours, whereas the pain from meningitis persists.
- Intracerebral haemorrhage usually presents with sudden onset of severe headache and focal neurological signs. The patient will also have a falling level of consciousness if the intracerebral haemorrhage is severe.
- Anticoagulants include warfarin and dabigatran, but not antiplatelet agents such as aspirin, clopidogrel or ticagrelor.
- Temporal arteritis is an inflammatory condition affecting the blood vessels supplying the temporal area of the head. It is also sometimes called giant cell arteritis. It is an emergency because untreated it can lead to blindness. It most commonly occurs in patients over the age of 60 years and may present with any combination of:
  - Headache.
  - Fever.
  - Jaw pain (which may get worse with chewing).
  - Altered vision.
  - Scalp sensitivity.
  - Stiff aching joints.
- Hypertension during pregnancy is a potential sign of pre-eclampsia. In general, to be considered hypertensive, a pregnant patient needs to have a systolic BP greater than 140 mmHg or a diastolic BP greater than 90 mmHg. However, it is possible for a pregnant patient to have pre-eclampsia with blood



pressures below those described. Personnel should recommend transport to an ED if a pregnant patient has headache and a blood pressure that is higher than their normal blood pressure.

- Onset of severe headache during sexual activity may be associated with subarachnoid haemorrhage.
- Onset of severe headache during exercise, particularly strenuous exercise or heavy lifting may be associated with subarachnoid haemorrhage or vertebral artery dissection.

### **Pain relief**

- Opiate pain relief is discouraged for a patient with headache as it is not usually required, but is not contraindicated if the headache is severe, or due to subarachnoid haemorrhage or intracerebral haemorrhage.



## 13.7 Non-traumatic lumbar back pain

This section is for adults with non-traumatic lumbar back pain. Use this section to help determine which patients require referral to a medical facility and if so, to which type of facility.

- Assess the patient, including an assessment of the features contained within the flag table. See the 'making recommendations using the flag tables' section.



### Red flags

- Loss of bladder or bowel control.
- Temperature > 38°C.
- Rigors.
- Abnormal vital signs.
- Pain in the thoracic spine or chest.
- Abdominal pain or tenderness.
- Altered sensation in the saddle area.
- Altered sensation and/or power in both legs.
- Unable to mobilise.
- Signs or symptoms of generalised illness.
- Pain radiating down both legs.



### Orange flags - should be seen in primary care within 24 hours

- A history of cancer (other than skin cancer).
- Immunocompromised (for example on steroids or immunotherapy).
- Worsening pain, especially when lying down or at night.
- Recent unplanned weight loss.
- Pain radiating down one leg.
- Altered sensation or power in one leg.
- Osteoporosis.
- IV drug use.



### Green flags

- Pain and/or muscle spasm isolated to the lumbar area.
- Able to walk.

## Additional information

### General principles

- Non-traumatic back pain is usually precipitated by lifting or twisting, aggravated by movement and is often associated with muscle spasm.
- A prolapsed disc may compress a nerve root causing altered sensation and/or motor power in one leg. Pain that radiates into one or both legs is usually a sign of sciatic nerve involvement. If the altered sensation and/or power are only in one leg, the patient does not need immediate transport to ED provided no red flags are present.
- Always examine the back and abdomen for signs of tenderness. This will help localise the pain and may help distinguish back pain from tenderness over the kidney, lower ribs or abdominal organs.
- Always observe the patient walking. A patient with severe lumbar back pain will usually find it difficult to move from a supine to a standing position and walking may be painful. However, provided the patient is able to walk, immediate transport to ED is not required if no red flags are present.
- If the patient remains in the community:
  - A single dose of any combination of paracetamol, ibuprofen and tramadol may be administered.
  - Provide advice on taking regular pain relief and remaining mobile.
  - Provide them with the back pain information sheet.

### Red flags

- Loss of bladder or bowel control, loss of sensation over the saddle area, loss of sensation and/or power in both legs and an inability to walk are all signs of compression of the spinal cord.
- The saddle area covers the perineum, buttocks and upper posterior thighs.
- Fever is a sign of possible epidural abscess.
- Always take a history with regard to abdominal pain and examine the abdomen for signs of tenderness. Abdominal pain radiating to the lumbar spine or flank may result from conditions such as pancreatitis, gastric or duodenal ulceration, cholecystitis, pyelonephritis or a leaking abdominal aortic aneurysm.



## 13.8 Syncope

Use this section to help determine which patients with syncope or near-syncope require referral to a medical facility and if so, to which type of facility.

- Assess the patient, including an assessment of the features contained within the flag table. See the 'making recommendations using the flag tables' section.



### Red flags

- Abnormal vital signs.
- Failure to recover to normal.
- Chest pain.
- Abnormal 12 lead ECG with abnormalities of concern.
- New or unexplained shortness of breath.
- Clinically significant injury.
- Occurred during exertion.
- Pregnancy.
- Headache.
- Known valvular or congenital heart disease.



### Orange flags - should be seen in primary care within 24 hours

- Aged < 15 years.
- Aged  $\geq$  75 years.
- Postural hypotension.
- Abnormal 12 lead ECG but no abnormalities of concern.
- Palpitations.
- Family history of sudden death.
- History of heart failure.



### Green flags

- Clearly benign. Factors associated with benign syncope include:
  - Posture, for example prolonged standing.
  - Provoking factors, for example pain or a procedure.
  - Prodromal symptoms, for example sweating or feeling hot.

## Additional information

- Syncope (also known as fainting or transient loss of consciousness) is common and is usually benign. However, syncope can also be associated with clinically important disease, particularly heart disease.
- The most common cause of syncope is a brief, but significant fall in cardiac output. The patient should then regain a normal level of consciousness within a few minutes.
- Syncope in patients aged over 75 years may be due to intermittent bradydysrhythmia (particularly third degree heart block) or intermittent VT.
- Take and record a history from a witness if possible:
  - **What was the patient's posture before the syncope?** Sometimes there will be a prolonged period of standing prior to benign syncope.
  - **Were there any obvious provoking factors?** Sometimes pain or a procedure (particularly injection) will provoke benign syncope.
  - **Were there any obvious prodromal symptoms?** Commonly the patient will complain of feeling sweaty or feeling hot prior to benign syncope.
  - **What was the appearance and colour of the patient during the syncope?** Most commonly the patient will be very pale as a result of low cardiac output.
  - **Was there any twitching observed during the syncope?** It is common for a patient to have some abnormal twitching during syncope, but rhythmic jerking movements suggest a seizure has occurred.
  - **How long was the patient unconscious for?** Most patients should recover to a normal level of consciousness within a few minutes. Failure to quickly regain a normal level of consciousness suggests a neurological cause.
  - **Was the patient confused when they woke?** A very brief period of disorientation may occur, but confusion that persists beyond a few minutes suggests a neurological cause.
- Assess the patient:
  - Examine for signs of injury.
  - Examine for signs of tongue biting and/or urinary incontinence. This suggests a seizure has occurred.
  - Always perform a 12 lead ECG. Determining that abnormalities of concern are present requires clinical judgement, but examples include ST elevation in the absence of a clear STEMI mimic, ST depression in the absence of left ventricular hypertrophy, second or third degree heart block and a persistent heart rate of less than 50/minute. Any abnormality warrants medical follow up and personnel should have a low threshold for recommending transport to an ED by ambulance.
  - Measure a full set of vital signs, including a BP standing and sitting/lying. Postural hypotension is present if there is a fall of greater than 20 mmHg in the systolic or greater than 10 mmHg in the diastolic BP when standing.

## 13.9 Vertigo

Use this section to help determine which patients with vertigo require referral to a medical facility and if so, to which type of facility.

- Assess the patient, including an assessment of the features contained within the flag table. See the 'making recommendations using the flag tables' section.



### Red flags

- Signs of stroke.
- Headache.
- Unable to walk unaided.
- Neck pain.
- Visual disturbance.
- Abnormal coordination during the finger-nose test.
- Nystagmus that persists for more than 10 seconds with the head still.
- Altered level of consciousness.
- Abnormal vital signs.
- History of recent trauma, especially head or neck injury.
- Symptoms that do not improve when the head is still.



### Orange flags - should be seen in primary care within 24 hours

- First episode of vertigo.
- Symptoms worsened by changes in head position.
- Symptoms improve, but do not completely settle when the head is kept still.
- Tinnitus or loss of hearing.



### Green flags

- Symptoms totally resolve within 60 seconds when the head is kept still.
- Symptoms totally resolve following an Epley manoeuvre.

## Additional information

### General principles

- Vertigo is the false sensation that the body or its surroundings are moving or spinning and is usually accompanied by nausea and loss of balance. It is important to differentiate this from a feeling of light headedness.
- The three main causes of vertigo are cerebellar stroke, benign paroxysmal positional vertigo (BPPV) and vestibular neuritis. Cerebellar stroke is less common but much more serious and can easily be missed. BPPV and vestibular neuritis are both common and benign.
- A patient with green flags (and no orange or red flags) may remain in the community and be administered ondansetron. See the 'nausea and/or vomiting' section.

### Cerebellar stroke

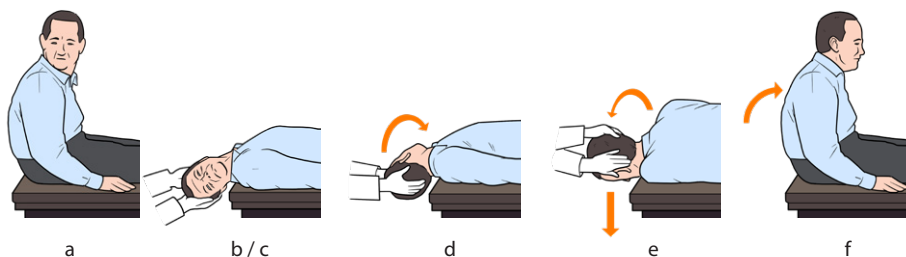
- Cerebellar stroke is usually ischaemic and occurs most commonly in patients aged over 50 years.
- The symptoms of cerebellar stroke usually come on suddenly (over a few minutes) and are associated with:
  - Vertigo that is not altered by head position.
  - Nausea and vomiting.
  - Loss of coordination with an abnormal finger-nose test.
  - Loss of balance with an inability to walk unaided.
- Hearing is not affected and tinnitus is not a feature.
- Cerebellar stroke may be associated with vertebral artery dissection and this may be associated with neck pain and/or recent head or neck injury.

### Benign paroxysmal positional vertigo (BPPV)

- BPPV is caused by calcium particles (called otoliths) which become dislodged and float to abnormal positions in the inner ear.
- The symptoms of BPPV usually come on slowly over 12-24 hours and are associated with:
  - Brief but very intense periods of vertigo that occur with changes in head position, for example sitting up or rolling over. Vertigo usually resolves over 30-60 seconds when the head is kept still.
  - Nausea is common but vomiting is rare.
  - Symptoms may be worse in the morning and may be worse when the head is tilted to a particular side.
- Hearing is not affected and tinnitus is not a feature.
- Mildly abnormal balance may be present, but the finger-nose test is normal.
- Perform an Epley manoeuvre if the patient has known BPPV.

## The Epley manoeuvre

- The Epley manoeuvre aims to reposition the calcium particles in the inner ear, and resolve symptoms of vertigo in patients with BPPV.
- During the manoeuvre the patient is likely to require coaching and reassurance. Vomiting is common, and preparation should be made for this. Movements between each position are rapid and the patient is likely to experience an initial worsening of their vertigo and associated symptoms.
- There are several variations, but the following is recommended:
  - a) Sit the patient upright on a bed or stretcher and rotate their head to face one side, preferably toward the side that makes symptoms worse.
  - b) Assist the patient to lie back, keeping their head turned. Recline their head, using a pillow under their shoulders or with their head hanging off the end of the bed/stretcher, and their ear parallel with the floor.
  - c) Hold the patient's head in this position for 60 seconds.
  - d) Quickly turn the patient's head to face the opposite side and hold this position for 60 seconds.
  - e) Turn the head further, so that the patient is facing downward (this may require the patient to move their body to accommodate this). Hold this position for 60 seconds.
  - f) Assist the patient into a sitting position and rotate their head forward.
- Repeat the Epley manoeuvre once if the symptoms do not resolve.



The Epley manoeuvre

## Vestibular neuritis

- Vestibular neuritis is caused by an inflammation of the vestibular nerve.
- The most common cause of vestibular neuritis is a viral infection.
- The symptoms of vestibular neuritis usually come on over 12-24 hours and are associated with:
  - Vertigo that is altered by position, but not as dramatically as BPPV.
  - Nausea and vomiting.
  - Reduced hearing (especially on one side) and/or tinnitus (buzzing noise).
- Mildly abnormal balance may be present when walking, but the finger-nose test is normal.





# 14.1 Medicines

## Introduction

- This section contains additional information on medicines, but does not incorporate all required knowledge.
- The information is limited to that which is particularly relevant. For example, only cautions and adverse effects relevant to medicine administration in the out-of-hospital setting are listed.

## Drawing up and administering medicines

- Medicines described for intravenous (IV) administration may be administered using the same dose via the intraosseous (IO) route.
- With the exception of adrenaline, medicines described for intramuscular (IM) administration may be administered using the same dose via the subcutaneous (SC) route.
- All medicines administered via the IV or IO route require an IV flush of 0.9% sodium chloride between medicines.
- Unless specifically described within these CPGs, medicines must not be combined within the same syringe.
- For each medicine, a standardised approach to drawing up, diluting and administering the medicine has been described. Taking a standardised approach reduces medication errors.
- The person with the medicine within their delegated scope of practice should usually be the person who draws up the medicine and administers it, as this reduces drug errors. However, it is acceptable for other personnel to draw up and/or administer the medicine, provided the person with the medicine within their delegated scope of practice is responsible for all aspects of medicine administration. For example, an EMT, Paramedic or ICP may allow a First Responder to administer ondansetron IM as a learning exercise, but the EMT, Paramedic or ICP is responsible for ensuring the 'five rights' as below.
- The person responsible for the administration of the medicine is responsible for ensuring the 'five rights':
  - a) The right medicine is being administered.
  - b) The right dose is being administered.
  - c) The right patient is receiving the medicine. In particular, the contraindications and cautions have been considered.
  - d) The right route is being used.
  - e) The medicine is being administered at the right time. In particular, the dosing interval is correct.
- All personnel are responsible for ensuring good practice:
  - a) If a second clinical person is present they must be shown the ampoule and asked to name it.

- b) The specified dilutions must be used.
- c) The syringe must be labelled with name of the medicine unless the medicine is being drawn up and administered in one uninterrupted manoeuvre. The concentration must be included on the label if the medicine has been diluted and the label must not obscure the volume markings on the syringe.
- d) If a second clinical person is present they should be asked to check the calculation of a diluted solution.
- e) If a medicine has a maximum dose and more than this has been drawn up, the excess dose must be discarded before administering the medicine.
- f) The person administering the medicine should clearly say the medicine name, dose and route out loud as it is administered.
- g) A medicine must not be provided to a transporting crew that is not within their delegated scope of practice, without instructions to do so from personnel on the Clinical Desk. For example, a Paramedic must not handover a patient to an EMT and provide the EMT with fentanyl for administration during transport, without being instructed to do so by personnel on the Clinical Desk.

### **Administering medicines with caution**

- The words 'use caution' or 'administer with caution' are used in a number of places within these CPGs.
- This indicates that personnel must consider the benefits and risks before administering the medicine, including the possibility of withholding the medicine, reducing the dose or extending the time between doses.

### **Documentation**

- All medicines administered must be documented, including:
  - a) The time, dose and route of administration.
  - b) The infusion rate, infusion concentration and total dose/volume administered, if an infusion is used.
- If a medicine is administered under supervision, the person providing the supervision should usually be recorded as the person administering it.

### **Reporting medicine errors**

- Medicine errors must be appropriately reported so that trends can be captured and preventable factors identified. This enables changes to be made to training and systems that improve patient safety.

## 14.2 Adenosine

### Mechanism of action

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

### Delegated scope of practice

- ICPs.

### Indications

- ✓ Patients aged greater than or equal to 12 years with SVT and a ventricular rate greater than or equal to 150/minute, and
  - Causing moderate cardiovascular compromise, or
  - Known to be responsive to adenosine.

### Contraindications

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

### Cautions

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

## **Use in pregnancy or when breastfeeding**

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

## **Dosage**

- 6 mg.
- A second dose of 12 mg may be administered if the rhythm fails to revert.

## **Administration**

- Administer undiluted as a rapid IV bolus, followed by a rapid flush of 20 ml of 0.9% sodium chloride, preferably via an antecubital fossa vein.

## **Common adverse effects**

- Bradycardia and/or sinus pause which may be up to 30 seconds.
- Shortness of breath and/or an urge to breathe deeply.
- Feeling light-headed.
- Nausea and flushing.
- Feeling of chest pressure and/or severe apprehension.

## **Usual onset of effect**

- 5-10 seconds.

## **Usual duration of effect**

- 10-20 seconds.

## **Pharmacokinetics**

- Adenosine is rapidly taken up and metabolised within seconds by red blood cells and vascular endothelial cells.

## **Usual preparation**

- Ampoule containing 6 mg in 2 ml.

