CHAPTER 20

EMERGENCIES AND INJURIES

CARDIOPULMONARY RESUSCITATION



*Abbreviations:* CPR = Cardiopulmonary Resuscitation; PEA = Pulseless Electrical Activity; VF = Ventricular Fibrillation; VT = Ventricular Tachycardia.

Figure 20.1: Advanced cardiac arrest algorithm *(adapted with permission from the Resuscitation Council of South Africa)*

In context of COVID:



Figure 20.2: Advanced cardiac arrest algorithm - suspected respiratory communicable disease *(adapted with permission from the Resuscitation Council of South Africa)*

20.1 CARDIAC ARREST IN ADULTS

I46.0/I46.9

**DESCRIPTION**

Described as the loss of a heartbeat and a palpable pulse, irrespective of the electrical activity captured on ECG tracing. Irreversible brain damage can occur within 2–4 minutes.

Clinical features include:

* sudden loss of consciousness, absent carotid pulses
* loss of spontaneous respiration

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| LoE: IVb[[1]](#endnote-1) |

**COVID-19 CONSIDERATIONS**

* The infection risk that CPR poses to providers due to aerosolization of coronavirus particles is not negligible.
* This potential risk should be weighed against the probability of achieving spontaneous return of circulation to inform the decision to initiate or stop CPR.
* For in hospital cardiac arrest in patients with suspected COVID-19, CPR has been shown to not be beneficial unless an immediate reversible cause is suspected, e.g., dislodgement of ET tube, etc. and is therefore not recommended.
* For out of hospital cardiac arrest in patients with suspected COVID-19, it is recommended to not start conventional CPR in unwitnessed cardiac arrest as it will likely not be beneficial.
* Appropriate PPE should be worn by all staff before initiating CPR: FFP3 mask, visor, gloves and gown.

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| LoE: IIIb[[2]](#endnote-2) |

**EMERGENCY TREATMENT**

* Diagnose rapidly. After ensuring the safety of the scene, commence resuscitation as per acute adult cardiac arrest algorithm – as above
* Make a note of the time of starting resuscitation.
* Place the patient on a firm flat surface and commence resuscitation immediately.
* Call for skilled help and an automated external defibrillator (AED) or defibrillator.
* Initiate CAB (Circulation Airway Breathing) sequence of CPR (cardiopulmonary resuscitation).
* Check the rhythm as soon as defibrillator or AED is available and defibrillate if a shockable rhythm is identified.
* Document medication and progress after the resuscitation.

**Cardiopulmonary resuscitation (CPR)**

Circulation

* Check for carotid pulse for about 5 seconds.
* If there is no pulse or you are not sure, start with chest compressions at a rate of 100-120 compressions per minute to a depth of +/- 5cm. Push hard and allow full recoil of chest with minimum interruptions.

Airway and breathing

* To open the airway, lift the chin forward with the fingers of the one hand and tilt the head backwards with other hand on the forehead.
* **Note:** Do not do this where a neck injury is suspected – refer below for management of suspected neck injury.
* Ensure airway is open throughout resuscitation.
* If there is no normal breathing, attempt 2 respirations with bag-valve-mask resuscitator and face mask.
* The administered breaths must cause visible chest rising in patient. If not, reposition and try again once and proceed to next step.
* Repeat the cycle of 30 compressions followed by 2 respirations for 5 cycles and then re-assess for a pulse.
* If advanced airway is placed, administer 1 breath every 6 second without interrupting chest compressions. Avoid excessive ventilation.
* Oxygenate with 100% oxygen.

Where neck injury is suspected:

* To open the airway, place your fingers behind the jaw on each side.
* Do not perform a chin lift or head tilt manoeuvre if a neck injury is suspected.
* Lift the jaw upwards while opening the mouth with your thumbs (jaw thrust).
* To open the airway, place your fingers behind the jaw on each side.
* Maintain in line cervical spine immobilisation.

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| LoE: IIb[[3]](#endnote-3) |

Initiate fluids, IV/IO access

* Sodium chloride 0.9%, IV
* Administer a bolus of 1 litre during CPR if an increase in preload may benefit the patient, e.g., hypovolaemic shock, distributive shock, haemorrhagic shock.
* Adminsiter fluid cautiously during CPR if an increase in the preload could be detrimental, e.g., massive pulmonary embolism or cardiac tamponade.

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| LoE: IIIb[[4]](#endnote-4) |

If pulseless with shockable rhythm (ventricular fibrillation/tachycardia)

* Defibrillate, as indicated per algorithm.
* Immediately resume CPR. Starting with chest compression.
* Continue CPR for 2 minutes.
* Administer adrenaline (epinephrine) as per algorithm.
* Seek reversible cause of arrest.
* Continue CPR until spontaneous breathing and/or pulse returns.
* For management of ventricular fibrillation or pulseless ventricular tachycardia that is unresponsive to defibrillation:
* Amiodarone, IV bolus, 300 mg, 2 minutes after adrenaline (epinephrine) dose.
* Follow by a bolus of 10 mL sterile water or sodium chloride 0.9%.
* Patient remains in a shockable rhythm following further 2 minutes of CPR, a defibrillation shock, another adrenaline (epinephrine) dose, and another 2 minutes of CPR (5 cycles of 30:2): Amiodarone, IV bolus, 150 mg.

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| *LoE:IIb[[5]](#endnote-5)* |

If pulseless with non-shockable rhythm

* Immediately resume CPR. Starting with chest compression.
* Continue CPR for 2 minutes.
* Administer adrenaline as per algorithm.
* Seek reversible cause of arrest.
* Continue CPR until spontaneous breathing and/or pulse returns.

**Immediate emergency medicine treatment**

Adrenaline (epinephrine) is the mainstay of treatment and should be given immediately, IV or intra-osseous, when there is no response to initial resuscitation or defibrillation.

* + Adrenaline (epinephrine), 1:1 000, 1 mL, IV immediately, as a single dose.
* Flush with 5–10 mL IV of sterile water or sodium chloride, 0.9%.
* Repeat every 3–5 minutes during resuscitation.

If no IV line is available:

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| *LoE:IVb[[6]](#endnote-6)* |

* + Adrenaline (epinephrine), intra-osseous (IO), 1:1000, 1 mL, via IO line.
* Flush with 5–10 mL of sterile water or sodium chloride 0.9%.
* Repeat every 3–5 minutes during resuscitation.

##### ADDITIONAL GUIDANCE

Continue CPR until spontaneous breathing and/or heart beat returns.

Assess continuously (every 2 minutes) until the patient shows signs of recovery.

