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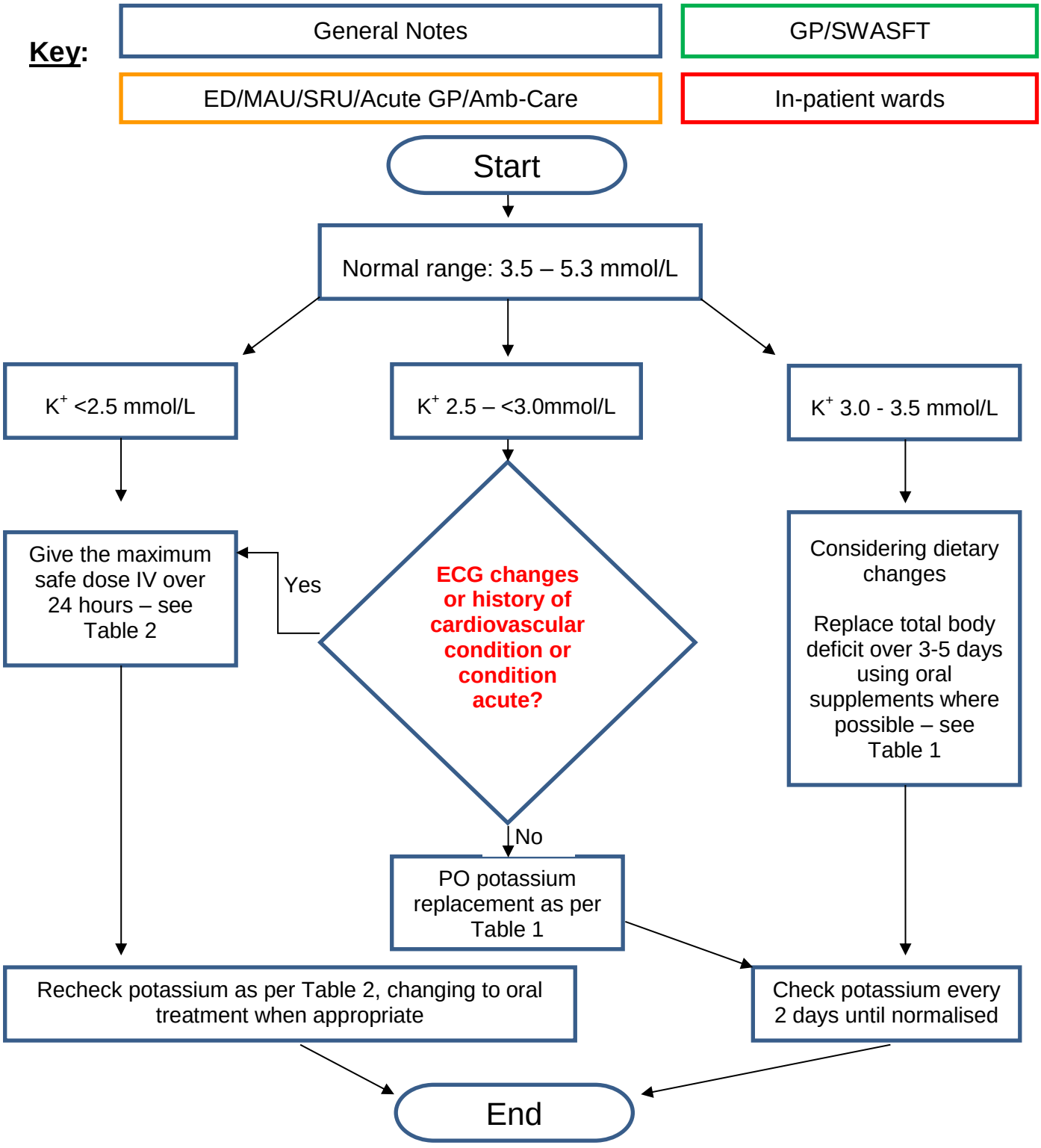
Royal Cornwall Hospitals NHS Trust

Management of Hypokalaemia Clinical Guideline

V2.0

August 2019

Summary



Check other electrolyte levels, particularly magnesium and phosphate

1. Aim/Purpose of this Guideline

1.1. To provide clinical staff with guidance relating to the management of hypokalaemia in adults.

1.2. This version supersedes any previous versions of this document.

1.3. **Data Protection Act 2018 (General Data Protection Regulation – GDPR) Legislation**

The Trust has a duty under the DPA18 to ensure that there is a valid legal basis to process personal and sensitive data. The legal basis for processing must be identified and documented before the processing begins. In many cases we may need consent; this must be explicit, informed and documented. We can't rely on Opt out, it must be Opt in.

