NHS Grampian Staff Guideline For The Management Of Acute Hypokalaemia In Adults

Co-ordinators:
Medicines Information Pharmacist

Consultation Group:
See relevant page in guidance

Approver:
Medicine Guidelines and Policies Group

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Across NHS Boards

Organisation Wide

Directorate

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<table>
<thead>
<tr>
<th>Revision Date</th>
<th>Previous Revision Date</th>
<th>Summary of Changes (Descriptive summary of the changes made)</th>
<th>Changes Marked* (Identify page numbers and section heading)</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 2021</td>
<td>May 2018</td>
<td>Clarified wording around continuous ECG</td>
<td>P3 - Table</td>
</tr>
<tr>
<td>August 2021</td>
<td>May 2018</td>
<td>Added detail on choice of dose</td>
<td>P2 - Dosage</td>
</tr>
<tr>
<td>August 2021</td>
<td>May 2018</td>
<td>Reduced maximum rate for peripheral line</td>
<td>P3 – Table</td>
</tr>
</tbody>
</table>

* Changes marked should detail the section(s) of the document that have been amended, i.e. page number and section heading.
NHS Grampian Staff Guideline for the Management of Acute Hypokalaemia in Adults

This guideline is for use within Primary or Secondary Care in NHS Grampian. Intravenous potassium replacement should only be used in an acute setting, as outlined below.

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

**POTASSIUM SUPPLEMENTS SHOULD NOT BE GIVEN IN SEVERE RENAL IMPAIRMENT, OR IF SERUM POTASSIUM IS GREATER THAN 5.0mmol/L**

Table 1 – Serum Potassium Classification of Hypokalaemia

<table>
<thead>
<tr>
<th>Normal</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.5 - 5.3mmol/L</td>
<td>3.0 - 3.4mmol/L</td>
<td>2.5 - 2.9mmol/L</td>
<td>&lt; 2.5mmol/L</td>
</tr>
</tbody>
</table>

**Causes of Hypokalaemia**

- High urine flow rate and distal sodium delivery, e.g. loop diuretics and thiazides, uncontrolled diabetes.
- External losses from the GI tract, e.g. vomiting, aspiration, fistulae, chronic diarrhoea, laxative abuse, gastric suction.
- Hypomagnesaemia – potassium can be difficult to correct until magnesium levels are normalised.
- Mediated by mineralocorticoid receptor (often associated with hypertension) e.g. primary aldosteronism, secondary aldosteronism, Cushing’s syndrome, steroid therapy, carbenoxolone and glycyrrhizinic acid (liquorice).
- Other medications: theophylline intoxication, insulin, B2 agonists (e.g. salbutamol and terbutaline).
- Reduced intake, e.g. inadequate dietary intake, potassium-free intravenous fluids.
- Sequestration of fluid in bowel, e.g. ileus, intestinal obstruction.
- Defective proximal reabsorption of potassium, e.g. recovery phase of acute tubular necrosis, after relief of urinary tract obstruction, proximal renal tubular acidosis, tubular damage by drugs, e.g. amphotericin.
- Shift of potassium into cells, e.g. metabolic alkalosis.
- Refeeding Syndrome.
- Artefactual: Prolonged contact of serum with cells (i.e. delayed sample transit) may cause measured levels to fall as well as rise.

**Signs and Symptoms of Hypokalaemia**

(Mild hypokalaemia rarely causes symptoms)

- Muscular weakness (possibly paralysis and respiratory failure) and cramping
- Reduced intestinal motility or paralytic ileus
- Polyuria
- ECG changes, ventricular arrhythmias or asystole.
Dosage, Administration and Monitoring

- When hypokalaemia is severe with marked clinical features, or unresponsive to oral therapy, potassium must be replaced intravenously. The speed of replacement is based on clinical symptoms.

- The presence of life-threatening emergency such as serious cardiac dysrhythmia or paralysis requires rapid correction. Otherwise, slow intravenous replacement is preferable to avoid induction of hyperkalaemia.

- The dose required is dependent upon the clinical presentation of the patient. Correction of the underlying cause may suffice when hypokalaemia is mild. For those with severe/symptomatic hypokalaemia, 40mmol/L can be given intravenously; a second or third dose may be required. A recommended maximum dose is 2-3mmol/kg of potassium in 24 hours. The recommended maximum should not be considered a target dose; such high doses may be inappropriate in larger patients given the likely infusion volume required. See Table 2 for more information on dosing.