## **Common interactions**

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

## **Additional information**

- Adenosine usually causes a brief period of very low cardiac output and this often causes the patient to feel severe apprehension and/or an impending sense of doom. Warn the patient they may feel awful but reassure them this will pass very quickly.
- Seek clinical advice if the patient is aged less than 12 years.

## 14.3 Adrenaline

### Mechanism of action

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

### Delegated scopes of practice

- EMTs: nebulised, IM, IN and topical adrenaline.
- Paramedics: all of the above and adrenaline IV for cardiac arrest.
- ICPs: all indications and all routes.

### Indications

- ✓ Cardiac arrest.
- ✓ Anaphylaxis.
- ✓ Severe asthma.
- ✓ Imminent respiratory arrest from COPD.
- ✓ Severe bradycardia.
- ✓ Blood pressure support if unresponsive to metaraminol.
- ✓ Septic shock, cardiogenic shock and neurogenic shock unresponsive to 0.9% sodium chloride IV and metaraminol IV.
- ✓ Moderate to severe stridor.
- ✓ IN for clinically significant epistaxis.
- ✓ Topical for clinically significant bleeding from a wound.

### Contraindications

- ✗ None.

### Cautions

- ⊖ Myocardial ischaemia. Adrenaline will increase myocardial oxygen consumption.
- ⊖ Tachydysrhythmias. Adrenaline will usually make tachydysrhythmias worse.

## Use in pregnancy or when breastfeeding

- Safe and should be administered when indicated.

## Dosage

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

## Administration

- Topical: dilute each mg of adrenaline to a total of 10 ml using 0.9% sodium chloride. This solution is 1:10,000 and contains 0.1 mg/ml. Apply topically in addition to direct pressure.
- IN: dilute each mg of adrenaline to a total of 10 ml using 0.9% sodium chloride. This solution is 1:10,000 and contains 0.1 mg/ml. Administer the appropriate dose into each bleeding nostril using a mucosal atomising device, in addition to direct pressure.
- Nebulised: administer undiluted.
- IM: administer undiluted. The preferred IM site is the lateral thigh. If this site is not suitable use the lateral upper arm.
- Cardiac arrest:
  - a) Adults and children whose weight has been rounded to 50 kg or more: administer undiluted as an IV bolus.
  - b) Children whose weight has been rounded to 40 kg or less: dilute 1 mg of adrenaline to a total of 10 ml using 0.9% sodium chloride. This solution is 1:10,000 and contains 0.1 mg/ml. Draw up the dose from this solution and administer as an IV bolus.
- IV infusion: place 1 mg of adrenaline into a 1 litre bag of 0.9% sodium chloride. Shake well and label. This solution is 1:1,000,000 and contains 0.001 mg/ml.
  - a) For an adult: administer as an IV infusion starting at 2 drops/second. Adjust the rate to the patient's condition.
  - b) For a child aged 5-14 years: administer as an IV infusion starting at 1 drop/second. Adjust the rate to the patient's condition.
- When administering an IV infusion of adrenaline using 1 mg of adrenaline in a 1 litre bag of 0.9% sodium chloride:
  - a) 2 drops/second via a standard IV administration set will administer approximately 0.4 mg/hour of adrenaline.
  - b) Record an estimate of the total dose of adrenaline administered.
- For all other IV administration: place 1 mg of adrenaline into a 1 litre bag of 0.9% sodium chloride, Shake well and label. This solution is 1:1,000,000 and contains 0.001 mg/ml. Draw up the dose from this solution and administer as an IV bolus.

## Common adverse effects

- Tachycardia.
- Tachydysrhythmia.
- Myocardial ischaemia.
- Ventricular ectopy.
- Hypertension.
- Nausea and vomiting.
- Tremor, anxiety and sweating.
- Hyperglycaemia.

## Usual onset of effect

- IV: 5-10 seconds.
- IM: 2-5 minutes.
- Nebulised, IN and topical: on contact with the target site.

## Usual duration of effect

- The cardiovascular effects last 5-15 minutes.
- The mast cell membrane effects may last for several hours.

## Usual preparation

- Ampoule containing 1 mg in 1 ml.

## Pharmacokinetics

- Adrenaline is metabolised by the liver and taken up by sympathetic nerve endings.
- There are no significant effects from liver impairment on acute administration.

## Common interactions

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





## 14.4 Amiodarone

### Mechanism of action

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

### Delegated scopes of practice

- Paramedics: cardiac arrest.
- ICPs: all indications.

### Indications

- ✓ Cardiac arrest with VF or VT at any time after the first dose of adrenaline.
- ✓ Adults with sustained VT in the absence of cardiac arrest.
- ✓ Adults with moderate cardiovascular compromise as a result of fast atrial fibrillation or fast atrial flutter.

### Contraindications

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

### Cautions

- ⊖ None if the patient is in cardiac arrest.
- ⊖ Poor perfusion or signs of low cardiac output. Amiodarone reduces inotropy and may cause a significant fall in cardiac output, particularly when administered rapidly.
- ⊖ Hypotension. Amiodarone causes vasodilation and may worsen hypotension, particularly when administered rapidly.
- ⊖ Atrial fibrillation associated with sepsis. Amiodarone may cause a significant fall in cardiac output.

- ⊖ Known sick sinus syndrome without an internal pacemaker in place. Amiodarone slows the heart rate and severe bradycardia may occur following reversion of a tachydysrhythmia.
- ⊖ Previous 2<sup>nd</sup> or 3<sup>rd</sup> degree heart block without an internal pacemaker in place. Amiodarone slows the heart rate and severe bradycardia may occur following reversion of a tachydysrhythmia.
- ⊖ Pregnancy.

### **Use in pregnancy or when breastfeeding**

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

### **Dosage**

- Cardiac arrest:
  - a) 300 mg for an adult.
  - b) If VF or VT persists, a second dose of 150 mg may be administered.
  - c) See the paediatric drug dose tables for a child.
- Tachydysrhythmia in an adult:
  - a) 300 mg IV over 30 minutes.
  - b) A further 150 mg IV over 30 minutes may be administered if the tachydysrhythmia persists.

### **Administration**

- Cardiac arrest: administer IV undiluted as a bolus.
- Tachydysrhythmia:
  - a) Place 300 mg of amiodarone in 100 ml of 5% glucose and label. 1 drop/second via a standard IV administration set will deliver 100 ml over approximately 30 minutes. Slow the rate of infusion if hypotension occurs.
  - b) The administration set will need to be flushed with 0.9% sodium chloride to ensure that all of the amiodarone has been administered.
  - c) An IV infusion over 30 minutes is the preferred method of administration. However, it is acceptable to dilute 300 mg of amiodarone to a total volume of 20-30 ml using 5% glucose or 0.9% sodium chloride. Administer this IV over 30 minutes and slow the rate of infusion if hypotension occurs.

### **Common adverse effects**

- Hypotension.
- Feeling light-headed.
- Bradydysrhythmia.

## Usual onset of effect

- 5-10 minutes.

## Usual duration of effect

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

## Usual preparation

- Ampoule containing 150 mg in 3 ml.

## Pharmacokinetics

- Amiodarone is metabolised in the liver.
- There are no significant effects from liver impairment on acute administration.

## Common interactions

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

## Additional information

- If the indication is atrial fibrillation causing moderate cardiovascular compromise, the goal of treatment is to control the ventricular rate and not to revert the rhythm to sinus rhythm, although treatment with amiodarone may result in reversion of the rhythm to sinus rhythm. If a patient has been in atrial fibrillation for longer than a few days, there is a small risk that this may be associated with emboli leaving the left atrium. This is why amiodarone is reserved for patients with cardiovascular compromise that is clinically significant.
- If amiodarone is commenced, the full dose should be administered even if the rhythm reverts to sinus rhythm, unless severe hypotension or bradycardia occurs.
- Amiodarone is often described as relatively contraindicated in the presence of a prolonged QT interval, but this only applies to long-term administration.
- When diluting amiodarone with 0.9% sodium chloride the solution will go slightly cloudy. This does not adversely affect the amiodarone.
- Avoid shaking the ampoule because this will cause the solution to froth.

## 14.5 Amoxicillin/clavulanic acid

### Mechanism of action

- Amoxicillin/clavulanic acid is a beta-lactam antibiotic with broad activity against gram-negative and gram-positive bacteria. It also has some activity against anaerobic bacteria, particularly those from the mouth.
- Amoxicillin is the active ingredient and is part of the penicillin class of antibiotics. Amoxicillin inhibits production of the bacterial cell wall, causing bacteria to die.
- Many bacteria are resistant to amoxicillin due to their ability to produce beta-lactamase (an enzyme) which destroys the active part of beta-lactam antibiotics. Clavulanic acid inhibits the beta-lactamase enzyme and has no direct antibacterial action.

### Delegated scopes of practice

- Paramedics and ICPs.

### Indications

- ✓ Sepsis and:
  - The patient is aged greater than or equal to 12 years, and
  - One or more high risk factors are present, and
  - Time to hospital is greater than 30 minutes.
- ✓ Cellulitis. In this setting a single IV dose may be administered if the patient is being referred to primary care and there may be a delay in the patient seeing a doctor.

### Contraindications

- ✗ Known severe allergy.
- ✗ Known severe allergy to penicillins. Up to 10% of the population claim to have a penicillin allergy, but only approximately 1% will have a clinically significant allergy. Unless the allergy is clearly severe, amoxicillin/clavulanic acid should be administered.
- ✗ Anaphylaxis to any beta-lactam antibiotic, for example penicillins or cephalosporins.

### Cautions

- ⊖ None.

### Use in pregnancy or when breastfeeding

- Safe and should be administered if indicated.

## Dosage

- 1.2 g.

## Administration

- Dissolve 1.2 g using approximately 4 ml of 0.9% sodium chloride and dilute to a total of 10 ml.
- Administer IV over 1-2 minutes, preferably into a running IV line.
- Do not administer IM if IV access cannot be obtained.

## Common adverse effects

- None.

## Usual onset of effect

- 30-60 minutes.

## Usual duration of effect

- 6-8 hours.

## Usual preparation

- Ampoule containing 1 g of amoxicillin and 200 mg of clavulanic acid as a powder for reconstitution.

## Pharmacokinetics

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

## Common interactions

- None.

## Additional information

- Rash is common with penicillin antibiotics and is not a contraindication.
- Diarrhoea and/or vaginal candidiasis (thrush) is common following a course of amoxicillin/clavulanic acid and is due to an antibiotic effect on the bacterial flora within the bowel and vagina. This is not an allergy.
- Seek clinical advice if the patient is aged less than 12 years.



## 14.6 Aspirin

### Mechanism of action

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

### Delegated scopes of practice

- EMTs, Paramedics and ICPs.

### Indications

- ✓ Myocardial ischaemia.

### Contraindications

- ✗ Known severe allergy.
- ✗ Third trimester of pregnancy.

### Cautions

- ⊖ Known bleeding disorder. Aspirin will increase the risk of bleeding, however the balance of risk is usually in favour of administering aspirin.
- ⊖ Clinically significant bleeding. Aspirin will increase the risk of bleeding and the nature and risk of the bleeding must be taken into account.
- ⊖ Known worsening of bronchospasm with NSAIDs. Some patients with asthma or COPD have known worsening of bronchospasm with NSAIDs (including aspirin) and a decision must be made based on the balance of risk. If there is a clear history of significant bronchospasm with NSAIDs, aspirin should be withheld.

### Use in pregnancy or when breastfeeding

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

### Dosage

- 300 mg.

## **Administration**

- Administer PO. Dispersible tablets may be chewed or dissolved in water.

## **Common adverse effects**

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

## **Usual onset of effect**

- 30-60 minutes.

## **Usual duration of effect**

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

## **Usual preparation**

- 300 mg dispersible tablets.

## **Pharmacokinetics**

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

## **Common interactions**

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

## **Additional information**

- 111 Call Handlers will give instructions for patients to take aspirin if they are suspected of having myocardial ischaemia. This means that some patients that do not have myocardial ischaemia will be advised to take aspirin. The risk for these patients is extremely low and there is potential benefit for those patients who are experiencing myocardial ischaemia.
- The contraindications to aspirin in the call handling protocols are different to those within these CPGs and these differences are not clinically significant.
- Many patients have enteric coated aspirin and not dispersible aspirin and they will be given instructions to chew and swallow their enteric coated aspirin.

- Enteric coated aspirin is not destroyed when it is chewed and will be absorbed. It is however, quite unpleasant to chew and swallow.
  - a) If the patient still has the tablets in their mouth, ask them to spit the tablets out and administer an additional 300 mg of dispersible aspirin.
  - b) If the patient has chewed and swallowed 300 mg of aspirin (including enteric coated aspirin), do not administer additional aspirin.
  - c) If the patient has swallowed (without chewing) 300 mg of enteric coated aspirin, administer an additional 300 mg of dispersible aspirin. This is because absorption of the enteric coated aspirin will be delayed.
  - d) If it is unclear what the patient has taken, administer an additional 300 mg of dispersible aspirin.
- Urea also impairs platelet function, but aspirin is not contraindicated in the setting of renal failure.





## 14.7 Atropine

### Mechanism of action

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

### Delegated scopes of practice

- ICPs.

### Indications

- ✓ Adults with sinus bradycardia, nodal bradycardia, 1<sup>st</sup> degree heart block, 2<sup>nd</sup> degree heart block or an undifferentiated narrow complex bradycardia causing clinically significant cardiovascular compromise.
- ✓ Organophosphate poisoning.

### Contraindications

- ✗ Known severe allergy.

### Cautions

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

### Use in pregnancy or when breastfeeding

- Safe and should be administered when indicated.
- May be administered if the patient is breastfeeding. Advise the patient to stop breastfeeding and seek further advice from their lead maternity carer or GP.

### Dosage

- 0.6 mg for an adult. Repeat as required without a maximum dose, if the bradycardia is responsive to atropine.
- Repeated and escalating doses are likely to be required for organophosphate poisoning.

### Administration

- Administer undiluted as a rapid IV bolus. Slow administration may result in transient bradycardia.

## Common adverse effects

- Tachycardia.
- Confusion. Particularly in the elderly or those with intellectual impairment.
- Dry mouth.
- Blurred vision.

## Usual onset of effect

- 5-10 seconds.

## Usual duration of effect

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

## Usual preparation

- Ampoule containing 0.6 mg in 1 ml.

## Pharmacokinetics

- Atropine is predominantly metabolised in the liver, but some is excreted in urine.
- There are no significant effects from liver or kidney impairment on acute administration.

## Common interactions

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



## 14.8 Calcium chloride

### Mechanism of action

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

### Delegated scopes of practice

- ICPs.

### Indications

- ✓ Release syndrome following crush injury in adults.

### Contraindications

- ✗ Known severe allergy.

### Cautions

- ⊖ None.

### Use in pregnancy or when breastfeeding

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

### Dosage

- 6.8 mmol (1 g of calcium) IV over 1 minute for an adult.
- Repeat the dose if signs of hyperkalaemia persist or recur.
- Seek clinical advice for a child.

### Administration

- Administer IV over 1 minute into a large vein via a running line, as this reduces venous irritation.
- Do not mix with other medicines (and in particular do not mix with sodium bicarbonate) as precipitation will occur. If other medicines are being administered via the same vein, ensure a minimum flush of 50 ml of 0.9% sodium chloride between medicines.

### **Common adverse effects**

- Venous irritation including redness and pain at the site of injection.
- Tingling sensation.
- Rapid administration may cause dysrhythmias.

### **Usual onset of effect**

- 2-5 minutes.

### **Usual duration of effect**

- 1-4 hours.

### **Usual presentation**

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

### **Pharmacokinetics**

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

### **Common interactions**

- None.

### **Additional information**

- Document the dose administered in mmol.
- Calcium gluconate is an alternative formulation of calcium, usually containing 2.2 mmol/10 ml. Administer two ampoules at a time if only calcium gluconate is available.



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## 14.9 Ceftriaxone

### Mechanism of action

- Ceftriaxone is a cephalosporin antibiotic with broad activity against gram-negative and gram-positive bacteria. It inhibits production of the bacterial cell wall, causing bacteria to die.

### Delegated scopes of practice

- Paramedics and ICPs.

### Indications

- ✓ Suspected meningococcal septicaemia.

### Contraindications

- ✗ Anaphylaxis to cephalosporins.

### Cautions

- ⊖ None.

### Use in pregnancy or when breastfeeding

- Safe and should be administered if indicated.

### Dosage

- 2 g IV for an adult.
- 2 g IM for an adult if IV access cannot be immediately obtained.
- See the paediatric drug dose tables for a child.

### Administration

- IV administration:
  - a) Add approximately 4 ml of 0.9% sodium chloride to a 2 g ampoule and shake until dissolved.
  - b) Draw up the ampoule and dilute to a total of 10 ml.
  - c) Discard unrequired volume before administration for a child.
  - d) Administer IV over 1-2 minutes, preferably into a running line.
- IM administration:
  - a) Add 4 ml of 0.9% sodium chloride to a 2 g ampoule and shake until dissolved.
  - b) Draw up the ampoule using two syringes with approximately half in each. The total volume will be 5 ml.
  - c) Discard unrequired volume before administration for a child.
  - d) Administer one syringe into each lateral thigh. If this site is not suitable, use each lateral upper arm.

## Common adverse effects

- None.