DPA18 is applicable to all staff; this includes those working as contractors and providers of services.

For more information about your obligations under the DPA18 please see the 'information use framework policy', or contact the Information Governance Team rch-tr.infogov@nhs.net

2. The Guidance

2.1. What is hypokalaemia?

For the purposes of this guideline, hypokalaemia is defined as a serum potassium concentration of less than 3.5 mmol/L. Severe hypokalaemia is a concentration of less than 2.5 mmol/L.

2.2. Causes of hypokalaemia

2.2.1. There are three major mechanisms by which hypokalaemia can occur:

- Decreased intake (*inadequate dietary potassium intake such as alcoholism, anorexia*)
- Increased losses (*renal and gastrointestinal losses*)
- *Renal*: ***diuretic therapy (loop or thiazide diuretics)****, urinary loss in congestive heart failure, primary or secondary hyperaldosteronism, Cushing's syndrome, large doses of corticosteroids*
- *Gastrointestinal*: ***prolonged diarrhoea*****, ***vomiting*****, excessive use of laxatives*
- Shifts in distribution (metabolic alkalosis, re-feeding, magnesium depletion, certain drugs such as *theophylline, insulin, B_2-agonists*)

*most common cause ** other common causes

2.2.2. Drugs that can cause hypokalaemia:

- Thiazide diuretics (e.g. bendroflumethiazide) and loop diuretics (e.g. furosemide)
- Amphotericin, cisplatin, foscarnet
- Aminoglycosides (e.g. amikacin, gentamicin)
- Beta-agonists (e.g. salbutamol, terbutaline)
- Insulin treatment (e.g. in the treatment of diabetic ketoacidosis)
- Corticosteroids (e.g. fludrocortisone, hydrocortisone)
- Caffeine, theophylline
- Adrenaline, pseudoephedrine
- High-dose penicillins
- Proton pump inhibitors (e.g. omeprazole)

2.3. Signs and Symptoms

Manifestations of hypokalaemia depend upon the severity of potassium depletion – see below:

- **3.0 – 3.5mmol/L** – Usually asymptomatic, but symptoms may include arrhythmias*, weakness, constipation, nausea, muscle cramps and fatigue. ECG changes may include a flat or inverted T wave, ST segment depression and prominent U waves.

- **2.5 – <3.0mmol/L** - As above, but more pronounced. Muscle necrosis and arrhythmias can occur in patients with underlying cardiac problems.

- **<2.5mmol/L** - Cardiac arrhythmias, paralysis of legs and respiratory muscles, rhabdomyolysis, ileus, myoglobinuria, acute renal failure.

* In patients with ischaemic heart disease, heart failure, or left ventricular hypertrophy, even mild hypokalaemia increases the likelihood of arrhythmias.

2.4. Treatment Information required to assess the situation

2.4.1. There are no national guidelines for the treatment of acute hypokalaemia.

2.4.2. The underlying cause of hypokalaemia should be identified and corrected before potassium supplementation (see section 2.2). In particular, consider potential drug causes and check magnesium concentration.

2.4.3. It has been demonstrated that there is an association between potassium and magnesium deficiencies. A patient with a low potassium concentration should have their magnesium concentration checked, as it can be very difficult to correct hypokalaemia in the presence of hypomagnesaemia.

2.4.4. The normal daily requirement of potassium of 50-100mmol (1 mmol/kg) per day also needs to be considered when supplementing potassium if there is no other intake.

2.5. Oral potassium administration.

2.5.1. For use in:

- Asymptomatic mild hypokalaemia (3.0 – 3.5 mmol/L)
- Asymptomatic moderate hypokalaemia (2.5 – 2.9 mmol/L)

Table 1: Oral potassium preparation suitable for use at RCHT

Preparation	Route	Contents of 1 tablet (mmol)		Dose
		Potassium	Chloride	
Sando-K	Oral	12	8	2 tablets three times a day. Total dose = 72 mmol/day

2.5.2. Monitor serum potassium concentration daily, especially in patients with cardiovascular disease or those taking digoxin.