- Consider changing loop diuretics to potassium-sparing agents.

- Caution should be used in patients with renal impairment or when ACE inhibitors or potassium-sparing diuretics are being administered concomitantly.

Side Effects of Potassium Administration

Oral

- Nausea and vomiting, abdominal pain, diarrhoea, flatulence – if these occur, give dose with or after food.
- Hyperkalaemia.

Intravenous

- Thrombophlebitis and pain.
- Tissue damage in the case of extravasation.
- Cardiac arrhythmias (ECG monitoring if rapid administration (i.e. >20mmol/hour) or high concentration used (i.e. >40mmol/L)), heart block, cardiac arrest.
- Hyperkalaemia.

Suggested monitoring intervals

**Serum potassium range 3.0-3.5 mmol/L** Monitor serum potassium twice weekly until stable. Once stable or potassium >4.5mmol/L, reassess need for supplementation.

**Serum potassium ≤2.9 mmol/L** When serum potassium is < 3mmol/L, intravenous supplementation is usually required. This must only be administered in a hospital setting. Monitor serum potassium following initial therapy, and then at least daily until serum potassium >2.9mmol/L then manage as above. More frequent monitoring may be required depending on the patient’s clinical condition. See Table 2.
Table 2: Administration and Dosage\textsuperscript{1-8}

Please note: In the table below K = potassium and Cl = chloride

<table>
<thead>
<tr>
<th>Route of administration</th>
<th>Presentation</th>
<th>Adult Dose</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral</td>
<td>Potassium chloride and bicarbonate effervescent tablets (Sando K)</td>
<td>Serum K range 3.0 to 3.5mmol/L</td>
<td>Each tablet contains 12mmol K and 8mmol Cl. Tablets dissolve in water which minimises local high concentrations and therefore possibly less risk of adverse effects. May be unpalatable. Give with food to minimise GI irritation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWO tablets THREE times per day (72mmol K per day)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Serum K range 2.5 to 2.9mmol/L</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>THREE tablets THREE times per day (108mmol K per day)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Potassium chloride 7.5% sugar free syrup (Kay-Cee-L)</td>
<td>Serum K range 3.0 to 3.5mmol/L</td>
<td>Liquid contains 1mmol/mL of K and Cl.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20mL THREE times per day (60mmol K per day)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Serum K range 2.5 to 2.9mmol/L</td>
<td>Take with food.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30mL THREE times per day (90mmol K per day)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>For available preparations see Table 3</td>
<td>Serum K range 2.5 to 3.5mmol/L</td>
<td>Hypokalaemia should be interpreted in terms of fluid balance. Any disturbances in acid-base balance or hypomagnesaemia should be corrected where appropriate.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Standard concentration via PERIPHERAL line</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rate of administration is based on the clinical picture.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum rate of administration: 10mmol/hour</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum concentration: 20mmol/500mL</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Serum K range &lt;2.5mmol/L</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>High concentration via PERIPHERAL line</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Use in fluid restriction or emergencies only. Give via a large vein under the direction of a consultant.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prescribe concentration required, up to 40mmol/500mL</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum concentration: 40mmol/500mL</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Usual maximum rate 20mmol/hour</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum of 2 hours duration then review. Further therapy is guided by serum potassium levels.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>High concentration via CENTRAL line</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>For use in ICU or HDU only.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>For safety, prescribe as dilute as the patient’s fluid status will reasonably allow.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum concentration 1mmol/mL</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Usual maximum rate 20mmol/hour</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum of 2 hours duration then review. Further therapy is guided by serum potassium levels.</td>
<td></td>
</tr>
</tbody>
</table>

IV infusion

For available preparations see Table 3

Serum K range 2.5 to 3.5mmol/L

Standard concentration via PERIPHERAL line

Rate of administration is based on the clinical picture.

Maximum rate of administration: 10mmol/hour

Maximum concentration: 20mmol/500mL

Serum K range <2.5mmol/L

High concentration via PERIPHERAL line

Use in fluid restriction or emergencies only. Give via a large vein under the direction of a consultant.

Prescribe concentration required, up to 40mmol/500mL.

