

Definition & Causes

Clinically relevant Hyperkalaemia is defined as a plasma potassium (K^+) level greater than 5.5 mmol/L (MUH Reference range 3.5-5.1mmol/L)

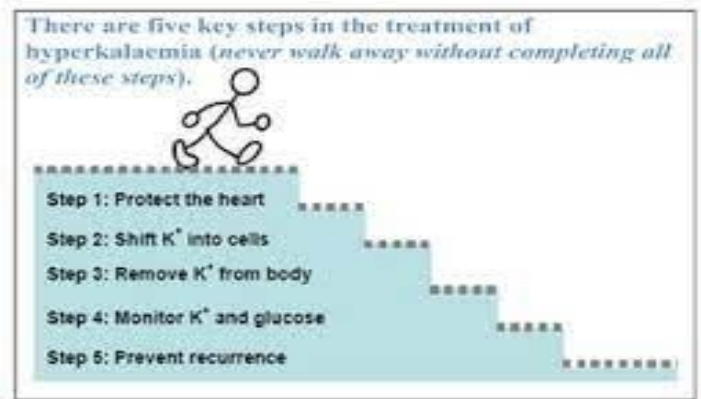
Hyperkalaemia is a common electrolyte abnormality, which may lead to an increased risk of cardiac arrhythmia. This risk underlies the need for treatment for hyperkalaemia. It is commonly associated with and occurs due to abnormal kidney function (AKI or CKD), drugs that affect the renin-angiotensin-aldosterone system (RAAS), and impaired glycaemic control. Identifying the potential cause is important, as many of the immediate treatments of hyperkalaemia act only to redistribute potassium, but not to increase potassium excretion.

Medicines known to increase serum potassium levels include ACE Inhibitors, Angiotensin receptor blockers, Aldosterone antagonists, other K^+ sparing diuretics (amiloride, triamterene), non-selective beta-blockers, potassium chloride/potassium salts, lithium, trimethoprim, co-trimoxazole, NSAIDs and Movicol.

Treatment

There are 5 key steps in the treatment of hyperkalaemia.

Treatment – see flow chart below



MONITORING

- **ECG:** 12 lead ECG should be undertaken where $K^+ \geq 5.5$ mmol/L.
- **Continuous ECG monitoring** or telemetry (once available) should be undertaken for all patients with
 - serum $K^+ \geq 6.5$ mmol/L
 - features of hyperkalaemia on 12 lead ECG (See Appendix 1)
 - serum $K^+ 6.0-6.4$ mmol/L who are clinically unwell or where a rapid rise of serum potassium is anticipated
- **Potassium:** Monitor closely (see Table 1) in all patients with hyperkalaemia to assess efficacy of treatment and to monitor for rebound hyperkalaemia after the initial response to treatment wanes. Aim to achieve serum potassium <6mmol/L within 2 hours.
- **Glucose:** Monitor as per Table 1 (**using glucometers**) as delayed hypoglycaemia is common with insulin/glucose management.
 - Record blood glucose measurements on Pg. 9 & 11 of Insulin Kardex
 - If blood glucose levels <4mmol/L treat as per Appendix 1 in Insulin Kardex (Treatment & Management of Hypoglycaemia in Adults with Diabetes Mellitus).
 - If the patient has been started on a continuous glucose infusion as per the hyperkalaemia algorithm, titrate the rate of infusion according to blood glucose levels. Target blood glucose levels: 5 – 7mmol/L.
 - If hypoglycaemia develops (<4mmol/L) on the glucose infusion - treat as per Appendix 1 in Insulin Kardex (Treatment & Management of Hypoglycaemia in Adults with Diabetes Mellitus) and seek senior medical advice immediately.

- Similarly, if hyperglycaemia develops on the glucose infusion, stop infusion & seek senior medical advice

Table 1: Monitoring recommendations for Potassium and Blood Glucose

Time	0 (End of insulin/ glucose infusion)	15min	30min	60min	90min	2hrs	3hrs	4hrs	5hrs	6hrs	8hrs	10hrs	12hrs	24hrs
K ⁺ (All patients)	✓			✓		✓		✓*		✓			✓	✓
Blood Glucose (All patients)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
Blood Glucose (Patients whose pre-treatment BG <7mmol/L)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

*once K⁺ <5.5 at 4 hr timepoint, next check can be done at the 12 hour time point.

METABOLIC ACIDOSIS

Treat metabolic acidosis if present (ideally Non-anion gap metabolic acidosis - NAGMA)

Isotonic 1.26% sodium bicarbonate IV if appropriate can be given/infused on the ward (in consultation with medical registrar)

- **To prepare a 1.26% solution:** Remove 150ml from a 1000ml bag of **Glucose 5%**, and add 150ml sodium bicarbonate 8.4% to the remaining 850ml in the bag. Mix well by inverting the bag several times. This gives 1000ml of a 1.26% solution. (**DO NOT INFUSE IN NaCl 0.9% - as this ends up with a hypertonic solution**)

Hypertonic 8.4% Sodium Bicarbonate IV – only via a central line in critical care areas, if appropriate.

Rationale: Slow-acting intracellular shift for temporary treatment in patients with metabolic acidosis, not monotherapy.

CAUTION

- Calcium
 - Calcium salts are irritant- monitor for extravasation if a large vein is not available.
 - Avoid calcium gluconate if digoxin-toxic or hypercalcaemic (adjusted Calcium ≥3mmol/L)
 - Do not mix calcium gluconate with any other drugs (risk of incompatibility)
- Insulin can be administered **without** 50ml glucose 50% if pre-treatment blood glucose >15mmol/L.

eGFR (ml/min/1.73m ²)	Dose of IV Actrapid® to be administered in NaCl 0.9%
>40	10 units
<40	Maximum 6 units

Monitor Blood Glucose as per Table 1 above. If ≤6mmol/L, give glucose infusion as per algorithm (pg. 3).

