Hyperkalaemia Guideline

1. Purpose

This evidence-based clinical practice guideline provides guidance for the management of hyperkalaemia in adults, including the prescription and administration of treatments. Refer to the following for hyperkalaemia management in different patient groups for:

- paediatrics refer to the Perth Children's Hospital (PCH) Hyperkalaemia Emergency Department Guideline
- neonates refer to the Child and Adolescent Health Service (CAHS) Neonatology Hyperkalaemia Guideline
- pregnant women refer to a consultant obstetrician, or obstetric physician.

2. Guideline

2.1 Introduction[1-6]

Normal potassium range is 3.5 to 5.2 mmol/L. Elevations in serum potassium can range from mild to severe. Hyperkalaemia can occur due to acute illness, medications and in chronic kidney disease. Pseudohyperkalaemia can occur due to traumatic / delayed sample collection or rare medical conditions (e.g. leucocytosis / thrombocytosis) and is not associated with clinical consequences.

Hyperkalaemia can be initially asymptomatic or can present with severe symptoms / signs such as muscle weakness progressing to flaccid paralysis and cardiac conduction abnormalities. It is potentially life-threatening and can result in fatal arrhythmias.

Renal and dialysis patients often have a higher baseline potassium compared to the normal range and this may influence decisions regarding their management (discuss with a nephrologist / renal registrar when required).

ATTENTION

Clinical signs or symptoms of hyperkalaemia is a medical emergency that can cause cardiac arrest.

Start treatment immediately if any of the following are present:

- electrocardiogram (ECG) changes
- clinical signs / symptoms of hyperkalaemia
- potassium > 6.5 mmol/L in the appropriate clinical scenario and pseudohyperkalaemia is not a consideration.

Intravenous insulin administration carries a high risk of hypoglycaemia. Rule out hypoglycaemia prior to use and monitor blood glucose levels regularly after administration.

Seek senior medical staff / renal team advice early if the patient is symptomatic, oliguric / anuric, has end stage kidney disease (ESKD) receiving dialysis or has advanced chronic kidney disease (CKD).

2.2 Common causes[1-6]

Include:

- diseases, e.g. renal disease, metabolic acidosis or hypoaldosteronism
- tissue damage or breakdown e.g. burns, trauma, rhabdomyolysis, haemolysis
- medication-induced e.g. angiotensin converting enzyme (ACE inhibitors), potassium-sparing diuretics, angiotensin II receptor blockers, non-steroidal anti-inflammatories, trimethoprim
- pseudohyperkalaemia which can occur from a haemolysed blood sample or delayed separation.

2.3 Assessment[1-6]

Establish the urgency of the clinical situation e.g. patients with acute kidney injury, severe metabolic acidosis and catabolic situations such as rhabdomyolysis or burns may require more aggressive treatment than chronic ambulant patients with CKD:

- Review the patient's medications, vital signs, venous blood gas, creatinine, urea and presence of urine output promptly.
- Perform an urgent ECG and consider commencing continuous cardiac monitoring if any of the following present: ECG changes, potassium > 6 mmol/L, clinical signs, or symptoms of hyperkalaemia.
- In addition to conduction abnormalities, clinical signs and symptoms may include muscle weakness or flaccid paralysis (diminished tendon reflexes and strength).
- Confirm that correct technique and timing of blood sampling for potassium occurred. If pseudohyperkalaemia is suspected repeat bloods urgently where necessary to confirm level i.e. rapid check with venous blood gas.

2.4 Severity and treatment[1-6]

The urgency of treatment varies with the presence or absence of the symptoms and signs associated with hyperkalaemia, the severity (and rate of rise) of the potassium elevation, and the cause(s):

- Identify the cause.
- Discontinue or withhold suspect medicines.
- Correct hypovolaemia – where severe metabolic acidosis co-exists, sodium bicarbonate may be preferred to normal saline, e.g. severe diarrhoea.
- Treat with medicines as per Appendix A: Pharmacological Management Options to either:
  - stabilise cardiac cell membrane
  - redistribute extracellular potassium into the cells
  - promote potassium excretion.
- Recheck biochemistry e.g. VBG and / or creatinine, urea and electrolytes regularly depending on severity (recommend checking in 1, 2, 4, 6 and 12 hours). If insulin is administered follow blood glucose level (BGL) monitoring requirements in Appendix A: Pharmacological Management Options - Insulin and glucose.

