GUIDELINE FOR THE MANAGEMENT OF HYPOKALAEMIA IN ADULTS

This guidance does not override the individual responsibility of health professionals to make appropriate decision according to the circumstances of the individual patient in consultation with the patient and /or carer. Health care professionals must be prepared to justify any deviation from this guidance.

Introduction

This guideline covers the treatment of acute hypokalaemia in adults on general medical and surgical wards. It **does not** cover the treatment of diabetic ketoacidosis (DKA) patients or patients whose hypokalaemia is being managed by additions to total parenteral nutrition (TPN). Patients on critical care areas such as intensive care units or surgical high dependency units may have their hypokalaemia managed differently, using information from additional sources, please seek senior advice if needed.
For the management of hypokalaemia in adult patients with DKA please refer to the WAHT Guideline for the treatment of Diabetic Ketoacidosis (WHAT-END-001).

This guideline is for use by the following staff groups :

All qualified healthcare professionals involved in prescribing or administering potassium supplements for adults patients (aged over 18 years). This document is designed to be a guideline for clinical staff working within general medical and surgical wards at the Worcestershire Acute Hospitals Trust and should be used in conjunction with clinical judgement.

Lead Clinician(s)

Dr Martin Ferring	Consultant Renal Medicine
Approved by Specialist Medicine DMB on:	15th February 2023
Approved by Medicines Safety on Committee on:	8th March 2023
Review Date: This is the most current document and is to be used until a revised version is available	8th March 2026

Key amendments to this guideline

Date	Amendment	Approved by:
21/12/2016	New Document	
05/12/2017	Sentence added in at the request of the Coroner	
25/11/2019	• Page 3: 'excess stoma input' changed to 'excess stoma output'. • Page 5: 'step 3' changed to 'step 4' and 'step 4' changed to 'step 5'.	Medicines Safety Committee
19/01/2023	• Page 1: 'For the management of hypokalaemia in adult patients please refer to the WAHT Guideline for the treatment of Diabetic Ketoacidosis', changed to 'For the management of hypokalaemia in adult patients **with DKA'.**	MSC

Guideline for the treatment of acute hypokalaemia

Introduction

Hypokalaemia is a common electrolyte abnormality in hospitalised patients, with some studies suggesting that, at any one time, up to 20% of hospital inpatients have low serum potassium. For many this never causes a problem, however for others it can be life-threatening. The majority of cases of hypokalaemia are associated with diarrhoea and vomiting or diuretic use. It is important that patients have adequate potassium replacement, as well as the correct investigations, and this document should be used as a guide for the management of hypokalaemia in adult patients. It does not cover the treatment of DKA patients or patients whose hypokalaemia is being managed by additions to TPN. This document is designed to be a guideline for clinical staff within the Worcestershire Acute Hospitals Trust and should be used in conjunction with clinical judgement.

Classification	Serum Level (mmol/L)
Normal	3.5 – 5.3
Mild Hypokalaemia	3.0-3.4
Moderate Hypokalaemia	2.5-2.9
Severe Hypokalaemia	<2.5

Aetiology

- **Inadequate intake-** (*adequate* dietary intake is approximately 90mmol/day) eating disorders, TPN where potassium has been inadequately replaced, dental problems (unable to eat), nausea.
- **Increased excretion-** diarrhoea and vomiting, osmotic diuresis, mineralocorticoid excess, excess stoma output.
- **Medications-** diuretics, proton pump inhibitors (e.g. omeprazole), theophylline, caffeine, verapamil (in overdose), quetiapine, high dose penicillins, bicarbonate, antifungals, aminoglycosides, cisplatin, beta-agonists, laxatives, glucocorticoids, fludrocortisone.
- **Endogenous excess mineralocorticoids**- Cushings, primary hyperaldosteronism, secondary hyperaldosteronism, genetic disorders.
- **Exogenous excess mineralocorticoids-** steroids, renal tubular acidosis, low magnesium.
- **Shift from extracellular to intracellular-** metabolic alkalosis, insulin and/or glucose administration, re-feeding, hypothermia, magnesium depletion.

Clinical Signs and Symptoms

Mild to moderate hypokalaemia is often asymptomatic, but signs and symptoms can include:

- **Neuromuscular-** weakness, muscle cramps, paraesthesia, hypotonia.
- **Palpitations**
- **Nausea**
- **Arrhythmias/ECG changes-** prolonged PR interval, ST depression, small/inverted T waves, U waves.

