# NHS Grampian Staff Guideline for the Management of Acute Hyperkalaemia In Adults

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See Page 10

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## Executive Sign-Off

This document has been endorsed by the Director of Pharmacy and Medicines Management

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NHS Grampian Staff Guideline for the Management of Acute Hyperkalaemia in Adults

Please note: treatment flowchart is on page 6

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NHS Grampian Staff Guideline for the Management of Acute Hyperkalaemia in Adults

1. **Definition**

This guideline is for use by healthcare professionals within primary or secondary care in NHS Grampian. Intravenous treatment should only occur in an acute setting.

The NHS Grampian reference range for serum potassium in patients over 16 years of age is 3.5 – 5.3 mmol/L.

**Table 1 – Serum Potassium Classification**

| Mild hyperkalaemia: 5.4-5.9 mmol/L (Routine review required) | Moderate hyperkalaemia: 6.0-6.4 mmol/L (Urgent review or treatment required) | Severe hyperkalaemia: ≥6.5 mmol/L or ≥6.0 mmol/L and ECG changes present (Potentially life threatening. Emergency treatment required) |

2. **Causes of Hyperkalaemia**

The following list is not exhaustive:

2.1. **Renal causes**

- Acute kidney injury (AKI)
- Chronic kidney disease
- Medication that interferes with renal potassium excretion (e.g. potassium sparing diuretics (spironolactone, eplerenone), trimethoprim, co-trimoxazole)
- Medication that interferes with the renin-angiotensin-aldosterone system (e.g. Angiotensin Converting Enzyme inhibitors or Angiotensin II Receptor Antagonists (including combined products containing either of these), Non-Steroidal Anti-inflammatory Drugs, heparins)
- Mineralocorticoid deficiency (hypoaldosteronism states), including hyperkalaemic renal tubular acidosis (type IV), Addison’s disease
2.2. Transcellular shift (intracellular to extracellular)

- Acidosis, including diabetic ketoacidosis (DKA) - Caution, during treatment of DKA life threatening hypokalaemia may develop
- Medication (e.g. digoxin poisoning, suxamethonium, beta blockers)
- Acute tumour lysis
- Burns
- Rhabdomyolysis

2.3. Other causes

- Heart failure
- Massive blood transfusion
- Use of salt substitutes/diet
- Medication (e.g. potassium supplementation)

Many patients, particularly those who are elderly, may have more than one risk factor for the development of hyperkalaemia.

3. Signs and Symptoms of Hyperkalaemia\(^1,3,5\)

May be asymptomatic.

- ECG abnormalities (see below) *requires emergency treatment*
- Muscle weakness
- Ascending paralysis (in severe hyperkalaemia)
- Paraesthesia
- Muscle cramps
- Hyperreflexia
- Cardiac arrest
- Nausea/vomiting
- Diarrhoea

4. ECG abnormalities\(^1,3,5,6\)

A normal ECG does not exclude the need for treatment if severe hyperkalaemia (≥6.5mmol/L) has been confirmed.

- Peaked T waves (this alone is not an automatic indication for urgent treatment)
- Prolongation of PR interval (>200ms)
- Loss of (or small) P waves
- QRS widening (>120ms)
- Eventual merger of QRS complex with the T wave
- Ventricular arrhythmias
- Asystole
- Bradycardia
- Heart block
Example ECG\textsuperscript{15}

This ECG displays many of the features of hyperkalaemia: Prolonged PR interval, broad QRS complexes (these merge with both the preceding P wave and subsequent T wave), and peaked T waves.

5. Management and Monitoring

See flowchart on Page 6, information below and information on individual medications on Page 7 and 8.

5.1. Exclude pseudohyperkalaemia\textsuperscript{2,5,6}

Relatively uncommon in hospitalised patients. Refers to falsely raised serum potassium which does not reflect the patient’s true level.

If the patient is well, and has none of the above signs and symptoms, repeat the test urgently as it may not be a true level.

Possible causes of pseudohyperkalaemia:

- Test tube haemolysis
- Delayed analysis
- Issues during venepuncture (prolonged tourniquet use, small needle calibre, excessive fist clenching, excessive plunger force to draw blood into syringe)
- Thrombocytosis
- Leukocytosis
- Sample drawn from limb infused with IV fluids containing potassium
5.2. Medication

Discontinue or reduce the dose of medications known to cause hyperkalaemia (see Causes, Page 2).