Termination of resuscitation:

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

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| LoE: IIIb[[7]](#endnote-7) |

Consider carrying on for longer especially with:

* hypothermia and drowning
* poisoning or medicine overdose
* neurotoxic envenomation (e.g. black and green mamba or Cape cobra snakebite) – see Section 21.3.1.4: Snakebites

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

20.2 POST CARDIAC ARREST CARE

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DESCRIPTION

Post cardiac arrest care starts following successful CPR. During this time the patient is vulnerable to several processes, including:

* the underlying disease condition or injury causing the cardiac arrest
* post cardiac arrest haemodynamic instability
* post cardiac arrest brain injury
* the sequelae of global ischaemia and reperfusion.

Care should be aimed at reversing or minimising the above processes to optimise the likelihood of neurologically intact survival.

**GENERAL MEASURES**

The priorities of management post cardiac arrest include:

Determining the cause of cardiac arrest

* careful history and physical examination
* bedside tests such as 12-lead ECG, blood glucose, Hb, pulse oximetry, blood gases
* special investigations such as chest x-ray, eFAST, CT of the brain

Treating reversible conditions

This will be specific to the presentation and clinical findings.

Evidence of ST elevation myocardial infarction (STEMI) on ECG should prompt urgent treatment. See section 3.2.1: ST elevation myocardial infarction (STEMI).

**Note:** Prolonged CPR may be a contraindication to administration of thrombolytic or fibrinolytic agents. Consult a specialist to determine whether referral for percutaneous intervention is possible.

Supportive care and prevention of complications

*Airway*

* Ensure that the airway is patent and protected.
* Endotracheal intubation may be required in patients that do not rapidly regain consciousness following return of spontaneous circulation.

*Breathing*

* Maintain oxygen saturation ≥ 94%.
* Avoid hyperoxia by weaning the inspired oxygen concentration to the lowest percentage required to maintain a SpO2 ≥ 94%.
* Maintain PaCO2 within normal range in ventilated patients where feasible.

*Circulation*

* Correct hypovolaemia if present, with judicious IV fluids.
* Monitor response to fluids: pulse rate, BP, urine output, skin perfusion, development of basal crepitations.
* If hypotension persists despite fluid resuscitation, in the absence of ongoing blood loss, commence inotropes (e.g. adrenaline (epinephrine)).
* Aim to maintain mean arterial blood pressure (MAP) above 65 mmHg.
* If brain or spinal cord injury is suspected, it is reasonable to increase the target MAP to 80 mmHg.

*Neurological care*

* Position head up 30 degrees.
* Monitor for seizures. Treat promptly and load with an anti-epileptic agent if seizures occur.

*Blood glucose control*

* Maintain blood glucose between 8 and 10 mmol/L and avoid hypoglycaemic episodes.

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| *LoE:IIIb[[8]](#endnote-8)* |

*Temperature control*

* Aim for normothermia by preventing fever in unconscious patients in the first 24 hours, using physical cooling methods e.g.: ice packs and fans, and antipyretics.

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| *LoE:IIIb[[9]](#endnote-9)* |

*Deep vein prophylaxis*

* Consider prophylaxis for venous thrombo-embolism, as required. See section 2.8: Venous thrombo-embolism.

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| *LoE:IIa[[10]](#endnote-10)* |

**Medical Treatment**

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| *LoE:IIIb[[11]](#endnote-11)* |

Hypoglycaemia

* Dextrose 50%, rapid IV injection 50 mL.

Assess clinical status and finger prick glucose level over the next 5–10 minutes.

Hypovalaemia

* Sodium chloride 0.9%.
* Consider giving a bolus of 1 litre during CPR if an increase in preload may benefit the patient, e.g., hypovolaemic shock, distributive shock, haemorrhagic shock.
* Cautious fluid administration is advised during CPR if an increase in the preload could be detrimental, e.g., massive pulmonary embolism or cardiac tamponade.

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| LoE: IIIb[[12]](#endnote-12) |

Hypotension (after volume correction)

* Adrenaline (epinephrine), IV infusion, start at 0.1 mcg/kg/minute titrated according to the response.
* Dilute 10 mg i.e. 10 ampoules of adrenaline 1:1 000 in 1 L sodium chloride 0.9%.
* Infuse according to weight and clinical response.
* Infusion rate: mL/hour:

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| **mcg/kg/minute** | **Weight in kg** |
| **50** | **60** | **70** | **80** | **90** | **100** | **110** |
| **0.1** | 30 | 36 | 42 | 48 | 54 | 60 | 66 |
| **0.2** | 60 | 72 | 84 | 96 | 108 | 120 | 132 |
| **0.3** | 90 | 108 | 126 | 144 | 162 | 180 | 198 |
| **0.4** | 120 | 144 | 168 | 192 | 216 | 240 | 264 |
| **0.5** | 150 | 180 | 210 | 240 | 270 | 300 | 330 |
| **0.6** | 180 | 216 | 252 | 288 | 324 | 360 | 396 |
| **0.7** | 210 | 252 | 294 | 336 | 378 | 420 | 462 |
| **0.8** | 240 | 288 | 336 | 384 | 432 | 480 | 528 |
| **0.9** | 270 | 324 | 378 | 432 | 486 | 540 | 594 |
| **1** | 300 | 360 | 420 | 480 | 540 | 600 | 660 |

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| *LoE:IIIb[[13]](#endnote-13)* |

Seizures

Treat seizures in post cardiac arrest, similar to management of status epilepticus. See section 14.4.1: Status epilepticus.

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| *LoE:IIIb[[14]](#endnote-14)* |

Fever

* Paracetamol, oral, 1 g 4–6 hourly when required.
* Maximum dose: 15 mg/kg/dose.
* Maximum daily dose: 4 g in 24 hours.

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| *LoE:IIIa[[15]](#endnote-15)* |

**Referral**

* Following successful resuscitation cases should be discussed with a hospital with intensive care facilities for transfer.
* If evidence of myocardial infarction is present or if strongly suspected cases should be discussed with a cardiology service.

20.3 CARDIAC DYSRHYTHMIAS

See section 3.3: Cardiac dysrhythmias.

**MEDICAL EMERGENCIES**

Emergency health conditions are those requiring rapid intervention to avert death or disability, and for which treatment delays of hours or less make interventions less effective. Concern that such a condition exists requires urgent assessment.

20.4 ACUTE CORONARY SYNDROMES

See sections 3.2.1: ST elevation myocardial infarction (STEMI) and 3.2.2: Non-ST elevation myocardial infarction (NSTEMI) and Unstable angina (UA)

20.5 ASTHMA, ACUTE

See section16.1: Asthma, acute for the management of status asthmaticus.

### 20.6 ANGIOEDEMA

T78.3 + (Y34.99/Y57.9/Y14.99)

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| Contact the 24/7 South African Angioedema Hotline at: 082 091 5684 4/7 if you require assistance with acute management, investigation or follow up. |

DESCRIPTION

Two major groups of angioedema should be differentiated: allergic angioedema forming part of a systemic reaction to an allergen, and non-allergic angioedema caused by bradykinin excess.