Investigations

- **U&E's-** For mild to moderate hypokalaemia, daily U&E's should be taken unless there is a specified review date in the medical notes *and* on the drug chart. In severe hypokalaemia, especially if a patient is symptomatic or has ECG changes, the potassium level should be checked every few hours.
- **Magnesium-** if magnesium level is low, replace alongside potassium. Follow Trust guidance for treatment of hypomagnesaemia – WHAT-PHA-012.
- **ECG-** if the patient has severe or symptomatic hypokalaemia, concurrent heart disease or renal impairment, check at least one ECG. However, the patient should ideally be on continuous ECG monitoring.
- **ABG-** if patient has severe hypokalaemia or if hypokalaemia is persistent despite treatment.
- **24 hour urine collection-** if source of hypokalaemia is unclear from history, or patient has persistent hypokalaemia, consider investigating whether potassium is being lost in urine.

Treatment

- **Step 1-** Consider causes – can they be prevented or removed? e.g. are there any medicines which can be safely stopped?
  Step 2 - Offer dietary sources of potassium e.g. fruit, fruit juice and vegetables.
- **Step 3-** Replacement:

Classification	Oral Treatment	Intravenous Treatment	Frequency of monitoring
Mild K^+ 3.0-3.4 mmol/L	Oral therapy usually adequate: Sando K TWO tablets TWICE DAILY (total 48 mmol/day of potassium) If Sando K unpalatable consider: Kay-Cee-L 15mL THREE TIMES A DAY (total 45 mmol/day of potassium)	Reserved for patients who are unable to tolerate oral or enteral replacement: Give initial intravenous dose of 20-40mmol/L and then review	Daily U&E monitoring until normokalaemia
Moderate K^+ 2.5-2.9 mmol/L	Oral therapy usually adequate: Sando K TWO tablets THREE TIMES A DAY (total 72 mmol/day of potassium). If Sando K unpalatable consider: Kay-Cee-L 25mL THREE TIMES A DAY (75 mmol/day of potassium)	Reserved for patients who are unable to tolerate oral or enteral replacement: Give initial intravenous dose of 40mmol/L and then review	Daily U&E monitoring until normokalaemia

Severe K^+ <2.5 mmol/L **OR** **<3.0 mmol/L with ECG changes** **OR** **symptomatic**	Rarely adequate. Replace intravenously.	Give initial 40mmol/L intravenously. Further doses are likely to be needed. Repeat as appropriate. Maximum 2-3mmol/kg intravenous potassium in 24 hours	Continuous ECG monitoring required. Recheck U+Es regularly. Clinical judgement required. Intensive monitoring likely to be required for those with severe renal impairment.

PRECAUTIONS FOR INTRAVENOUS POTASSIUM USE

- Rate of administration must not exceed 10mmol/hour.
- In emergencies, intravenous potassium chloride may be given at a rate of 20mmol/hour but **cardiac monitoring is mandatory**. Administration of potassium at faster rate may cause arrhythmias, cardiac toxicity or cardiac arrest.
- Concentration of potassium **should not** exceed 40mmol/L for administration via a peripheral cannula.
- Where possible, avoid glucose containing fluids. Glucose 5% may cause intracellular shift of potassium.

PRE-MIXED SOLUTIONS MUST BE USED

First line available solutions include:

- Potassium Chloride 0.3% (40mmol) + Sodium Chloride 0.9% - 1 litre
- Potassium Chloride 0.15% (20mmol) + Sodium Chloride 0.9% - 1 litre

Glucose containing fluids are available but should be avoided if possible.

