

Hyperkalaemia

Definition of hyperkalaemia

- Elevated serum potassium concentration >5.5 mM

Staging of hyperkalaemia

- Mild: 5.5-6.0 mM
- Moderate: 6.1-6.9 mM
- Severe: ≥ 7.0 mM

Causes of hyperkalaemia

- Excess intake
 - Potassium supplements (oral [PO] or intravenous [IV])
 - Massive blood transfusion
- Release from intracellular fluid (ICF)
 - Rhabdomyolysis
 - Burns
 - Crush injury
 - Tumour lysis syndrome
 - Haemolysis
 - Acidosis
 - Insulin deficiency
 - Beta-blockers
 - Digoxin
 - Suxamethonium
- Inadequate excretion
 - Renal impairment
 - Acute kidney injury (AKI)
 - Chronic kidney disease (CKD)
 - Medications
 - Angiotensin converting enzyme inhibitors (ACEIs)
 - Angiotensin receptor blockers (ARBs)
 - Non-steroidal anti-inflammatory drugs (NSAIDs)
 - Potassium-sparing diuretics
 - Aldosterone deficiency eg Addison's disease
- Pseudohyperkalaemia
 - Laboratory artefact typically caused by haemolysis during venepuncture

Presentation of hyperkalaemia

- Asymptomatic
- Nausea and vomiting
- Diarrhoea
- Hypotonia
- Muscle weakness
- Hyporeflexia
- Paraesthesia
- Cardiac arrhythmias

Investigation of hyperkalaemia

- Urea & electrolytes (U&Es)
- Venous blood gas (VBG)
- Whole blood potassium (WBK)
- Electrocardiogram (ECG) changes include
 - Classical changes – occurring in this order:
 - 1. Flattened P waves
 - 2. Tall tented T waves
 - 3. Wide QRS becoming sinusoidal
 - Full list of changes
 - Flattened P waves
 - Prolonged PR interval (first degree heart block)
 - Prolonged QRS interval
 - Shortened QT interval
 - ST segment depression
 - Tall tented T waves
 - Sinusoidal QRST
 - Bradycardia
 - Pulsed monomorphic ventricular tachycardia (VT)

Initial management of hyperkalaemia

- If potassium concentration ≤ 6.5 mM and no ECG changes are present, verify hyperkalaemia
 - U&Es: may be falsely elevated by haemolysis; consider sending a repeat U&Es accompanied by a WBK before commencing treatment
 - VBG: there is often a significant discrepancy between potassium concentration on VBG and U&Es; consider waiting for formal U&Es to come back before commencing treatment
- If potassium concentration >6.5 mM and/or ECG features are present, treat as follows
- 1. Myocardial protection
 - Calcium chloride or gluconate 10 ml of 10% by slow IV injection
 - No effect on serum potassium concentration but buys time by stabilising the myocardium
- 2. Drive potassium into ICF
 - Salbutamol 5 mg nebuliser
 - Insulin-dextrose infusion: 10 units of actrapid in 50 ml of 50% dextrose IV over 30 minutes
 - Sodium bicarbonate 50 ml of 8.4% IV
- 3. Potassium elimination
 - Calcium resonium PO or per rectum (PR)
 - Hydrocortisone if thought to be secondary to Addison's disease
- 4. Identify and treat the cause

Further management of hyperkalaemia

- Consider continuous renal replacement therapy (CRRT) if serum potassium concentration >6.5 mM and refractory to medical management

Complications of hyperkalaemia

- Cardiac arrhythmias
- Cardiac arrest

Common questions concerning hyperkalaemia

- List the three stages of hyperkalaemia
 - Mild: 5.5-6.0 mM
 - Moderate: 6.1-6.9 mM
 - Severe: ≥ 7.0 mM
- List the four broad causes of hyperkalaemia
 - Excess intake
 - Release from intracellular fluid (ICF)
 - Inadequate excretion
 - Pseudohyperkalaemia: laboratory artefact typically caused by haemolysis during venepuncture
- List the classic changes occurring in hyperkalaemia and the order in which they usually occur
 - 1. Flattened P waves
 - 2. Tall tented T waves
 - 3. Wide QRS becoming sinusoidal
- List the other possible ECG changes in hyperkalaemia
 - Flattened P waves
 - Prolonged PR interval (first degree heart block)
 - Prolonged QRS interval
 - Shortened QT interval
 - ST segment depression
 - Tall tented T waves
 - Sinusoidal QRST
 - Bradycardia
 - Pulsed monomorphic ventricular tachycardia (VT)
 - Cardiac arrest rhythms are not listed here as they should only be seen on a defibrillator or cardiac monitor, not an ECG!
- List the four main strategies in treating hyperkalaemia
 - Myocardial protection
 - Drive potassium into ICF
 - Potassium elimination
 - Identify and treat the cause
- List three drugs you would give immediately
 - Calcium chloride or gluconate 10 ml of 10% by slow IV injection
 - Salbutamol 5 mg nebuliser
 - Insulin-dextrose infusion: 10 units of actrapid in 50 ml of 50% dextrose over 30 minutes
- When would you consider CRRT in hyperkalaemia?
 - If serum potassium concentration > 6.5 mM and refractory to medical management