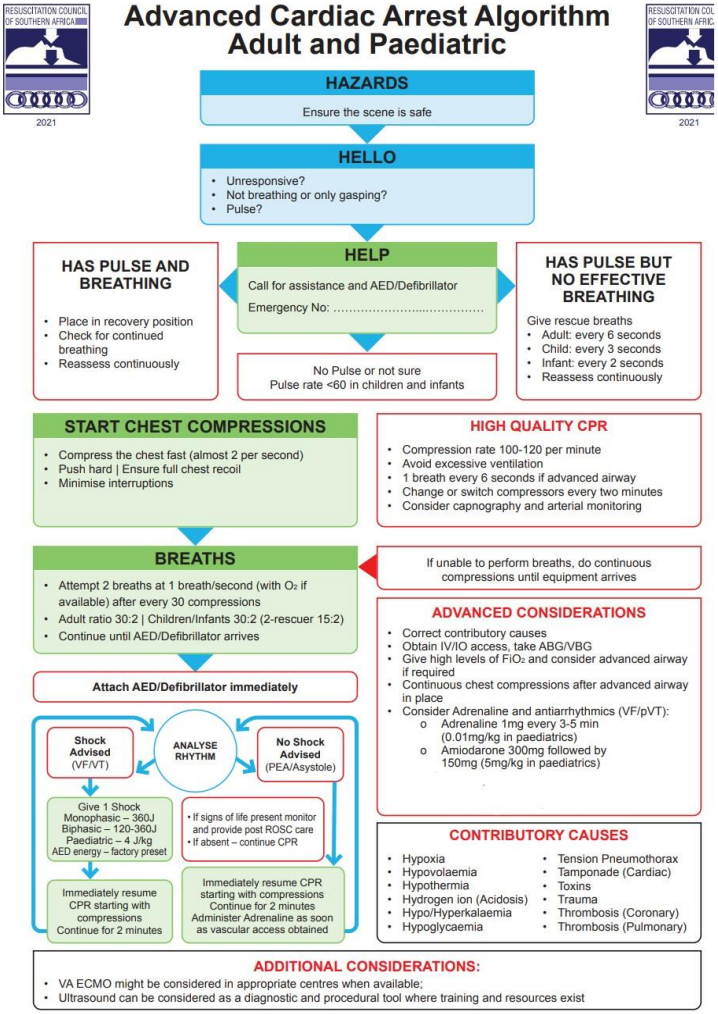
CHAPTER 20
EMERGENCIES AND INJURIES

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:

