

## **1. Introduction and Who Guideline applies to**

This guideline is applicable to all patients in an Intensive Care setting in whom their potassium is greater than 5.5 mmol/L.

## **2. Guideline Standards and Procedures**

### **SEE APENDIX 1 FOR EMERGENCY MANAGEMENT OF HYPERKALAEMIA**

#### **Acute management**

Repeat arterial/venous gas for confirmation whilst treatment is being started. Is this a spurious reading? Has sample been taken from limb/CVC receiving potassium containing fluid? Send repeat sample for Urea and Electrolytes to lab for later confirmation of potassium.

**Severe Hyperkalaemia – Potassium > 6.5mmol/L – Initiate acute treatment.** Treatment should not be delayed whilst awaiting confirmation. Presence or absence of ECG changes should not alter decision to treat. Continuous 3 lead ECG monitoring needed.

**Hyperkalaemic cardiac arrest** – uncommon but potentially reversible after even prolonged resuscitation efforts. Success has been reported with dialysis during cardiopulmonary resuscitation.

#### **Acute Treatment**

- 1. Intravenous calcium salts – 10ml 10% Calcium Chloride (6.8mmol Ca<sup>2+</sup>) (available as pre-filled syringe – if ampoules used (14.7 % strength) then administer 7 mls) or 30ml 10% Calcium Gluconate (6.78mmol Ca<sup>2+</sup>) over 5 minutes to stabilise the myocardium – effects last approximately 30-60 minutes**
- 2. Insulin-glucose infusion – 10 units insulin (actrapid/novorapid) in 25g glucose (50ml 50% glucose or 125ml 20% glucose) this should be given over 15 minutes. Lasts around 60 minutes – 4 hours. Can be repeated.**
- 3. Sodium zirconium cyclosilicate (Lokelma) 10g orally. An oral potassium binder approved by NICE in September 2019 for life-threatening hyperkalaemia (K<sup>+</sup> ≥ 6.5 mmol/l) alongside standard treatment with insulin-glucose and salbutamol.**
- 4. Consider options for elimination of potassium –CVVH(DF)**
- 5. Reassess – Continuous 3 lead ECG monitoring, repeat potassium at 30 minutes and at least at 1 hour, 2 hours, 4 hours, and 6 hours. Be aware of hypoglycaemia and monitor glucose post infusion at 15minutes, 30mins, 60mins, 120 mins, 180mins, 240 mins, 300 mins and 360mins for a minimum of 6 hours after infusion.**

**Moderate 6.0-6.4mmol/l** –Potassium of >6.0 should prompt a 12 lead ECG to assess for signs of hyperkalaemia and acute treatment initiated if ECG changes are present with acute management as above

**Mild 5.5-5.9mmol/l** – consideration should be given to rate of rise of potassium in deciding need for acute treatment and likely disease course. If patient is oligoanuric or with deteriorating renal function and no hope of rapid improvement, renal replacement therapy should be considered.

### **Chronic management of hyperkalaemia on intensive care**

- Confirm hyperkalaemia on lab sample.
- Eliminate causes of pseudohyperkalaemia
- Assess for sources of potassium (potassium containing fluids, tissue breakdown, tumour lysis, rhabdomyolysis) or limitations to excretion (AKI/Oliguria, potassium sparing diuretics, ACE-inhibitors, Angiotensin II receptor antagonists, NSAIDS, Trimethoprim,azole antifungals)
- Limit potassium intake. Assess drug chart. Consider low potassium diet/ low potassium NG feed with discussion with dietician. Promote diuresis with appropriate fluids. Sodium zirconium cyclosilicate (Lokelma) is a potassium exchange resin. 10g BD for 3 days followed by 5g OD orally.
- If patient is oligo/anuric or declining renal function consideration should be given to initiating renal replacement therapy to maintain control of potassium levels and eliminate excess potassium.

### **Treatment notes**

**Serum K<sup>+</sup> >5.5mmol/l** is widely considered to represent hyperkalaemia but it is a spectrum associated with increasing cardiac instability with increasing potassium concentration as well as the rate of rise in potassium. Effects are exacerbated by co-existent acidosis, hyponatraemia and hypocalcaemia. Above potassium of 6.5mmol/l there is increasing likelihood of dysrhythmia and associated symptoms of muscle weakness or paraesthesia should be cause for concern. Note acute changes in potassium are associated with cardiac mortality and rapid changes in potassium concentration should be treated with caution.

**ECG changes** – Progress with increasing potassium from tented T waves, to prolonged PR interval, wide QRS complexes, sine wave, to arrhythmias and ultimately asystole. Of note ECG may be normal even in the setting of severe hyperkalaemia.

**Calcium Salts – Calcium Chloride 10ml of 10% Calcium Chloride.** Calcium chloride contains approximately three times more calcium (6.8 mmol/ 10ml) as compared with calcium gluconate (2.26mmol/ 10ml). Calcium chloride has been recommended in the setting of haemodynamic instability, including cardiac arrest. Tissue necrosis can occur with extravasation and Calcium gluconate may be less toxic to veins. Bradycardia and arrhythmias can occur if calcium is given rapidly via central venous access. Caution is advised in patients taking digoxin as hypercalcaemia may potentiate digoxin toxicity and slower administration over 30 minutes has been recommended. Avoid administration with bicarbonate solutions as there is risk of insoluble calcium salt formation.