## Usual onset of effect

- 30-60 minutes.

## Usual duration of effect

- 24 hours.

## Usual preparation

- Ampoule containing 2 g of ceftriaxone as a powder for reconstitution.

## Pharmacokinetics

- 50% is excreted in urine and 50% in bile.
- Neither renal impairment nor hepatic impairment alter the initial (loading) dose.

## Common interactions

- None.

## Additional information

- Some references describe dissolving ceftriaxone using 1% lignocaine for IM injection, to reduce the pain of injection. In the setting of suspected meningococcal septicaemia this reduction in pain is not significant and ceftriaxone should be dissolved using 0.9% sodium chloride.
- As meningococcal bacteria die they release endotoxins. The body's immune response to endotoxins can cause profound worsening of shock following antibiotic administration. Be prepared to treat this with 0.9% sodium chloride IV, and metaraminol or adrenaline IV. It is rare for significant amounts of endotoxins to be released from other bacteria.



## 14.10 Clopidogrel

### Mechanism of action

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

### Delegated scopes of practice

- Paramedics and ICPs.

### Indications

- ✓ STEMI in conjunction with fibrinolytic therapy.

### Contraindications

- ✗ Known severe allergy.

### Cautions

- ⊖ Clinically significant bleeding. Clopidogrel will increase bleeding.
- ⊖ At risk of bleeding. If there are any cautions or contraindications present within the fibrinolytic/PCI checklist, personnel must seek clinical advice or discuss with the STEMI coordinator prior to administration.
- ⊖ Pregnancy.

### Use in pregnancy or when breastfeeding

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

### Dosage

- 300 mg if the patient is aged less than 75 years.
- 75 mg if the patient is aged greater than or equal to 75 years.

### Administration

- Administer PO.

### Common adverse effects

- Increased bleeding.

### Usual onset of effect

- 30-60 minutes.

**Usual duration of effect**

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

**Usual preparation**

- 75 mg tablets.

**Pharmacokinetics**

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

**Common interactions**

- The risk of bleeding will be increased if the patient is taking an anticoagulant.





# 14.11 Droperidol

## Mechanism of action

- Droperidol blocks dopamine and alpha receptors centrally, resulting in sedation, reduced agitation and a state of mental detachment.

## Delegated scopes of practice

- Paramedics and ICPs.

## Indications

- ✓ Patients aged greater than or equal to 12 years with agitated delirium causing a mild to moderate risk to safety, when olanzapine has not been administered or is ineffective.

## Contraindications

- ✗ Known severe allergy.

## Cautions

- ⊖ Parkinson's disease. There is a risk of worsening the movement disorder associated with Parkinson's disease.
- ⊖ Concurrent administration of other sedatives. This will increase and prolong the effects.
- ⊖ Intoxication. This will increase and prolong the effects.
- ⊖ Elderly and/or frail. These will increase and prolong the effects.

## Use in pregnancy or when breastfeeding

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

## Dosage

- 10 mg IM or IV.
- Reduce the dose to 5 mg if the patient is frail.
- The dose may be repeated once after 20 minutes.

## Administration

- Administer IM undiluted. The preferred site is the lateral thigh as this has the best absorption. If this site is not suitable use the lateral upper arm. The IM route is as effective as the IV route.
- Dilute 10 mg to a total of 10 ml and administer IV over 1-2 minutes.
- IV administration may occur if IV access is already in place, but IM administration should not be delayed while IV access is obtained.

### **Common adverse effects**

- Hypotension. This particularly occurs if an IV dose is administered rapidly.

### **Usual onset of effect**

- 5-10 minutes.

### **Usual duration of effect**

- 4-6 hours.

### **Usual preparation**

- Ampoule containing 10 mg in 2 ml.

### **Pharmacokinetics**

- Droperidol is predominantly metabolised in the liver with metabolites being excreted in the urine.
- There are no significant effects from liver impairment on acute administration.

### **Common interactions**

- Intoxication. Droperidol will have increased sedative effects if the patient is intoxicated with alcohol or has taken recreational drugs.
- Sedative drugs. Concurrent administration with other sedative drugs (such as olanzapine or midazolam) will result in an increased sedative effect.

### **Additional information**

- Droperidol has been reported to prolong the QT interval. This generally involved repeated and/or high doses and one or two doses are safe, even if the patient is known to have a prolonged QT interval.
- Droperidol may cause dyskinesia (abnormal, uncoordinated and involuntary movements) but this is unusual following one or two doses.



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## 14.12 Enoxaparin

### Mechanism of action

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

### Delegated scopes of practice

- Paramedics and ICPs.

### Indications

- ✓ STEMI in conjunction with fibrinolytic therapy.

### Contraindications

- ✗ Known severe allergy.

### Cautions

- ⊖ Clinically significant bleeding. Enoxaparin will increase bleeding.
- ⊖ At risk of bleeding. If there are any cautions or contraindications present within the fibrinolytic/PCI checklist, personnel must seek clinical advice or discuss with the STEMI coordinator prior to administration.
- ⊖ Pregnancy.

### Use in pregnancy or when breastfeeding

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

## Dosage

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

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

## Administration

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

## Common adverse effects

- Increased bleeding.

## Usual onset of effect

- 10-30 minutes.

## Usual duration of effect

- 12-24 hours.

## Usual preparation

- Pre-filled syringe containing 100 mg in 1 ml.

## Pharmacokinetics

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

## Common interactions

- The risk of bleeding will be increased if the patient is taking an anticoagulant.

# 14.13 Fentanyl

## Mechanism of action

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

## Delegated scopes of practice

- Paramedics and ICPs.

## Indications

- ✓ Moderate to severe pain.
- ✓ Cardiogenic pulmonary oedema with severe anxiety.
- ✓ Rapid sequence intubation.
- ✓ Sedation post intubation.
- ✓ Symptom control during end of life care.

## Contraindications

- ✗ Known severe allergy.
- ✗ Unable to obey commands (exceptions: administration for RSI, end of life care and post intubation).
- ✗ Respiratory depression.

## Cautions

- ⊖ Aged less than one year. Children under the age of one year are at increased risk of respiratory depression following opiate administration.
- ⊖ At high risk of respiratory depression. For example, severe COPD, morbid obesity or on home BiPAP. Such patients may develop respiratory depression following opiate administration.
- ⊖ Labour. Opiates cross the placenta and may cause drowsiness and/or respiratory depression in the baby, particularly when administered within an hour or two of birth. Discuss administration with the lead maternity carer if possible. Following birth, close observation of the baby is required and personnel must be prepared to treat respiratory depression.
- ⊖ Concurrent administration of other opiates, ketamine or midazolam. This will increase and prolong the effects.
- ⊖ Elderly and/or frail. These will increase and prolong the effects.
- ⊖ Signs of shock. Fentanyl may make shock worse.

## Use in pregnancy or when breastfeeding

- Safety has not been demonstrated in pregnancy, but fentanyl should be administered if indicated.
- May be administered if the patient is breastfeeding. Advise the patient to stop breastfeeding and seek further advice from their lead maternity carer or GP.

## Dosage

- IV for analgesia:
  - a) 10-50 mcg every five minutes for an adult. Use a dose at the lower end of the range if the patient is small, frail or cardiovascularly unstable.
  - b) See the paediatric drug dose tables for a child.
- IN for analgesia:
  - a) 100 mcg IN for an adult weighing 80 kg or less. Further doses of 50 mcg may be administered every ten minutes without a maximum dose. Halve these doses if the patient is frail or cardiovascularly unstable.
  - b) 200 mcg IN for an adult weighing greater than 80 kg. Further doses of 100 mcg may be administered every ten minutes without a maximum dose. Halve these doses if the patient is frail or cardiovascularly unstable.
  - c) See the paediatric drug dose tables for a child.
- IM for analgesia if IV access cannot be obtained and IN administration is inappropriate:
  - a) 50-100 mcg IM for an adult. Use a dose at the lower end of the range if the patient is small, frail or cardiovascularly unstable. This may be repeated once after 20 minutes.
  - b) See the paediatric drug dose tables for a child. This may be repeated once after 20 minutes.
- IV for RSI: see the 'RSI' section.
- IV for sedation post intubation: see the 'post intubation' section.

## Administration

- The preferred route for administration is IV.
- IV for analgesia:
  - a) Dilute 100 mcg to a total of 10 ml for an adult or a child whose weight has been rounded up to 30 kg or more. This final solution contains 10 mcg/ml.
  - b) Dilute 100 mcg to a total of 100 ml for a child whose weight has been rounded up to 20 kg or less. This final solution contains 1 mcg/ml.
- IN administration in children:
  - a) Draw up fentanyl undiluted, placing half of the total dose into two separate 1 ml syringes. When drawing up the first syringe, draw up an additional 0.1 ml of fentanyl over and the above the planned volume and expel this slowly through the mucosal atomiser in order to fill the dead space. This does not need to be done with subsequent doses.

- b) Administer fentanyl IN by rapidly injecting one syringe (half of the total dose) into each nostril. Rapid injection is required in order to achieve a fine mist, which maximises absorption.
- IN administration in adults:
  - a) Draw up fentanyl undiluted using 1 ml syringes. Administer a maximum of 1 ml at a time per nostril. The dead space of the mucosal atomiser is very small in relation to the overall volume administered and does not need to be taken into account.
  - b) Administer fentanyl IN by rapidly injecting one syringe (half of the total dose) into each nostril. Rapid injection is required in order to achieve a fine mist, which maximises absorption.
  - c) If the dose is 200 mcg, administer 1 ml into each nostril, wait five minutes and then administer a further 1 ml into each nostril. This maximises absorption.
- IM administration: administer undiluted.

### **Common adverse effects**

- Respiratory depression.
- Bradycardia.
- Hypotension.
- Sedation.
- Nausea and vomiting.
- Itch.
- Euphoria.

### **Usual onset of effect**

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

### **Usual duration of effect**

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

### **Usual preparation**

- Ampoule containing 100 mcg in 2 ml.

## Pharmacokinetics

- Fentanyl is more lipophilic (fat soluble) than morphine and this is why fentanyl is well absorbed through the nasal mucosa.
- Fentanyl may cause a small amount of histamine release. In combination with relief of pain this usually results in a small fall in blood pressure.
- Fentanyl is metabolised in the liver.
- There are no significant effects from liver impairment on acute administration.

## Common interactions

- The effects will be increased in the presence of other opiates and sedatives, for example benzodiazepines or alcohol.

## Additional information

- A patient administered fentanyl must be given a clear recommendation to be transported to a medical facility by ambulance, unless the patient is being treated using the 'end of life care' section, the 'patella dislocation' section, or the 'shoulder dislocation' section.
- Transport should usually be to an ED unless the patient has a chronic condition and can be taken to a primary care facility with staff that know the patient well.





# 14.14 Gentamicin

## Mechanism of action

- Gentamicin is an aminoglycoside antibiotic with broad activity against gram-negative bacteria. It inhibits bacterial cell protein synthesis.

## Delegated scopes of practice

- Paramedics and ICPs.

## Indications

- ✓ Sepsis (in addition to amoxicillin/clavulanic acid), where the site of infection is the urinary tract, the abdomen, or is unknown and:
  - The patient is aged greater than or equal to 12 years, and
  - One or more high risk factors are present, and
  - Time to hospital is greater than 30 minutes.

## Contraindications

- ✗ Known severe allergy.
- ✗ Pregnancy.

## Cautions

- ⊖ None.

## Use in pregnancy or when breastfeeding

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

## Dosage

- 400 mg if weighs greater than 80 kg.
- 320 mg if weighs 60-80 kg.
- 240 mg if weighs less than 60 kg.

## Administration

- Dilute the dose to a total of 10-20 ml using 0.9% sodium chloride and administer IV over 1-2 minutes, preferably into a running IV line.
- Do not administer IM if IV access cannot be obtained.

### **Common adverse effects**

- Although renal impairment is commonly listed, this is usually not of significant concern unless there is repeated and/or prolonged dosing.
- Ototoxicity (damage to the inner ear) has been reported, but this usually only happens with repeated and/or prolonged dosing.

### **Usual onset of effect**

- 30-60 minutes.

### **Usual duration of effect**

- 24 hours.

### **Usual preparation**

- Ampoule containing 80 mg in 2 ml.

### **Pharmacokinetics**

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

### **Common interactions**

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

### **Additional information**

- Gentamicin is not contraindicated if the patient has renal failure.
- Seek clinical advice if the patient is aged less than 12 years.



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## 14.15 Glucagon

### Mechanism of action

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

### Delegated scopes of practice

- EMTs, Paramedics and ICPs.

### Indications

- ✓ Hypoglycaemia when the patient cannot safely swallow glucose/food and IV access cannot be obtained.

### Contraindications

- ✗ Known severe allergy.

### Cautions

- ⊖ None.

### Use in pregnancy or when breastfeeding

- Safe and should be administered if indicated.

### Dosage

- 1 mg IM once for an adult or child aged greater than or equal to five years.
- 0.5 mg IM once for a child aged less than five years.

### Administration

- Dissolve the powder using the syringe within the kit and administer IM.
- The preferred site is the lateral thigh as this has the best absorption. If this site is not suitable use the lateral upper arm.

### Common adverse effects

- None.

### Usual onset of effect

- 5-10 minutes.

### Usual duration of effect

- 15-60 minutes.

### Usual preparation

- Ampoule containing 1 mg as powder.

## Pharmacokinetics

- Glucagon is predominantly excreted unchanged into bile and urine.
- There are no significant effects from liver or kidney impairment on acute administration.

## Common interactions

- None.

## Additional information

- Glucagon relies on stored glycogen being available to exert its effect and if glycogen stores are not available, glucagon may be ineffective. Examples include if the patient:
  - Does not have diabetes.
  - Has sepsis.
  - Is a young child.
  - Has undergone strenuous exercise.
  - Has not eaten food for more than 12 hours.
  - Is suffering from adrenal insufficiency.
  - Is suffering from chronic hypoglycaemia.
  - Is suffering from alcohol-induced hypoglycaemia.
- Following glucagon administration the patient's glycogen stores will be depleted. For this reason it is important the patient eats food as described in the 'hypoglycaemia' section.
- Glucagon also reduces the tone and motility of the smooth muscle in the gastrointestinal tract, but is not recommended in the setting of oesophageal obstruction.
- Glucagon is sometimes suggested as part of the treatment for bradycardia caused by beta-blockers because it stimulates cardiac cells via a mechanism that is independent of the beta receptor. However, glucagon has almost no role in the out-of-hospital setting because it rarely provides a sustained heart rate rise in addition to adrenaline and requires much higher doses than that carried by ambulance personnel.



## 14.16 Glucose gel

### Mechanism of action

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

### Delegated scopes of practice

- All personnel. ATP is not required to administer glucose gel.

### Indications

- ✓ Hypoglycaemia in adults and children provided the patient is conscious enough to be able to swallow safely.
- ✓ Hypoglycaemia in neonates.

### Contraindications

- ✗ None.

### Cautions

- ⊖ None.

### Use in pregnancy or when breastfeeding

- Safe and should be administered if indicated.

### Dosage

- 10-20 g for all ages.
- Administer one sachet and repeat every ten minutes if hypoglycaemia persists or recurs.

### Administration

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

### Common adverse effects

- None.

### Usual onset of effect

- 5-10 minutes.

### Usual duration of effect

- 30-60 minutes.



## 14.17 Glyceryl trinitrate (GTN) spray

### Mechanism of action

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

### Delegated scopes of practice

- EMTS, Paramedics and ICPs.

### Indications

- ✓ Myocardial ischaemia.
- ✓ Cardiogenic pulmonary oedema.
- ✓ Control of hypertension associated with autonomic dysreflexia.
- ✓ Control of hypertension (usually in conjunction with labetalol or metoprolol) prior to fibrinolytic treatment for STEMI.
- ✓ Control of hypertension (usually in conjunction with labetalol or metoprolol) during inter-hospital transfer for STEMI.

### Contraindications

- ✗ Known severe allergy.
- ✗ Systolic BP less than 100 mmHg.
- ✗ Heart rate less than 40/minute.
- ✗ Heart rate greater than 150/minute.
- ✗ Ventricular tachycardia.

### Cautions

- ⊖ STEMI, particularly STEMI involving the right ventricle. GTN may cause a significant fall in cardiac output and if there are signs of low cardiac output GTN should be withheld.
- ⊖ The patient is small, frail or physiologically unstable.
- ⊖ Poor perfusion. This is a sign of reduced cardiac output which may fall further with GTN administration.

- Dysrhythmia. This may cause a reduced cardiac output which may fall further with GTN administration.
- A drug for erectile dysfunction has been taken within the last 24 hours. See common interactions.
- Known aortic or mitral stenosis. With aortic or mitral stenosis, cardiac output may be reduced as a result of the narrowed valve and a fall in preload may cause a further fall in cardiac output.

### **Use in pregnancy or when breastfeeding**

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

### **Dosage**

- Myocardial ischaemia: 0.4 mg every 3-5 minutes. Increase the dosing interval to ten minutes if caution is required.
- Cardiogenic pulmonary oedema: 0.8 mg every 3-5 minutes. Increase the dosing interval to ten minutes if caution is required. Increase the dose and frequency if the patient is not improving, provided the systolic BP is greater than 100 mmHg.
- Control of hypertension: 0.4-0.8 mg every 3-5 minutes.