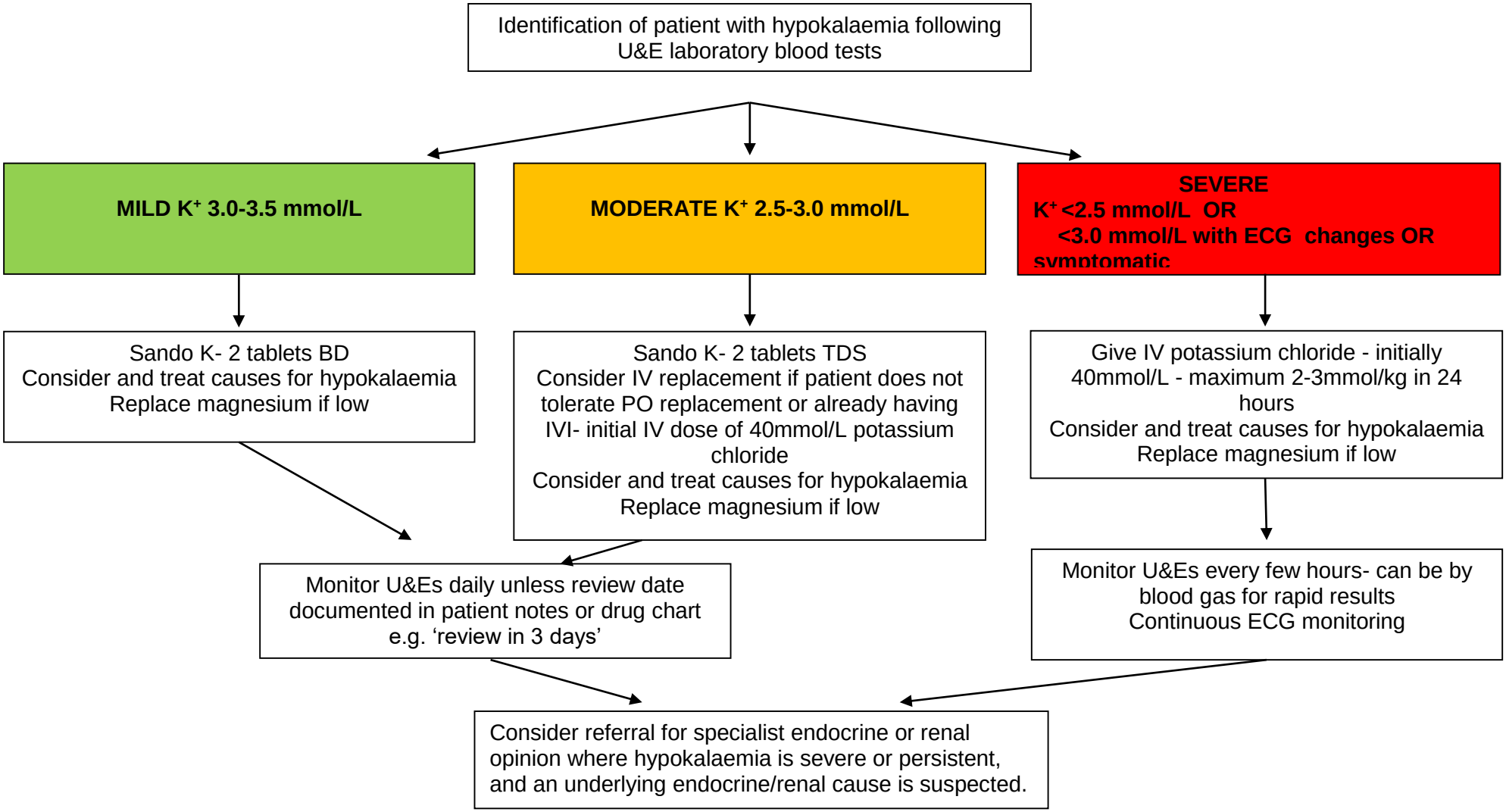
- **Step 4-** Correct hypomagnesaemia if present- see hypomagnesaemia guideline WAHT-PHA-012
- **Step 5-** Consider referral for specialist endocrine or renal opinion where hypokalaemia is severe or persistent, and an underlying endocrine/renal cause is suspected.

Other precautions and information

- Replace potassium cautiously in patients with renal impairment or concomitant use of potassium-sparing diuretics or renin-angiotensin system agents - they are at risk of hyperkalaemia due to impaired potassium excretion.
- Be careful with potassium solutions (follow NPSA advice):
    - Pre-mixed solutions must be used. If a strong potassium solution (>40mmol/L) is required, or a more concentrated solution is required (e.g. due

to fluid restriction), refer to MedPolSOP23. Patient should be managed on CCU/ICU if these are required
    - Maximum concentration via a peripheral cannula is 40mmol/L- concentrations >40mmol/L should be given via central venous access to reduce risk of pain and phlebitis
    - Suggested rate of administration = 10mmol/hour
    - Administration at a rate of 20mmol/hour can **only be given** for short periods of time with mandatory cardiac monitoring/telemetry.
- Side effects of oral potassium therapy may include:
    - Nausea and vomiting
    - Diarrhoea
    - Abdominal cramps

Appendix 1: Flow chart for the management of hypokalaemia in adult patients



Monitoring Tool

This should include realistic goals, timeframes and measurable outcomes.