In allergic angioedema, features of allergy or anaphylaxis will often be present, including urticaria, bronchospasm, hypotension or gastrointestinal upset. Anaphylaxis should be treated urgently. See section 20.7: Anaphylaxis/anaphylactic shock.

Non-allergic angioedema is most commonly caused by ACE-inhibitors in susceptible individuals. It may also be caused by hereditary angioedema or acquired C1 esterase deficiency. Associated features of allergy are absent.

**Symptoms**

Swelling usually occurs around eyes and lips but may occur elsewhere.

Life-threatening airway obstruction can occur with angioedema of upper airways.

#### GENERAL MEASURES

Stop all suspected agents, e.g. ACE-inhibitor.

In case of angioedema with airway obstruction, early airway management is essential. If oedema is extensive or progressive, establish a definitive airway. The most skilled person available must handle airway interventions.

Avoid re-exposure to the offending agent and provide an alert bracelet.

#### MEDICINE TREATMENT

In severe cases of hypersensitivity where airway obstruction may be imminent:

**Note:** A definitive airway may be required before patient responds to medical treatment. Low threshold to surgical airway tracheostomy.

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| In cases where angioedema is part of anaphylaxis, treat as anaphylaxis. See section 20.7: Anaphylaxis/Anaphylactic shock. |

If urticaria and/or itch present (no imminent airway compromise):

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| *LoE:IIIb[[16]](#endnote-16)* |

* Promethazine, IM/IV, 25–50 mg as a single dose.

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| *LoE:IIIb[[17]](#endnote-17)* |

* Hydrocortisone, IV, 100 mg as a single dose.

Severe ACE-inhibitor induced angioedema with threatened airway:

**Note:** A definitive airway may be required before patient responds to medical treatment. Low threshold to surgical airway tracheostomy.

* Lyophilised plasma, IV, 2 units.

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| *LoE:IVb* |

If lyophilised plasma is unavailable:

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| *LoE:IIIa[[18]](#endnote-18)* |

* FFP, IV, 2 units.

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| Observe all cases until resolution. |

20.7 ANAPHYLAXIS/ANAPHYLACTIC SHOCK

T78.2 + (Y34.99/Y57.9/Y14.99)

#### description

An acute, potentially life-threatening hypersensitivity reaction.

The reaction usually starts within seconds to minutes after administration of, or exposure to a substance to which the individual has been sensitised.

Clinical manifestations range from mild urticaria and angioedema to upper airway obstruction, bronchospasm, hypotension, shock and death.

The reaction can be short-lived, protracted or biphasic, i.e. acute with recurrence several hours later.

Immediate reactions are usually the most severe and/or life threatening.

#### GENERAL MEASURES

Remove the inciting cause (e.g., stop infusion of medicine that caused anaphylaxis).

Administer adrenaline (epinephrine) immediately (see below)

Cardiopulmonary resuscitation, if required.

Maintain an open airway. Intubate, if necessary.

Monitor all vital parameters (including pulse and blood pressure) closely.

Reassure and comfort the patient.

Patient counselling to prevent recurrence.

An alert bracelet should be worn at all times.

Anaphylaxis associated with vaccinations:

1. Always keep a fully equipped emergency tray at the immunisation point.
2. It is advisable to observe clients for 15 minutes after a vaccination. If a client is known with severe allergies, an observation period of 30 minutes is advised.
3. Clients who develop symptoms should be assessed for possible vaccination associated anaphylaxis by considering the following:
* If signs and symptoms are generalised – involving more than 2 body systems, manage as anaphylaxis.
* If signs and symptoms are serious or life-threatening, even if only one body. system is involved, treat as anaphylaxis (including hypotension, respiratory distress significant swelling of lips or tongue).
* If isolated rash in an otherwise well client, monitor for 30 minutes.
1. Clients who collapse following vaccination:
* Call for help and put patient on his/her back and raise legs.
* Check if responsive – if unresponsive, commence CPR (See section 21.1)
* A vasovagal episode is usually associated with a transient loss of consciousness (< 1 minute), relieved by raising the legs when supine, transient low BP and low HR.
* Collapsing after vaccination usually occurs 5-10 minutes post-vaccination, but can occur up to an hour afterwards.
* Treat as anaphylaxis if loss of consciousness is not brief and not relieved by raising the legs, or when any of the warning signs for anaphylaxis occur.



Table 20.1.: Differences between anaphylaxis, general acute stress response and vasovagal reaction with syncope

*Source: Immunization stress-related response. A manual for program managers and health professionals to prevent, identify and respond to stress related responses following immunization. Geneva: World Health Organization; 2019.* [*https://apps.who.int/iris/handle/10665/330277*](https://apps.who.int/iris/handle/10665/330277)

#### MEDICINE TREATMENT

* Adrenaline (epinephrine) 1:1000, 0.5 mL, IM, immediately into anterolateral thigh.
* Repeat dose every 5 minutes, as required.

In cases of persistent hypotension or where multiple repeat doses are required:

* Adrenaline (epinephrine), IV infusion, start at 0.05 mcg/kg/minute titrated according to the response.
* Dilute 10 mg i.e. 10 ampoules of adrenaline 1:1 000 in 1 L sodium chloride 0.9%.
* Infuse according to weight and clinical response.
* Infusion rate: mL/hour:

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| **mcg/kg/minute** | **Weight in kg** |
| **50** | **60** | **70** | **80** | **90** | **100** | **110** |
| **0.05** | 15 | 18 | 21 | 24 | 27 | 30 | 33 |
| **0.1** | 30 | 36 | 42 | 48 | 54 | 60 | 66 |
| **0.2** | 60 | 72 | 84 | 96 | 108 | 120 | 132 |
| **0.3** | 90 | 108 | 126 | 144 | 162 | 180 | 198 |
| **0.4** | 120 | 144 | 168 | 192 | 216 | 240 | 264 |
| **0.5** | 150 | 180 | 210 | 240 | 270 | 300 | 330 |
| **0.6** | 180 | 216 | 252 | 288 | 324 | 360 | 396 |
| **0.7** | 210 | 252 | 294 | 336 | 378 | 420 | 462 |
| **0.8** | 240 | 288 | 336 | 384 | 432 | 480 | 528 |
| **0.9** | 270 | 324 | 378 | 432 | 486 | 540 | 594 |
| **1** | 300 | 360 | 420 | 480 | 540 | 600 | 660 |

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| *LoE:IVb* |

###### AND

* Hydrocortisone, IV/IM, 200 mg, immediately as a single dose.

**AND**

**Intravenous fluids**

Establish an intravenous line:

* Sodium chloride 0.9%, IV.

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| *LoE:IIa[[19]](#endnote-19)* |

If bronchospasm:

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| LoE:IIb[[20]](#endnote-20) |

* Oxygen if saturation <94%.

###### AND

Salbutamol, nebulisation, 5 mg.