### **Administration**

- Spray under the tongue. If this cannot be achieved it is acceptable to spray into the mouth.
- If GTN is administered in the presence of a caution:
  - a) The patient should be lying flat.
  - b) IV access should have been obtained whenever possible.
  - c) The dosing interval should be increased to ten minutes.
  - d) Personnel should be ready to administer 0.9% sodium chloride IV if there is a significant fall in cardiac output or blood pressure.

### **Common adverse effects**

- Hypotension.
- Flushing.
- Headache.
- Tachycardia.
- Feeling light-headed.

### **Usual onset of effect**

- 1-2 minutes.



## Usual duration of effect

- 15-30 minutes.

## Usual preparation

- Metered dose bottle delivering 0.4 mg doses.

## Pharmacokinetics

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

## Common interactions

- The effects may be increased if the patient is taking an antihypertensive medicine.
- Severe and/or prolonged hypotension may occur if a medicine for erectile dysfunction has been taken within the last 24 hours:
  - 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.
  - All of these medicines are long-acting vasodilators and the administration of GTN may cause further vasodilation.

## Additional information

- GTN must be used with caution in the presence of STEMI because the risks may outweigh the benefits:
  - GTN may cause a significant fall in cardiac output.
  - GTN has a role in treating symptomatic myocardial ischaemia, but does not usually have a significant role in treating STEMI.
- Particular caution must be used in the presence of STEMI involving the right ventricle and personnel must have a low threshold for withholding GTN:
  - STEMI involving the right ventricle can result in a significant reduction in right ventricular contractility.
  - When the right ventricle is significantly impaired, it may provide little in the way of contribution to cardiac output and blood may be passively flowing down a pressure gradient between the inferior vena cava (IVC), the superior vena cava (SVC) and the left atrium.
  - This may result in the preload (filling) of the left side of the heart being dependent on the venous pressures within the IVC and SVC.
  - GTN can result in a significant fall in venous pressure (and thus a fall in preload) which may cause a significant fall in cardiac output.

## 14.18 Glyceryl trinitrate (GTN) patch

### Mechanism of action

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

### Delegated scopes of practice

- EMTS, Paramedics and ICPs.

### Indications

- ✓ Cardiogenic pulmonary oedema not rapidly responding to GTN SL.
- ✓ Control of hypertension associated with autonomic dysreflexia not rapidly responding to GTN SL.
- ✓ Control of hypertension prior to fibrinolysis for STEMI.
- ✓ Control of hypertension during inter-hospital transfer for STEMI.
- ✓ Control of hypertension during inter-hospital transfer for stroke clot retrieval.

### Contraindications

- ✗ Known severe allergy.
- ✗ Systolic BP less than 100 mmHg.
- ✗ Heart rate less than 40/minute
- ✗ Heart rate greater than 150/minute.
- ✗ Ventricular tachycardia.

### Cautions

- ⊖ STEMI, particularly STEMI involving the right ventricle. GTN may cause a significant fall in cardiac output, however if the patient is hypertensive the balance of risk is usually in favour of administering GTN with caution.
- ⊖ The patient is small, frail or physiologically unstable.
- ⊖ Poor perfusion. This is a sign of reduced cardiac output which may fall further with GTN administration.

- Dysrhythmia. This may cause a reduced cardiac output which may fall further with GTN administration.
- A drug for erectile dysfunction has been taken within the last 24 hours. See common interactions.
- Known aortic or mitral stenosis. With aortic or mitral stenosis, cardiac output may be reduced as a result of the narrowed valve and a fall in preload may cause a further fall in cardiac output.

### **Use in pregnancy or when breastfeeding**

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

### **Dosage**

- Apply a transdermal therapeutic system (TTS) 10 patch. This releases approximately 0.5 mg of GTN per hour.

### **Administration**

- Apply to dry skin, preferably on the lateral aspect of the upper arm.
- Avoid areas of skin with significant hair whenever possible and consider shaving the skin if significant hair is present.

### **Common adverse effects**

- Hypotension.
- Flushing.
- Headache.
- Tachycardia.
- Feeling light-headed.

### **Usual onset of effect**

- 10-20 minutes.

### **Usual duration of effect**

- 18 hours. The effect will dissipate over 10-20 minutes once the patch is removed.

### **Usual preparation**

- A transdermal patch of approximately 20 cm<sup>2</sup> in size.

## Pharmacokinetics

- GTN is released from the patch into the skin and is then absorbed into the circulation, reaching a plateau of absorption rate at approximately two hours.
- GTN is predominantly metabolised in the liver.
- There are no significant effects from liver impairment on administration.

## Common interactions

- The effects may be increased if the patient is taking an antihypertensive medicine.
- Severe and/or prolonged hypotension may occur if a medicine for erectile dysfunction has been taken within the last 24 hours:
  - 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.
  - All of these medicines are long-acting vasodilators and the administration of GTN may cause further vasodilation.



# 14.19 Heparin

## Mechanism of action

- Heparin is an anticoagulant. It potentiates the activity of antithrombin III (a naturally occurring anticoagulant) causing inhibition of multiple coagulation factors.

## Delegated scopes of practice

- Paramedics and ICPs.

## Indications

- ✓ STEMI in conjunction with fibrinolytic therapy.

## Contraindications

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

## Cautions

- ⊖ Clinically significant bleeding. Heparin will increase bleeding.
- ⊖ At risk of bleeding. If there are any cautions or contraindications present within the fibrinolytic/PCI checklist, personnel must seek clinical advice or discuss with the STEMI coordinator prior to administration.
- ⊖ Pregnancy.

## Use in pregnancy or when breastfeeding

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

## Dosage

- 5000 units.

## Administration

- Dilute to a total volume of 10 ml using 0.9% sodium chloride.
- Administer IV over 1-2 minutes.

## Common adverse effects

- Increased bleeding.



## 14.20 Hydrocortisone

### Mechanism of action

- Hydrocortisone is a corticosteroid with anti-inflammatory and immunosuppressant actions. It inhibits the production of inflammatory mediators, including prostaglandins and leukotrienes, resulting in a reduction in the inflammatory and immune response.

### Delegated scopes of practice

- ICPs.

### Indications

- ✓ Adults with angioedema occurring during inter-hospital transfer for stroke clot retrieval.

### Contraindications

- ✗ Known severe allergy.

### Cautions

- ⊖ None.

### Use in pregnancy or when breastfeeding

- Safety has not been demonstrated during pregnancy. However, there is significant clinical experience with steroids, they appear to be safe and hydrocortisone should be administered if indicated.
- May be administered if the patient is breastfeeding. Advise the patient to stop breastfeeding and seek further advice from their lead maternity carer or GP.

### Dosage

- 100 mg.

### Administration

- Press down on the plastic cap to force the diluent into the vial.
- Shake until the powder is dissolved.
- Remove the central plastic cap and draw up the contents.
- Dilute to approximately 10 ml using 0.9% sodium chloride and administer IV over 1-2 minutes.

### Common adverse effects

- Fatigue.
- Sodium and water retention. This may worsen hypertension and heart failure, but is usually only of clinical significance with repeated and/or prolonged dosing.

**Usual onset of effect**

- 10-20 minutes.

**Usual duration of effect**

- 8-12 hours.

**Usual preparation**

- Vial with two chambers, one containing 100 mg of hydrocortisone powder and the other containing 2 ml of sterile water for reconstitution.

**Pharmacokinetics**

- Hydrocortisone is metabolised in the liver.
- Clearance is prolonged if the patient has significant liver impairment, but this does not alter the initial (loading) dose.

**Common interactions**

- None.

**Additional information**

- Hydrocortisone may have a role in treating hypoadrenal states if the patient does not have their own hydrocortisone for administration. In this setting seek clinical advice.
- Hydrocortisone is not carried in all ambulances.





## 14.21 Ibuprofen

### Mechanism of action

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

### Delegated scopes of practice

- EMTs, Paramedics and ICPs.

### Indications

- ✓ Mild pain (usually in combination with paracetamol), particularly soft tissue pain, musculoskeletal pain or headache.
- ✓ May be administered in addition to other medicines for moderate to severe pain, particularly when the transport time is long. This is not a priority but will reduce the need for subsequent analgesia and improve the quality of pain relief.

### Contraindications

- ✗ Known severe allergy.
- ✗ Third trimester of pregnancy.

### Cautions

- ⊖ The patient has taken ibuprofen within the last four hours. Ibuprofen is contained in many products such as cold and flu tablets/drinks, combination analgesics and migraine tablets. Additional ibuprofen may be administered provided it is clear that the total dose taken within a four hour period does not exceed the dose described within the CPGs. Withhold ibuprofen if there is any doubt.
- ⊖ Abdominal pain, particularly if the patient is very unwell or vomiting. Clinical judgement is required, but if the patient is very unwell or vomiting the possibility of significant intra-abdominal pathology exists and oral medicines should usually be withheld.
- ⊖ Age greater than or equal to 75 years, particularly in the presence of illness, infection or dehydration. In this setting renal impairment is likely and ibuprofen may worsen renal impairment.
- ⊖ Dehydration or shock. Renal impairment is likely and ibuprofen may worsen renal impairment.
- ⊖ Known renal impairment. Ibuprofen may worsen renal impairment.

- ⊖ Known bleeding disorder. Ibuprofen will increase the risk of bleeding and because other forms of analgesia are available, the balance of risk is usually in favour of withholding ibuprofen.
- ⊖ Clinically significant bleeding. Ibuprofen will increase the risk of bleeding and the nature and risk of the bleeding must be taken into account.
- ⊖ Known worsening of bronchospasm with NSAIDs. Some patients with asthma or COPD have known worsening of bronchospasm with NSAIDs. If there is a clear history of significant bronchospasm with NSAIDs, ibuprofen should be withheld.
- ⊖ Taking warfarin. Ibuprofen displaces warfarin from binding sites and increases the activity of warfarin. This effect is usually only clinically important with chronic administration, however ibuprofen should be withheld if a patient taking warfarin has signs of bleeding or a clinical condition that may involve bleeding. Examples include trauma or a likely need for surgery. If there is any doubt the balance of risk is in favour of withholding ibuprofen.
- ⊖ Pregnancy.

### **Use in pregnancy or when breastfeeding**

- May cause harm during pregnancy. Ibuprofen has been associated with premature delivery and premature closure of the ductus arteriosus, when administered during the third trimester of pregnancy. Because other forms of analgesia are available ibuprofen should be usually be withheld during pregnancy.
- May be administered if the patient is breastfeeding. Advise the patient to stop breastfeeding and seek further advice from their lead maternity carer or GP.

### **Dosage**

- 600 mg for an adult weighing greater than 80 kg.
- 400 mg for an adult weighing 80 kg or less.
- See the paediatric drug dose tables for a child.

### **Administration**

- Administer PO.
- Children unable to swallow tablets may be administered ibuprofen syrup, or tablets that have been crushed and placed in a soft food such as jam or honey.

### **Common adverse effects**

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

### **Usual onset of effect**

- 30-60 minutes.

### **Usual duration of effect**

- 4-6 hours.

### **Usual preparation**

- 200 mg tablets.
- Syrup containing 20 mg/ml.

### **Pharmacokinetics**

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

### **Common interactions**

- Warfarin. Ibuprofen displaces warfarin from binding sites and increases the activity of warfarin.

### **Additional information**

- Ibuprofen is not indicated for pain associated with myocardial ischaemia.
- All personnel (including those without ATP) may give ibuprofen to a patient for self-administration, provided the package instructions are followed.
- A patient may be administered ibuprofen for pain associated with a minor condition and be given a recommendation that immediate referral to a medical facility is not required.



## 14.22 Ipratropium

### Mechanism of action

- Ipratropium is a bronchodilator.
- Ipratropium is an anticholinergic agent with predominantly antimuscarinic activity. It antagonises (blocks) acetylcholine receptors, causing vagal inhibition resulting in bronchodilation.

### Delegated scopes of practice

- EMTs, Paramedics and ICPs.

### Indications

- ✓ Bronchospasm secondary to asthma or COPD.
- ✓ Prominent bronchospasm secondary to airway burns, smoke inhalation or chest infection.

### Contraindications

- ✗ Known severe allergy.

### Cautions

- ⊖ None.

### Use in pregnancy or when breastfeeding

- Safety has not been demonstrated during pregnancy, but ipratropium should be administered if indicated.
- May be administered if the patient is breastfeeding. Advise the patient to stop breastfeeding and seek further advice from their lead maternity carer or GP.

### Dosage

- 0.5 mg for adults and children once only.

### Administration

- Administer nebulised undiluted, in combination with 5 mg of salbutamol.

### Common adverse effects

- Tachycardia.
- Dry mouth.
- Blurred vision. This usually only occurs with repeated doses.

### Usual onset of effect

- 2-5 minutes.

### **Usual duration of effect**

- 6 hours.

### **Usual preparation**

- Ampoule containing 0.5 mg in 2 ml.

### **Pharmacokinetics**

- Only a small amount of the nebulised dose is absorbed, with most of the dose being nebulised to the atmosphere. The inhaled ipratropium is absorbed through the lungs and some is swallowed.
- Excretion is predominantly via the urine.
- Clearance is prolonged if the patient has significant kidney impairment, but this does not alter the initial (loading) dose.

### **Common interactions**

- None.

### **Additional information**

- Ipratropium does not have a significant role in the treatment of bronchospasm as a result of smoke, toxic gas inhalation or chest infection. However, it may be administered if bronchospasm is prominent.
- Ipratropium has been reported to cause worsening of glaucoma, but only with frequent doses of nebulised ipratropium (with the nebulised drug contacting the eyes) in the setting of poorly controlled glaucoma. Glaucoma is not a caution when administering a single dose.



# 14.23 Ketamine

## Mechanism of action

- Ketamine is an analgesic. It has complex actions, but is predominantly an N-methyl-d-aspartate (NMDA) receptor antagonist (blocker), resulting in inhibition of excitatory neurotransmitters in the brain.
- Low doses cause analgesia, larger doses cause amnesia and dissociation, and high doses cause anaesthesia.

## Delegated scopes of practice

- Paramedics: pain relief.
- ICPs: all indications.

## Indications

- ✓ Severe pain (in addition to other medicines), particularly musculoskeletal or burn pain that has not been adequately controlled with an opiate.
- ✓ Inducing dissociation, for example for cardioversion, joint relocation or limb alignment.
- ✓ Agitated delirium causing a severe to immediately life-threatening risk to safety.
- ✓ Rapid sequence intubation (RSI).
- ✓ Significant movement during CPR that is interfering with resuscitation.
- ✓ Asthma with severe agitation that is impairing the ability to safely provide treatment and/or transport.

## Contraindications

- ✗ Known severe allergy.
- ✗ Aged less than one year.

## Cautions

- ⊖ Unable to obey commands. Ketamine will reduce the level of consciousness.
- ⊖ Active psychosis. Ketamine may make this worse.
- ⊖ Hypertension. Ketamine may make this worse.
- ⊖ Clinical conditions that may be made worse by hypertension, for example haemorrhagic stroke.
- ⊖ Current myocardial ischaemia. Ketamine may increase myocardial oxygen demand.
- ⊖ Concurrent administration of sedatives or midazolam. This will increase and prolong the effects.
- ⊖ Elderly and/or frail. These will increase and prolong the effects.

## Use in pregnancy or when breastfeeding

- Safety has not been demonstrated during pregnancy, but ketamine should be administered if indicated.
- May be administered if the patient is breastfeeding. Advise the patient to stop breastfeeding and seek further advice from their lead maternity carer or GP.

## Dosage

- For analgesia:
  - a) 30 mg IV over approximately 15 minutes if the patient weighs greater than 80 kg. Repeat as required.
  - b) 20 mg IV over approximately 15 minutes if the patient weighs 50-80 kg. Repeat as required.
  - c) See the paediatric drug dose tables for a child and administer IV over approximately 15 minutes.
  - d) 0.5 mg/kg IM or PO (up to a maximum of 50 mg) if IV access cannot be obtained. This may be repeated once after 20 minutes.
- For dissociation:
  - a) 1 mg/kg IV (up to a maximum of 100 mg). This may be repeated once after five minutes.
  - b) 2 mg/kg IM (up to a maximum of 200 mg) if IV access cannot be obtained. This may be repeated once after 20 minutes.
  - c) See the paediatric drug dose tables for a child.
- For severe agitated delirium:
  - a) 1 mg/kg IV (up to a maximum of 100 mg) every five minutes as required, or
  - b) 400 mg IM if the patient weighs greater than 80 kg, or
  - c) 200 mg IM if the patient weighs 50-80 kg.
  - d) The IM dose may be repeated once after 20 minutes.
- For RSI: see the 'RSI' section.
- For significant movement during CPR that is interfering with resuscitation administer 1 mg/kg (up to a maximum of 100 mg) of ketamine IV once.

## Administration

- The preferred route of administration is IV.
- Administer analgesia doses IV over approximately 15 minutes as this appears to reduce adverse side effects.
- Dilute 100 mg (1 ml) of ketamine in a 100 ml bag of 5% glucose. Shake well and label:
  - a) For adults: draw up the dose and administer 2 mg (2 ml) every 1-2 minutes.
  - b) For children: draw up the dose, dilute the volume further to a total of 20 ml and administer 2 ml every 1-2 minutes.