- Avoid nebulised salbutamol in patients with significant tachycardia HR>120bpm
 - Nebulised salbutamol may not be effective (especially if the patient is taking beta-blockers, digoxin or on chronic dialysis) and should only be used as first-line treatment while awaiting IV access for insulin/glucose.
- Calcium Resonium® should **not** be used for the emergency treatment of severe hyperkalaemia due to slow onset of action. It may be considered for mild to moderate hyperkalaemia in particular patients. Consult BNF/Pharmacy for prescribing advice.
 - Calcium Resonium® is contraindicated in obstructive bowel disease, stoma patients & hypercalcemia
 - Always give with laxative e.g. lactulose 15mls tds

REFERENCES

Treatment of Acute HyperKALAEMIA in Adults. The Renal Association Clinical Practice Guidelines. June 2020; CUH Guidelines for the Management of hyperKALAEMIA in Adults (2020)

MANAGEMENT OF HYPERKALAEMIA

Check K⁺ (Venous Blood Gas & Laboratory sample)

Exclude pseudohyperkalaemia (check FBC & check for haemolysis).

Mild
K⁺ 5.5 - 5.9 mmol/L

Moderate
K⁺ 6.0 - 6.4 mmol/L

SEVERE
K⁺ ≥6.5mmol/L

Perform 12 lead ECG. Check for presence of **ECG changes/symptoms?**

For patients in cardiac arrest follow BLS/ACLS algorithm & activate medical emergency response 2222

ECG
CHANGES

For Myocardial Protection (Give once K⁺ ≥6mmol/L +/- ECG changes):

Give 30mls of calcium gluconate 10% in 100mls NaCl 0.9% over 15 mins

- Administer via central line or large peripheral vein
- Give over 30mins if on digoxin
- Consider further dose after 5 mins if ECG changes persist

NO ECG
CHANGES

Give **10 UNITS** of soluble insulin (**Actrapid®**) in 50mls of glucose 50% IV over 15 mins into a large vein

- Check blood glucose prior to administration ("pre-treatment" blood glucose)
- Draw up insulin using an Insulin syringe

Give nebulised salbutamol 10mg. Consider repeating if no cardiac concerns

REDUCE THE RISK OF HYPOGLYCAEMIA

If pre-treatment blood glucose <7 mmol/L, follow with glucose infusion:

Give 10% glucose @50ml/hr for 5 hours (25g)

**TO PREPARE
25g GLUCOSE:**

250ml 10% glucose
OR
50ml 50% glucose

Monitor serum potassium and blood glucose (see Table 1)

If post-treatment Blood Glucose <4mmol/L, follow hypoglycaemia protocol.

Treat metabolic acidosis if present (Pg. 2)

PROMOTE POTASSIUM EXCRETION AND ADDRESS CAUSE

CONSIDER:

Calcium resonium 15g tds po (needs normal functioning gut to work).
Volume resuscitation, if clinically indicated
Furosemide 40mg IV x 1 dose (if adequate volume status)
Team to stop all K⁺ supplements and K⁺ promoting drugs/infusions if appropriate.
Refer to dietetics for low potassium diet where appropriate.

**Consulting team to
contact Renal team
urgently if:
(may need dialysis)**

Serum K⁺ refractory
to treatment
(>6.5mmol/L)

OR

ESRD/HD/PD
patient OR if
oliguric/anuric AKI
patient

OR

ECG changes persist
despite treatment.

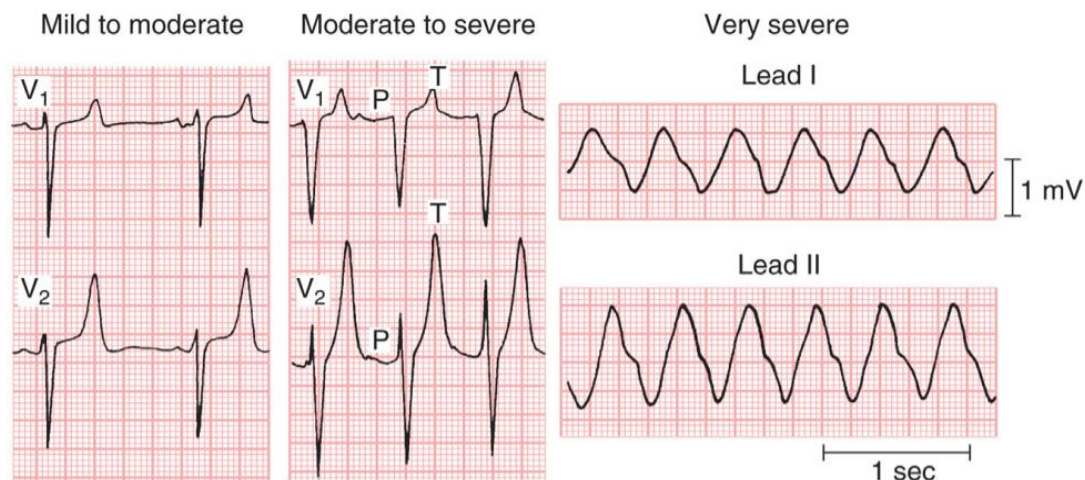


Fig. 11.3 The earliest change with hyperkalemia is peaking ("tenting") of the T waves. With progressive increases in the serum potassium concentration, the QRS complexes widen, the P waves decrease in amplitude and may disappear, and finally a *sine wave* pattern leads to asystole unless emergency therapy is given.

Ref: Goldberger's Clinical electrocardiography 10th Edition