* Nebulise continuously (refill the nebuliser reservoir every 20 minutes) at a flow rate of 6–8 L/minute.

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| *LoE: IVb[[21]](#endnote-21)* |

**AND**

* Ipratropium bromide, nebulisation 0.5 mg, added to salbutamol solution.

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| *LoE: IVb*[[22]](#endnote-22) |

If urticaria and/or itch present:

* Antihistamine, e.g.:
* Promethazine, IV 25–50 mg as a single dose.

**OR**

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| *LoE:IIIb[[23]](#endnote-23)* |

Cetirizine, oral, 10 mg as a single dose.

20.8 DELIRIUM

F05.0-1/F05.8-9/R45.1/R45.4-6

**Description**

Delirium is a disturbance in attention, awareness (reduced orientation to the environment), and cognition (e.g. memory deficit, language, visuospatial ability, or perception). It is acute, developing within hours to days, and fluctuates during the day, worsening in the evenings. It may be hyperactive, with increased mood lability, agitation, and/or uncooperative behavior, or hypoactive, with poor responsiveness and stupor.

Delirium should not be mistaken for a psychiatric disorder. It is a physiological consequence of another medical condition, substance intoxication or withdrawal (including prescription or over the counter medications and recreational substances), exposure to a toxin, or multiple etiologies. Risk factors include

* > 65 years of age
* dementia
* history of previous delirium or of falls
* history of stroke, epilepsy, or other neurological disorders
* HIV infection
* multiple comorbidities
* medicines such as anticholinergics, hypnotics, and opioids
* polypharmacy
* psychoactive substance use
* severe illness

**GENERAL MEASURES**

1. Investigations need to be done to exclude or diagnose an underlying medical problem, **the treatment of which is the primary management.**

**Checklist for diagnosis:**

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| D | Drugs (Intoxication and withdrawal. Consider Wernicke’s encephalopathy). |
| I | Infections, e.g. sepsis, pneumonia, urinary tract infections, peritonitis, meningitis. |
| M | Metabolic, e.g. hypoglycaemia, electrolyte abnormalities (e.g. hyponatraemia); organ failure (e.g. liver failure, renal dysfunction), CO2 narcosis. |
| T | Trauma, e.g. chronic subdural haematoma. |
| O | Oxygen deficit (including hypoxia, carbon monoxide poisoning). |
| P | Psychiatric or physical conditions, e.g. severe stressor pain. |

1. Assess for and address dehydration, constipation, hypoxia, infections, pain, and discomfort.
2. Avoid abrupt substance withdrawal (see Adult Hospital STGs and EML; Chapter 15: Mental Health conditions, Substance misuse).
3. Review all medicines that the person has been taking – optimise doses; gradually wean and stop any unnecessary medication, including sedatives and analgesics.

**Nursing interventions:**

1. Nurse in calm, predictable environment, avoid changes of staff or rooms
2. Maintain circadian rhythm: in the day mobilise, provide sensory stimulation/ spectacles/ hearing aids; at night avoid noise, light and procedures
3. Ensure effective communication: introduce self with each patient contact, be aware of patient’s non-verbal cues, listen attentively, reassure frequently
4. Re-orientate verbally, with a clock, and signage

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| **CAUTION – Physical Restraint*** Worsens the outcomes of delirious patients: this is a last resort when all else has failed and is a short-term measure until chemical restraint and other measures have been achieved.
* Manual restraint: respectful, controlled, applied by personnel of the same sex as the patient.
* Mechanical restraint: only if absolutely necessary to protect the patient and others for as short a time as possible. Document the type, sites and duration of any restraints used. 15-minute monitoring of vital signs, the mental state, restraint sites, and reasons for use.
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**MEDICINE TREATMENT**

* Treat the underlying medical or surgical condition.
* Keep antipsychotic or benzodiazepine use to a minimum.
* Use small doses regularly rather than large doses less frequently.
* Adjust doses according to clinical circumstances, e.g., lower doses in the elderly, debilitated, or where HIV infection or HIV-related dementia is known or suspected.

**Acute management**

For management of severe aggression and disruptive behaviour: see section 15.1: Aggressive disruptive behaviour in adults.

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| *LoE:IVb[[24]](#endnote-24)* |

For agitated and acutely disturbed patient:

* Olanzapine, oral dispersible tablet or IM, 2.5–5 mg.
* This can be repeated in 30–60 minutes, if required and then 6 hourly to a maximum dose of 20 mg within 24 hours.
* Monitor vital signs and beware of oversedation, neuroleptic malignant syndrome, and acute dystonia.

Once able to swallow, continue with oral treatment until behaviour contained:

* Haloperidol, oral, 0.75–2.5 mg at night.

**OR**

* Olanzapine, oral, 2.5–5 mg at night.

**OR**

For substance withdrawal, Parkinson’s disease, or intolerability to olanzapine:

* Benzodiazepine, repeat as necessary, to achieve containment, e.g.:
* Lorazepam, IM, 0.25–1 mg, 2 to 4 hourly, maximum dose 3 mg in 24 hours

**OR**

 Clonazepam, IM, 0.5–2 mg.

**OR**

 Diazepam, IV, 5–10 mg.

* Switch to oral route once containment is achieved.

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| *LoE:IIIb[[25]](#endnote-25)* |

* In the elderly, a starting dose of 2 mg is recommended

**Note:**

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| **CAUTION - Benzodiazepines*** Can cause respiratory depression, especially diazepam IV.
* Can aggravate delirium.
* In the frail and elderly patient or where respiratory depression is a

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| *LoE:IVb[[26]](#endnote-26)* |

concern, reduce the dose by half.* The safest route of administration is oral followed by IM; IV route has the highest risk of respiratory depression and arrest.
* Monitor vital signs closely during and after administration.
* Allow at least 15–30 minutes for the medication to take effect. Repeated IM doses of benzodiazepines may result in toxicity owing to accumulation.
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**If alcohol withdrawal/ Wernicke’s encephalopathy suspected:**

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| LoE:IVb[[27]](#endnote-27) |

* + Thiamine, IM, 200 mg immediately.

### 20.9 DIABETIC EMERGENCIES

See sections 8.6.1: Hypoglycaemia and 8.6.2: Diabetic ketoacidosis (DKA) and hyperosmolar hyperglycaemic state (HHS).

### 20.10 PULMONARY OEDEMA, ACUTE

J81

#### description

A life-threatening condition with abnormal accumulation of fluid in the lungs.

Common causes include acute decompensation of chronic underlying heart failure and acute renal failure (e.g. acute nephritis).

#### The acute decompensated heart failure patient appears extremely ill, restless, poorly perfused and sweaty, tachypnoeic, tachycardic, hypoxic, increased work of breathing, frothy sputum.

#### GENERAL MEASURES

Maintain open airway. Consider non-invasive positive pressure ventilation.

Position in Fowler’s position, unless hypotensive or comatose.

Correct electrolyte disturbances.