- Alternatively, for adults or children weighing over 40 kg only, place the analgesia dose into a 100 ml bag of 5% glucose and infuse over approximately 15 minutes:
  - a) 2-3 drops/second via a standard IV administration set will deliver 100 ml over approximately 15 minutes.
  - b) The administration set will need to be flushed with 0.9% sodium chloride to ensure that all of the ketamine has been administered.
- Administer dissociation doses by diluting 100 mg (1 ml) to a total of 10 ml and administering the dose as an IV bolus.
- The IM route is preferred over the PO route as IM absorption is more reliable. Administer IM ketamine undiluted. The preferred site is the lateral thigh as this has the best absorption. If this site is not suitable use the lateral upper arm.
- The PO route should be reserved for the very unusual circumstance in which IM injection is contraindicated or not feasible. Administer ketamine PO undiluted in a liquid, for example paracetamol syrup or water.

### **Common adverse effects**

- Transient hypertension.
- Tachycardia.
- Apnoea.
- Nausea and vomiting.
- Sedation.
- Hallucinations.

### **Usual onset of effect**

- IV: 1-2 minutes.
- IM: 5-10 minutes.
- PO: 10-20 minutes.

### **Usual duration of effect**

- 10-60 minutes.

### **Usual preparation**

- Ampoule containing 200 mg in 2 ml.

### **Pharmacokinetics**

- Ketamine is predominantly metabolised in the liver.
- There are no significant effects from liver impairment on acute administration.

### **Common interactions**

- The effects will be increased in the presence of other analgesic medicines or sedatives, for example opiates, benzodiazepines or alcohol.



## Additional information

- Warn the patient it is possible to feel strange following ketamine administration.
- Prior to administering ketamine for pain, sufficient fentanyl should be administered that further doses are not providing additional analgesia. This will usually require 150-200 mcg of fentanyl for an adult.
- Do not treat hallucinations routinely with midazolam because the combination of midazolam and ketamine is commonly associated with a reduced level of consciousness, particularly if an opiate has also been administered. Most hallucinations will settle with a combination of explanation and time. However, midazolam in low doses may be administered IV if the hallucinations are severe provided the patient is obeying commands and physiologically stable.
- When administering ketamine to induce dissociation, routinely administer oxygen and task one person to continually monitor the patient's SpO<sub>2</sub>, breathing and level of consciousness until the patient recovers.
- Round the patient's weight to the nearest 10 kg when calculating ketamine doses.



## 14.24 Labetalol

### Mechanism of action

- Labetalol is a beta-blocker and an alpha-blocker. It antagonises (blocks) beta-1 receptors in the heart, causing a decrease in heart rate, cardiac output and blood pressure and it antagonises (blocks) alpha-1 receptors peripherally, causing vasodilation and a decrease in blood pressure.

### Delegated scopes of practice

- ICPs.
- Paramedics may only administer labetalol in discussion with the STEMI coordinator or the on call doctor via the Clinical Desk.

### Indications

- ✓ Control of hypertension prior to fibrinolytic therapy for STEMI.
- ✓ Control of hypertension during inter-hospital transfer for STEMI.
- ✓ Control of hypertension during inter-hospital transfer for stroke clot retrieval.
- ✓ Control of hypertension associated with autonomic dysreflexia.

### Contraindications

- ✗ Known severe allergy.
- ✗ Bradycardia. Labetalol will further reduce the heart rate.
- ✗ Hypotension. Labetalol will further reduce the blood pressure.

### Cautions

- ⊖ 1<sup>st</sup> degree heart block. Labetalol may cause bradycardia.
- ⊖ Known sick sinus syndrome without an internal pacemaker in place. Labetalol may cause bradycardia.
- ⊖ Previous 2<sup>nd</sup> or 3<sup>rd</sup> degree heart block without an internal pacemaker in place. Labetalol may cause worsening of heart block and bradycardia.
- ⊖ Asthma or COPD. Labetalol may cause bronchospasm and should usually be withheld if the patient regularly takes bronchodilators.
- ⊖ Heart failure. Labetalol will reduce cardiac output and may make heart failure worse.

### Use in pregnancy or when breastfeeding

- Safety has not been demonstrated during pregnancy. The likelihood of administration being required in a woman who is pregnant is low and personnel should seek clinical advice prior to administration.
- May be administered if the patient is breastfeeding. Advise the patient to stop breastfeeding and seek further advice from their lead maternity carer or GP.

## **Dosage**

- 10 mg IV.
- Repeat the dose every ten minutes as required.
- There is no maximum dose but personnel should seek clinical advice if a total of more than 50 mg is required.

## **Administration**

- Draw up the dose and dilute to approximately 5-10 ml using 0.9% sodium chloride. Administer IV over 1-2 minutes.

## **Common adverse effects**

- Hypotension.
- Bradycardia.
- Bronchospasm.

## **Usual onset of effect**

- 2-3 minutes.

## **Usual duration of effect**

- 1-2 hours.

## **Usual preparation**

- Ampoule containing 100 mg in 20 ml.

## **Pharmacokinetics**

- Labetalol is metabolised in the liver.
- There are no significant effects from liver impairment on acute administration.

## **Common interactions**

- The blood pressure effect will be potentiated by other medicines that lower blood pressure. For example, GTN, antihypertensive medicines and amiodarone.
- The heart rate effects will be potentiated by other medicines that lower heart rate. For example, amiodarone and centrally acting calcium channel blockers such as diltiazem.

## **Additional information**

- Labetalol is not carried by all ambulance services.

## 14.25 1% lignocaine

### Mechanism of action

- Lignocaine is a local anaesthetic.
- Lignocaine blocks the initiation and transmission of nerve impulses by blocking the movement of sodium ions across the nerve cell membrane.

### Delegated scopes of practice

- Paramedics and ICPs.

### Indications

- ✓ Subcutaneous injection for prophylaxis of pain associated with IV cannulation.
- ✓ Subcutaneous injection for digital ring blocks for analgesia.
- ✓ Intraosseous injection for bone pain associated with fluid infusion via an intraosseous needle.

### Contraindications

- ✗ Known severe allergy.
- ✗ Local infection in the area of injection.

### Cautions

- ⊖ Taking an anticoagulant (ring blocks).

### Use in pregnancy or when breastfeeding

- Safe. May be administered if indicated.

### Dosage

- Subcutaneous:
  - a) The maximum subcutaneous dose for an adult is 200 mg (20 ml of 1% lignocaine).
  - b) See the paediatric drug dose tables for the maximum dose for a child.
  - c) The subcutaneous dose may be repeated once after 30 minutes.
- Intraosseous:
  - a) 50 mg (5 ml of 1% lignocaine) for an adult.
  - b) See the paediatric drug dose tables for a child.
  - c) The intraosseous dose may be repeated once after 15 minutes.

### Administration

- Subcutaneous for IV insertion: administer into the subcutaneous tissue at the site of cannulation. Raise a bleb and wait approximately one minute before insertion.

- Digital ring blocks: administer approximately 1-2 ml of 1% lignocaine into the tissue on either side of the web space of the digit.
- Intraosseous: administer slowly over 1-2 minutes and wait one further minute before infusing fluid. This is intended to limit the amount of lignocaine flushed into the circulation.

### **Common adverse effects**

- Stinging at the time of injection.

### **Usual onset of effect**

- 1-2 minutes for IV cannulation.
- 5-10 minutes for digital ring blocks.

### **Usual duration of effect**

- 30-60 minutes.

### **Usual preparation**

- Ampoule containing 50 mg in 5 ml.

### **Pharmacokinetics**

- Lignocaine is metabolised in the liver.
- There are no significant effects from liver impairment on acute administration.

### **Common interactions**

- None.

### **Additional information**

- Do not apply lignocaine topically to the eye because the solution contains a preservative that may cause harm.
- Warming lignocaine, for example in your pocket or hand, may reduce the stinging associated with subcutaneous injection.
- Overdose of lignocaine when administered subcutaneously is very rare, but can occur if doses exceed 3 mg/kg or more than 1 mg/kg is inadvertently administered IV. If this occurs the following may develop:
  - Tingling around the mouth.
  - Seizures.
  - Dysrhythmias, particularly bradycardias.
  - Hypotension.
  - Cardiac arrest.

## 14.26 Loratadine

### Mechanism of action

- Loratadine is a non-sedating antihistamine.
- Loratadine antagonises (blocks) peripheral histamine receptors, blocking the action of histamine and reducing itching and redness.

### Delegated scopes of practice

- EMTs, Paramedics and ICPs.

### Indications

- ✓ Minor allergic reactions confined to skin involvement.
- ✓ Prominent itch associated with anaphylaxis, provided all systemic signs of anaphylaxis have resolved.

### Contraindications

- ✗ Known severe allergy.
- ✗ Age less than one year.

### Cautions

- ⊖ Pregnancy.

### Use in pregnancy or when breastfeeding

- Safety has not been demonstrated during pregnancy. Because minor allergic reactions rarely require specific treatment, the balance of risk is such that loratadine should usually be withheld.
- May be administered if the patient is breastfeeding. Advise the patient to stop breastfeeding and seek further advice from their lead maternity carer or GP.

### Dosage

- 10 mg for an adult or child aged greater than or equal to 12 years.
- 5 mg for a child aged 1-11 years.

### Administration

- Administer PO.
- Always ask a parent (or guardian) if a young child can swallow tablets. Loratadine may be crushed and placed in a soft food such as jam or honey.

### Common adverse effects

- None.

### **Usual onset of effect**

- 30-60 minutes.

### **Usual duration of effect**

- 12-24 hours.

### **Usual preparation**

- 10 mg tablets.

### **Pharmacokinetics**

- Loratadine is predominantly metabolised by the liver.
- There are no significant effects from liver impairment on acute administration.

### **Common interactions**

- None.
- Increases in plasma concentrations of loratadine have been reported after concurrent administration of ketoconazole, erythromycin and roxithromycin. In a small number of patients this was associated with a prolonged QT interval, but this only occurred with long-term administration.

### **Additional information**

- All personnel (including those without ATP) may give loratadine to a patient for self-administration, provided the package instructions are followed.



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# 14.27 Magnesium sulphate

## Mechanism of action

- Magnesium is the active ingredient in magnesium sulphate.
- Magnesium reduces bronchial smooth muscle contraction resulting in bronchodilation.

## Delegated scope of practice

- ICPs.

## Indications

- ✓ Bronchospasm secondary to severe or immediately life-threatening asthma.

## Contraindications

- ✗ Known severe allergy.

## Cautions

- ⊖ Hypotension. Magnesium is a vasodilator and may make hypotension worse.

## Use in pregnancy or when breastfeeding

- Safe and should be administered when indicated.
- Muscle weakness may occur in the baby if administered within two hours of birth and this may cause respiratory depression.

## Dosage

- 10 mmol (2.47 g) IV for an adult.
- See the paediatric drug dose tables for a child.
- A second dose may be administered if transport time is longer than 30 minutes and the patient is not improving.

## Administration

- Administer IV over approximately 15 minutes.
- Dilute to a total of 10 ml using 0.9% sodium chloride and administer 1 ml every 1-2 minutes, preferably into a running IV line.
- Alternatively, in adults or children weighing over 40 kg only, add to a 100 ml bag of 5% glucose, shake well, label and infuse over approximately 15 minutes:
  - a) 2-3 drops/second via a standard IV administration set will deliver 100 ml over approximately 15 minutes.
  - b) The administration set will need to be flushed with 0.9% sodium chloride to ensure that all of the magnesium has been administered.



### **Common adverse effects**

- Flushing. Particularly if administered rapidly.
- Hypotension. Particularly if administered rapidly.
- Muscle weakness. This is usually only seen with doses exceeding 20 mmol.

### **Usual onset of effect**

- 5-10 minutes.

### **Usual duration of effect**

- 30-60 minutes.

### **Pharmacokinetics**

- Magnesium is primarily excreted in the urine.
- There are no significant effects from renal impairment on the initial (loading) dose.

### **Usual preparation**

- 5 ml ampoule containing 10 mmol (2.47 g) of magnesium.

### **Common interactions**

- May increase the effect of neuromuscular blockers.

### **Additional information**

- Do not administer magnesium into an IV line that has an adrenaline infusion running through it concurrently, because precipitation may occur.
- Rarely, magnesium may have a role in the treatment of torsade de pointes, severe pre-eclampsia and eclampsia. In these settings seek clinical advice.
- Document the dose administered in mmol.



## 14.28 Metaraminol

### Mechanism of action

- Metaraminol is an alpha receptor agonist. It stimulates alpha-1 receptors in peripheral blood vessels, causing vasoconstriction and a rise in blood pressure.
- Some references describe a small degree of stimulation of beta receptors, but this is usually clinically insignificant.

### Delegated scopes of practice

- ICPs.

### Indications

- ✓ Hypotension in the setting of septic shock, post cardiac arrest, cardiogenic shock, severe traumatic brain injury, neurogenic shock, rapid sequence intubation and post intubation.

### Contraindications

- ✗ Known severe allergy.

### Cautions

- ⊖ Bradycardia. Metaraminol may make bradycardia worse as reduced endogenous release of adrenaline may occur as blood pressure is raised. Consider administering adrenaline if the patient is hypotensive and bradycardic.

### Use in pregnancy or when breastfeeding

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

### Dosage

- Titrate the dose and frequency to the patient's blood pressure:
  - a) Administer an infusion via an infusion pump, or
  - b) Administer 0.5-1 mg IV every 5-10 minutes as required for an adult, or
  - c) See the paediatric drug dose tables for bolus doses for a child, and administer IV every 5-10 minutes as required.
- If an infusion is administered in an adult:
  - a) Administer an initial bolus of 0.5-1 mg IV.
  - b) Start the infusion at 2 mg/hour and adjust the rate as required.
  - c) The patient is likely to require approximately 2-3 mg/hour.

## Administration

- IV bolus administration in an adult: administer undiluted, preferably via a running line.
- IV bolus administration in a child:
  - a) Take a 100 ml bag of 5% glucose. Remove and discard 10 ml.
  - b) Add 10 ml containing 10 mg of metaraminol to the bag.
  - c) Shake well and label. This final solution contains 0.1 mg/ml.
  - d) See the paediatric drug dose tables for dosing/volume and draw up doses from the bag of 5% glucose.
- IV infusion:
  - a) Follow service guidelines for dilution and infusion pump set up.
  - b) Adjust the infusion rate every 10-15 minutes as required.

## Common adverse effects

- Hypertension. This usually only occurs when boluses greater than 1 mg are administered in an adult.
- Bradycardia. See cautions.

## Usual onset of effect

- 1-2 minutes.

## Usual duration of effect

- 10-15 minutes.

## Usual preparation

- Pre-filled syringe containing 10 mg in 10 ml.

## Pharmacokinetics

- Metaraminol is predominantly metabolised in the liver with metabolites being excreted in the urine.
- Liver impairment does not alter the dose which is titrated to effect.

## Common interactions

- None.

## Additional information

- Some references describe the IM administration of metaraminol but this has no role in the out-of-hospital setting.

# 14.29 Methoxyflurane

## Mechanism of action

- Methoxyflurane is an inhalational analgesic.
- The mechanism of action is not clear.

## Delegated scopes of practice

- EMTs, Paramedics and ICPs.

## Indications

- ✓ Moderate to severe pain when:
  - Personnel able to administer fentanyl and/or ketamine are not available within an appropriate time, or
  - Fentanyl and/or ketamine administration is inappropriate.

## Contraindications

- ✗ Known severe allergy.
- ✗ Personal or family history of malignant hyperthermia.
- ✗ Unable to obey commands.
- ✗ Known renal impairment.
- ✗ Has received methoxyflurane within the last week. Frequent administration increases the risk of renal impairment.

## Cautions

- ⊖ Age greater than or equal to 75 years, particularly in the presence of illness, infection or dehydration. In this setting renal impairment is likely and methoxyflurane may worsen renal impairment.
- ⊖ Pre-eclampsia. In this setting renal impairment is likely and methoxyflurane may worsen renal impairment.
- ⊖ Administration within a confined space.

## Use in pregnancy or when breastfeeding

- Safety has not been formally demonstrated in pregnancy, but methoxyflurane may be administered. Methoxyflurane has been extensively used during labour in Australia and New Zealand for many years without adverse effects.
- Methoxyflurane may cause temporary drowsiness in the baby and administration should be discussed with the lead maternity carer if there are known signs of foetal distress.
- May be administered if the patient is breastfeeding. Advise the patient to stop breastfeeding and seek further advice from their lead maternity carer or GP.

## **Dosage**

- Maximum of 6 ml (two doses) for a patient aged greater than or equal to 12 years.
- Maximum of 3 ml (one dose) for a child aged less than 12 years.

## **Administration**

- Whenever possible have the patient self-administer methoxyflurane.
- Administer 3 ml (one dose) at a time and always use the charcoal filter. Using a charcoal filter maximises the amount of exhaled methoxyflurane that is absorbed, limiting exposure to personnel.
- Instruct the patient to breathe out through the inhaler.
- Do not administer supplementary oxygen via the inhaler as this significantly increases the amount of methoxyflurane lost through evaporation.
- Place the inhaler in a closed plastic bag if the methoxyflurane has not been fully used. It may subsequently be reused by the same patient.
- An ambulance is not considered a confined space. Maximising ventilation (for example having ventilation fans on) reduces occupational exposure. Consider not administering methoxyflurane in an ambulance if the patient cannot cooperate with breathing out through the inhaler.