5.3. Monitoring

If ECG changes have been identified, or if serum potassium ≥6.5mmol/L irrespective of ECG changes, begin continuous ECG monitoring. Consider transfer to high dependency environment.

Visible bedside ECG and blood pressure monitoring should be in place before administration of intravenous calcium gluconate.

Monitor urea and electrolytes one hour post treatment. Once serum potassium is <6mmol/L, then monitor urea and electrolytes at a minimum of 2, 4, 6, and 24 hours in patients who have been treated for moderate or severe hyperkalaemia to ensure adequate treatment and detect any ‘rebound’ rise in potassium requiring further treatment.

If, following treatment, a potassium level ≥ 6.5mmol/L recurs or remains persistent, discuss with the renal team.

In primary care, if mild hyperkalaemia is detected unexpectedly and patient is stable, serum potassium should be repeated within 3 days, or as soon as feasible. If moderate hyperkalaemia (without ECG changes) is detected, serum potassium should be repeated within 1 day. Consider referral to hospital if clinically unwell or AKI present.
5.4. Treatment flowchart - For each medication, please see detailed information on next page
[senior = registrar, consultant or GP, as appropriate]

Hyperkalaemia (serum potassium ≥ 5.4mmol/L)

Airway Breathing Circulation Disability Exposure (ABCDE) approach
Seek advice from seniors if A, B or C compromised
Record NEWS score

Mild
5.4-5.9mmol/L

Consider and address causes

Moderate
6.0-6.4mmol/L

12 lead ECG
Ensure continuous ECG monitoring in place if Moderate hyperkalaemia with ECG changes or Severe hyperkalaemia

Severe
≥6.5mmol/L

Get senior assistance and treat as emergency

No

Acute ECG changes present?

Yes

Get senior assistance and treat as emergency
If based in primary care, will require admission to Acute

Calcium gluconate injection 10% w/v
To protect heart
Give 10mL over 5-10 minutes using large vein.
Can repeat at 5-10 minute intervals until ECG normalises (up to 50mL may be required). Use infusion in patients on digoxin – see overleaf

Insulin-glucose intravenous infusion*
For intracellular potassium shift
Give 10 units soluble insulin (i.e. Actrapid) in 250mL 10% glucose over at least 15 minutes

Nebulised salbutamol
For intracellular potassium shift
Give 10-20mg via nebuliser

INSULIN-GLUCOSE*
If prescribing insulin-glucose infusion, monitor capillary blood glucose at:
• Baseline
• 15 minutes
• 30 minutes
• 60 minutes
• 90 minutes
• 2 hours
• 3 hours
• 4 hours
• 6 hours
• 8 hours
• 12 hours

Using NHS Grampian Blood Glucose Monitoring

Consider causes

Monitor serum potassium at a minimum of 2, 4, 6, and 24 hours

Consider calcium resonium
To remove potassium

Consider causes and address to prevent occurrence
Senior review may be necessary

Start infusion of glucose 10% at 50mL/hour for 5 hours in patients with a pre-treatment blood glucose <7.0mmol/L to avoid hypoglycaemia.
If patient is fluid-restricted, see guidance overleaf.

Consider dialysis
Refer to Renal team
(E.g. CKD or serum potassium ≥6.5mmol/L despite medical treatment or ongoing tissue damage (e.g. severe rhabdomyolysis))

Monitor serum potassium at a
minimum of 2, 4, 6, and 24 hours

Sodium zirconium cyclosilicate
Restricted use in renal department
6. Dosage and Administration

6.1. Calcium gluconate injection 10% w/v

- **Function:** protect the heart
- **NB:** does not lower potassium
- **Ensure visible bedside ECG and blood pressure monitoring are in place**
- **Dose:** Administer 10mL calcium gluconate 10% w/v injection intravenously over 5-10 minutes
  - **NB:** For patients on **digoxin**, give as an infusion over 20-30 minutes (e.g. dilute 10mL 10% calcium gluconate injection in 100mL in sodium chloride 0.9% or glucose 5%)
- **Use a large vein. Central administration is preferred if immediately available.**
- **Flush with sodium chloride 0.9%**
- **Onset of action:** 1-3 minutes
- **Can repeat dose at 5-10 minute intervals until ECG features of hyperkalaemia have normalised. Some patients require up to 50mL of calcium gluconate 10%w/v.**
- **Duration of action:** 30-60 minutes
- **Contraindications:** hypercalcaemia
- **Caution:** May potentiate arrhythmias in digoxin toxicity
- **Extravasation can cause tissue necrosis**