2.5.3. Dose and duration of treatment depends on the existing potassium deficit and whether there are continuing losses. Larger doses may be required in patients with digitoxicity or diabetic ketoacidosis. Specialist advice should be sought in such situations.

2.5.4. Side-effects include abdominal discomfort, diarrhoea, nausea and vomiting.

2.5.5. If gastric irritation occurs, Sando-K should be given with or after food.

2.5.6. Excessive doses can lead to hyperkalaemia (see section 5)

2.6. Intravenous administration

2.6.1. For use in:

- Symptomatic hypokalaemia
- Severe hypokalaemia (<2.5 mmol/L)
- Patients unable to tolerate oral therapy, or those in whom the oral route is inappropriate (e.g. if not absorbing)

2.6.2. Intravenous potassium preparations suitable for use at RCHT:

2.6.2.1. Potassium Chloride 20mmol

- in sodium chloride 0.9% 1L or 500mL
- in sodium chloride 0.18%/glucose 4% 1L or 500mL

2.6.2.2. Potassium Chloride 40mmol

- in sodium chloride 0.9% 1L or 500mL

- in sodium chloride 0.18%/glucose 4% 1L

Table 2: Suggested initial doses for intravenous replacement therapy (assuming normal renal function):

Serum potassium concentrations	Suggested IV replacement	Serum potassium monitoring
2.5-3.4 mmol/L (e.g. if patient unable to take potassium orally)	20 - 40 mmol potassium chloride in 1 litre sodium chloride 0.9% over at least 8 hours.	Monitor after 24 hours. Repeat infusion if appropriate. Switch to oral management as soon as practical.
< 2.5 mmol/L or patient symptomatic	40 mmol potassium chloride in 1 litre sodium chloride 0.9% over 6 hours.	Monitor after 6 hours and repeat infusion if appropriate.

2.6.3. Initial potassium replacement therapy should not involve glucose infusions, as glucose may cause a further decrease in the plasma-potassium concentration. This will unmask the intracellular deficit, which will indicate that further replacement is required.

2.6.4. The rate of administration should not exceed 10mmol/hour, unless in emergencies, where 20mmol/hour can be given for short periods with close, cardiac monitoring, including continuous ECG monitoring.

2.6.5. 40mmol/L is usually recommended as the maximum concentration for peripheral infusion.

2.6.6. In this hospital, the most concentrated preparation available is 80mmol/L (40mmol in 500mLs). This can be given peripherally in exceptional circumstances only – e.g. in severely fluid restricted patients. It should be advised that this is infused into a large vein with close monitoring of the injection site.

2.6.7. High concentrations of potassium can cause serious cardiotoxicity; it is therefore recommended that concentrations exceeding 40mmol/L be administered with caution and with close cardiac monitoring, including continuous ECG monitoring.

2.6.8. The maximum dose that can be given in 24 hours is 3mmol/kg (assuming normal renal function). Care needs to be taken to avoid fluid overload.

2.7. Subcutaneous administration

2.7.1. Low concentrations of potassium may be administered subcutaneously, for example to long-term fluid-dependent patients with no venous access.

2.7.2 A maximum concentration of 34mmol per litre may be infused. In exceptional circumstances, 40mmol/L may be used with close monitoring for any signs of ulceration.

2.8. Monitoring during intravenous replacement.

2.8.1. Urea and electrolytes, with special attention to the following

2.8.1.1. Potassium
Potassium concentration must be closely monitored during replacement. See sections 3.2 and 3.3 for further information.

2.8.1.2. Magnesium
Failure to correct hypokalaemia despite appropriate treatment may be due to underlying hypomagnesaemia, which may require magnesium supplementation.

2.8.1.3. Chloride
Potassium depletion is frequently associated with chloride depletion and with metabolic alkalosis.

Regular monitoring of acid-base balance is essential and a continuing metabolic alkalosis is an indicator of potassium deficiency.