## **Common adverse effects**

- Sedation.
- Feeling light-headed.

## **Usual onset of effect**

- 1-2 minutes.

## **Usual duration of effect**

- 2-5 minutes after stopping administration.

## **Usual preparation**

- 3 ml bottle accompanying a plastic inhaler.

## **Pharmacokinetics**

- Approximately 20% is exhaled. The remainder is metabolised in the liver.
- One of the metabolites is fluoride ions. High concentrations of fluoride ions have been associated with renal impairment and this is the reason for known renal impairment being a contraindication and for having a maximum dose.

## **Common interactions**

- The effects will be increased in the presence of other pain relieving medicines or sedatives, for example opiates, benzodiazepines or alcohol.

## Additional information

- Malignant hyperthermia (MH) is a rare, inherited disorder of muscle metabolism affecting approximately 20 families in New Zealand, many of whom are in the Manawatu area. When exposed to some anaesthetic agents (including methoxyflurane) the patient may develop a life-threatening hypermetabolic state with severe hyperthermia. Patients with MH (or a family history of MH) usually know about it.
- Renal failure with dialysis is not a contraindication or a caution to methoxyflurane administration because once a patient is receiving dialysis further renal impairment is of no clinical consequence.
- Kidney stones and/or renal colic are not a contraindication or a caution to methoxyflurane administration because these are rarely associated with renal impairment.
- Some lead maternity carers may ask that methoxyflurane is not administered during labour and may ask to provide their own Entonox during transfer. This is acceptable provided the Entonox cylinder is no larger than an A size and is appropriately restrained.



## 14.30 Metoprolol

### Mechanism of action

- Metoprolol is a beta-blocker. It antagonises (blocks) beta-1 receptors in the heart, causing a decrease in heart rate, cardiac output and blood pressure.

### Delegated scopes of practice

- ICPs.
- Paramedics may only administer metoprolol in discussion with the STEMI coordinator or the on call doctor via the Clinical Desk.

### Indications

- ✓ Control of hypertension prior to fibrinolytic therapy for STEMI.
- ✓ Control of hypertension during inter-hospital transfer for STEMI.
- ✓ Control of hypertension during inter-hospital transfer for stroke clot retrieval.
- ✓ Control of hypertension associated with autonomic dysreflexia.

### Contraindications

- ✗ Known severe allergy.
- ✗ Bradycardia. Metoprolol will further reduce the heart rate.
- ✗ Hypotension. Metoprolol will further reduce the blood pressure.

### Cautions

- ⊖ 1<sup>st</sup> degree heart block. Metoprolol may cause bradycardia.
- ⊖ Known sick sinus syndrome without an internal pacemaker in place. Metoprolol may cause bradycardia.
- ⊖ Previous 2<sup>nd</sup> or 3<sup>rd</sup> degree heart block without an internal pacemaker in place. Metoprolol may cause worsening of heart block and bradycardia.
- ⊖ Asthma or COPD. Metoprolol may cause bronchospasm and should usually be withheld if the patient regularly takes bronchodilators.
- ⊖ Heart failure. Metoprolol will reduce cardiac output and may make heart failure worse.

### Use in pregnancy or when breastfeeding

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

## **Dosage**

- 2.5 mg IV.
- The dose may be repeated every ten minutes as required.
- There is no maximum dose but personnel should seek clinical advice if a total of more than 10 mg is required.

## **Administration**

- Draw up the dose and dilute to approximately 5-10 ml using 0.9% sodium chloride. Administer IV over 1-2 minutes.

## **Common adverse effects**

- Hypotension.
- Bradycardia.
- Bronchospasm.

## **Usual onset of effect**

- 2-3 minutes.

## **Usual duration of effect**

- 1-2 hours.

## **Usual preparation**

- Ampoule containing 5 mg in 5 ml.

## **Pharmacokinetics**

- Metoprolol is metabolised in the liver.
- There are no significant effects from liver impairment on acute administration.

## **Common interactions**

- The blood pressure effect will be potentiated by other medicines that lower blood pressure. For example, GTN, antihypertensive medicines and amiodarone.
- The heart rate effects will be potentiated by other medicines that lower the heart rate. For example, amiodarone and centrally acting calcium channel blockers such as diltiazem.



## 14.31 Midazolam

### Mechanism of action

- Midazolam is a benzodiazepine.
- Midazolam enhances the activity of gamma-aminobutyric acid (GABA) at GABA receptors within the central nervous system, resulting in anticonvulsant activity, sedation, amnesia, anxiolysis and muscle relaxation.

### Delegated scopes of practice

- Paramedics: IM and IV for seizures, and IM for agitated delirium.
- ICPs: all routes and all indications.

### Indications

- ✓ Prolonged seizures.
- ✓ Agitated delirium causing a mild to moderate risk to safety and droperidol is unavailable or ineffective.
- ✓ Pain associated with severe muscle spasm.
- ✓ Sedation, for example for joint relocation.
- ✓ Sedation post intubation.
- ✓ Severe anxiety associated with COPD.

### Contraindications

- ✗ Known severe allergy.

### Cautions

- ⊖ Concurrent administration of opiates, ketamine or other sedatives. This will increase and prolong the effects.
- ⊖ Intoxication. This will increase and prolong the effects.
- ⊖ Elderly and/or frail. These will increase and prolong the effects.

### Use in pregnancy or when breastfeeding

- Safety has not been demonstrated during pregnancy, but midazolam should be administered if indicated.
- May be administered if the patient is breastfeeding. Advise the patient to stop breastfeeding and seek further advice from their lead maternity carer or GP.

### Dosage

- The dose of midazolam is dependent on the indication and the route. See the individual sections.
- If a dose range is described, use a dose at the lower end of the range if the patient is small, elderly, frail or physiologically unstable.

## Administration

- IV administration:
  - a) Dilute 2 ml from a 15 mg/3 ml ampoule to a total of 10 ml using 0.9% sodium chloride. This solution contains 1 mg/ml.
  - b) Administer IV as a bolus.
- IM administration:
  - a) Draw up the dose from a 15 mg/3 ml ampoule. Do not dilute.
  - b) The preferred site is the lateral thigh as this has the best absorption. If this site is not suitable use the lateral upper arm.
- For sedation post intubation: combine 10 mg of midazolam with 100 mcg of fentanyl and dilute to a total of 10 ml using 0.9% sodium chloride.

## Common adverse effects

- Sedation.
- Respiratory depression.
- Hypotension.
- Amnesia.

## Usual onset of effect

- IV: 2-3 minutes.
- IM: 3-5 minutes.

## Usual duration of effect

- 30-60 minutes. The sedative effect may be longer, particularly in the elderly.

## Usual preparation

- Ampoule containing 15 mg in 3 ml.

## Pharmacokinetics

- Midazolam is predominantly metabolised by the liver.
- There are no significant effects from liver impairment on acute administration.

## Common interactions

- The effects will be increased and prolonged in the presence of other sedatives or pain relieving medicines (for example other benzodiazepines, opiates, ketamine and alcohol).

## Additional information

- When administering midazolam for sedation or analgesia the patient must be able to obey commands at all times.

## 14.32 Naloxone

### Mechanism of action

- Naloxone is an opiate receptor antagonist (blocker). By blocking opiate receptors naloxone reverses the effects of opiates, particularly respiratory depression and sedation.

### Delegated scopes of practice

- Paramedics and ICPs.

### Indications

- ✓ Opiate poisoning is suspected and the patient has a significantly impaired level of consciousness or significantly impaired breathing.
- ✓ Excess adverse effects from administration of opiates.

### Contraindications

- ✗ Known severe allergy.

### Cautions

- ⊖ Chronic opiate use. If the patient is taking an opiate chronically, there is a risk of adverse physiological effects associated with rapid opiate withdrawal.

### Use in pregnancy or when breastfeeding

- Safety has not been demonstrated in pregnancy, but naloxone should be administered if indicated.
- May be administered if the patient is breastfeeding. Advise the patient to stop breastfeeding and seek further advice from their lead maternity carer or GP.

### Dosage

- 0.1-0.4 mg IV every five minutes as required for an adult.
- 0.8 mg IM as required for an adult. This may be repeated every 20 minutes.
- See the paediatric drug dose tables for a child.

### Administration

- The preferred route for administration is IV.
- IV: dilute 0.4 mg to a total of 4 ml. This final solution contains 0.1 mg/ml.
- Administer the minimum dose required to produce improvement. Rapid reversal of opiates may be associated with seizures, hypertension, pulmonary oedema or severe agitation, particularly if the patient takes opiates regularly.
- IM: administer undiluted. The preferred site is the lateral thigh as this has the best absorption. If this site is not suitable use the lateral upper arm.

## **Common adverse effects**

- Sweating.
- Tachycardia.
- Hypertension.

## **Usual onset of effect**

- IV: 1-2 minutes.
- IM: 5-10 minutes.

## **Usual duration of effect**

- 30-60 minutes.
- The duration of action of naloxone may be shorter than the duration of action of the opiate that has been administered/taken and naloxone may need to be repeated.

## **Usual preparation**

- Ampoule containing 0.4 mg in 1 ml.

## **Pharmacokinetics**

- Naloxone is predominantly metabolised by the liver.
- There are no significant effects from liver impairment on acute administration.

## **Common interactions**

- None.

## **Additional information**

- There is no role for naloxone in the treatment of cardiac arrest associated with opiate poisoning. In this setting cardiac arrest is secondary to respiratory arrest and once cardiac arrest has occurred naloxone has no useful effect. The best treatment is CPR that includes a focus on ventilation. If ROSC occurs, naloxone should still not be administered because it may be associated with seizures, hypertension, pulmonary oedema or severe agitation.
- There is no evidence to support the commonly held view that adequate oxygenation prior to naloxone administration reduces the severity of agitation following naloxone administration. However, treatment of severe hypoxia takes precedence over the administration of naloxone.
- Acute opiate withdrawal following naloxone administration can lead to patient agitation and/or aggression, particularly when there has also been a period of hypoxia. Ensure a planned team approach to maintain safety of both the patient and personnel.

## 14.33 Olanzapine

### Mechanism of action

- Olanzapine is an atypical antipsychotic.
- Olanzapine has actions at multiple receptors within the brain causing a reduction in agitation, sedation, anxiolysis and stabilisation of mood.

### Delegated scopes of practice

- Paramedics and ICPs.

### Indications

- ✓ Patients aged greater than or equal to 12 years with agitated delirium causing a mild to moderate risk to safety, when the patient will take an oral medicine.

### Contraindications

- ✗ Known severe allergy.
- ✗ Poisoning with an antipsychotic, for example quetiapine or risperidone.

### Cautions

- ⊖ Pregnancy.
- ⊖ Intoxication. This will increase and prolong the effects.
- ⊖ Elderly and/or frail. These will increase and prolong the effects.

### Use in pregnancy or when breastfeeding

- Safety has not been demonstrated during pregnancy and the balance of risk is such that olanzapine should usually be withheld.
- May be administered if the patient is breastfeeding. Advise the patient to stop breastfeeding and seek further advice from their lead maternity carer or GP.

### Dosage

- 10 mg PO.
- Reduce the patient to 5 mg PO if the patient is frail.
- The dose may be repeated once after 20 minutes.

### Administration

- Administer PO. The tablet is dispersible and will dissolve in the mouth. A sip of liquid will aid absorption but is not routinely required.
- The tablet may be dissolved in liquid. For example, water, tea or coffee.

### Common adverse effects

- Sedation.

**Usual onset of effect**

- 10-20 minutes.

**Usual duration of effect**

- 12-24 hours.

**Usual preparation**

- 5 mg dispersible tablets (wafers).

**Pharmacokinetics**

- Olanzapine is predominantly metabolised by the liver.
- There are no significant effects from liver impairment on acute administration.

**Common interactions**

- Intoxication. Olanzapine will have increased and prolonged effects if the patient is intoxicated with alcohol or has taken recreational drugs.
- Sedative drugs. Concurrent administration with other sedative drugs (such as midazolam or droperidol) will result in an increased and prolonged effect.



## 14.34 Ondansetron

### Mechanism of action

- Ondansetron is an antiemetic.
- Ondansetron antagonises (blocks) serotonin receptors centrally in the brain and peripherally in the gastrointestinal tract, resulting in a reduction in nausea and vomiting.

### Delegated scopes of practice

- EMTs: IM.
- Paramedics and ICPs: IV and IM.

### Indications

- ✓ Clinically significant nausea and/or vomiting.

### Contraindications

- ✗ Known severe allergy.
- ✗ Age less than one year.

### Cautions

- ⊖ None.

### Use in pregnancy or when breastfeeding

- Safety has not been demonstrated during pregnancy, but ondansetron may be administered if nausea and/or vomiting is severe.
- May be administered if the patient is breastfeeding. Advise the patient to stop breastfeeding and seek further advice from their lead maternity carer or GP.

### Dosage

- 8 mg IV once for an adult. See the paediatric drug dose tables for a child.
- 4 mg IM for an adult, if IV access cannot be obtained. See the paediatric drug dose tables for a child.
- The IM dose may be repeated once after 20 minutes if required.
- One IV dose may be administered in addition to one IM dose, if clinically significant nausea and/or vomiting persists and IV access is subsequently obtained. For example, in this setting a maximum total dose of 12 mg may be administered to an adult.

## Administration

- The preferred route of administration is IV.
- Administer IV undiluted.
- Administer IM undiluted. The preferred site is the lateral thigh as this has the best absorption. If this site is not suitable use the lateral upper arm.

## Common adverse effects

- Headache.
- Flushing.

## Usual onset of effect

- IV: 2-5 minutes.
- IM: 5-10 minutes.

## Usual duration of effect

- 4-8 hours.

## Usual preparation

- Ampoule containing 4 mg in 2 ml
- Ampoule containing 8 mg in 4 ml.

## Pharmacokinetics

- Ondansetron is predominantly metabolised by the liver.
- There are no significant effects from liver impairment on acute administration.

## Common interactions

- Ondansetron has been reported to prolong the QT interval, particularly if high doses are administered in conjunction with other medicines that also prolong the QT interval, for example erythromycin. However, one or two doses in this setting is safe.

## Additional information

- Prophylactic administration of ondansetron is not routinely required. Consider administering ondansetron if the nature of the patient's injuries and transport position are such that vomiting would be particularly problematic.
- Ondansetron should not be administered for vomiting associated with an altered level of consciousness because it is rarely effective in this setting.
- Ondansetron has been reported to further prolong the QT interval in patients known to have a prolonged QT syndrome. This generally involved repeated and/or high doses and one or two doses is safe, even if the patient is known to have a prolonged QT syndrome.



## 14.35 Oxytocin

### Mechanism of action

- Oxytocin is a synthetic version of the naturally occurring hormone oxytocin which is normally released from the pituitary gland.
- Oxytocin stimulates oxytocin receptors on the uterus, causing increased uterine contraction and reducing blood loss from the uterus.

### Delegated scopes of practice

- Paramedics and ICPs.

### Indications

- ✓ Following normal birth.
- ✓ Postpartum haemorrhage.

### Contraindications

- ✗ Known severe allergy.

### Cautions

- ⊖ None.

### Use in pregnancy or when breastfeeding

- Safe and should be administered if indicated.

### Dosage

- 10 units.

### Administration

- Administer IM undiluted. The preferred site is the lateral thigh as this has the best absorption. If this site is not suitable use the lateral upper arm.
- If multiple babies are present administration must occur after delivery of the last baby.
- If oxytocin has already been administered as part of routine treatment following normal birth, an additional 10 units of oxytocin should be administered (in the other thigh) if postpartum haemorrhage develops. This may require meeting another vehicle.

### Common adverse effects

- Abdominal cramping.
- Tachycardia.
- Flushing.

## Usual onset of effect

- 5-10 minutes.

## Usual duration of effect

- 30-60 minutes.

## Usual preparation

- Ampoule containing 10 units in 1 ml.

## Pharmacokinetics

- Oxytocin is metabolised in the liver and kidneys.
- There are no significant effects from liver or kidney impairment on acute administration.

## Common interactions

- None.

## Additional information

- Oxytocin that is not within kits must be refrigerated:
  - Without refrigeration it loses approximately 5-10% of activity per month.
  - It may be safely stored in kits provided it is labelled with the discard date which is three months after removal from the fridge.
  - It may be transported for up to 12 hours between stores/stations in a container that keeps it cool, without affecting the expiry date, provided it is placed into a fridge immediately on arrival.
- Routine administration of oxytocin following normal birth is controversial, but appears to reduce the incidence of postpartum haemorrhage.
- Oxytocin has been reported to cause prolongation of the QT interval if the patient is taking other medicines that also prolong the QT interval. However, this is usually associated with prolonged IV infusions and is not a clinically significant consideration when administering one or two IM doses.
- Oxytocin must not be administered IV unless instructed to do so by a lead maternity carer or a doctor via the Clinical Desk. Oxytocin IV must be given by infusion because IV boluses carry a high risk of causing hypotension. The dose and method of administration must be discussed with the lead maternity carer or doctor, but commonly 10-40 units of oxytocin is placed into a 1 litre bag of 0.9% sodium chloride and administered over 1-4 hours.



