HealthCare TRAINING SERVICE

Potential causes of Cardiopulmonary Arrest - 4 Hs

The Four Hs

Causes	Signs & Symptoms	Management
Hypoxia		
▪ Lack of oxygen to the heart, brain & vital organs ▪ Airway obstruction ▪ Drowning ▪ Asthma ▪ Anaphylaxis ▪ Respiratory arrest	▪ History of respiratory insult or episode ▪ Cyanosis ▪ Decreased oxygen saturation ▪ Hypoxaemia evident on arterial blood gases	▪ Ensure adequate oxygenation by providing as close to 100% oxygen (O_2) as soon as possible ▪ Ensure adequate ventilation ▪ Ensure good CPR
Hypovolaemia		
▪ Trauma ▪ Haemorrhage post-surgery ▪ Post partum haemorrhage ▪ Dehydration ▪ Relative hypovolaemia – sepsis, anaphylaxis	▪ History ▪ Assessment – bleeding evident, drains are full, abdominal distension, compartment syndrome, discolouration ▪ Dry mucous membranes, poor skin turgor, sunken eyes	▪ If active bleeding evident, arrest haemorrhage, apply pressure ▪ Rapidly restore intravascular volume with at least 20mL/kg of fluid IV (e.g. Hartmann's solution or 0.9% Sodium Chloride)
Hypothermia / Hyperthermia		
Hypothermia		
▪ Exposure ▪ Risk is increased by: · alcohol or drug ingestion · exhaustion · injury	▪ History of exposure, cold and/or wet – Mild: T° >34°C – Moderate: T° 30°C to 34°C – Severe: T° <30°C · Lower oesophageal temperature provides best recording · Bladder & rectal temperatures lag behind core temperature	▪ Careful active rewarming ▪ **Moderate:** start CPR, VT/VF → defibrillate, IV access, give drugs spaced at longer intervals (double the time intervals between drug doses), provide active rewarming ▪ **Severe:** start CPR, VT/VF → up to 3 shocks then withhold, as well as withhold drugs until T° >30°C, provide active rewarming ▪ **External warming:** dry body, heating blankets → rewarm central area only, warm fluids ▪ **Internal warming:** extracorporeal circulation, warm humidified gases
Hyperthermia		
▪ Heat stroke – hyperthermia is associated with systemic inflammatory response Malignant hyperthermia ▪ Anaesthetic agents ▪ Drugs: 'ecstacy', MDMA, amphetamines	▪ History ▪ Headache, flushing, vomiting, diarrhoea, acute respiratory distress, seizures ▪ Hot dry skin ▪ T° >40.6°C	▪ Rapidly cool patient to 39 °C ▪ Active cooling measures: ice packs, cooling blankets, cold IV fluids, extracorporeal circulation, cooled humidified gases ▪ Fluid replacement ▪ Correct electrolyte abnormalities Malignant hyperthermia ▪ Administer Dantrolene

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Hyperkalaemia or Hypokalaemia

Normal potassium range: 3.5 – 5.0 mmol/L.

Potassium gradient across cell membranes contributes to excitability of nerve and muscle cells.

Hyperkalaemia ▪ Renal failure ▪ Drugs ▪ Rhabdomyolysis (breakdown of skeletal muscle) ▪ Metabolic acidosis (ketoacidosis) Severe hyperkalaemia: K^+ level >6.5mmol/L	**Hyperkalaemia** ▪ History ▪ **Symptoms:** weakness, fatigue, paraesthesia, respiratory difficulty ▪ **Signs:** flattened P waves, tall T waves, depressed ST segment ▪ Pathology results, ABG analysis, i-STAT system analysis	**Hyperkalaemia** Stabilise & protect myocardium ▪ 10mL 10% Calcium chloride IV rapid bolus Shift potassium into the cells ▪ Glucose & insulin infusion (e.g. 10 units short-acting insulin + 25 g glucose IV by rapid injection) ▪ Sodium bicarbonate (1mmol/kg IV rapid injection if severe acidosis or renal failure) Remove potassium from the body ▪ Dialysis
Hypokalaemia ▪ Malnutrition ▪ Drugs ▪ Profuse diarrhoea and/or vomiting ▪ Metabolic alkalosis ▪ Magnesium depletion Severe hypokalaemia: K^+ level <2.5mmol/L	**Hypokalaemia** ▪ History ▪ **Symptoms:** weakness, fatigue, leg cramps, respiratory difficulty ▪ **Signs:** flattened T waves, U waves ▪ Pathology results, ABG analysis, i-STAT system analysis	**Hypokalaemia** ▪ Potassium replacement ▪ Replete magnesium stores

Metabolic disorders – Hyper/hypocalcaemia; Hyper/hypomagnesaemia

Hypercalcaemia ▪ Malignancy ▪ Drugs ▪ Sarcoidosis **Hypocalcaemia** ▪ Renal failure ▪ Acute pancreatitis ▪ Rhabdomyolysis	**Hypercalcaemia** ▪ History ▪ **Symptoms:** weakness, confusion, ▪ **Signs:** hypotensive, short QT interval **Hypocalcaemia** ▪ History ▪ **Symptoms:** paraesthesia, tetany ▪ **Signs:** prolonged QT interval, T waves inverted	**Hypercalcaemia** ▪ Fluid replacement ▪ Diuresis **Hypocalcaemia** ▪ 10 mL 10% Calcium chloride ▪ Magnesium 
Hypermagnesaemia ▪ Renal failure ▪ Iatrogenic **Hypomagnesaemia** ▪ Malnutrition ▪ Polyuria	**Hypermagnesaemia** ▪ History ▪ **Symptoms:** weakness, confusion, ▪ **Signs:** prolonged PR & QT interval, Peaked T waves **Hypomagnesaemia** ▪ History ▪ **Symptoms:** Ataxia, tremors ▪ **Signs:** prolonged PR & QT interval, T waves inverted, Torsades de pointes	**Hypermagnesaemia** ▪ Calcium chloride 10% x 5 – 10mL ▪ Diuresis **Hypomagnesaemia** ▪ Magnesium

Truhlar et al, 2015, p 150-153; ANZCOR Guideline 11.2 & 11.5, 2016; Gale et al, 2011

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