Pseudohyperkalaemia: a rare complication of splenectomy

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ABSTRACT

Pseudohyperkalaemia is an uncommon and frequently unrecognised biochemical abnormality. It occurs as a consequence of aggregation and lysis of platelets in vitro. As a result, potassium is released, which causes an elevated serum concentration. We present the case of a 21-year-old man with a traumatic splenic injury necessitating laparotomy and splenectomy. Following surgery he developed hyperkalaemia. Further investigations diagnosed pseudohyperkalaemia, one of the causes of which is thrombocytosis secondary to splenectomy.

KEYWORDS

Splenectomy – Splenic injury – Spleen – Hyperkalaemia – Pseudohyperkalaemia

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Case history

A 21-year-old man collapsed 6 days after a minor road traffic collision. Computed tomography demonstrated a grade III splenic injury, which necessitated emergency laparotomy and splenectomy. Six days postoperatively, serum potassium was 5.7mmol/L without symptoms or signs on electrocardiography (ECG). Platelet count was 1551 so aspirin 75mg once a day was commenced. Two days later, serum potassium was 6.3mmol/L and an ECG demonstrated flattened P waves and P–R prolongation. Appropriate treatment was instituted (10% calcium gluconate, 50% dextrose, acitrapid and nebulised salbutamol) and serum potassium decreased.

No obvious cause for the apparent persistent hyperkalaemia could be identified. After further consideration and a haematology opinion, it was advised that the likely aetiology was pseudohyperkalaemia. This was confirmed by simultaneous measurement of serum and plasma potassium. The patient was discharged home and was well at follow-up.

Investigations

Pseudohyperkalaemia is diagnosed when serum potassium exceeds plasma levels by more than 0.4mEq/L.¹ Elevated serum levels are the result of potassium release from platelets during aggregation and degranulation in vitro. A serum potassium level is collected in a clotted biochemistry bottle but a plasma potassium level is collected in a lithium/sodium heparin bottle. Heparin prevents aggregation and lysis of platelets, thus preventing potassium release, which would cause a falsely elevated potassium level.² Plasma and serum potassium levels should be measured simultaneously to permit comparison. Measuring plasma potassium gives

the true level and thus avoids the risk of unnecessary treatment and potentially causing hypokalaemia.

Differential diagnosis

Causes of hyperkalaemia are well known. They include renal failure, acute kidney injury, mineralocorticoid deficiency, rhabdomyolysis, massive blood transfusion, supplements and drugs (angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, non-steroidal anti-inflammatories, trimethoprim and digoxin toxicity). Many clinicians are, however, unaware of the aetiology of pseudohyperkalaemia, which includes excessive suction during venepuncture (which disrupts cell membranes, releasing potassium), fist clenching, familial pseudohyperkalaemia (leakage of potassium at 4°C due to gene 16q23-ter),³ infectious mononucleosis, rheumatoid arthritis, leucocytosis ($>70,000/\text{mm}^3$)⁴ and, most commonly, thrombocytosis greater than $500,000/\text{mm}^3$.

Treatment

Serum potassium levels that are 0.4mEq/L greater than plasma potassium levels are diagnostic of pseudohyperkalaemia. If the plasma potassium level is within normal range then no treatment is indicated, avoiding the potential harmful consequences of hypokalaemia. In this case, a plasma potassium level confirmed that the true potassium level was in the normal biochemical range. Post-splenectomy thrombocytosis normally resolves in weeks to months, although it may persist for longer. The serum potassium level should normalise as the platelet count decreases. Aspirin should be continued until the platelet count normalises, to reduce the risk of thrombosis.

Discussion

Pseudohyperkalaemia is a rare phenomenon in which thrombocytosis causes a rise in serum potassium concentration due to in vitro aggregation and lysis of platelets. The higher the platelet count and the longer the interval between venepuncture to biochemical analysis, the larger the discrepancy between plasma and serum potassium concentrations. Hartmann *et al*, who noted hyperkalaemia in the absence of common causes, first reported this in 1958.¹

The likelihood of pseudohyperkalaemia is highest in patients with primary thrombocytosis and polycythaemia rubra vera, followed by myelofibrosis and reactive thrombocytosis.⁶ Two-thirds of splenectomy patients were shown to have pseudohyperkalaemia.⁵ Other causes of reactive thrombocytosis, such as iron deficiency and infection, were also found to cause pseudohyperkalaemia.

Nijsten *et al* identified a significant positive correlation between the difference in serum and plasma potassium concentrations and platelet counts in trauma patients.⁵ This was supported in a retrospective study by Ong *et al*, which demonstrated a positive correlation between serum potassium and platelet counts.⁶ All patients with a platelet count of greater than $752 \times 10^9/L$ had at least one elevated serum potassium level of 5.2mmol/L or more.⁶ Neither study showed correlation between plasma potassium levels and platelet counts. Thurlow *et al* recommended that when the platelet count is more than $500 \times 10^9/L$ and serum potassium level is elevated greater than 5.4mmol/L, laboratory staff should withhold the result until plasma potassium is measured.⁷

This case highlights the need for education and awareness of this curious biochemical anomaly, especially in departments where it may be more frequently encountered.

This would prevent unnecessary treatment of 'apparent' hyperkalaemia, which could cause patient harm by inducing hypokalaemia.

Learning points

- > Where there is hyperkalaemia with a platelet count greater than $500 \times 10^9/L$ consider pseudohyperkalaemia.
- > To make a diagnosis of pseudohyperkalaemia, samples should be sent in a standard biochemistry tube as well as a lithium/sodium heparin bottle, which will quantify both serum and plasma potassium, respectively. Pseudohyperkalaemia is diagnosed when serum potassium exceeds plasma by more than 0.4mEq/L.
- > Blood samples should be sent at room temperature and analysed within 1 hour to ensure accurate results.

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