Mild[1-6]

- Serum potassium 5.2 to 5.9 mmol/L.
- ECG: Peaked T waves.
- Clinical manifestations of hyperkalaemia are uncommon when potassium is < 6 mmol/L.
- Treatment is guided by clinical condition, clinical signs and symptoms of hyperkalaemia, ECG changes and rate of serum potassium rise.
- Follow moderate - severe pathway only if ECG changes, clinical signs or symptoms present.
- Otherwise, consider cause and need for treatment. Management can include therapies that gradually reduce the serum potassium, e.g., low-potassium diet, loop or thiazide diuretics (if appropriate), treatment of chronic metabolic acidosis, or reversal of factors that can cause -hyperkalaemia such as cessation of medicines that can increase serum potassium (e.g. nonsteroidal anti-inflammatories, renin-angiotensin-aldosterone inhibitors) and correction of hypovolemia.

Moderate[1-6]

- Serum potassium 6 to 6.5 mmol/L.
- ECG: Peaked T waves, flat / absent P waves.
- If ECG changes present: Give calcium gluconate under continuous ECG monitoring and repeat as required to maintain response.
- Consider insulin with glucose infusion and/or salbutamol nebuliser and / or Resonium®.
- If acidotic consider sodium bicarbonate.

Severe[1-6]

- Serum potassium > 6.5 mmol/L.
- ECG: Absent P waves, widened QRS complex and ventricular arrhythmias.
- Give calcium gluconate under continuous ECG monitoring and repeat as required to maintain response.
- Commence insulin with glucose infusion, salbutamol nebuliser and Resonium®.
- If acidotic consider sodium bicarbonate.
- Urgently contact senior medical staff, arrange monitored bed and may need discussion with metropolitan ICU / renal team.

3. Roles and Responsibilities

The **Prescribers** are responsible for appropriate prescribing, monitoring and review of patients per this guideline.

The **Nurses / midwives** are responsible for appropriate preparation and administration of medicines / therapies and monitoring of patients with hyperkalaemia per this guideline.

The **Pharmacists** are responsible for providing clinical review of medicines per this guideline.

All staff are to work within:

- their scope of practice appropriate to their level of training and job role responsibilities.
- policies and guidelines to make sure that WACHS is a safe, equitable and positive place to be.

4. Monitoring and Evaluation

4.1 Monitoring

Adverse events and clinical incidents relating to the management of hyperkalaemia, including the prescribing and administration of medicines, are to be reported via the approved clinical incident management system (CIMS) e.g. DATIX, and managed as per the WACHS Medication Prescribing and Administration Policy and the MP 0122/19 Clinical Incident Management Policy 2019. The WACHS Medication Safety Committee and regional Medicines and Therapeutics Committees reviews clinical incident data relevant to medications.

4.2 Evaluation

This guideline will be reviewed as required to determine effectiveness, relevance and currency. At a minimum it will be reviewed every five years by the WACHS Medication Safety Committee.

5. Compliance

This guideline is aligned to the *Health Services Act 2016*.

Guidelines are designed to provide staff with evidence-based recommendations to support appropriate actions in specific settings and circumstances. As such, WACHS guidelines should be followed in the first instance. In the clinical context, where a patient's management should vary from an endorsed WACHS guideline, this variation and the clinical opinion as to reasons for variation must be documented in accordance with the Documentation - Clinical Practice Standard.

WACHS staff are reminded that compliance with all policies and procedures is mandatory.