**Insulin-dextrose infusions** appear most effective in acutely lowering serum potassium but care must be taken as effects last only up to 6 hours and patients are liable to rebound unless other measures are taken to eliminate potassium from the body.

**Beta-agonists** (salbutamol 10-20mg nebulised) can be used as adjuvant therapy and appears to be effective but up to 40% of patients are unresponsive. This should be considered an adjunct to insulin-glucose therapy and not a replacement. It should not be used as single agent treatment for hyperkalaemia.

**Sodium bicarbonate** is often used but there is little evidence to support its use with some studies showing very limited effect on decreasing potassium concentrations.

**Potassium exchange resins** - Sodium zirconium cyclosilicate (Lokelma) is a potassium exchange resin. Administered as 10g BD for 3 days followed by 5g OD orally. It is very effective at controlling potassium level including in the acute setting.

**Diuretics and intravenous fluids** can be used to promote potassium excretion but there is currently no evidence to support their use in hyperkalaemia.

**CRRT/Dialysis/SLED/Renal replacement therapies** – CRRT/SLED/Dialysis are the most effective methods of acutely controlling hyperkalaemia and eliminating potassium from the body. They both require large bore central venous catheters to allow sufficient access to large flows of blood. Consideration can be made for potassium free replacement solution for rapid control of potassium. CRRT effluent volumes of greater than 20ml/kg/hr should be used.

**Established haemodialysis** patients may have a tunnelled “permcath” central venous catheter that can be accessed and used in emergency, but discussion should be had with renal registrar at earliest opportunity and care should be taken to lock the line with appropriate anticoagulant after use. Haemodialysis patients using fistula for dialysis should be discussed with renal team as occasionally it is possible to avoid further CVC insertion and use the fistula for vascular access with appropriate support.

**Peritoneal dialysis** patients presenting with raised potassium should be discussed with renal team as soon as possible and ideally within working hours as it is occasionally possible to arrange peritoneal dialysis to control their potassium.

### **3. Education and Training**

No additional training is required for this guideline.

#### 4. Monitoring Compliance

What will be measured to monitor compliance	How will compliance be monitored	Monitoring Lead	Frequency	Reporting arrangements
Snapshot Audit	Audit of guideline usage in cases of hyperkalaemia	R Porter	3 yearly	To ICU Core Group

#### 5. Supporting References (maximum of 3)

- CLINICAL PRACTICE GUIDELINES - TREATMENT OF ACUTE HYPERKALAEMIA IN ADULTS UK Renal Association 2014 <http://www.renal.org/docs/default-source/default-document-library/hyperkalaemia-guideline.pdf?sfvrsn=0>

#### 6. Key Words

Hyperkalaemia

Adult Intensive Care Unit

AICU

.

CONTACT AND REVIEW DETAILS	
<b>Guideline Lead (Name and Title)</b> Dr R Bell (Consultant in Intensive Care and Renal Medicine)	<b>Executive Lead</b>
<b>Details of Changes made during review:</b> <b>B30/10/17</b> – minor formatting adjustments and insertion into trust clinical guidelines.	

# **Appendix 1 – Management of Acute Hyperkalaemia on AICU**

## **Acute management**

Repeat arterial/venous gas for confirmation whilst treatment is being started. Is this a spurious reading? Has sample been taken from limb/CVC receiving potassium containing fluid? Send repeat sample for Urea and Electrolytes to lab for later confirmation of potassium.

**Severe Hyperkalaemia – Potassium > 6.5mmol/L – Initiate acute treatment.** Treatment should not be delayed whilst awaiting confirmation. Presence or absence of ECG changes should not alter decision to treat. Continuous 3 lead ECG monitoring needed.

**Hyperkalaemic cardiac arrest** – uncommon but potentially reversible after even prolonged resuscitation efforts. Success has been reported with dialysis during cardiopulmonary resuscitation.

## **Acute Treatment**

1. **Intravenous calcium salts – 10ml 10% Calcium Chloride (6.8mmol Ca<sup>2+</sup>) (available as pre-filled syringe – if ampoules used (14.7 % strength) then administer 7 mls) or 30ml 10% Calcium Gluconate (6.78mmol Ca<sup>2+</sup>) over 5 minutes to stabilise the myocardium – effects last approximately 30-60 minutes**
2. **Insulin-glucose infusion – 10 units insulin (actrapid/novorapid) in 25g glucose (50ml 50% glucose or 125ml 20% glucose) this should be given over 15 minutes. Lasts around 60 minutes – 4 hours. Can be repeated.**
3. **Consider options for elimination of potassium – CVVH(DF)**
4. **Reassess – Continuous 3 lead ECG monitoring, repeat potassium at 30 minutes and at least at 1 hour, 2 hours, 4 hours, and 6 hours. Be aware of hypoglycaemia and monitor glucose post infusion at 15minutes, 30mins, 60mins, 120 mins, 180mins, 240 mins, 300 mins and 360mins for a minimum of 6 hours after infusion.**

**Moderate 6.0-6.4mmol/l** –Potassium of >6.0 should prompt a 12 lead ECG to assess for signs of hyperkalaemia and acute treatment initiated if ECG changes are present with acute management as above

**Mild 5.5-5.9mmol/l** – consideration should be given to rate of rise of potassium in deciding need for acute treatment and likely disease course. If patient is oligoanuric or with deteriorating renal function and no hope of rapid improvement, renal replacement therapy should be considered.