2.9. Renal function

2.9.1 Potassium is excreted renally, and accumulation can occur in patients with poor kidney function.

2.9.2. Replace potassium with **extreme caution** in patients with severe renal impairment and monitor frequently. Seek specialist advice from the renal team.

2.9.3. Lower doses of replacement therapy are required for patients with renal disease.

2.10. ECG and blood pressure

2.10.1 ECG monitoring is essential when potassium is given intravenously; periodic evaluation is recommended with oral supplementation.

2.10.2 ECG monitoring is particularly important in patients with cardiac disease and in those receiving digoxin.

2.10.3 Correction of hypokalaemia may lower blood pressure.

2.11. Injection site

Extravasation may cause tissue damage due to high osmolarity and low pH. Monitor for local pain and phlebitis, particularly at higher concentrations.

2.12. Adverse effects of potassium replacement.

2.12.1. Excessive doses of potassium may lead to the development of hyperkalaemia, particularly in patients with renal impairment. Symptoms include:

2.12.2. Cardiovascular (*cardiac arrhythmias, heart block, cardiac arrest*)

2.12.3. Musculoskeletal (*muscle weakness, paralysis*)

2.12.4. Neurological (*paraesthesia of the extremities, confusion*)

2.12.5. Pain, phlebitis or serious injury following intravenous administration via peripheral veins, particularly at higher concentrations.

2.13. Interactions

Potassium supplements should be used with caution in patients receiving drugs that increase serum potassium concentrations. These include:

- Potassium-sparing diuretics (e.g. spironolactone, amiloride, triamterene, co-amilofruse, co-amilozide)
- ACE inhibitors (e.g. ramipril, lisinopril)
- Angiotensin II receptor antagonists (e.g. irbesartan, losartan, candesartan)
- Tacrolimus
- Ciclosporin
- Drugs that contain potassium, such as the potassium salts of penicillin. *Please note also the potential potassium content of other intravenously administered drugs*.

3. Monitoring compliance and effectiveness

Element to be monitored	Compliance with the clinical guideline
Lead	Medication Safety Pharmacist
Tool	Incident reports via DATIX system
Frequency	When incident reports are received
Reporting arrangements	The completed report to be sent to the Medication Safety Group for review
Acting on recommendations and Lead(s)	The Medication Safety Group will report any necessary actions to the Medicines Practice Committee.
Change in practice and lessons to be shared	Required changes to practice will be identified and actioned within 3 months. A lead member of the team will be identified to take each change forward where appropriate. Lessons will be shared with all the relevant stakeholders

4. Equality and Diversity

4.1. This document complies with the Royal Cornwall Hospitals NHS Trust service Equality and Diversity statement which can be found in the 'Equality, Inclusion & Human Rights Policy' or the Equality and Diversity website.

4.2. Equality Impact Assessment

The Initial Equality Impact Assessment Screening Form is at Appendix 2.

Appendix 1. Governance Information

Document Title	Management of Hypokalaemia Clinical Guideline V2.0			
Date Issued/Approved:	July 2019			
Date Valid From:	August 2019			
Date Valid To:	August 2022			
Directorate / Department responsible (author/owner):	Bronwin Staple, Pharmacy Medicines Information Simon Fleming, Biochemistry			
Contact details:	01872 252587			
Brief summary of contents	This guideline provides guidance on the appropriate management of hypokalaemia			
Suggested Keywords:	Hypokalaemia, Potassium			
Target Audience	RCHT	CFT	KCCG	
	✓			
Executive Director responsible for Policy:	Medical Director			
Date revised:	N/A			
This document replaces (exact title of previous version):	Clinical Guideline for the Management of Hypokalaemia			
Approval route (names of committees)/consultation:	Medicines Practice Committee (July 2019)			
Care Group General Manager confirming approval processes	Sidwell Lawler			
Name and Post Title of additional signatories	Not Required			
Name and Signature of Care Group/Directorate Governance Lead confirming approval by specialty and care group management meetings	{Original Copy Signed}			
	Name: Robin Jones			
Signature of Executive Director giving approval	{Original Copy Signed}			
Publication Location (refer to Policy on Policies – Approvals and Ratification):	Internet & Intranet	✓	Intranet Only	