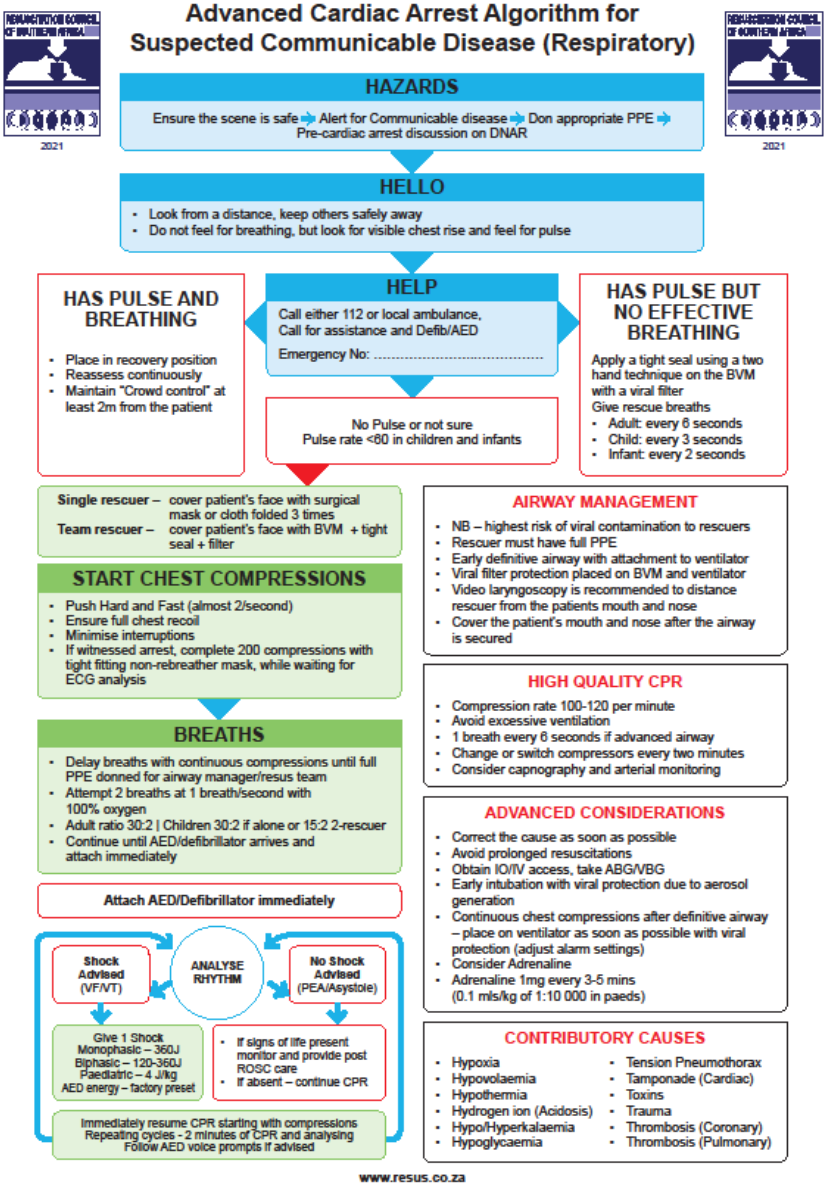


Figure 20.2: Advanced cardiac arrest algorithm - suspected respiratory communicable disease *(adapted with permission from the Resuscitation Council of South Africa)*

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

LoE: IVb[i]

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.

LoE: IIIb[ii]

EMERGENCY TREATMENT

» Diagnose rapidly. After ensuring the safety of the scene, commence resuscitation as per the appropriate acute adult cardiac arrest algorithm – Fig 20.1 or 20.2 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 seconds without interrupting chest compressions. Avoid excessive ventilation.
• Oxygenate with 100% oxygen.
» Where neck injury is suspected:
  ✓ Do not perform a chin lift or head tilt manoeuvre if a neck injury is suspected
  ✓ To open the airway, place your fingers behind the jaw on each side.
  ✓ Lift the jaw upwards while opening the mouth with your thumbs (jaw thrust).
  ✓ Maintain in line cervical spine immobilisation.

Initiate fluids, IV/IO access

• Sodium chloride 0.9%, IV *LoE: IIb[iii]*
  ○ 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.
  ○ Administer fluid cautiously during CPR if an increase in the preload could be detrimental, e.g., massive pulmonary embolism or cardiac tamponade.

LoE:IIIb[iv]

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 and directions below (Immediate emergency medicine treatment).
» 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.

LoE:IIb[v]

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:

- Adrenaline (epinephrine), intra-osseous (IO), 1:1000, 1 mL, via IO line. *LoE:IVb*[vi]
  - 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 (in the absence of the factors below).

LoE: IIIb[vii]

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 PHC STG 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

I46.0

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.

LoE:IIIb[viii]

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.

LoE:IIIb[ix]

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

LoE:IIa[x]

MEDICAL TREATMENT

Hypoglycaemia

LoE:IIIb[xi]

- 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.

LoE: IIIb[xii]

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:

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

LoE:IIIb[xiii]

Seizures

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

LoE:IIIb[xiv]

Fever

- Paracetamol, oral, 500mg-1 g 4–6 hourly when required (to a maximum of 4 g in 24 hours)
  - Maximum dose: 15 mg/kg/dose.

LoE:IIIa[xv]

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 section 16.1: Asthma, acute for the management of status asthmaticus.

20.6 ANGIOEDEMA

T78.3 + Y57.9

Contact the 24/7 South African Angioedema Hotline at: 082 091 5684 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.

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):

- Promethazine, IM/IV, 25–50 mg as a single dose. *LoE:IIIb*[xvi]

ADD

- Hydrocortisone, IV, 100 mg as a single dose. *LoE:IIIb*[xvii]

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. *LoE:IVb*

If lyophilised plasma is unavailable:

- FFP, IV, 2 units. *LoE:IIIa*[xviii]

Observe all cases until resolution.

20.7 ANAPHYLAXIS/ANAPHYLACTIC SHOCK

T78.2 + Y57.9

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.
Counsel patient to prevent recurrence.
Patient should wear an alert bracelet at all times.

Anaphylaxis associated with vaccinations:

» Always keep a fully equipped emergency tray at the vaccination point.
» 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.
» 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 (including hypotension, respiratory distress significant swelling of lips or tongue), even if only one body system is involved, treat as anaphylaxis.
  - If isolated rash in an otherwise well client, monitor for 30 minutes.
» 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.