6. References

Government of Western Australia South Metropolitan Health Service [Intranet] Fiona Stanley Fremantle Hospitals Group Hyperkalaemia Guideline. 2022 [cited 03 January 2023]

Medford-Davis, L., & Rafique, Z. (2014). Derangements of Potassium. (2014) Emergency Medicine Clinics of North America, 32(2), 329–347. doi: 10.1016/j.emc.2013.12.005

Nyirenda, M., Tang, J., Padfield, P. & Seckl, J. (2009). Hyperkalaemia clinical review. BMJ, 339:b4114. doi: 10.1136/bmj.b4114

Therapeutic Guidelines [Internet]. Hyperkalaemia. [cited: 03 January 2023]
UpToDate® [Internet]. Mount, DB. (2022). Treatment and prevention of hyperkalaemia in adults. [cited 03 January 2023].

Emergency Care Institute, NSW [Internet]. Potassium – hyperkalaemia. [cited 05 January 2024].

Australian Injectable Drugs Handbook [Internet] SHPA. [cited: 03 January 2023]

Australian Medicines Handbook [Internet]. AMHS Pty Ltd. Polystyrene sulfonate resins. 2022 [cited: 03 January 2023].

7. Definitions

Nil

8. Document Summary

Coverage	WACHS wide
Audience	Medical, nursing, midwifery and pharmacy staff
Records Management	Clinical: Health Record Management Policy
Related Legislation	• *Health Services Act 2016* (WA) • *Medicines and Poisons Act 2014* (WA) • Medicines and Poisons Regulations 2016 (WA)
Related Mandatory Policies / Frameworks	• MP 0130/20 High Risk Medication Policy • Clinical Governance, Safety and Quality Policy Framework • Public Health Policy Framework
Related WACHS Policy Documents	• Diabetes – Inpatient Management Clinical Practice Standard • High Risk Medications Procedure • Medication Prescribing and Administration Policy
Other Related Documents	• CAHS Hyperkalaemia Management Guideline - Neonatology • PCH Hyperkalaemia Guideline - Emergency Department
Related Forms	• MR156A WACHS Insulin Subcutaneous Order and Blood Glucose Record – Adult • MR156B WACHS Obstetric Subcutaneous Insulin Order and Blood Glucose Record • MR176 WACHS Intravenous Fluid Treatment • MR176P WACHS Neonatal / Paediatric Intravenous Fluid Treatment
Related Training Packages	• High Risk Medications: Introduction (HRMINT EL2)
Aboriginal Health Impact Statement Declaration (ISD)	ISD Record ID: 1939
National Safety and Quality Health Service (NSQHS) Standards	1.27, 1.28, 4.01, 4.13, 4.14, 4.15
Aged Care Quality Standards	Nil
Chief Psychiatrist's Standards for Clinical Care	Nil

9. Document Control

Version	Published date	Current from	Summary of changes
1.00	4 April 2024	4 April 2024	First version.
1.01	7 May 2024	4 April 2024	Minor amendment: • Removal of sentence in Appendix A: ○ "All intravenous medications are to be charted on the WACHS MR176 Intravenous Fluid Treatment form."

10. Approval

Policy Owner	Executive Director Clinical Excellence
Co-approver	Executive Director Nursing and Midwifery
Contact	Chief Pharmacist
Business Unit	Pharmacy Services
EDRMS #	ED-CO-23-81344

This document can be made available in alternative formats on request.

Appendix A: Pharmacological Management Options[1-8]