Document Library Folder/Sub Folder	Clinical / Pharmacy
Links to key external standards	None
Related Documents:	Hyperkalaemia, hyponatraemia, hypophosphataemia guidelines
Training Need Identified?	No

Version Control Table

Date	Version No	Summary of Changes	Changes Made by
May 2016	V1.0	Initial Issue	Liam Kelly, Medicines Information
July 2019	V2.0	Reformatted to match other electrolyte guidelines. Updated summary page to match advice given in guideline. Points 2.4 and 3.1 amalgamated into point 3.1. Point 3.1.4 removed, as information thought superfluous. Information on subcutaneous administration updated to include monitoring of injection site for concentrations of 34-40mmol/L Point 7 removed as felt to be superfluous/most information already stated elsewhere as well. Complicated calculations removed for simplicity and usability.	Bronwin Staple, Medicines Information Pharmacist

All or part of this document can be released under the Freedom of Information Act 2000

This document is to be retained for 10 years from the date of expiry.
This document is only valid on the day of printing

Controlled Document

This document has been created following the Royal Cornwall Hospitals NHS Trust Policy for the Development and Management of Knowledge, Procedural and Web Documents (The Policy on Policies). It should not be altered in any way without the express permission of the author or their Line Manager.

Appendix 2. Initial Equality Impact Assessment Form

<table>
<tr><td colspan="6">Name of the strategy / policy /proposal / service function to be assessed

Management of Hypokalaemia Clinical Guideline V2.0</td></tr>
<tr><td colspan="3">Directorate and service area:
Pharmacy</td><td colspan="3">New or existing document:
Existing</td></tr>
<tr><td colspan="3">Name of individual completing assessment:
Liam Kelly</td><td colspan="3">Telephone:
01872 252587</td></tr>
<tr><td>1. Policy Aim*

Who is the strategy / policy / proposal / service function aimed at?</td><td colspan="5">This guideline has been written to inform doctors, pharmacists and nursing staff and provide a reference in the management of hypokalaemia in adults</td></tr>
<tr><td>2. Policy Objectives*</td><td colspan="5">Guide the management of hypokalaemia</td></tr>
<tr><td>3. Policy – intended Outcomes*</td><td colspan="5">Guide hypokalaemia management</td></tr>
<tr><td>4. *How will you measure the outcome?</td><td colspan="5">Monitoring incident reports</td></tr>
<tr><td>5. Who is intended to benefit from the policy?</td><td colspan="5">Doctors, pharmacists, nurses, patients</td></tr>
<tr><td rowspan="3">6a Who did you consult with

b). Please identify the groups who have been consulted about this procedure.</td><td>Workforce</td><td>Patients</td><td>Local groups</td><td>External organisations</td><td>Other</td></tr>
<tr><td>X</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="5">Please record specific names of groups

Medicines Practice Committee</td></tr>
<tr><td>What was the outcome of the consultation?</td><td colspan="5">Agreed.</td></tr>
</table>

7. The Impact
Please complete the following table. **If you are unsure/don't know if there is a negative impact you need to repeat the consultation step**.

Are there concerns that the policy **could** have differential impact on:

Equality Strands:	Yes	No	Unsure	Rationale for Assessment / Existing Evidence
Age		✓		
Sex (male, female, trans-gender / gender reassignment)		✓		
Race / Ethnic communities /groups		✓		
Disability - Learning disability, physical impairment, sensory impairment, mental health conditions and some long term health conditions.		✓		
Religion / other beliefs		✓		
Marriage and Civil partnership		✓		
Pregnancy and maternity		✓		
Sexual Orientation, Bisexual, Gay, heterosexual, Lesbian		✓		

You will need to continue to a full Equality Impact Assessment if the following have been highlighted:

- You have ticked "Yes" in any column above and
- No consultation or evidence of there being consultation- this excludes any *policies* which have been identified as not requiring consultation**. or**
- Major this relates to service redesign or development

8. Please indicate if a full equality analysis is recommended.	**Yes**		**No**	✓

9. If you are **not** recommending a Full Impact assessment please explain why.

Not indicated

Date of completion and submission	July 2019	Members approving screening assessment	Policy Review Group (PRG) **APPROVED**

This EIA will not be uploaded to the Trust website without the approval of the Policy Review Group.

A summary of the results will be published on the Trust's web site.