	ANAPHYLAXIS	ACUTE STRESS RESPONSE	
		GENERAL	VASOVAGAL REACTION WITH SYNCOPE
Onset	Usually 5 min after immunization but may be delayed up to 60 min	Sudden, occurs before, during or shortly after (< 5 min) immunization	Sudden, occurs before, during or shortly after (< 5 min) immunization. May present after 5 min if the individual stands suddenly.
System			
Skin	Generalized urticaria (hives) or generalized erythema, angioedema, localized or generalized, generalized pruritus with or without skin rash, generalized prickle sensation, localized injection site urticaria, red and itchy eyes	Pale, sweaty, cold, clammy	Pale, sweaty, cold, clammy
Respiratory	Persistent cough, noisy breathing and airway constriction: wheeze, stridor. If very severe, respiratory arrest.	Hyperventilation (rapid, deep breathing)	Normal to deep breaths
Cardiovascular	↑ heart rate, ↓ blood pressure, circulatory arrest	↑heart rate, normal or ↑systolic blood pressure	↓ heart rate with or without transient ↓in blood pressure
Gastrointestinal	Nausea, vomiting, abdominal cramps	Nausea	Nausea, vomiting
Neurological and other symptoms	Uneasiness, restlessness, agitation, loss of consciousness, little response when supine or lying flat	Fearfulness, light-headedness dizziness, numbness, weakness, tingling around the lips, spasms in hands, feet	Transient loss of consciousness, good response once supine or lying flat, with or without tonic–clonic seizure

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

MEDICINE TREATMENT

- Adrenaline (epinephrine) 1:1 000, 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:

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

LoE:IVb

AND

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

AND

Intravenous fluids

LoE:IIa[xix]

Establish an intravenous line:

- Sodium chloride 0.9%, IV.

If bronchospasm:

- Oxygen if saturation <94%.

LoE:IIb[xx]

AND

- Salbutamol, nebulisation, 5 mg.
  - Nebulise continuously (refill the nebuliser reservoir every 20 minutes) at a flow rate of 6–8 L/minute.

LoE: IVb[xxi]

AND

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

LoE: IVb[xxii]

If urticaria and/or itch present:

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

LoE:IIIb[xxiii]

OR

- 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

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

Checklist for diagnosis:

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), CO_2 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.

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

Nursing interventions:

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

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.

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.

For agitated and acutely disturbed patient:

- Haloperidol, oral, 0.75–1.5 mg twice daily
  - May be repeated 4 hourly if needed to a maximum dose of 10mg in 24 hours.
  - May be continued short-term (usually 7 days or less) at lowest dose at which behaviour is contained.

OR

If unable to swallow or oral medication declined:

- Haloperidol, IM, 0.5–1mg
  - May be repeated after 30–60 minutes if needed and then 4 hourly, to a maximum dose of 10mg in 24 hours.
  - Monitor vital signs and beware of acute dystonia, other extra-pyramidal side effects, and neuroleptic malignant syndrome.

OR

If haloperidol, IM is not available: *LoE:IVb*[xxiv]

- 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.

OR

For substance withdrawal, Parkinson's disease, or intolerability to haloperidol or 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. *LoE:IIIb*[xxv]
  - Switch to oral route once containment is achieved.
  - In the elderly, a starting dose of 2 mg is recommended

CAUTION - Benzodiazepines

» Can cause respiratory depression, especially diazepam IV.
» Can aggravate delirium.
» In the frail and elderly patient or where respiratory depression is a concern, reduce the dose by half. *LoE:IVb*[xxvi]
» 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.

If alcohol withdrawal/ Wernicke's encephalopathy suspected:

- Thiamine, IM, 200 mg immediately. *LoE:IVb*[xxvii]

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).
Patients with acute decompensated heart failure appear extremely ill, restless, poorly perfused and sweaty, tachypnoeic, tachycardic, and hypoxic, with increased work of breathing, and 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.: *LoE:IVb*
- Isosorbide dinitrate, SL, 5 mg repeat every 5–10 minutes, if necessary.
  - Monitor blood pressure. Do not administer if hypotensive.

OR

- Glyceryl trinitrate, IV, 5–200 mcg/minute, titrated to response.
  - Guidance on preparation and administration included below.