Determine and correct any dysrhythmias.

#### MEDICINE TREATMENT

* Administer oxygen using face mask to deliver 40% oxygen at a rate of 6–8 L per minute.

Fluid overload suspected/detected:

* Furosemide, slow IV, 40 mg.
* If response is adequate, follow with 40 mg in 2–4 hours.
* If no response within 20–30 minutes: furosemide, IV, 80 mg.

Followed by:

* Nitrates, e.g.:
* Isosorbide dinitrate, SL, 5 mg repeat every 5–10 minutes, if necessary.
* Monitor blood pressure. Do not administer if hypotensive.

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| *LoE:IVb* |

**OR**

* Glyceryl trinitrate, IV, 5–200 mcg/minute, titrated to response.
* Start with 5 mcg/minute and increase by 5 mcg/minute every 5 minutes until response or until the rate is 20 mcg/minute.
* If no response after 20 mcg/minute increase by 20 mcg/minute until response.

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| *LoE:IVb[[28]](#endnote-28)* |

* Flush the PVC tube before administering to patient.
* Monitor blood pressure carefully.

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| **Volume of diluent** | **Glyceryl trinitrate** **5 mg/mL** | **Concentration of dilution** |
| 250 mL | 5 mL (25 mg) | 100 mcg/mL |
| 10 mL (50 mg) | 200 mcg/mL |
| 20 mL (100 mg) | 400 mcg/mL |
| 500 mL | 10 mL (50 mg) | 100 mcg/mL |
| 20 mL (100 mg) | 200 mcg/mL |
| 40 mL (200 mg) | 400 mcg/mL |
| **Solution****Concentration (mcg/mL)** | **100****mcg/mL solution** | **200****mcg/mL solution** | **400****mcg/mL solution** |
| Dose (mcg/min) | Flow rate (microdrops/min = mL/hr) |
| 5 | 3 | – | – |
| 10 | 6 | 3 | – |
| 15 | 9 | – | – |
| 20 | 12 | 6 | 3 |
| 30 | 18 | 9 | – |
| 40 | 24 | 12 | 6 |
| 60 | 36 | 18 | 9 |
| 80 | 48 | 24 | 12 |
| 100 | 60 | 30 | 15 |
| 120 | 72 | 36 | 18 |
| 160 | 96 | 48 | 24 |
| 200 | – | 60 | 30 |

No fluid overload present:

Initiate nitrates, followed by furosemide.

If hypotensive consider inotropic support, e.g.:

* Dobutamine, IV infusion, 5–20 mcg/kg/minute.
	+ Dilute 1 vial (250 mg/20 mL) up to 50 mL with sodium chloride 0.9% or dextrose 5%. (Solution = 5 mg/mL or 5 000 mcg/mL)
	+ Administer under constant ECG monitoring.
	+ Rate of infusion in mL/hour: see weight-dose table in section 20.11.3: Cardiogenic shock.
	+ Monitor the blood pressure continuously.

**CAUTION**

Do not use morphine for pulmonary oedema, as there is observational data providing a signal of harm.

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| LoE:IIIb[[29]](#endnote-29) |

### 20.11 Rapid sequence induction and intubation

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| *LoE:IVb[[30]](#endnote-30)* |

Anaesthetic and sedative medication may only be administered by medical practitioners trained and experienced in their use. Sound theoretical and practical training followed by supervised experience in the administration of anaesthetic and sedative medication is essential. Even within the recommended dosage range, anaesthetic agents can cause death when inappropriately used.

Medicines and equipment for resuscitation should be functional and immediately available whenever general anaesthesia, regional anaesthesia or sedation is administered.

The doses of the medicines given are those recommended for healthy adults. Patients who are acutely or chronically sick, and or elderly, may require substantial reductions in the doses given otherwise life-threatening adverse effects may ensue.

Patients at risk of aspiration require a rapid sequence intubation. An IV induction agent is given through an IV line with fast running fluids, immediately followed by a rapidly acting muscle relaxant. The rapid onset of action enables the time to intubation to be short enough to avoid mask ventilation, as this can result in gastric insufflation and aspiration of gastric contents.

### 20.11.1 Induction agents

T07/Z99.1

Respiratory depression occurs following induction of anaesthesia and ventilation should be supported as required.

Administer at appropriate doses, after consideration of patient factors and contraindications:

* Propofol is the most widely used IV induction agent but can produce hypotension.
* Etomidate or ketamine is preferred in haemodynamically unstable patients.

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| *LoE:IVb[[31]](#endnote-31)* |

* Propofol, IV, 1.5–2.5 mg/kg.
* Etomidate, IV, 0.3 mg/kg (0.2–0.6 mg/kg)
* Ketamine, IV, 1–2 mg/kg.

### 20.11.2 Muscle relaxants

T07/Z99.1

* Suxamethonium, 1–1.5 mg/kg, IV. (See section 12.3.1: Depolarising muscle relaxants).
	+ Preferred agent as, in the event of a failed intubation, it wears off quickly enabling spontaneous respiration to resume.
	+ Contraindications to suxamethonium
	+ Congenital and acquired medical conditions associated with severe, potentially lethal suxamethonium-induced hyperkalaemia.

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| *LoE:IIb[[32]](#endnote-32)* |

* + Malignant hyperthermia.

If suxamethonium is contra-indicated, consider:

* Rocuronium, 0.9 mg/kg, IV.

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| *LoE:IIb[[33]](#endnote-33)* |

* + Duration +/- 60 minutes.

Sub-optimal conditions for intubating and prolonged effect can be problematic in the event of a difficult or failed intubation and if the procedure is short*.*

### 20.11.3 Post-intubation sedation

T07/Z99.1

Sedation requirements fluctuate rapidly and warrant regular review. Individualised sedation objectives should be clearly defined, and level of sedation regularly recorded. Sedation protocols that recognise the need for dose minimisation, weaning and sedation interruptions probably improve outcomes.

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| *LoE:IIIb[[34]](#endnote-34)* |

Adequate pain control is often more efficacious than sedatives for reducing agitation. The doses listed apply to ventilated patients in whom short term respiratory depression is not a concern.

**Sedation**

**Short term sedation (less than 24 hours)**

* Midazolam, IV infusion, 0.05–0.2 mg/kg/hour.

**OR**

 Propofol, IV infusion, 0.5 mg/kg/hour.

Note: Propofol does have cardiovascular effects; benzodiazepines

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| *LoE:IVb[[35]](#endnote-35)* |

are preferred.

**Longer term sedation (expected 72 hours or more)**

* Midazolam, IV, 0.2 mg/kg/hour.

**OR**

 Lorazepam, IV, 0.1 mg/kg/hour.

**Note**: Lorazepam (0.1 mg/kg/hour) is as effective (and as easy to wean) as midazolam 0.2 mg/kg/hour) but is more difficult to titrate. Due to high fat solubility, midazolam also becomes ‘long acting’ after infusions of more than 24 hours.