How will monitoring be carried out?

Who will monitor compliance with the guideline?

Page/ Section of Key Document	Key control:	Checks to be carried out to confirm compliance with the policy:	How often the check will be carried out:	Responsible for carrying out the check:	Results of check reported to: *(Responsible for also ensuring actions are developed to address any areas of non-compliance)*	Frequency of reporting:
	WHAT?	**HOW?**	**WHEN?**	**WHO?**	**WHERE?**	**WHEN?**
	Treatment of hypokalaemia is as per guideline Method of potassium replacement use in relation to biochemistry Frequency of monitoring of biochemistry Frequency of ECG monitoring	Audit	Annually	Foundation Year 1 Doctor as part of programme	Adult Directorate Clinical Governance – to be added to forward plan	Annually
	Compliance to guideline for treatment of severe hypokalaemia to determine whether patients have been undertreated due to a lack of resource for cardiac monitoring/telemetry	Audit	Annually	Foundation Year 1 Doctor as part of programme	Adult Directorate Clinical Governance – to be added to forward plan	Annually

References

Cohn JN, Kowey PR, Whelton PK, Prisant LM., 2000. New guidelines for potassium replacement in clinical practices: a contemporary review by the National Council on Potassium in Clinical Practice. *Archive of Internal Medicine,* 160, pp.2429-36

Gennari FJ.1998. Hypokalemia. *New England Journal of Medicine,* 339 pp.451-458

Greenfeld D, Mickley D, Quinlan DM, Roloff P. 1995. Hypokalaemia in outpatients with eating disorders. *American Journal of Psychiatry,* 152(1), pp.60-3

National Patient Safety Agency. Patient Safety Alert. 23 July 2002

Oram RA, McDonald TJ, Vaidya B., 2013. Investigating hypokalaemia. *BMJ,* 347, pp.5137

Pezhouman A, Singh N, Song Z, Nivala M, Eskandari A, Cao H, et al., 2015. Molecular basis of hypokalaemia-induced ventricular fibrillation. *Circulation,* 20;132(16), pp.1528-37

Reid A, Jones G, Isles C. 2012. Hypokalaemia: common things occur commonly- a retrospective survey. *JRSM Short Reports,* 3 p.80

Royal College of Pathologists, 2010. Out-of-hours reporting of laboratory results requiring urgent clinical action to primary care: advice to pathologists and those that work in laboratory medicine.

Siegel D, Hulley SB, Black DM, Cheitlin MD, Sebastian A, Seeley DG et al. 1992. Diuretics, serum and intracellular electrolyte levels, and ventricular arrhythmias in hypertensive men. *JAMA,* 267, pp.1083-9

UK Medicines Information. Medicines Q&A 412.1 How is hypokalaemia treated in adults? July 2014. [accessed 25/11/2019] Available from: www.evidence.nhs.uk

World Health Organisation. 2012. Guideline: Potassium intake for adults and children.

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Contribution List

This key document has been circulated to the following individuals for consultation;

Designation
Dr Rebecca Warner (Foundation Doctor)
Miss Katherine Alexander (Specialist Clinical Pharmacist – Medicine)
Dr David Jenkins (Consultant Endocrinologist)
Dr Martin Ferring (Consultant Physician)- 2023
Mr Abhimanyu Jaiswal (Specialist Pharmacist)
Mrs Lindsay Stewart (Lead Pharmacist)- 2023

This key document has been circulated to the chair(s) of the following committee's / groups for comments;

Committee
Medicines Safety Committee
Key Guidelines and Documents Approval Group
Specialty Medicine Governance Committee
Pharmacy Governance Committee

Supporting Document 1 - Equality Impact Assessment Tool

To be completed by the key document author and included as an appendix to key document when submitted to the appropriate committee for consideration and approval.