Maximum concentration: 40mmol/500mL.

Usual maximum rate 20mmol/hour

Maximum of 2 hours duration then review. Further therapy is guided by serum potassium levels.

High concentration via CENTRAL line

For use in ICU or HDU only.

For safety, prescribe as dilute as the patient’s fluid status will reasonably allow.

Maximum concentration 1mmol/mL.

Usual maximum rate 20mmol/hour

Maximum of 2 hours duration then review. Further therapy is guided by serum potassium levels.

Continuous ECG monitoring is mandatory for infusion rates exceeding 20mmol/hour, and for concentrations of 40mmol/500mL or higher.

Monitor plasma potassium regularly dependent on the patient’s clinical situation.

Glucose containing solutions may reduce serum potassium concentrations, so glucose-free solutions may be more suitable for initial IV therapy of hypokalaemia.

Concentrated infusions can cause thrombophlebitis and pain (pain usually decreases with duration of administration) especially during peripheral administration.

Change to oral preparations as soon as possible.

Rapid administration can cause cardiac arrhythmias and asystole due to the development of hyperkalaemia.
### Table 3: Parenteral potassium preparations in sodium chloride 0.9% available in NHS Grampian

<table>
<thead>
<tr>
<th>Preparation (infusion fluid and potassium chloride [KCL])</th>
<th>Millimoles (grams) of potassium chloride per bag</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>500mL bag</td>
</tr>
<tr>
<td>Sodium chloride 0.9% + 0.15% KCL</td>
<td>10mmol (0.75g)</td>
</tr>
<tr>
<td>Sodium chloride 0.9% + 0.3% KCL</td>
<td>20mmol (1.5g)</td>
</tr>
<tr>
<td>Sodium chloride 0.9% + 0.6% KCL</td>
<td>40mmol (3g)</td>
</tr>
</tbody>
</table>

**Please note:** Solutions containing glucose are less suitable for the initial correction of hypokalaemia. Glucose containing solutions may reduce serum potassium concentrations.

### Table 4: Parenteral potassium preparations containing glucose available in NHS Grampian

<table>
<thead>
<tr>
<th>Preparation (infusion fluid and potassium chloride [KCL])</th>
<th>Millimoles (grams) of potassium chloride per bag</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>500mL bag</td>
</tr>
<tr>
<td>Sodium chloride 0.18% + Glucose 4% + 0.15% KCL</td>
<td>Not stocked</td>
</tr>
<tr>
<td>Sodium chloride 0.18% + Glucose 4% + 0.3% KCL</td>
<td>Not stocked</td>
</tr>
<tr>
<td>Sodium chloride 0.45% + Glucose 5% + 0.15% KCL</td>
<td>10mmol (0.75g)</td>
</tr>
<tr>
<td>Sodium chloride 0.45% + Glucose 5% + 0.3% KCL</td>
<td>20mmol (1.5g)</td>
</tr>
<tr>
<td>Glucose 5% + 0.15% KCL</td>
<td>Not stocked</td>
</tr>
<tr>
<td>Glucose 5% + 0.3% KCL</td>
<td>20mmol (1.5g)</td>
</tr>
<tr>
<td>Glucose 5% + 0.6% KCL</td>
<td>40mmol (3g)</td>
</tr>
<tr>
<td>Glucose 10% + 0.15% KCL</td>
<td>10mmol (0.75g)</td>
</tr>
<tr>
<td>Glucose 10% + 0.3% KCL</td>
<td>20mmol (1.5g)</td>
</tr>
</tbody>
</table>

### Consultation Group

Sarah O’Beirne Lead Pharmacist Medicines Information  
Lynne Davidson Clinical Pharmacist Cardiology  
Dr Adelle Dawson Cardiology Consultant  
Dr Iain Macleod ITU Consultant

### References

4. Summary of Product Characteristics Sando K, access online at [http://www.medicines.org.uk/emc/medicine/812 on 05/01/2021](http://www.medicines.org.uk/emc/medicine/812 on 05/01/2021)
5. Summary of Product Characteristics Kay-Cee-L Syrup, accessed online at https://mhraproducts4853.blob.core.windows.net/docs/b52817499cad6c2f30b95abe0fdefc6741fc5b4f0 on 05/01/2021