**Supplemental analgesia:**

**ADD** an analgesia to any of the above regimens:

* Morphine, IV infusion, 0.1–0.2 mg/kg/hour.

**OR**

 Fentanyl, IV infusion, 1 mcg/kg/hour (also becomes long acting after prolonged infusion due to fat solubility).

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| *LoE:IIIb[[36]](#endnote-36)* |

**OR**

 Ketamine, IV infusion, 0.5–1 mg/kg/hour.

**Note:** **If haemodynamically unstable, use adjunctive ketamine for analgosedation.**

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| *LoE:IIIb[[37]](#endnote-37)* |

## 20.12 SHOCK

## 20.12.1 HypovolaemiC shock

### 20.12.1.1 NON-TRAUMA RELATED HypovolaemiC shock

R57.1

#### description

This happens when there is loss of intravascular fluid, e.g. severe diarrhoea and dehydration, haemorrhage or fluid shifts.

#### GENERAL MEASURES

Control obvious bleeding with direct pressure.

Insert one or two large bore IV catheters; peripheral lines are adequate.

#### MEDICINE TREATMENT

##### Non trauma related

* Sodium chloride 0.9%, IV, 1–2 L.

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| *LoE:IIa[[38]](#endnote-38)* |

Monitor blood pressure, pulse and clinical response.

### 20.12.1.2 TRAUMA-RELATED HypovolaemiC shock

T79.4 + (R57.1 + Y34.99/Y57.9/Y14.99)

#### description

Shock is inadequate perfusion of the vital organs. Clinically this may manifest with hypotension, tachycardia, weak pulses, clammy skin, pallor, altered mental state, poor urine output and elevated lactate.

The presence of shock in a patient with bleeding indicates that a significant volume of blood has already been lost.

The common traumatic sites of blood loss include the chest, abdomen, pelvis, long bone fractures and vascular injuries.

Major non-traumatic bleeds include gastrointestinal haemorrhage, ruptured ectopic pregnancy and obstetric haemorrhage.

#### GENERAL MEASURES

Control bleeding. Techniques may include:

* Direct, sustained pressure over the bleeding point.
* Use of tourniquets in exsanguinating limb haemorrhage, e.g. manual BP cuff or specialized tourniquet while awaiting transfer to theatre. (Do not use for longer than 6 hours).
* Tamponade techniques e.g. inflated Foley catheter in neck, axilla or femoral wounds.

Obtain large bore IV access, preferably two lines.

Prevent hypothermia.

Send blood sample to blood bank as early as possible for blood type and screening. Notify blood bank of possible massive transfusion.

#### MEDICINE TREATMENT

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| LoE:IIb[[39]](#endnote-39) |

Oxygen if saturation <94%.

**Trauma related**

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| *LoE:IIa[[40]](#endnote-40)* |

* Sodium chloride 0.9%, IV.

Consider blood products If more than 1 litre of fluid is needed, consider blood products:

* In cases of major bleeding, limit fluid volumes to less than 1.5 litres in total where possible. Replace acute blood loss with blood and blood products.
* Emergency blood should be used in unstable patients and when there will be significant delay in obtaining cross-matched blood from a blood bank.
* Rh typing is advised when possible.
* Type O Rh negative blood should be reserved for women of childbearing age that are Rh negative or Rh status unknown.
* Type O Rh positive blood may be given to Rh positive women of childbearing age, females >50 years of age or males regardless of Rh status.
* After 2 units of emergency blood, consider activation of massive transfusion protocol. See section 20.10.1.2.1: Massive transfusion.

#### 20.12.1.2.1 Massive transfusion

Z51.8

**DESCRIPTION**

A massive transfusion is the replacement of a patient’s blood volume or 10 units over a 24-hour period, or replacement of half of that volume over 4 hours.

**GENERAL MEASURES**

Actively treat and prevent hypothermia.

When it is anticipated that large volumes of blood will be required, the replacement of platelets and clotting factors in addition to red blood cells is needed to prevent coagulopathy.

**MEDICINE TREATMENT**

Facilities without access to a blood bank:

* Lyophilised plasma, IV.
	+ 1 unit for each unit of emergency blood transfused.

Arrange urgent transfer to a centre with blood bank and specialist services.

Facilities with access to a blood bank:

* Ensure that the blood bank receives an appropriate specimen as soon as the possible need for transfusion is identified.
* Notify the blood bank as soon as possible of the need for a massive transfusion and request a massive transfusion pack.

A massive transfusion pack will typically consist of:

* Red blood cells (RBCs), 6 units.

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| *LoE:IVb* |

**AND**

* Lyophilised plasma, IV.
	+ 1 unit for each unit of emergency blood transfused.

**OR**

 FFP, 6 units - thawed when requested.

**AND**

* Platelets, 1 mega-unit (normally 6 pooled donor units).
	+ Aim to transfuse the above products in a 1:1:1 ratio, or as guided by laboratory parameters.
	+ Send specimens for FBC and INR and continue to monitor.

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| *LoE:IVb[[41]](#endnote-41)* |

Expedite definitive control of bleeding:

* Tranexamic acid, IV, 1 g, infused over 10 minutes.

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| *LoE:Ia[[42]](#endnote-42)* |

* Followed with IV infusion, 1 g, over 8 hours.
* Benefit is greatest if initiated in the 1st hour. Initiation of tranexamic acid more than 3 hours after the initial trauma may be harmful.

If patient responds initially and subsequently deteriorate, there may be an ongoing occult haemorrhage. If no response occurs, consider:

* Occult exsanguinating haemorrhage: intra-abdominal, retroperitoneal and intrapleural.
* Non-hypovolaemic shock: tension pneumothorax, myocardial contusion, cardiac tamponade or myocardial infarct.

### 20.12.2 DISTRIBUTIVE SHOCK

This happens when the blood vessels are abnormally dilated and presents with a low blood pressure, tachycardia and warm peripheries. There are 3 causes of this type of shock:

* neurogenic shock,
* septic shock, and
* anaphylactic shock (see section: 20.7 Anaphylaxis/anaphylactic shock).

20.12.2.1 NEUROGENIC SHOCK

T09.3 + (Y34.99/R57.8)

#### description

Occurs in spinal cord trauma when there is an interruption of the sympathetic chain causing vasodilatation.

**GENERAL MEASURES**

Check circulation, airway and breathing.

Spinal cord immobilisation.

Exclude other injuries that could cause low blood pressure.

#### MEDICINE TREATMENT

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| LoE:IIb[[43]](#endnote-43) |

* Oxygen if saturation <94%.

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| *LoE:IIa[[44]](#endnote-44)* |

* Sodium chloride 0.9%, IV.
* Administer crystalloid in titrated boluses up to 1 litre.

