QUIZ FEEDBACK

Sodium and potassium imbalance

Introduction

This quiz feedback provides an opportunity to revisit Best Tests, September 2011 which looked at the primary care approach to investigating sodium and potassium imbalance. All general practitioners who responded to this quiz will receive personalised online feedback and CME points

1.	**In which of the following scenarios would immediate referral to secondary care for treatment of hyponatraemia be warranted?**	Your peers	Preferred
☐	Serum sodium 130 mmol/L, no specific symptoms	1%	
☐	Serum sodium 120 mmol/L, some neurological symptoms	98%	✓
☐	Serum sodium 135 mmol/L, deteriorating to 125 mmol/L the following day	82%	✓
☐	Any level of hyponatraemia in association with dehydration	15%	

Comment:
The majority of respondents correctly identified the indications for urgent referral to secondary care, which is recommended for patients with a serum sodium <120 mmol/L, if the levels are rapidly decreasing or if neurological symptoms are present.

Often patients with mild hyponatraemia are either asymptomatic or may have non-specific symptoms, e.g. nausea and lethargy. Patients with dehydration will often display signs and symptoms consistent with hypovolaemia, e.g. dizziness.

As a general rule, mild, asymptomatic hyponatraemia does not require corrective measures except for the treatment of the underlying factors. When a patient has symptoms, addressing the underlying cause will often help address both the symptoms and the hyponatraemia.

2.	**If a patient with hyponatraemia is hypervolaemic (i.e. has fluid overload), which of the following are possible causes?**	Your peers	Preferred
☐	Hypothyoidism	14%	
☐	Pancreatitis	4%	
☐	Congestive heart failure	99%	✓
☐	Liver cirrhosis	96%	✓

Comment:
The majority of respondents correctly identified that the possible causes of hyponatraemia in a hypervolaemic patient were liver cirrhosis and congestive heart failure. Other causes are renal failure and nephrotic syndrome.

Pancreatitis tends to be associated with hypovolaemia. Hypothyroidism is a possible cause of hyponatraemia but is not necessary associated with hypovolaemia.

3.	Which of the following medicines are reported to cause hyponatraemia?	Your peers	Preferred
☐	Bendrofluazide	98%	✓
☐	Citalopram	98%	✓
☐	Naproxen	89%	✓
☐	Nortriptyline	83%	✓

Comment:
All four medicines are reported to cause hyponatraemia. Diuretics cause hyponatraemia in approximately 20% of people who take them, and severe hyponatraemia is more commonly seen in thiazide rather than loop diuretics. SSRIs cause hyponatraemia in up to one-third of people who take them. Serum sodium levels should be checked before and several weeks after starting a SSRI in older patients and those taking other medicines associated with hyponatraemia. NSAIDs can cause hyponatraemia by promoting water retention (by increasing water permeability across the renal collecting ducts). Tricyclic antidepressants are one of a number of other medicines that are associated with hyponatraemia.

4.	Which of the following statements about hypernatraemia are true?	Your peers	Preferred
☐	A patient with serum sodium of 148 mmol/L should be referred to secondary care immediately for treatment	4%	
☐	A serum osmolality test should be ordered to investigate a high sodium level	10%	
☐	The signs and symptoms of hypernatraemia are primarily neurological	92%	✓
☐	Diabetes insipidus is a possible cause of hypernatraemia	92%	✓

Comment:
A patient should be referred to secondary care for treatment if their serum sodium is ≥ 155 mmol/L, if levels are rapidly rising, if neurological symptoms are present or the patient is systemically unwell, or if oral rehydration is not possible. The signs and symptoms of hypernatraemia are primarily neurological and can include lethargy, weakness and irritability. With more severe hypernatraemia or a rapid rise in sodium level, this can progress to twitching, seizures, coma and death.

The cause of hypernatraemia is usually derived from the clinical assessment and history. When associated with a net water loss, diabetes insipidus (either neurogenic or nephrogenic) can be a cause. Osmolality tests (serum or urine) are only rarely required to be requested in the primary care setting.

5.	Which of the following medicines are reported to cause hypernatraemia?	Your peers	Preferred
☐	Lithium	82%	✓
☐	Furosemide	84%	✓
☐	Prednisone	61%	✓
☐	Amoxicillin	1%	

Comment:
The majority of respondents correctly identified the medicines that can cause hypernatraemia, which include lithium, loop diuretics (e.g. furosemide) and corticosteroids (e.g. prednisone). The most common complication of chronic lithium therapy is nephrogenic diabetes insipidus (causing a net water loss). Medicines such as loop diuretics, mannitol, urea, corticosteroids and high protein supplements can also result in hypernatraemia (by causing hypotonic fluid losses). Amoxicillin is not known to be associated with hypernatraemia.