CAUTION
Glyceryl trinitrate IV formulation must be diluted before infusion

STEP 1: Select the concentration as required for the individual patient
- For patients who are fluid congested or require higher doses for a clinical response, consider using a more concentrated solution e.g. 200 or 400 mcg/mL.

STEP 2: Select the volume of the diluent
- Patients who are likely to require treatment for a longer duration e.g. unstable angina prepare a larger volume e.g. 500mL.
- Compatible diluents include sodium chloride 0.9% or dextrose 5%.

STEP 3: Confirm the formulation of glyceryl trinitrate available and mix with diluent
- Confirm the strength of the GTN solution i.e. whether a 1mg/mL or 5mg/mL formulation is available.
- Depending on the formulation available, select the number of ampoules to be used based on the concentration and volume of the diluent as decided in Step 1 and 2 above.
- Ensure that the equivalent volume of diluent is removed from the bag before adding the total GTN volume e.g. if 100mLs of GTN is to be added, first remove 100mL of diluent from the bag before adding the GTN.

STEP 4: Set the flow rate for infusion
- Flush the PVC tube before administering to patient.
- Start with the lowest flow rate possible based on the concentration of the solution prepared.
- Increase by 5 mcg/minute every 5 minutes until response achieved or until the rate is 20 mcg/minute.
- If no response after 20 mcg/minute increase by 20 mcg/minute until response. Monitor blood pressure carefully.

E.g. To prepare a 200mcg/mL solution for a patient likely to require several hours of the GTN infusion:
Use 10 ampoules (100mL) of the 1mg/mL GTN formulation mixed with 400mL of diluent (100mL to be removed from a 500mL bag). Initiate the infusion at a flow rate 3mL/hr and titrate the infusion rate based on the patient's response.

STEP 1	STEP 2	STEP 3			
Concentration of dilution	**Volume of diluent**	**Glyceryl trinitrate 1 mg/mL**		**Glyceryl trinitrate 5 mg/mL**	
		Volume (Dose)	Number of 10mL ampoules	Volume (Dose)	Number of 10mL ampoules
100 mcg/mL	250 mL	25 mL (25 mg)	2.5	5 mL (25 mg)	0.5
200 mcg/mL		50 mL (50 mg)	5	10 mL (50 mg)	1
400 mcg/mL		100 mL (100 mg)	10	20 mL (100 mg)	2
100 mcg/mL	500 mL	50 mL (50 mg)	5	10 mL (50 mg)	1
200 mcg/mL		100 mL (100 mg)	10	20 mL (100 mg)	2
400 mcg/mL		200 mL (200 mg)	20	40 mL (200 mg)	4

STEP 4	**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.

LoE:IIIb[xxviii]

20.11 RAPID SEQUENCE INDUCTION AND INTUBATION

Anaesthetic and sedative medication may be administered only 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. *LoE:IVb*[xxix]

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

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.

LoE:IVb[xxx]

- 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

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.
    - Malignant hyperthermia. *LoE:IIb[xxxi]*

If suxamethonium is contra-indicated, consider:

- Rocuronium, 0.9 mg/kg, IV.
  - Duration +/- 60 minutes. *LoE:IIb[xxxii]*

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

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. *LoE:IIIb[xxxiii]*

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. *LoE:IVb[xxxiv]*

Note: Propofol has cardiovascular effects; benzodiazepines are preferred. *LoE:IIIb[xxxv]*

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 analgesic 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).

OR

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

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

LoE:IIIb[xxxvi]

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

LoE:IIa[xxxvii]

- Sodium chloride 0.9%, IV, 1–2 L.
  - Monitor blood pressure, pulse and clinical response.

20.12.1.2 TRAUMA-RELATED HYPOVOLAEMIC SHOCK

T79.4 + R57.1

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

- Oxygen if saturation <94%. *LoE:IIb*[xxxviii]

Trauma related

- Sodium chloride 0.9%, IV. *LoE:IIa*[xxxix]

<u>If more than 1 litre of fluid is needed, consider blood products:</u>
» 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 20.12.1.2.1: 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. *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.