## 14.36 Paracetamol

### Mechanism of action

- Paracetamol inhibits the production of prostaglandins resulting in a reduction in pain and fever.

### Delegated scopes of practice

- EMTs, Paramedics and ICPs.

### Indications

- ✓ Mild or moderate pain, usually in combination with other medicines.
- ✓ Paracetamol may be administered in addition to other medicines for severe pain, particularly if the transport time is long. This is not a priority but will reduce the need for subsequent analgesia and improve the quality of pain relief.

### Contraindications

- ✗ Known severe allergy.

### Cautions

- ⊖ The patient has taken paracetamol within the last four hours. Paracetamol is contained in many products such as cold and flu tablets/drinks, cough mixtures, combination pain relievers and migraine tablets. Additional paracetamol may be administered provided it is clear that the total dose taken within a four hour period does not exceed the dose described within the CPGs. Withhold paracetamol if there is any doubt.
- ⊖ Abdominal pain, particularly if the patient is very unwell or vomiting. Clinical judgement is required, but if the patient is very unwell or vomiting, the possibility of significant intra-abdominal pathology exists and oral medicines should usually be withheld.
- ⊖ Known severe liver disease. Liver disease must be severely impaired before paracetamol clearance is altered, but the balance of risk is such that paracetamol should usually be withheld in this setting.

### Use in pregnancy or when breastfeeding

- Safe and may be administered if indicated.

### Dosage

- 1.5 g PO for an adult weighing greater than 80 kg.
- 1 g PO for an adult weighing 80 kg or less.
- See the paediatric drug dose tables for a child.

## **Administration**

- Administer PO.
- Always ask a parent (or guardian) of a young child if the child can swallow tablets and consider administering syrup.

## **Common adverse effects**

- None.

## **Usual onset of effect**

- 30-60 minutes.

## **Usual duration of effect**

- 4-6 hours.

## **Usual preparation**

- 500 mg tablets.
- Syrup containing 50 mg/ml.

## **Pharmacokinetics**

- Paracetamol is metabolised in the liver.
- If liver impairment is severe, paracetamol clearance will be significantly delayed, but this does not affect the initial (loading) dose.

## **Common interactions**

- None.

## **Additional information**

- The described doses of paracetamol are higher than those usually recommended in many references. However, the described doses are safe provided they are not administered repeatedly.
- Paracetamol is not indicated for the treatment of fever because fever may confer some benefit if the patient has an infection. However, paracetamol may be administered if the patient has a temperature greater than 39°C and the fever is causing discomfort.
- Paracetamol is not indicated for pain associated with myocardial ischaemia.
- All personnel (including those without ATP) may give paracetamol to a patient for self-administration, provided the package instructions are followed.
- A patient may be administered paracetamol for pain associated with a minor condition and be given a recommendation that immediate referral to a medical facility is not required.

## 14.37 Prednisone and prednisolone

### Mechanism of action

- Prednisone is a prodrug that is metabolised to prednisolone in the liver.
- Prednisolone is a corticosteroid with anti-inflammatory and immunosuppressant actions. It inhibits the production of inflammatory mediators, including prostaglandins and leukotrienes, resulting in a reduction in the inflammatory and immune response.

### Delegated scopes of practice

- EMTs, Paramedics and ICPs.

### Indications

- ✓ Bronchospasm associated with asthma or COPD.
- ✓ Croup.
- ✓ Prominent rash associated with anaphylaxis, provided all systemic signs of anaphylaxis have resolved.
- ✓ Minor allergy associated with rash.

### Contraindications

- ✗ Known severe allergy.

### Cautions

- ⊖ Age less than five years with asthma. Steroids do not usually have a role in children aged less than five years because they do not generally alter the course of their asthma exacerbation. However, a steroid is indicated if the child has a clear history of asthma and has previously received oral steroids.

### Use in pregnancy or when breastfeeding

- Safety has not been demonstrated during pregnancy. However, there is significant clinical experience with steroids and they appear to be safe. A steroid should be administered if there is bronchospasm, but should be withheld if the clinical problem is minor, for example rash or itch.
- May be administered if the patient is breastfeeding. Advise the patient to stop breastfeeding and seek further advice from their lead maternity carer or GP.

### Dosage

- 40 mg for an adult.
- See the paediatric drug dose tables for a child.

- If the patient is already taking prednisone:
  - a) Administer an additional full dose if the patient is taking a dose that is lower than that described in these CPGs. If the patient is not transported by ambulance to a medical facility, advise the patient to discontinue their usual prednisone, take the prednisone supplied by ambulance personnel and have their treatment reviewed in primary care (preferably by their own GP) within two days.
  - b) Do not administer an additional dose if the patient is taking a dose equal to or higher than that described in these CPGs. If the patient is not transported by ambulance to a medical facility, advise the patient to continue taking their usual prednisone and have their treatment reviewed by a doctor (preferably their own GP) within two days.

## **Administration**

- Administer PO.
- Prednisone tablets are very bitter. Do not crush prednisone tablets because this may cause vomiting.
- The tablets may be divided. The tablet does not always break evenly and this is not of clinical importance. The larger piece of the divided tablet should be chosen for administration.
- Patients aged ten years and over should usually be administered prednisone tablets, but may be administered the same dose of prednisolone syrup.
- Patients aged under ten years should usually be administered prednisolone syrup, but may be administered the same dose of prednisone tablets.
- Always ask a parent (or guardian) of a young child if the child can swallow tablets.

## **Common adverse effects**

- Fatigue.
- Sodium and water retention. This may worsen hypertension and heart failure, but is usually only of clinical significance with prolonged dosing.
- Gastrointestinal reflux.

## **Usual onset of effect**

- 30-60 minutes.

## **Usual duration of effect**

- 24 hours.

## Usual preparation

- 5 mg prednisone tablets.
- 20 mg prednisone tablets.
- Prednisolone syrup containing 5 mg/ml.

## Pharmacokinetics

- Prednisone and prednisolone are predominantly metabolised by the liver.
- Prednisone is a prodrug that is metabolised to prednisolone in the liver. A dose of prednisone provides slightly less steroid equivalence than the same dose of prednisolone, but this is not clinically significant.
- There are no significant effects from liver impairment on acute administration.

## Common interactions

- None.

## Prednisone packs

- If the patient is aged greater than or equal to 12 years and is not transported, a prednisone pack should be provided unless the patient already has an asthma or COPD action plan for administering their own steroid.
- Also provide an information sheet, ensuring the information is explained to the patient and to any carers.
- The pack contains four days' supply of prednisone and this is usually sufficient for a complete course of prednisone. However, it is important to advise the patient to be seen in primary care (preferably by their own GP) for a review of their treatment within two days.
- Prednisone packs are not carried in all vehicles.



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# 14.38 Promethazine

## Mechanism of action

- Promethazine is a phenothiazine with antihistaminic and anticholinergic effects.

## Delegated scopes of practice

- ICPs.

## Indications

- ✓ Adults with angioedema occurring during inter-hospital transfer for stroke clot retrieval.

## Contraindications

- ✗ Known severe allergy.

## Cautions

- ⊖ Reduced level of consciousness. Promethazine may cause sedation and further reduce the level of consciousness.
- ⊖ Elderly and/or frail. These will increase and prolong the effects.
- ⊖ Confusion. The anticholinergic effects of promethazine may make confusion worse.
- ⊖ Hypotension. Promethazine may worsen hypotension.

## Use in pregnancy or when breastfeeding

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

## Dosage

- 12.5 mg IV.

## Administration

- Dilute the dose to approximately 10 ml using 0.9% sodium chloride and administer IV over 1-2 minutes.

## Common adverse effects

- Sedation.
- Hypotension.
- Dry mouth.

## Usual onset of effect

- 5-10 minutes.



### **Usual duration of effect**

- 4-8 hours.

### **Usual preparation**

- Ampoule containing 50 mg in 2 ml.

### **Pharmacokinetics**

- Promethazine is metabolised in the liver.
- There are no significant effects of liver impairment on acute administration.

### **Common interactions**

- None.

### **Additional information**

- Promethazine has been reported to cause worsening of glaucoma, but this usually only occurs when it is administered regularly.
- Promethazine has been reported to further prolong the QT interval in patients known to have a prolonged QT interval. This generally involved repeated and/or high doses and a single dose is safe, even if the patient is known to have a prolonged QT interval.
- Promethazine is not carried in all ambulances.



# 14.39 Rocuronium

## Mechanism of action

- Rocuronium is a neuromuscular blocker. It antagonises (blocks) nicotinic acetylcholine receptors at the neuromuscular junction (motor nerve end plate) of skeletal muscle. This results in the inability of skeletal muscles to contract.

## Delegated scopes of practice

- Only ICPs credentialed to perform rapid sequence intubation (RSI) may administer rocuronium for the purposes of RSI.
- All ICPs may administer rocuronium post intubation, provided the endotracheal tube position has been confirmed with capnography.

## Indications

- ✓ Neuromuscular blockade for rapid sequence intubation (RSI).
- ✓ Neuromuscular blockade following endotracheal intubation:
  - Rocuronium is routinely administered following RSI if suxamethonium is used as the neuromuscular blocker.
  - Rocuronium is administered if the patient shows clinically significant signs of moving following intubation without RSI.
- ✓ Patient movement during cardiac arrest that is interfering with resuscitation, despite ketamine administration, provided the patient has been intubated and the endotracheal tube position has been confirmed with capnography.

## Contraindications

- ✗ Known severe allergy.
- ✗ Endotracheal tube position has not been confirmed by capnography (this does not apply if the indication is for RSI).

## Cautions

- ⊖ Predicted difficult intubation (this only applies if the indication is for RSI).
- ⊖ If the indication is for neuromuscular blockade following endotracheal intubation:
  - Chronic muscle weakness. Examples include myasthenia gravis, motor neuron disease and muscular dystrophy. Rocuronium may cause prolonged muscle weakness and should be withheld if possible. If rocuronium is administered the dose should be halved.
  - An adult with a very poor prognosis. Examples include severe comorbidities requiring long-term care, unwitnessed cardiac arrest and cardiac arrest with a first rhythm of asystole. Rocuronium should be withheld if possible because the patient is unlikely to benefit from admission to an intensive care unit and may be extubated in the ED.

## **Use in pregnancy or when breastfeeding**

- Safe and should be administered when indicated.

## **Dosage**

- For RSI: see the 'RSI' section.
- For neuromuscular blockade following endotracheal intubation:
  - a) 100 mg IV for an adult weighing greater than 80 kg.
  - b) 50 mg IV for an adult weighing less than or equal to 80 kg.
  - c) See the paediatric drug dose tables for a child.
  - d) Repeat as required.

## **Administration**

- Administer IV as a bolus.

## **Common adverse effects**

- None.

## **Usual onset of effect**

- 30-60 seconds. This is predominantly affected by cardiac output and will be prolonged if cardiac output is low.

## **Usual duration of effect**

- 30-60 minutes.

## **Usual preparation**

- Ampoule containing 50 mg in 5 ml.

## **Pharmacokinetics**

- Rocuronium is metabolised in the liver and excreted in urine.
- Significant hepatic or renal impairment will delay clearance and prolong the duration of effect.

## **Common interactions**

- None.

## Additional information

- Rocuronium that is not within kits must be refrigerated:
  - Without refrigeration it loses approximately 5-10% of activity per month.
  - It may be safely stored in kits provided it is labelled with the discard date which is three months after removal from the fridge.
  - It may be transported for up to 12 hours between stores/stations in a container that keeps it cool, without affecting the expiry date, provided it is placed into a fridge immediately on arrival.
- Rocuronium is a non-depolarising neuromuscular blocker. This means that the acetylcholine receptor at the neuromuscular junction is not stimulated prior to being blocked and no fasciculations will occur. This is in contrast to suxamethonium which is a depolarising neuromuscular blocker. Suxamethonium binds to the acetylcholine receptor at the neuromuscular junction and stimulates the receptor before blocking it, resulting in brief muscle contractions which are seen as fasciculations.
- During cardiac arrest the blood flow generated by CPR may be insufficient to deliver adequate levels of rocuronium to skeletal muscle and neuromuscular blockade may not occur. If sustained ROSC is achieved, neuromuscular blockade will occur and the patient will require an adequate level of sedation.
- Adequate sedation and analgesia must always be administered to a patient if rocuronium is administered. See the 'post intubation' section.



## 14.40 0.75% ropivacaine

### Mechanism of action

- Ropivacaine is a local anaesthetic. It blocks the initiation and transmission of nerve impulses by blocking the movement of sodium ions across the nerve cell membrane.

### Delegated scopes of practice

- ICPs.

### Indications

- ✓ Fascia iliaca block in a patient aged greater than or equal to 12 years, for moderate to severe pain associated with fractured neck of femur, fractured shaft of femur or dislocated hip.
- ✓ Digital ring blocks for moderate to severe pain associated with digital injuries.

### Contraindications

- ✗ Known severe allergy.
- ✗ Local infection at the site of injection.

### Cautions

- ⊖ Taking an anticoagulant.

### Use in pregnancy or when breastfeeding

- Safe and may be administered if indicated.

### Dosage

- 150 mg (20 ml of 0.75% diluted to 40 ml) for a fascia iliaca block.
- Maximum dosage:
  - a) 150 mg (20 ml of 0.75%) for an adult. If more than 20 ml is required dilute to 0.375%.
  - b) See the paediatric drug dose tables for maximum doses for a child.
  - c) The SC dose may be repeated:
    - Once after 60 minutes, or
    - Once after 30 minutes, if 1% lignocaine has been administered.

### Administration

- Digital ring blocks: administer approximately 1-2 ml of 0.75% into the tissue on either side of the web space of the digit.
- Fascia iliaca block: administer 40 ml of 0.375% (20 ml of 0.75% diluted to 40 ml) into the fascia iliaca space.

### **Common adverse effects**

- Stinging at the time of injection.

### **Usual onset of effect**

- 5-10 minutes.

### **Usual duration of effect**

- 1-2 hours.

### **Usual preparation**

- Ampoule containing 150 mg in 20 ml (0.75%).

### **Pharmacokinetics**

- Ropivacaine is metabolised in the liver.
- There are no significant effects from liver impairment on acute administration.

### **Common interactions**

- None.

### **Additional information**

- Overdose of ropivacaine is very rare, but can occur if doses exceed 150 mg in an adult or it is inadvertently administered IV. If this occurs the following may develop:
  - Tingling around the mouth.
  - Seizures.
  - Dysrhythmias, particularly bradycardias.
  - Hypotension.
  - Cardiac arrest.



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# 14.41 Salbutamol

## Mechanism of action

- Salbutamol is a bronchodilator. It is an agonist (stimulator) of beta-2 receptors.

## Delegated scopes of practice

- EMTs, Paramedics and ICPs.

## Indications

- ✓ Bronchospasm secondary to asthma or COPD.
- ✓ Prominent bronchospasm secondary to airway burns, smoke inhalation or chest infection.
- ✓ Release syndrome following crush injury.

## Contraindications

- ✗ Known severe allergy.

## Cautions

- ⊖ None.

## Use in pregnancy or when breastfeeding

- Safe and may be administered if indicated.

## Dosage

- 5 mg for adults and children. The initial dose is combined with 0.5 mg ipratropium, but subsequent doses are not.

## Administration

- Administer nebulised undiluted.

## Common adverse effects

- Tremor.
- Tachycardia.

## Usual onset of effect

- 2-5 minutes.

## Usual duration of effect

- 1-2 hours.

## Usual preparation

- Ampoule containing 5 mg in 2.5 ml.
- Ampoule containing 2.5 mg in 2.5 ml.

## Pharmacokinetics

- Only a small amount of the nebulised dose is absorbed, with most of the dose being nebulised to the atmosphere. The inhaled salbutamol is absorbed through the lungs and some is swallowed.
- Salbutamol is metabolised in the liver and excreted in urine.
- There are no significant effects from liver or kidney impairment on acute administration.

## Common interactions

- Salbutamol will be less effective in the presence of a beta-blocker, with the reduction in effect being most pronounced with a non-selective beta-blocker such as propranolol.

## Additional information

- Salbutamol does not have a significant role in the treatment of bronchospasm as a result of smoke, toxic gas inhalation or chest infection. However, it may be administered if bronchospasm is prominent.





## 14.42 8.4% sodium bicarbonate

### Mechanism of action

- 8.4% sodium bicarbonate is a systemic alkalinising agent. It increases plasma bicarbonate, buffers hydrogen ions and raises the blood pH.
- Following crush injury 8.4% sodium bicarbonate has a role because:
  - a) Sodium ions help protect cardiac cell membranes from the effects of hyperkalaemia.
  - b) A rise in pH results in potassium moving into the cells, which lowers the potassium concentration in blood.
  - c) A rise in urinary pH reduces myoglobin deposition in the kidneys.

### Delegated scopes of practice

- ICPs.

### Indications

- ✓ Release syndrome following crush injury in an adult.

### Contraindications

- ✗ Known severe allergy.

### Cautions

- ⊖ IV access via a small vein. 8.4% sodium bicarbonate is hyperosmolar and will cause venous irritation if administered via a small vein.

### Use in pregnancy or when breastfeeding

- Safety has not been demonstrated, but 8.4% sodium bicarbonate should be administered if indicated.