6.2. Soluble insulin-glucose intravenous infusion

- **Function:** move potassium into cells
- **Dose:** 10 units soluble insulin (i.e. Actrapid) in 250 mL 10% glucose over at least 15 minutes
- **Use an insulin syringe to measure the insulin**
- **Use a large vein. Central administration is preferred if immediately available.**
- **Risk of hypoglycaemia for up to 12 hours after treatment. Patients with End Stage Renal Disease (ESRD) are more susceptible due to decreased excretion of insulin. Monitor patient for hypoglycaemia as per the instruction box in the flowchart on page 6. Must be highlighted in medical and nursing notes, and at handover.**
- **The risk of hypoglycaemia in patients with low pre-treatment glucose concentration (<7mmol/L) may be reduced by providing additional glucose (as 10% glucose 250mL infusion at 50mL/hour for 5 hours)**
- **Fluid restriction:** for patients where fluid load is a concern, treat with soluble insulin and glucose, ensure blood glucose monitoring is undertaken at the specified intervals, and only start glucose infusion if blood glucose concentration falls below <7mmol/L post treatment.
- **Onset of action:** within 15 minutes
- **Duration of action:** 2-4 hours
- **Peak action:** 30-60 minutes
- **Serum potassium may fall by up to 1mmol/L**
- **Increased effectiveness if given with nebulised salbutamol**
- **If hypoglycaemia occurs, give dextrose tablets (e.g. Dextrose Energy) or glucose 40% gel (e.g. GlucoBoost). Avoid fruit juice given high potassium content.**
6.3. **Nebulised salbutamol**

- Function: move potassium into cells
- **Dose:** 10-20mg via nebuliser.
- **Caution:** cardiovascular disease. High doses can precipitate arrhythmias, use 10mg if history of Ischaemic Heart Disease
- **Onset of action:** within 30 minutes
- **Duration of action:** up to 2 hours
- **Avoid** if tachyarrhythmia present
- Some patients may have limited response to nebulised salbutamol treatment (e.g. patients on non-selective beta-blockers and patients with End Stage Renal Disease)
- **Serum potassium may fall by 0.5-1mmol/L**
- Do not use as monotherapy, unless in exceptional circumstance where there is no intravenous access to administer insulin and glucose

6.4. **Calcium resinonium powder**

- Function: remove potassium from body
- **Dose:** 15g made into a suspension using a small amount of water and given orally four times daily OR 30g resin in 150mL of water or 10% glucose given rectally as a retention enema twice daily
- **Oral route is preferable**
- **Not appropriate for emergency treatment**
- **Onset:** slow and variable, hours to days
- **Contraindications:** bowel obstruction
  - Administer calcium resinonium at least 3 hours before or 3 hours after other oral medications. For patients with gastroparesis, a 6-hour separation should be considered
  - Consider risk of bowel obstruction and perforation
- **Oral use:** consider co-prescribing a laxative (avoid Laxido/Movicol due to potassium content)
- **Rectal use:** enema should be retained for at least 9 hours then colon irrigated with water by medical staff to remove resin as per SmPC.

6.5. **Sodium zirconium cyclosilicate**

- Function: increase gastrointestinal loss of potassium
- **Dose:** 10g three times daily for up to 72 hours
- Mix the contents of each 10g sachet of powder with approximately 45 mL of water and stir well. The powder will not dissolve and the suspension should be taken while it is cloudy; if the powder settles it should be stirred again.
- **Onset of action:** within 1 hour
- **Lowers potassium by up to 1.1mmol/L within 48 hours.** In patients with serum potassium >6.0mmol/L, it can lower serum potassium by 1.5mmol/L within 48 hours.
- **Restricted to correction phase use within the renal department, as emergency bridging use for adults where dialysis is unavailable but urgently needed, and potassium is dangerously elevated**
- **Caution:** with abdominal x-rays. Sodium zirconium cyclosilicate may be opaque to x-rays.
7. References


8. Consultation Group

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