Expedite definitive control of bleeding: *LoE:IVb*[xl]

- Tranexamic acid, IV, 1 g, infused over 10 minutes.
  - Followed with IV infusion, 1 g, over 8 hours. *LoE:Ia*[xli]
  - 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 deteriorates, 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 + 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

- Oxygen if saturation <94%. *LoE:IIb*[xlii]
- Sodium chloride 0.9%, IV. *LoE:IIa*[xliii]
  - Administer crystalloid in titrated boluses up to 1 litre.
- Adrenaline (epinephrine), IV infusion, start at 0.05 mcg/kg/minute titrated according to the response. *LoE:IVb*
  - 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

- Oxygen if saturation <94%. *LoE:IIb*[xliv]

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

- Ceftriaxone, IV, 2 g daily. *LoE:IIIb*[xlv]

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 administered.
  - 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 hyponatraemia, previous renal placement therapy): *LoE:Ia*[xlvi]

- Balanced solution, e.g.:
- Ringer's lactate, 500 mL boluses over 30 minutes, whilst monitoring clinical response, until 30 mL/kg has been administered.
  - 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

- Oxygen if saturation <94%.

LoE:IIb[xlvii]

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

- Sodium chloride 0.9%, IV.
  - Administer 250–500 mL as a bolus and assess fluid responsiveness.

LoE:IIa[xlviii]

- 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.
  - Rate of infusion in mL/hour:

LoE:IVb[xlix]

	Weight (kg)									
Dose mcg/kg/min	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:

- » cardiac tamponade,
- » acute pulmonary embolism, and
- » tension pneumothorax,
- » 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

DESCRIPTION

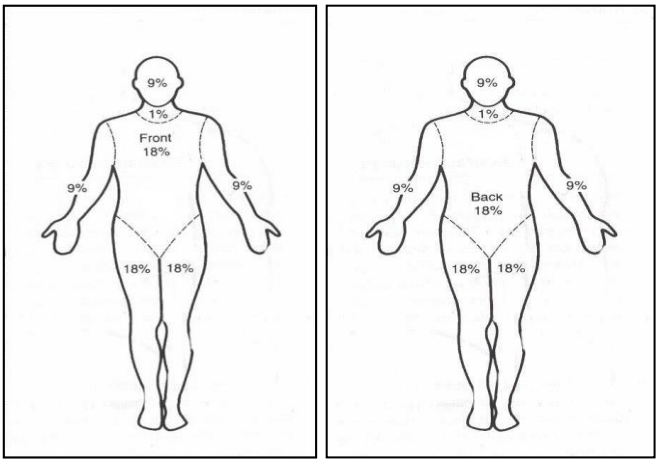
Skin and tissue damage caused by:

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

ASSESSMENT OF BURNS

Depth of burn wound	SURFACE /COLOUR	PAIN SENSATION/HEALING
Superficial or epidermal	Dry, minor blisters, erythema	» Painful » Heals within 7 days
Partial thickness superficial or superficial dermal	Blisters, moist	» Painful » Heals within 10–14 days
Partial thickness deep or deep dermal	Moist white or yellow slough, red mottled	» Less painful » 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	» Painless, firm to touch » 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/neck 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

» 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 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.
» 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).
» Assess neurological state of the patient.
» 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.
» Remove any sources of heat or chemicals. Removal constrictive clothing/accessories.
» Estimate percentage of total body surface area involved.
» Support vital organ function.
» Look for aggravating comorbidities, e.g. seizures, hyperkalaemia, renal failure.
» Assess need for decompression incisions: escharotomies.
» Local wound care: Clean superficial burns can be managed by occlusive dressings. Deeper wounds may have to be excised and grafted.
» Rehabilitation involving physiotherapy and occupational therapy.

Local wound care
» Melted plastic and tar can be removed with the topical application of liquid paraffin solution.
» Wash burn wounds with soap and water or 1% chlorhexidine.
» Cool burns less than 3 hours old with cold tap water for at least 30 minutes and then dry the patient.
» Keep the wound clean and dress with sterile dressings.
» If infected burn:
- Povidone-iodine 5%, cream, applied daily.

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

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

Nutrition
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
First 24 hours:

- Sodium chloride 0.9%, IV. *LoE:IIa*
  - 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, 500mg -1 g 4–6 hourly when required (to a maximum of 4 g in 24 hours).
  - Maximum dose: 15 mg/kg/dose.

Tetanus prophylaxis Z23.5
- Tetanus toxoid vaccine, IM, 0.5 mL immediately, if not previously immunised within the last 5 years.

Stress ulcer prophylaxis
» Feeding patients provides protection against gastric ulcers developing and prophylaxis is not necessary in patients who are tolerating feeds.
» Stress ulceration, a complication of critical illness, needs to be prevented.
» Oral or enteral feeding should be initiated as soon as possible.
- Pantoprazole, 40mg, IV daily.
  - Stop stress ulcer prophylaxis once the patient is tolerating enteral 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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