### Dosage

- 100 mmol (100 ml) for an adult.
- Repeat the dose every 10-20 minutes as required if ECG signs of hyperkalaemia persist or recur.
- Seek clinical advice for a child.

### Administration

- Administer IV over one minute, preferably into a large vein via a running line.
- Do not mix with other medicines as precipitation will occur. If other medicines are being administered via the same vein, ensure a minimum IV flush of 50 ml of 0.9% sodium chloride between medicines.

## Common adverse effects

- None.

## Usual onset of effect

- 1-2 minutes.

## Usual duration of effect

- 1-2 hours.

## Usual preparation

- Ampoule containing 1 mmol/ml of sodium bicarbonate.
- Ampoules may be 10 ml, 50 ml or 100 ml.

## Pharmacokinetics

- 8.4% sodium bicarbonate dissociates into sodium and bicarbonate ions which are excreted in urine.
- There are no significant effects from renal impairment on administration.

## Common interactions

- None.

## Additional information

- Document the dose administered as mmol.
- 8.4% sodium bicarbonate may have a role in cyclic antidepressant poisoning if there are signs of severe cardiovascular compromise.
  - Part of the toxicity from cyclic antidepressants comes from the drug binding to sodium channels within the heart and this may be reduced by a large dose of sodium ions.
  - The total dose of sodium ions administered is more important than the nature of the IV fluid containing sodium. 100 ml of 8.4% sodium bicarbonate contains 100 mmol of sodium and 1 litre of 0.9% sodium chloride contains 150 mmol of sodium. 100 ml of 8.4% sodium bicarbonate may be administered IV in addition to 0.9% sodium chloride, provided 8.4% sodium bicarbonate is immediately available, but there is usually no role for calling for 8.4% sodium bicarbonate to be delivered to the scene.
- 8.4% sodium bicarbonate will cause a rise in carbon dioxide concentration within blood because bicarbonate combines with hydrogen ions and dissociates into water and carbon dioxide. However, the rise in carbon dioxide concentration is not usually clinically significant unless the patient has inadequate breathing.

## 14.43 Suxamethonium

### Mechanism of action

- Suxamethonium is a neuromuscular blocker. It antagonises (blocks) nicotinic acetylcholine receptors at the neuromuscular junction (motor nerve end plate) of skeletal muscle. This results in the inability of skeletal muscles to contract.

### Delegated scopes of practice

- ICPs credentialed to perform rapid sequence intubation (RSI).

### Indications

- ✓ Neuromuscular blockade for rapid sequence intubation (RSI).

### Contraindications

- ✗ Known severe allergy.
- ✗ Known personal or family history of malignant hyperthermia (MH). In susceptible patients suxamethonium will trigger life-threatening MH.
- ✗ Pre-existing paraplegia or quadriplegia. Long-term muscle weakness causes proliferation of acetylcholine receptors on skeletal muscle and suxamethonium may cause life-threatening hyperkalaemia.
- ✗ Muscle disorder with long-term weakness. Examples include muscular dystrophy and motor neurone disease. Long-term muscle weakness causes proliferation of acetylcholine receptors on skeletal muscle and suxamethonium may cause life-threatening hyperkalaemia.
- ✗ Hyperkalaemia is strongly suspected. Suxamethonium will cause a brief rise in the potassium concentration within blood of 0.5-1 mmol/litre. In the presence of hyperkalemia this rise may be significant.

### Cautions

- ⊖ Predicted difficult intubation.

### Use in pregnancy or when breastfeeding

- Safe and should be administered if indicated.

### Dosage

- See the 'RSI' section.
- The onset of adequate neuromuscular blockade may be delayed if cardiac output is very low. Consider increasing the dose of suxamethonium to approximately 3 mg/kg, up to a maximum of 200 mg.

## Administration

- Administer undiluted for an adult or a large child.
- Dilute 100 mg to a total volume of 10 ml for a small child. This solution contains 10 mg/ml.
- Administer IV as a bolus, preferably into a running IV line.

## Common adverse effects

- Bradycardia. This is due to stimulation of acetylcholine receptors in the parasympathetic nervous system and is usually only clinically significant in young children.

## Usual onset of effect

- 30-60 seconds. This is predominantly affected by cardiac output and will be prolonged if cardiac output is low.

## Usual duration of effect

- 4-8 minutes.

## Usual preparation

- Ampoule containing 100 mg in 2 ml.

## Pharmacokinetics

- Suxamethonium is metabolised by the enzyme pseudocholinesterase. In most patients suxamethonium is cleared within 4-8 minutes.
- The neuromuscular blocking effects of suxamethonium can be increased to 4-12 hours if the patient has pseudocholinesterase deficiency.
- Pseudocholinesterase deficiency is rare.

## Common interactions

- None.

## Additional information

- Suxamethonium that is not within kits must be refrigerated:
  - Without refrigeration it loses approximately 5-10% of activity per month.
  - It may be safely stored in kits provided it is labelled with the discard date which is three months after removal from the fridge.
  - It may be transported for up to 12 hours between stores/stations in a container that keeps it cool, without affecting the expiry date, provided it is placed into a fridge immediately on arrival.
- Suxamethonium is a depolarising neuromuscular blocker. This means that the acetylcholine receptor at the neuromuscular junction is stimulated prior to being blocked and muscle fasciculations occur prior to the onset of neuromuscular blockade.

- Malignant hyperthermia (MH) is a rare, inherited disorder of muscle metabolism affecting approximately 20 families in New Zealand, many of whom are in the Manawatu area. When exposed to some anaesthetic agents (including suxamethonium) the patient may develop a life-threatening hypermetabolic state with severe hyperthermia. Patients with MH (or a family history of MH) usually know about it.
- Burn injury is often quoted as a contraindication to the administration of suxamethonium because life-threatening hyperkalaemia may occur. However, this is not a contraindication immediately following burn injury or once the patient is well enough to be discharged from hospital.



# 14.44 Tenecteplase

## Mechanism of action

- Tenecteplase is a fibrinolytic that accelerates the breakdown of blood clots. It converts the plasma protein plasminogen into the active enzyme plasmin, which breaks down fibrin within blood clots.

## Delegated scope of practice

- Paramedics and ICPs.

## Indications

- ✓ STEMI when primary percutaneous coronary intervention (PCI) is not the chosen reperfusion strategy.

## Contraindications

- ✗ Known severe allergy.
- ✗ Suspected aortic dissection.
- ✗ Major surgery, major trauma or severe brain injury within the last six weeks.
- ✗ Intracranial surgery within the last six months.
- ✗ Ischaemic stroke within the last six months.
- ✗ Previous intracerebral haemorrhage.
- ✗ Known cerebral aneurysm, arteriovenous malformation or tumour.

## Cautions

- ⊖ Clinically significant bleeding.
- ⊖ More than ten minutes of CPR.
- ⊖ Non-compressible vascular puncture within the last 24 hours.
- ⊖ Internal bleeding within the last six weeks.
- ⊖ Lumbar puncture or epidural insertion within the last six weeks.
- ⊖ TIA within the last three months.
- ⊖ Known bleeding disorder.
- ⊖ Taking an anticoagulant. If the patient is taking warfarin document their last known INR result if possible.
- ⊖ Systolic BP greater than 180 mmHg or diastolic BP greater than 110 mmHg.
- ⊖ Known to be pregnant or less than two weeks postpartum.
- ⊖ Time of onset of symptoms was greater than 12 hours ago.
- ⊖ Dependent on others for activities of daily living.
- ⊖ Another disease significantly shortens their life expectancy.
- ⊖ Very frail.

## Use in pregnancy or when breastfeeding

- Administration during pregnancy or within two weeks of birth carries a significant risk of bleeding. The likelihood of STEMI occurring in a woman who is pregnant or within two weeks of birth is very low and personnel must seek clinical advice or discuss with the STEMI coordinator prior to administration.
- May be administered if the patient is breastfeeding. Advise the patient to stop breastfeeding and seek further advice from their lead maternity carer or GP.

## Dosage

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

	Age less than 75 years		Age 75 years or older	
Weight	Tenecteplase (dose IV)	Tenecteplase (volume IV)	Tenecteplase (dose IV)	Tenecteplase (volume IV)
< 60 kg	30 mg	6 ml	15 mg	3 ml
60-69 kg	35 mg	7 ml	17.5 mg	3.5 ml
70-79 kg	40 mg	8 ml	20 mg	4 ml
80-89 kg	45 mg	9 ml	22.5 mg	4.5 ml
≥ 90 kg	50 mg	10 ml	25 mg	5 ml

## Administration

- Dissolve the powder using the syringe within the kit.
- Carefully discard unwanted drug from the syringe, preferably into the ampoule before administration, ensuring the correct dose remains in the syringe.
- If an error is made in discarding unwanted drug and the correct dose cannot be drawn up, administer the remaining drug and update the STEMI coordinator.
- Administer undiluted as an IV bolus, preferably into a running IV line.

## Common adverse effects

- Bleeding. Tenecteplase commonly causes superficial bleeding, including epistaxis, bruising and bleeding from IV sites.
- Dysrhythmia. It is common for dysrhythmia to occur if the coronary artery reperfuses. Most commonly the rhythm is accelerated idioventricular rhythm (AIVR) which does not require specific treatment. Other dysrhythmias should be treated using the appropriate section.

## Usual onset of effect

- 5-10 minutes.

## Usual duration of effect

- 2-6 hours.

## Pharmacokinetics

- Tenecteplase is metabolised by the liver.
- There are no significant effects from liver impairment on acute administration.

## Usual preparation

- Glass ampoule containing 50 mg of tenecteplase, in powder form with a pre-filled syringe containing 10 ml of sterile water.

## Common interactions

- None.

## Additional information

- Do not place additional IV lines after the administration of tenecteplase unless absolutely necessary, as this further increases the risk of bleeding.
- Rarely, tenecteplase may be associated with severe internal bleeding and this is why frequent vital sign recording is required post administration.
- The most common life-threatening bleeding following tenecteplase administration is spontaneous intracerebral bleeding. Patients aged greater than or equal to 75 years are particularly at risk and this is why the dose is reduced in this age group. If intracerebral bleeding occurs the patient will usually have sudden onset of headache, a falling level of consciousness, vomiting and focal neurological signs.





## 14.45 Tramadol

### Mechanism of action

- Tramadol is an analgesic. It has multiple actions within the central nervous system, including opiate receptor stimulation and inhibition of the re-uptake of noradrenaline and serotonin.

### Delegated scopes of practice

- EMTs, Paramedics and ICPs.

### Indications

- ✓ Aged greater than or equal to 12 years with moderate to severe pain (usually in combination with paracetamol and/or ibuprofen), particularly if personnel are not available to administer fentanyl and/or ketamine.

### Contraindications

- ✗ Known severe allergy.

### Cautions

- ⊖ Tramadol has been taken within the last four hours. Additional tramadol may be administered provided it is clear that the total dose taken within a four hour period does not exceed the dose described within the CPGs. Withhold tramadol if there is any doubt.
- ⊖ Abdominal pain, particularly if the patient is very unwell or vomiting. Clinical judgement is required, but if the patient is very unwell or vomiting the possibility of significant intra-abdominal pathology exists and oral medicines should usually be withheld.
- ⊖ Aged greater than or equal to 75 years, particularly if there is a previous history of dementia or confusion. Tramadol has anticholinergic activity and this may cause confusion, particularly in the elderly.
- ⊖ Confusion. Tramadol has anticholinergic activity and this may worsen confusion.
- ⊖ Pregnancy.

### Use in pregnancy or when breastfeeding

- Safety has not been demonstrated in pregnancy and tramadol should usually be withheld.
- May be administered if the patient is breastfeeding. Advise the patient to stop breastfeeding and seek further advice from their lead maternity carer or GP.

### Dosage

- 50 mg PO.

## **Administration**

- Administer PO.

## **Common adverse effects**

- Nausea and/or vomiting.
- Feeling light-headed or unusual.
- Sedation.
- Dry mouth.

## **Usual onset of effect**

- 30-60 minutes.

## **Usual duration of effect**

- 4-8 hours.

## **Usual preparation**

- 50 mg capsules.

## **Pharmacokinetics**

- Tramadol is metabolised in the liver and excreted by the kidneys.
- There are no significant effects from liver or kidney impairment on the initial (loading) dose.

## **Common interactions**

- Tramadol has been reported to cause serotonin syndrome in patients taking other medicines or recreational drugs that also raise serotonin levels within the brain. Examples include selective serotonin re-uptake inhibitors (SSRIs), tricyclic antidepressants and Ecstasy. However, this usually only occurs when doses of tramadol higher than 50 mg are taken regularly.

## **Additional information**

- Tramadol is not indicated for pain associated with myocardial ischaemia.
- Do not routinely administer tramadol if fentanyl is administered because tramadol does not usually provide significant additional pain relief and may worsen side effects. However, tramadol may be administered taking into account the overall clinical scenario, particularly if the patient has taken tramadol before and found it effective.
- Do not administer tramadol if ketamine is administered because it does not usually produce significant additional pain relief and may worsen side effects.
- Some patients experience nausea and/or feel unusual with tramadol and may refuse to have it again. These are side effects, not an allergy and are most likely to occur with doses higher than 50 mg administered IV.

- Tramadol has been reported to lower the seizure threshold in patients with epilepsy. However, this usually only occurs with doses higher than 50 mg taken regularly.
- A patient may be administered tramadol (in combination with paracetamol and/or ibuprofen) for pain associated with a minor condition and be given a recommendation that immediate referral to a medical facility is not required provided:
  - Adequate pain control is achieved, and
  - The patient is advised to be seen in primary care (preferably by their own GP) for a review of their condition within 24 hours.



# 14.46 Tranexamic acid

## Mechanism of action

- Tranexamic acid is an antifibrinolytic medicine. It blocks the conversion of plasminogen to plasmin, reducing fibrinolysis (breakdown of blood clots) and bleeding.

## Delegated scopes of practice

- Paramedics and ICPs.

## Indications

- ✓ Postpartum haemorrhage.
- ✓ Hypovolaemia from uncontrolled bleeding.
- ✓ Any other form of bleeding severe enough to cause hypovolaemia requiring 0.9% sodium chloride to be administered IV.

## Contraindications

- ✗ Known severe allergy.
- ✗ Trauma when tranexamic acid will be administered more than three hours after the time of injury. This appears to increase mortality rates, the cause of which is not clear.

## Cautions

- ⊖ None.

## Use in pregnancy or when breastfeeding

- Safety has not been demonstrated, but the balance of risk is such that it should be administered if indicated.

## Dosage

- 1 g IV for an adult.
- See the paediatric drug dose tables for a child.

## Administration

- Administer IV over 1-2 minutes.

## Common adverse effects

- None.

## Usual onset of effect

- 30-60 minutes.

### **Usual duration of effect**

- 8 hours.

### **Usual preparation**

- 10 ml ampoule containing 1 g
- 5 ml ampoule containing 500 mg.

### **Pharmacokinetics**

- Tranexamic acid is predominantly excreted in the urine.
- Renal impairment does not alter the initial (loading) dose.

### **Common interactions**

- None.

### **Additional information**

- Some references describe the topical administration of tranexamic acid for control of superficial bleeding. This usually has no role in the out-of-hospital setting and personnel should seek clinical advice if it is being considered.
- If the patient has trauma and can be randomised into the PATCH study, this must occur instead of administering 'open label' (non-PATCH study ampoules) tranexamic acid.



# 14.47 Valproate

## Mechanism of action

- Valproate is an anticonvulsant. It predominantly blocks sodium channels but also enhances the activity of gamma-aminobutyric acid (GABA) at GABA receptors within the central nervous system.
- The active ingredient in sodium valproate is valproate.

## Delegated scopes of practice

- Paramedics and ICPs.

## Indications

- ✓ Status epilepticus that has not responded to two doses of midazolam.

## Contraindications

- ✗ Known severe allergy.

## Cautions

- ⊖ None.

## Use in pregnancy or when breastfeeding

- Valproate has been demonstrated to increase the risk of harm to the unborn baby. However, this has only been demonstrated with chronic administration and the balance of risk is in favour of administration if the mother has status epilepticus.
- Small amounts are excreted in breast milk but the balance of risk is in favour of administration if the mother has status epilepticus.

## Dosage

- 1200 mg for an adult.
- See the paediatric drug dose tables for a child.

## Administration

- The ampoules are usually supplied with a 4 ml ampoule of water for reconstitution. The water ampoule may be discarded and 0.9% sodium chloride used for reconstitution.
- Dissolve each ampoule using 4 ml of 0.9% sodium chloride. Draw up the required dose into one syringe and dilute to a total of 10-20 ml using 0.9% sodium chloride.
- Administer IV over 1-2 minutes, preferably into a running IV line.
- Do not administer IM as this causes muscle necrosis.

**Common adverse effects**

- None.

**Usual onset of effect**

- 10-20 minutes.

**Usual duration of effect**

- 6-12 hours.

**Usual preparation**

- Ampoule containing 400 mg as powder for reconstitution.

**Pharmacokinetics**

- Valproate is predominantly metabolised in the liver.
- There are no significant effects from liver impairment on the initial (loading) dose.

**Common interactions**

- None.

**Additional information**

- Paramedics must call for backup from an ICP if valproate is to be administered.



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