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| *LoE:IVb* |

* Adrenaline (epinephrine), IV infusion, start at 0.05 mcg/kg/minute titrated according to the response.
* Dilute 10 mg (10 ampoules) of adrenaline 1:1 000 in 1 L sodium chloride 0.9%.
* Infuse according to weight and clinical response.
* Infusion rate: mL/hour:

|  |  |
| --- | --- |
| **mcg/kg/minute** | **Weight in kg** |
| **50** | **60** | **70** | **80** | **90** | **100** | **110** |
| **0.05** | 15 | 18 | 21 | 24 | 27 | 30 | 33 |
| **0.1** | 30 | 36 | 42 | 48 | 54 | 60 | 66 |
| **0.2** | 60 | 72 | 84 | 96 | 108 | 120 | 132 |
| **0.3** | 90 | 108 | 126 | 144 | 162 | 180 | 198 |
| **0.4** | 120 | 144 | 168 | 192 | 216 | 240 | 264 |
| **0.5** | 150 | 180 | 210 | 240 | 270 | 300 | 330 |
| **0.6** | 180 | 216 | 252 | 288 | 324 | 360 | 396 |
| **0.7** | 210 | 252 | 294 | 336 | 378 | 420 | 462 |
| **0.8** | 240 | 288 | 336 | 384 | 432 | 480 | 528 |
| **0.9** | 270 | 324 | 378 | 432 | 486 | 540 | 594 |
| **1** | 300 | 360 | 420 | 480 | 540 | 600 | 660 |

### 20.12.2.2 SEPTIC SHOCK

R57.2

**DESCRIPTION**

Shock caused by a confirmed or suspected infection, with vasodilatation, increased capillary permeability, and decreased contractility of the heart.

**GENERAL MEASURES**

Check airway, breathing and circulation.

#### MEDICINE TREATMENT

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| LoE:IIb[[45]](#endnote-45) |

* Oxygen if saturation <94%.

Take blood culture (or any other tissue/body fluid), then administer appropriate parenteral broad spectrum antibiotics urgently, e.g.:

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| *LoE:IIIb[[46]](#endnote-46)* |

* Ceftriaxone, IV, 2 g daily.

Perform a fluid challenge for hypotension:

* Sodium chloride 0.9%, 500 mL boluses over 30 minutes, whilst monitoring clinical response until 30 mL/kg has been achieved.
* Assess BP and pulse rate response. Response is defined by a good urine output (>0.5 mL/kg/hour) and adequate cerebral perfusion rather than an absolute BP value.

Balanced solutions may be appropriate in some patients (i.e. presentation with

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| *LoE:Ia[[47]](#endnote-47)* |

hyponatraemia, previous renal placement therapy):

* Balanced solution, e.g.:
* Ringer lactate, 500 mL boluses over 30 minutes, whilst monitoring clinical response, until 30 mL/kg has been achieved.
* Assess blood pressure and pulse rate response. Response is defined by a good urine output (>0.5 mL/kg/hour) and adequate cerebral perfusion rather than an absolute blood pressure value.

Avoid over-hydrating as this could exacerbate hypoxia associated with adult respiratory distress syndrome.

If no haemodynamic response to early aggressive fluid resuscitation:

* Adrenaline (epinephrine), IV infusion, 0.05 mcg/kg/minute titrated according to the response.
* Dilute 10 mg (10 ampoules) of adrenaline 1:1000 in 1 L sodium chloride 0.9%.
* Infuse according to weight and clinical response. (Aim for target MAP 65 mmHg and urine output 0.5 mL/kg/hour).
* See section 20.1.4.1: Neurogenic shock, for the infusion rate.

### 20.12.3 CARDIOGENIC SHOCK

R57.0

**DESCRIPTION**

Patients are hypotensive, cold and clammy and their pulse rate may be variable. Causes include an acute myocardial infarction, myocardial contusion, myocarditis, dysrhythmias, valvular heart disease, aortic dissecting aneurysm etc.

Consult with specialist and consider referring patients after initial emergency measures have been taken.

**GENERAL MEASURES**

Check circulation, airway and breathing.

ECG.

Treat the underlying cause, e.g.: MI, dysrhythmia, etc.

**MEDICINE TREATMENT**

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| LoE:IIb[[48]](#endnote-48) |

* Oxygen if saturation <94%.

A right ventricular myocardial infarction may respond to a fluid challenge:

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| *LoE:IIa[[49]](#endnote-49)* |

* Sodium chloride 0.9%, IV.
* Administer 250–500 mL as a bolus and assess fluid responsiveness.
* Dobutamine, infusion, 5–10 mcg/kg/minute.
* Dilute 1 vial (250 mg/20 mL) up to 50 mL with sodium chloride 0.9% or dextrose 5% (5 mg/mL or 5 000 mcg/mL).
* Monitor the blood pressure.

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| *LoE:IVb[[50]](#endnote-50)* |

* Rate of infusion in mL/hour:

|  |  |
| --- | --- |
| **Dose mcg/kg/min** | **Weight (kg)** |
| 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 |
| 2 | 0.9 | 1.2 | 1.5 | 1.8 | 2.1 | 2.4 | 2.7 | 3 | 3.3 | 3.6 |
| 5 | 1.8 | 2.4 | 3 | 3.6 | 4.2 | 4.8 | 5.4 | 6 | 6.6 | 7.2 |
| 7.5 | 2.7 | 3.6 | 4.5 | 5.4 | 6.3 | 7.2 | 8.1 | 9 | 9.9 | 10.8 |
| 10 | 3.6 | 4.8 | 6 | 7.2 | 8.4 | 9.6 | 10.8 | 12 | 13.2 | 14.4 |

### 20.12.4 OBSTRUCTIVE SHOCK

R57.8

**DESCRIPTION**

Occurs when there is an obstruction to the filling of the right ventricle or an obstruction in blood flow. Clinical signs include hypotension, tachycardia, cold peripheries and distended neck veins.

Causes include:

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| 1. cardiac tamponade,
 | 1. tension pneumothorax,
 |
| 1. acute pulmonary embolism, and
 | 1. severe bronchospasm.
 |

**TREATMENT**

Treat the cause.

Acute pulmonary embolism and cardiac tamponade require urgent consultation with a specialist and referral after initial emergency measures have been taken

### 20.13 Status epilepticus

See section 14.4.1: Status epilepticus

**TRAUMA AND INJURIES**

For trauma-related haemorrhage, presenting within 3 hours of injury, see section 20.1.3 Hypovolaemic shock.

### 20.14 ACUTE KIDNEY INJURY

See section 7.1.4: Acute kidney injury.

### 20.15 BITES AND STINGS

See chapter 19: Poisonings – envenomation.

### 20.16 BURNS

T30.0-3 + (T31.0-9/Y34.99

#### description

Skin and tissue damage caused by:

* exposure to extremes of temperature,
* contact with an electrical current,
* exposure to a chemical agent, and
* radiation.

