

Station Number THREE: Teaching

Candidate instructions

This is a 7 minute Teaching station.

You are a consultant in a tertiary emergency department. You are approached by a new intern who wants to discuss an ECG with you.

An overnight registrar managed a patient with severe hyperkalaemia, and the intern would like to know more about the condition as the registrar seemed very worried about the patient during the morning handover. The registrar gave you a copy of the ECG and told you there were good learning points in it prior to going home. The patient is now in intensive care.

Your tasks are to:

- Discuss the ECG findings of hyperkalaemia with the intern and answer any questions they may have.
- Teach the intern about the causes and treatment of hyperkalaemia in the ED.

Domains:

- Scholarship and Teaching 30%
 - Medical Expertise
 - Assessment 30%
 - Management 40%
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Role player instructions

You are a new intern that just started on the job 2 weeks ago. ED is your first rotation.

You want to speak to the consultant about the ECG of a patient with severe hyperkalaemia whom the senior registrar saw overnight, as it seemed to draw a lot of attention from the morning team and you heard that the patient was now in the intensive care after being peri-arrest in the ED.

You have learned about hyperkalaemia as a student and know the basics of the condition. You are aware that normal levels are from 3.5-5.0 mmols/L. If asked about the ECG, you say that you know that there can be changes of hyperkalaemia on an ECG, but you are not sure of the details. You are worried because you're not sure you would have picked hyperkalaemia as the diagnosis in a timely fashion from this ECG.

If asked, you know that you give insulin to treat it, although you have forgotten how this works.

Prompts:

- ***What are the obvious changes in this ECG that would make you think the patient had hyperkalaemia?***
 - ***What other ECG signs can occur that are not demonstrated here? Do these changes normally occur in a stepwise fashion?***
 - ***Is there anything that causes a falsely elevated potassium?***
 - ***At what level of potassium would you consider treating?***
 - ***What are the differences between Calcium chloride and gluconate?***
 - ***I have read about calcium resonium as a treatment, is this something you would advise?***
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Examiner Instructions

This is a 7 minute Teaching station on the subject of Hyperkalaemia. The candidate is expected to Teach a novice learner about Hyperkalaemia including ECG changes, causes and ED management. The candidate is expected to demonstrate expert level knowledge of this core topic.

Medical Expertise

Potassium (K⁺) is vital for regulating the normal electrical activity of the heart. Increased extracellular K⁺ reduces myocardial excitability, with depression of both pacemaking and conducting tissues.

Progressively worsening hyperK⁺ leads to suppression of impulse generation by the SA node and reduced conduction by the AV node and His-Purkinje system, resulting in bradycardia and conduction blocks and ultimately cardiac arrest.

- Hyperkalaemia is defined as a potassium level > 5.5 mEq/L
- Moderate hyperkalaemia is a serum potassium > 6.0 mEq/L
- Severe hyperkalaemia is a serum potassium > 7.0 mEq/L

Causes

Excretion failure

- Renal failure
- Diabetes
- Drugs – potassium sparing diuretics and ACEi's
- Addison's disease

Excessive intake

- Potassium supplements/ iatrogenic via IV administration

Redistributive

- Acidosis
 - Rhabdomyolysis
 - Haemolysis (including transfusion of old RBCs)
 - Drugs / toxins, in particular: Suxamethonium, Massive digoxin overdose, Systemic effects of hydrofluoric acid burns.
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Catabolic states

- Sepsis
- Multitrauma
- Burns

Pseudohyperkalaemia

- Haemolysis of blood sample
- Significant delays in separating RBCs from serum (delayed analysis)
- Extreme leucocytosis/ thrombocytosis
- Blood taken from IV drip arm, receiving fluids with supplemental potassium.

Other

- Hyperkalaemia periodic paralysis

Symptoms/Signs:

- Usually asymptomatic
- Generalised muscle weakness

Effects of hyperkalaemia on the ECG

The ECG provided demonstrates huge peaked T waves with a sine wave appearance

Serum potassium > 5.5 mEq/L is associated with **repolarization abnormalities:**

- Peaked T waves (usually the earliest sign of hyperkalaemia)

Serum potassium > 6.5 mEq/L is associated with **progressive paralysis of the atria:**

- P wave widens and flattens
 - PR segment lengthens
 - P waves eventually disappear
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Serum potassium > 7.0 mEq/L is associated with **conduction**

abnormalities and bradycardia:

- Prolonged QRS interval with bizarre QRS morphology
- High-grade AV block with slow junctional and ventricular escape rhythms
- Any kind of conduction block (bundle branch blocks, fascicular blocks)
- Sinus bradycardia or slow AF
- Development of a sine wave appearance (a pre-terminal rhythm)

Serum potassium level of > 9.0 mEq/L causes **cardiac arrest due to:**

- Asystole
- Ventricular fibrillation
- PEA with bizarre, wide complex rhythm

Higher level candidates will reinforce that in individual patients, the serum K⁺ level may not correlate closely with the ECG changes, which can be non-specific and insensitive.