Medication	Dose & Administration	Onset	Duration	Effect On Potassium	Precautions	Comments
Stabilises cardiac cell membrane (alleviates the membrane depolarisation of severe hyperkalaemia)						
CALCIUM GLUCONATE	Calcium gluconate 10% 10 mL (2.2 mmol calcium) undiluted IV over 5 minutes into a large vein. **Repeat after 5 minutes if ECG changes persist or to maintain response.**	1 - 5 min	30 to 60 minutes	Does not lower serum potassium.	Avoid use in digoxin toxicity (increases digoxin effect). Hypercalcaemia.	Administer under continuous ECG monitoring to monitor response. Avoid extravasation.
Redistributes extracellular potassium into the cells						
INSULIN WITH GLUCOSE	ACTRAPID® 10 units in 50 mL of glucose 50% IV over 15 min. Emergencies: may give Actrapid® 10 units in 50mL Glucose 50% over 3-5 minutes for faster onset Subsequent IV glucose infusion may be required	Lowers serum potassium over 30 min	4 to 6 hours	Lowers K^+ by 0.5 - 1.5 mmol/L.	Rule out hypoglycaemia before giving insulin. Profound refractory hypoglycaemia can be induced by giving insulin in the presence of adrenal insufficiency.[4] Corticosteroid replacement is the primary treatment in adrenal insufficiency.[4,6]	Glucose requirements vary. Patients at increased risk of iatrogenic severe hypoglycaemia require supplemental glucose infusion, e.g.: • pre-treatment BGL < 7 mmol/L • no history of diabetes / or pancreatic insufficiency • CKD/Oliguric AKI. Supplemental glucose may not be necessary if patient is hyperglycaemic. **Measure and document BGL prior to administration, then 15 to 30 min after insulin treatment, then hourly for up to 6 hours (or 12 hours in renal impairment).**

Medication	Dose & Administration	Onset	Duration	Effect On Potassium	Precautions	Comments
Redistributes extracellular potassium into the cells						
SALBUTAMOL (Nebulised)	Salbutamol 10 mg nebulised over 10 minutes.	30 min. Peaks at 90 min.	2 to 6 hours.	Lowers serum potassium by 0.5 - 1.5 mmol/L.	High doses can lead to tachycardia and can exacerbate ischaemic heart disease (IHD).	Has an additive effect with insulin. Ineffective in patients on β-blockers.
SODIUM BICARBONATE	Sodium bicarbonate 8.4% 50 mL (undiluted) IV over 5 to 10 minutes via central or large peripheral vein. Undiluted administration indicated ONLY in severe metabolic acidosis. Preferred administration in isotonic volumes. Refer to preparation in the AIDH - SODIUM BICARBONATE (health.wa.gov.au) for isotonic dilution.	Variable.	Variable.	Inconsistent effects.	Fluid overload. Heart failure.	Not indicated as a single agent for treatment of hyperkalaemia. Lowers potassium concentration if acidotic. Do not give in the same IV line as calcium. May be repeated in 60 to 120 minutes. Avoid extravasation.
Promotes potassium excretion						
FUROSEMIDE	20 to 40 mg IV over 5 to 10 mins. Prescribe with fluid replacement if clinically appropriate.	Variable.	Variable.		Hypovolaemia. Anuric patients.	Patient needs adequate renal function for furosemide to be effective. May be useful adjunct, should not be used alone for treatment of acute hyperkalaemia.

Medication	Dose & Administration	Onset	Duration	Effect On Potassium	Precautions	Comments
Promotes potassium excretion						
RESONIUM **Sodium polystyrene sulfonate** **Calcium polystyrene sulfonate**	Sodium resonium is preferred over calcium resonium except in patients with hypernatraemia, CKD, CCF, liver disease or those who cannot tolerate a sodium load. Resonium® 15 g to 30 g orally, 3 or 4 times daily (suspended in 45 to 60 mL of water). *Please specify type of resonium when prescribing on medication chart, i.e. sodium or calcium.*	Several hours.		Lowers serum potassium by 0.5 to 1 mmol/L over 1 to 6 hours.	Contraindicated: • Bowel Obstruction • Ileus • For oral resonium: reduced conscious state. Avoid calcium resonium if the patient has a condition associated with hypercalcaemia.	Stop resonium treatment when the serum potassium is lower than 5.2 mmol/L. Do NOT mix with fruit juices as they contain potassium. Do NOT use concurrently with sorbitol (risk of colonic necrosis). May cause constipation and faecal impaction. Sodium resonium 30 g contains 122 mmol of sodium and results in approx. 500 - 800 mL of fluid retention.
PATIROMER						Indications for use as per the WA Statewide Medicines Formulary (health.wa.gov.au).