

## Hyperkalaemia Scenario

A 67 year old male with multiple tibial fractures had an external fixation device applied 2 days ago. He is hypertensive and has non-insulin dependent diabetes mellitus. He has developed compartment syndrome, and requires a fasciotomy. He is not fasted. Following a rapid sequence induction, he has an uneventful general anaesthetic. He is extubated in theatre and transferred to the post anaesthesia care unit.

He is reconnected to the monitor and you notice that the ECG on the monitor looks unusual. Despite moving the leads around and reducing the gain the trace still looks abnormal so you ask the recovery nurse to record a 12 lead ECG (Fig 1)

### 1 What does this ECG show?

*Small P waves  
Prolonged QRS duration  
Tall tented T waves*

10 minutes later the recovery nurse is teaching a student to use the ECG machine and so records another 12 lead ECG (Fig 2)

### 2 What does the ECG show now?

*No P waves  
Broadening of QRS complexes*

### 3 What is the likely diagnosis?

*Hyperkalaemia (K > 9.0 in these cases)*

### 4 What are the likely causes in this case?

*Massive release of K from necrotic tissue  
Suxamethonium used for rapid sequence induction  
Medication – patient is hypertensive and may be taking ACE inhibitors or potassium sparing diuretics  
Renal failure secondary to rhabdomyolysis and NIDDM.  
Accidental administration  
High preop level*

**5 Describe the immediate management of this condition**

**(a) Direct antagonism of hyperkalaemia upon membrane hyperpolarisation**

*10mls 10% Calcium Gluconate (or chloride)*

*Acts within minutes and lasts up to 1 hour*

*May be repeated if effective*

*Caution if patient is also digoxin toxic as calcium may potentiate the effects of digoxin*

**(b) Movement of extracellular potassium into the intracellular compartment**

*Insulin Dextrose infusion*

*Acts within 15 – 30 minutes and effective for 2 – 4 hours*

*50mls 50% Dextrose with 20 units soluble insulin over 10-15 minutes.*

*Salbutamol nebuliser 2.5 – 5mg*

*Acts within 20 – 30 minutes and lasts 2 – 3 hours*

*Sodium Bicarbonate 8.4% 50mls*

*Less effective than the above at shifting potassium into cells but may be beneficial in situations of concurrent acidosis.*

*Delayed effect*

**(c) Removal of potassium from the body**

*This is necessary to prevent recurrence of the hyperkalaemia*

*Loop diuretics e.g. Frusemide 10 – 20 mg depending upon renal function. Acts within 1 hour.*

*Polystyrene sulphonate resin (Calcium Resonium) 15-30g orally 8 hourly. Effect within 4 – 6 hours. This can also be given as a 30g enema – must be retained for at least 30 – 60 minutes.*

*Colonic irrigation is required 9 hours later to remove resin from the colon.*

*Avoid calcium resonium in obstructive bowel disease or in hypercalcaemia.*

*Renal replacement therapy (CVVH or haemodialysis).*

## **6 Describe the serial ECG changes of hyperkalaemia (Figs 3-5)**

*Tall tented T waves – first sign*

*Small/absent P waves*

*AV conduction block*

*Widened QRS*

*Shortened/absent ST segment with slurring into T waves*

*Sine wave rhythm*

*VF*

*Asystole*

*No particular serum level of potassium is associated with any particular ECG changes.*

*Rapid rises of potassium seem to be more dangerous, especially in patients without a history of chronic renal disease.*

## **7 List some causes of hyperkalaemia in the perioperative patient**

*Shift of potassium out of cells*

*Tissue breakdown – rhabdomyolysis, burns, trauma*

*Drugs – suxamethonium, beta-blockers, digoxin*

*Impaired potassium excretion*

*Renal failure*

*Drugs – potassium sparing diuretics, ACE inhibitors, NSAIDs, cyclosporine, tacrolimus, pentamidine.*

*Mineralocorticoid deficiency – Addison's disease.*

*Excess administration*

Equipment: Table, chairs, attached ECG sheets