Please complete assessment form on next page;

Herefordshire & Worcestershire STP - Equality Impact Assessment (EIA) Form
Please read EIA guidelines when completing this form

Section 1 - Name of Organisation (please tick)

Herefordshire & Worcestershire STP		Herefordshire Council		Herefordshire CCG	
Worcestershire Acute Hospitals NHS Trust	x	Worcestershire County Council		Worcestershire CCGs	
Worcestershire Health and Care NHS Trust		Wye Valley NHS Trust		Other (please state)	

Name of Lead for Activity	**Dr Marton Ferring**

Details of individuals completing this assessment	**Name**	**Job title**	**e-mail contact**
	Lindsay Stewart	**Clinical Team Lead Pharmacist**	**Lindsay.stewart4@nhs.net**
Date assessment completed	**19/1/23**		

Section 2

Activity being assessed (e.g. policy/procedure, document, service redesign, policy, strategy etc.)	**Title: Guideline for treatment of acute hypokalaemia**			
What is the aim, purpose and/or intended outcomes of this Activity?	See document			
Who will be affected by the development & implementation of this activity?	❑ ☒ ❑ ❑	Service User Patient Carers Visitors	❑ ❑ ❑ ❑	Staff Communities Other _____
Is this:	☒ Review of an existing activity ❑ New activity ❑ Planning to withdraw or reduce a service, activity or presence?			

What information and evidence have you reviewed to help inform this assessment? (Please name sources, eg demographic information for patients / services / staff groups affected, complaints etc.	n/a- no change
Summary of engagement or consultation undertaken (e.g. who and how have you engaged with, or why do you believe this is not required)	n/a no change
Summary of relevant findings	n/a

Section 3

Please consider the potential impact of this activity (during development & implementation) on each of the equality groups outlined below. **Please tick one or more impact box below for each Equality Group and explain your rationale**. Please note it is possible for the potential impact to be both positive and negative within the same equality group and this should be recorded. Remember to consider the impact on e.g. staff, public, patients, carers etc. in these equality groups.

Equality Group	Potential positive impact	Potential neutral impact	Potential negative impact	Please explain your reasons for any potential positive, neutral or negative impact identified
Age				
Disability				
Gender Reassignment				
Marriage & Civil Partnerships				
Pregnancy & Maternity				
Race including Traveling Communities				
Religion & Belief				
Sex				
Sexual Orientation				
Other Vulnerable and Disadvantaged Groups (e.g. carers; care leavers; homeless; Social/Economic deprivation, travelling communities etc.)				

Equality Group	Potential positive impact	Potential neutral impact	Potential negative impact	Please explain your reasons for any potential positive, neutral or negative impact identified
Health Inequalities (any preventable, unfair & unjust differences in health status between groups, populations or individuals that arise from the unequal distribution of social, environmental & economic conditions within societies)				

Section 4

What actions will you take to mitigate any potential negative impacts?	Risk identified	Actions required to reduce / eliminate negative impact	Who will lead on the action?	Timeframe
		.		
How will you monitor these actions?				
When will you review this EIA? (e.g in a service redesign, this EIA should be revisited regularly throughout the design & implementation)				

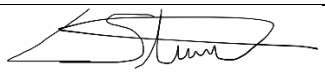
Section 5 - Please read and agree to the following Equality Statement

1. Equality Statement

1.1. All public bodies have a statutory duty under the Equality Act 2010 to set out arrangements to assess and consult on how their policies and functions impact on the 9 protected characteristics: Age; Disability; Gender Reassignment; Marriage & Civil Partnership; Pregnancy & Maternity; Race; Religion & Belief; Sex; Sexual Orientation

1.2. Our Organisations will challenge discrimination, promote equality, respect human rights, and aims to design and implement services, policies and measures that meet the diverse needs of our service, and population, ensuring that none are placed at a disadvantage over others.

1.3. All staff are expected to deliver services and provide services and care in a manner which respects the individuality of service users, patients, carer's etc, and as such treat them and members of the workforce respectfully, paying due regard to the 9 protected characteristics.

Signature of person completing EIA	
Date signed	19/1/23

Comments:	
Signature of person the Leader Person for this activity	
Date signed	
Comments:	

Supporting Document 2 – Financial Impact Assessment

To be completed by the key document author and attached to key document when submitted to the appropriate committee for consideration and approval.

	Title of document:	Yes/No
1.	Does the implementation of this document require any additional Capital resources	No
2.	Does the implementation of this document require additional revenue	No
3.	Does the implementation of this document require additional manpower	No
4.	Does the implementation of this document release any manpower costs through a change in practice	No
5.	Are there additional staff training costs associated with implementing this document which cannot be delivered through current training programmes or allocated training times for staff	No
	Other comments:	