NHS Grampian

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

Co-ordinators:	Consultation Group:	Approver:
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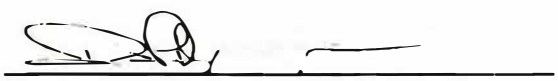
Executive Sign-Off

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

Signature: 

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Across NHS Boards	Organisation Wide	Directorate	Clinical Service	Sub Department Area

Lead Author/Co-ordinator: Medicines Information Pharmacist

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Process Document: Policy, Protocol, Procedure or Guideline Guideline

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Purpose/description: To guide the management of hypokalaemia in adults.

Responsibilities for implementation:

Organisational: Chief Executive and Management Teams
Corporate: Senior Managers
Departmental: Heads of Service/Clinical Leads
Area: Line Managers
Hospital/Interface services: Assistant General Managers and Group Clinical Directors
Operational Management Unit: Unit Operational Managers

Policy statement: It is the responsibility of all staff to ensure that they are working to the most up to date and relevant policies, protocols procedures.

Review: This policy will be reviewed in three years or sooner if current treatment recommendations change.

Responsibilities for review of this document:	Medicines Information Pharmacist
Responsibilities for ensuring registration of this document on the NHS Grampian Information/ Document Silo:	Pharmacy and Medicines Directorate
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Revision History:

Revision Date	**Previous Revision Date**	**Summary of Changes (Descriptive summary of the changes made)**	**Changes Marked* (Identify page numbers and section heading)**
June 2021	May 2018	Clarified wording around continuous ECG	P3 - Table
August 2021	May 2018	Added detail on choice of dose	P2 - Dosage
August 2021	May 2018	Reduced maximum rate for peripheral line	P3 – 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[1]

Table 1 – Serum Potassium Classification of Hypokalaemia

Normal	Mild	Moderate	Severe
3.5 - 5.3mmol/L	3.0 - 3.4mmol/L	2.5 - 2.9mmol/L	< 2.5mmol/L

Causes of Hypokalaemia[2,3]

- 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[2,3]

(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[2,7]

- 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[1,4]

Oral

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

Intravenous[6]

- 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[3]

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[1-8]

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

Route of administration	Presentation	Adult Dose	Notes
Oral			
	Potassium chloride and bicarbonate effervescent tablets (Sando K)	**Serum K range 3.0 to 3.5mmol/L** TWO tablets THREE times per day (72mmol K per day) **Serum K range 2.5 to 2.9mmol/L** THREE tablets THREE times per day (108mmol K per day)	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.
	Potassium chloride 7.5% sugar free syrup (Kay-Cee-L)	**Serum K range 3.0 to 3.5mmol/L** 20mL THREE times per day (60mmol K per day) **Serum K range 2.5 to 2.9mmol/L** 30mL THREE times per day (90mmol K per day)	Liquid contains 1mmol/mL of K and Cl. Take with food.
IV infusion			
Intravenous supplements are indicated if the patient cannot eat, is vomiting, is unlikely to absorb potassium orally or has profound hypokalaemia	For available preparations see Table 3	**Serum K range 2.5 to 3.5mmol/L** **<u>Standard concentration via PERIPHERAL line</u>** 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** **<u>High concentration via PERIPHERAL line</u>** 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. **<u>High concentration via CENTRAL line</u>** 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.	Hypokalaemia should be interpreted in terms of fluid balance. Any disturbances in acid-base balance or hypomagnesaemia should be corrected where appropriate. **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

Preparation (infusion fluid and potassium chloride (KCL))	Millimoles (grams) of potassium chloride per bag	
	500mL bag	1000mL bag
Sodium chloride 0.9% + 0.15% KCL	10mmol (0.75g)	Not stocked
Sodium chloride 0.9% + 0.3% KCL	20mmol (1.5g)	Not stocked
Sodium chloride 0.9% + 0.6% KCL	40mmol (3g)	Not stocked

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

Preparation (infusion fluid and potassium chloride (KCL))	Millimoles (grams) of potassium chloride per bag	
	500mL bag	1000mL bag
Sodium chloride 0.18% + Glucose 4% + 0.15% KCL	Not stocked	20mmol (1.5g)
Sodium chloride 0.18% + Glucose 4% + 0.3% KCL	Not stocked	40mmol (3g)
Sodium chloride 0.45% + Glucose 5% + 0.15% KCL	10mmol (0.75g)	Not stocked
Sodium chloride 0.45% + Glucose 5% + 0.3% KCL	20mmol (1.5g)	Not stocked
Glucose 5% + 0.15% KCL	Not stocked	20mmol (1.5g)
Glucose 5% + 0.3% KCL	20mmol (1.5g)	Not stocked
Glucose 5% + 0.6% KCL	40mmol (3g)	Not stocked
Glucose 10% + 0.15% KCL	10mmol (0.75g)	Not stocked
Glucose 10% + 0.3% KCL	20mmol (1.5g)	Not stocked

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References

1. British National Formulary. Online. Accessed via medicinescomplete.com on 06/11/2020
2. The Merck Manual, R. Porter, K. Kaplan, 19th Edition, 2011
3. Handbook of Clinical Medicine 8th Edition
4. Summary of Product Characteristics Sando K, access online at 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/b52817499cad6c2f30b95abe0fdfc6741fc5b4f0 on 05/01/2021
6. Medusa Injectable Medicines Guide, potassium chloride monograph. Accessed online at http://medusa.wales.nhs.uk/ on 18/02/2021
7. UKMi Q&A How should intravenous (IV) potassium chloride be administered in adults? G. Woodland. Published 20th September 2020. Accessed online at https://www.sps.nhs.uk/articles/how-should-intravenous-iv-potassium-chloride-be-administered-in-adults/
8. Minimum Infusion Volumes for fluid restricted critically ill patients. UKCPA Critical Care Group. 4th Edition. December 2012. Available online at https://www.scottishintensivecare.org.uk/uploads/2014-07-24-19-56-30-Minimuminfusionvolumesinl-40262.pdf