Patients with relatively normal ECGs may still experience sudden hyperK⁺ cardiac arrest without clinical warning. Danger depends on the rate of the rise.

Management

**** Immediate if ECG changes or serum K⁺ > 7.0**

See table below

Agent	Dose	Onset	Duration	Complications
<u>MEMBRANE STABILISATION/ CARDIOPROTECTION</u> Calcium: Chloride Gluconate	5 – 30 mls of 10% 10 – 60 mls of 10% Slow IV over ~ 5 mins	< 5 mins	30-60 mins (may need to repeat dose)	Hypercalcaemia Volume overload hypertonicity Tissue necrosis Hypotension if pushed as bolus
<u>REDISTRIBUTION OF POTASSIUM (intracellular shift of K)</u> Insulin (with Dextrose) Salbutamol	10 units of IV Actrapid (short acting) in 50 mls 50% Dextrose over ~5 mins	15-30 mins	2-6 hours	Hypoglycaemia
Bicarbonate	0.5mg IV Or 5-30mg nebulised	15-90 mins	1-2 hours	Tachyarrhythmias
	1 ml/Kg of 8.4% solution (maximum 100 mls) over 5-10 minutes	15-30 mins	1-2 hours	Fluid overload
<u>ELIMINATION</u> Calcium Resonium (ion binding)	Resonium A, (sodium polystyrene sulfonate) 15 grams (suspended in 45 to 60 mL of water) orally 3 or 4 times a day. OR rectally, as 25 to 50 grams retention enema, daily.	1-6 hours	4-6 hours	Hypernatraemia Volume overload Hypokalaemia Rebound alkalosis Ionised hypocalcaemia
Dialysis		Within minutes		

Also:

- Temporary chronotropes / pacing / adrenaline as required whilst urgent therapy for hyperK⁺ being administered
- Repeat K⁺ measurement after 1 hour of therapy
- Disposition – dependent on severity and cause (SSU/Gen Med/Renal/HDU/ICU)

Calcium Chloride vs Calcium Gluconate:

- Chloride is x3 more potent
- More risk of tissue necrosis if IV extravasation > increased thrombophlebitis (large IV access preferable prior to administration with CaCl)
- Gluconate requires liver metabolism – slower onset
- Chloride does not require liver breakdown – potentially better option in shocked patient who needs urgent management
- Quicker onset (more rapid increase in serum calcium)

Minimum Pass criteria (medical expertise)

Expert level knowledge of Hyperkalaemia including:

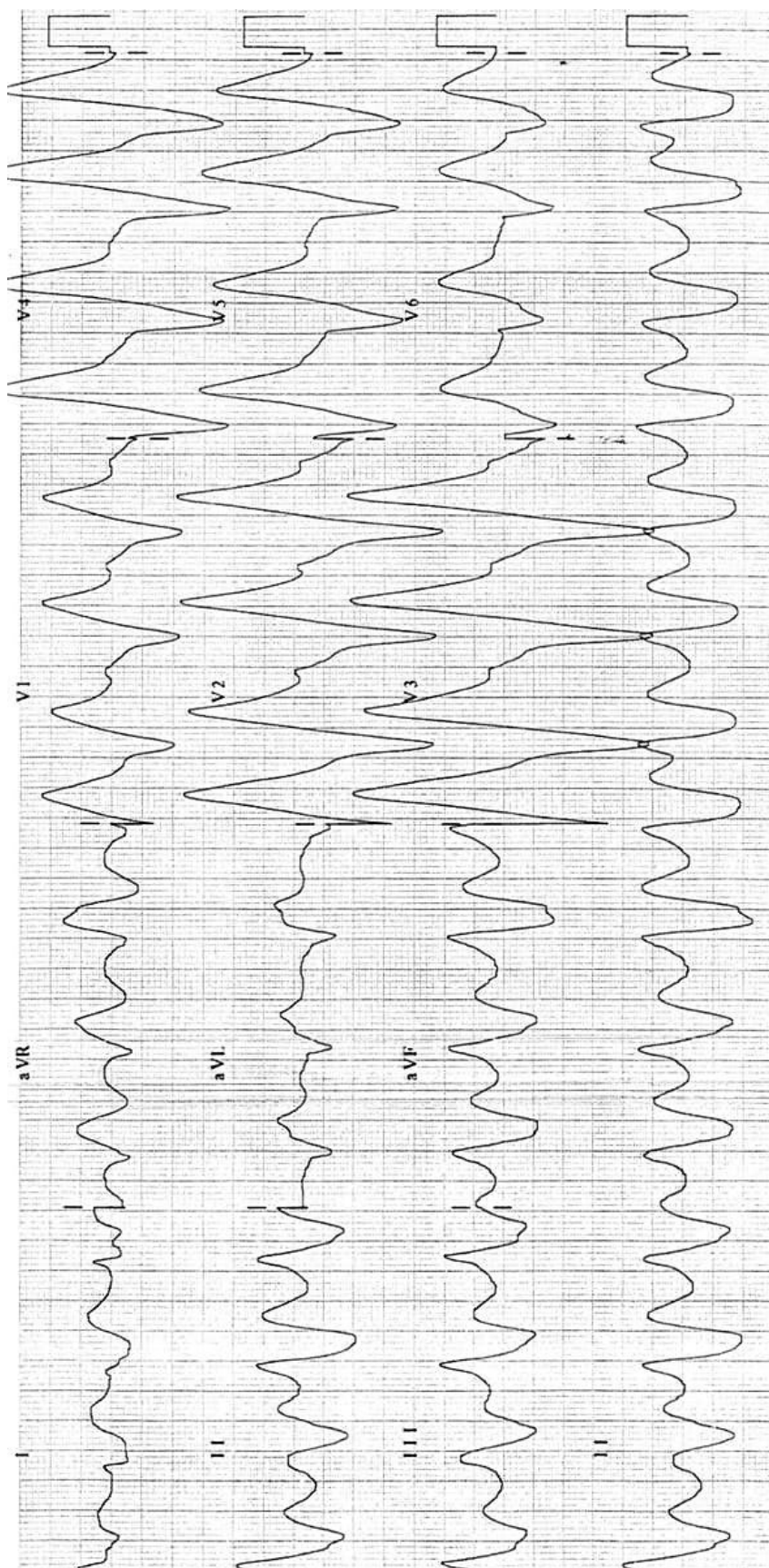
- ECG description of the key features
 - Outline of the main causes
 - Management in ED - recognises high risk and gives safe management plan
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Scholarship and Teaching (ACEM guidelines)

- Checks for level of prior knowledge/ understanding
- Defines learning goals matched to learner's needs
- Demonstrates a structured approach to the topic
- Establishes rapport

Teaching technique

- Demonstrates well-paced communication
 - Uses language appropriate for learner's level
 - Covers the topic in appropriate detail
 - Uses a teaching modality appropriate for the scenario
 - Explains the evidence base for information being taught
 - Ensuring the learner has received and understood the relevant information
 - Checks understanding in learner (regularly and at conclusion)
 - Invites questions and clarifies any areas of uncertainty
 - Summarises the session with appropriate emphasis of key elements
 - Repeats framework of teaching session and provides cognitive strategies to assist learning and memory if appropriate e.g. acronyms, rhyming phrases to help
 - Suggests follow up activities/advises where to find resources. Note: A just at standard candidate may provide a generic answer however an 'above standard' candidate is expected to name a source for the resource e.g. national guideline, published article,
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Examiner name(s):

Candidate Name:

OSCE Station:

For each domain below select the **ONE** option which best represents this candidates performance. The option '**Minimum level of competency displayed**' represents the minimum level of safe independent practice as a junior FACEM in Australasia.

A horizontal bar chart with seven categories on the x-axis, each represented by a rounded rectangle of a different shade of blue. The categories and their corresponding percentages are as follows:

Response Category	Percentage
Very poor	1%
Well below minimum standard	1%
Below minimum standard	1%
At minimum standard	1%
Above minimum standard	1%
High standard	1%
Very High standard	1%

Please rate all the following domains:

[illegible]

GLOBAL ASSESSMENT RATING

Please rate this candidate's OVERALL performance in this OSCE:

In terms of a **safely practising junior emergency physician** please select the ONE option which best reflects this candidate's performance in this station

**Well
Below
Standard**

☐

**Below
Standard**

☐

**Just at
Standard**

☐

**Above
Standard**

☐

**Well
Above
Standard**

☐