6.	In which of the following statements about the cardiac effects of hypokalaemia are true?	Your peers	Preferred
☐	Hypokalaemia is not associated with cardiac signs and symptoms	3%	
☐	ECG changes are not typically seen with hypokalaemia	4%	
☐	Cardiac symptoms do not become apparent unless serum potassium is < 2.5 mmol/L	12%	
☐	Mild hypokalaemia can cause life-threatening cardiac arrhythmias in people with underlying cardiac disease	94%	✓

Comment:
Hypokalaemia can be associated with hypotension, bradycardia or tachycardia, premature atrial or ventricular beats, ventricular arrhythmias and cardiac arrest. Characteristic progressive ECG changes can be seen as the serum potassium level drops but there is no cut-off level at which they become apparent. However, it is recommended that an ECG be performed in patients with a serum potassium < 3.0 mmol/L.

Mild hypokalaemia is often well tolerated in otherwise healthy people, however, in people with co-morbidities, particularly those with hypertension, underlying heart disease or liver cirrhosis, it is associated with an increased incidence of life-threatening cardiac arrhythmias, sudden death, and rarely hepatic coma.

7.	Which of the following clinical scenarios is a potential cause of hypokalaemia?	Your peers	Preferred
☐	Acute gastroenteritis	98%	✓
☐	Test-tube haemolysis (of the blood sample)	3%	
☐	Use of a diuretic for one week	78%	✓
☐	Inadequate potassium in the diet	84%	✓

Comment:
Hypokalaemia can be caused by increased losses from the gastrointestinal tract such as acute gastroenteritis, and by increased urinary potassium excretion with the use of medicines such as diuretics. Diuretic induced hypokalaemia usually occurs within the first two weeks of treatment.

Reduced dietary intake of potassium is a rare cause of hypokalaemia, but may be an important factor in patients concurrently taking diuretics, e.g. an elderly patient on a "tea and toast" diet, or in a person aiming to achieve rapid weight loss on a diet of low calorie liquid protein drinks.

Test–tube haemolysis tends to be associated with pseudohyperkalaemia, not hypokalaemia.

8.	If no obvious cause is found for hypokalaemia, which of the following blood or urine tests may be appropriate?		
		Your peers	Preferred
☐	Serum magnesium	93%	✓
☐	Urine magnesium	3%	
☐	Serum bicarbonate	95%	✓
☐	CRP and ESR	1%	

Comment:
If no obvious cause for the hypokalaemia can be found, additional blood and urine tests may be useful. Measuring urinary potassium excretion (although rarely done in general practice) and serum magnesium concentrations (to investigate for hypomagnesaemia) can be appropriate. Serum bicarbonate levels may help determine if an acid-base disorder is present e.g. metabolic alkalosis. Unexplained hypokalaemia is not an indication to request both CRP and ESR together.

9.	Which of the following statements about hyperkalaemia are true?		
		Your peers	Preferred
☐	Urgent referral to secondary care is required for an asymptomatic patient with serum potassium 6.0 mmol/L	5%	
☐	Pseudohyperkalaemia, caused by sampling or analysis error, is a common cause of a high serum potassium result	96%	✓
☐	An ECG is recommended for patients with serum potassium > 6.0 mmol/L	98%	✓
☐	Medicines are rarely the cause of a raised serum potassium level	2%	

Comment:
Urgent referral to secondary care is recommended for patients with serum potassium ≥ 7.0 mmol/L or potassium ≥ 5.5mmol/L with any ECG changes or symptoms.

Pseudohyperkalaemia is a common reason for an isolated raised potassium level. It is advisable to contact the laboratory for any level of potassium > 6.0 mmol/L, especially if unexpected, to discuss potential reasons such as haemolysis that may explain the raised level.

An ECG is recommended for patients with serum potassium levels > 6.0 mmol/L. ECG changes are not usually seen below this level in hyperkalaemia. A raised serum potassium level is most commonly caused as an adverse effect of a medicine or secondary to a disease process.

10.	Which of the following ECG changes may be seen with hyperkalaemia?		
		Your peers	Preferred
☐	Peaked T waves	98%	✓
☐	Absence of P waves	91%	✓
☐	U waves	6%	
☐	Sine waves	85%	✓

Comment:
ECG changes that can be seen with hyperkalaemia include: progressive abnormalities including peaked T waves, flattening or absence of P waves, widening of QRS complexes and sine waves (which can indicate that arrest is imminent).

U waves are one of the characteristic ECG changes seen with hypokalaemia.