ASSESSMENT OF BURNS

|  |  |  |
| --- | --- | --- |
| **Depth of burn wound** | Surface /colour | Pain sensation/healing |
| Superficial or epidermal | Dry, minor blisters, erythema | 1. Painful
2. Heals within 7 days
 |
| Partial thickness superficial or superficial dermal | Blisters, moist | 1. Painful
2. Heals within 10–14 days
 |
| Partial thickness deep or deep dermal | Moist white or yellow slough, red mottled | 1. Less painful
2. Heals within a month or more Generally needs surgical debridement and skin graft
 |
| Full thickness (complete loss of skin) | Dry, charred whitish, brown or black | 1. Painless, firm to touch
2. Healing by contraction of the margins (generally needs surgical debridement and skin graft)
 |

**The figures below are used to calculate body surface area %.**

**These diagrams indicate percentages for the whole leg/arm/head (and neck in adults) not just the front or back.**

**Children ≥8 years and adults**



*Source:* Karpelowsky JS, Wallis L, Madaree A, Rode H; South African Burn Society. South African Burn Society burn stabilisation protocol. S Afr Med J. 2007 Aug;97(8):574-7. <http://www.ncbi.nlm.nih.gov/pubmed/17966146>

#### GENERAL MEASURES

1. Assess airway, breathing
* Look for signs of inhalational burn- history of hot gas, smoke, steam.
* INTUBATE if significant airway obstruction present or WORSENING symptoms.
* Intubation is necessary in the case of unconscious patients, hypoxic patients with severe smoke inhalation, or patients with flame or flash burns involving the face and neck if there is evidence of compromised airway patency.
* Intubate early if burns are inhalational, or in the presence of pharyngeal burns with soft tissue swelling, as these patients frequently tend to develop respiratory failure.
* Close monitoring is essential during the first 24-48 hours
* If breathing is compromised because of tight circumferential trunk burns, consult with burn centre surgeons immediately. Urgent escharotomies may be required to facilitate chest expansion
1. Assess circulation
* Establish large-bore intravenous (IV) lines and provide resuscitation bolus fluid.
* Reminder: IV lines may be placed through the burned area if necessary (suture to secure).
1. Assess neurological state of the patient
2. Assess for associated trauma related injuries
* Secure the C–spine with an inline stabilising collar, when the mechanism of injury could indicate additional trauma.
* Identify potential sources of internal bleeding.
* Stop any external bleeding.
1. Remove any sources of heat or chemicals. Removal constrictive clothing/accessories.
2. Estimate percentage of total body surface area involved.
3. Support vital organ function.
4. Look for aggravating comorbidities, e.g. seizures, hyperkalaemia, renal failure.
5. Assess need for decompression incisions: escharotomies
6. Local wound care: Clean superficial burns can be managed by occlusive dressings. Deeper wounds may have to be excised and grafted.
7. Rehabilitation involving physiotherapy and occupational therapy.

Burn injuries put patients into a hypermetabolic state which requires early and adequate nutritional support. Seek early guidance from local burns centre. See section 12.13.1: Nutritional support.

#### MEDICINE TREATMENT

**Fluid replacement**

Burns ≤10% Total Body Surface Area (TBSA):

* Oral rehydration solution.

Burns >10% of TBSA:

* Sodium chloride 0.9%, IV fluid for resuscitation, replacement and maintenance.

**Calculation of fluid replacement**

Replacement fluids for burns

1. First 24 hours:

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| *LoE:IIa[[51]](#endnote-51)* |

* Sodium chloride 0.9%, IV.
	+ Calculate total fluid requirement in 24 hours:

*Total % burn x weight (kg) x 4 mL.*

* + Give half this volume in the 1st 8 hours.
	+ Administer remaining fluid volume in next 16 hours.

**Note:** If urine output is not adequate, increase fluids for the next hour by 50%. Continue at a higher rate until urine output is adequate, then resume normal calculated rate. Aim for urine output 0.5 mL/kg/hr.

**Analgesia**

Ensure adequate analgesia particularly at change of dressing, i.e.:

* Morphine, IV, to a total maximum dose of 10 mg (See Appendix II, for individual dosing and monitoring for response and toxicity).

**AND**

* Paracetamol, oral, 1 g 4–6 hourly when required.
* Maximum dose: 15 mg/kg/dose.
* Maximum daily dose: 4 g in 24 hours.

**Tetanus prophylaxis** Z23.5

Tetanus toxoid vaccine, IM, 0.5 mL immediately.

**Local Wound Care**

1. Melted plastic and tar can be removed with the topical application of liquid paraffin solution
2. Wash burn wounds with soap and water or 1% chlorhexidine.
3. Cool burns less than 3 hours old with cold tap water for at least 30 minutes and then dry the patient.
4. Keep the wound clean and dress with sterile dressings.

**For chemical burns**

1. Remove all clothing.
2. Brush powdered chemicals off the wound
3. Flush chemical burns for a minimum of 30 minutes using copious volumes of running water.
4. Reminder: Never neutralise an acid with a base or vice versa.
5. Determine what chemical (and what concentration) caused the injury.
6. Ocular burns: T26.4 + (Y34.99)
* Sodium chloride 0.9% gentle eye washes or irrigations as soon as possible. Follow with an ophthalmology consultation

**For electrical burns**

1. Differentiate between low-voltage (<1 000 v) and high-voltage (>1 000 v) injuries.
2. Attach a cardiac monitor; treat life-threatening dysrhythmias as needed.
3. Suspect compartmental syndrome, consider escharotomies.

##### Stress ulcer prophylaxis

Feeding patients provides protection against gastric ulcer developing and prophylaxis is not necessary in patients who are tolerating feeds.

Note: Pharmacokinetic parameters are altered in patients with severe burns, notably an increased volume of distribution. An appropriate loading dose should be given of certain medicines, e.g. aminoglycosides. Therapeutic drug monitoring (TDM) may inform dosing and should be requested, if available.

#### Discuss the following cases with a burns specialist:

* Burns >15% body surface area (BSA) or >10% BSA >50 years of age.
* Burns of face, hands, feet, genitalia, perineum or involving joints.
* Electrical burns, including lightning burns.
* Chemical burns.
* Inhalation injury or burns.
* Burns associated with major trauma.
* Circumferential burns.

### 20.17 EXPOSURE TO POISONOUS SUBSTANCES

See chapter 19: Poisoning.

### 20.18 eye injuries

See section 18.10: Medical management of eye injury.

### 20.19 POST EXPOSURE PROPHYLAXIS

See section 10.5: Post-exposure prophylaxis.

### 20.20 SOFT TISSUE INJURIES

See Primary Health Care STGs and EML; section 21.3.7: Soft tissue injuries.

### 20.21 SPRAINS AND STRAINS

See Primary Health Care STGs and EML; section 21.3.8: Sprains and strains.

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