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CORRESPONDENCE

Acute intraoperative tumour lysis syndrome

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To the Editor,

The patient provided written informed consent for the clinical report that follows. A previously healthy 54-yr-old woman presented to hospital with a two-week history of fatigue, dyspnea, and spontaneous bruising. Investigations revealed a white cell count of $3.9 \times 10^9 \cdot L^{-1}$ with blast cells, hemoglobin of 43 $g \cdot L^{-1}$, and a platelet count of $47 \times 10^9 \cdot L^{-1}$. A diagnosis of acute myeloid leukemia was made, and the patient was started on cytarabine and hydroxyurea. The next day, she developed left-sided weakness and confusion. Her platelet count had fallen to $10 \times 10^9 \cdot L^{-1}$, and computed tomography showed a large right tempo-parietal intracerebral hemorrhage with midline shift. She was transferred to our tertiary neurosurgical centre for emergency craniotomy and evacuation of the hematoma.

Upon admission to the intensive care unit (ICU), the patient had a Glasgow Coma Scale of 6, and her trachea was intubated after administering propofol and rocuronium. Preoperative laboratory investigations included arterial pH 7.42, $PaCO_2$ 32 mmHg, PaO_2 69 mmHg, Hb 58 $g \cdot L^{-1}$, platelets $91 \times 10^9 \cdot L^{-1}$, Na 132 $mmoL \cdot L^{-1}$, K 3.1 $mmoL \cdot L^{-1}$, and creatinine of 131 $\mu moL \cdot L^{-1}$. To treat hypokalemia, potassium chloride 10 mmoL *iv* was administered by the ICU staff prior to transferring the patient to the operating room (OR).

In the OR, the patient received two units of platelets prior to skin incision and four units of blood over the next 30 min. Approximately 40 min after skin incision, the patient's heart rate (HR) fell abruptly from 90 to 50 $beats \cdot min^{-1}$. The P waves remained visible on the electrocardiogram (ECG), but gradual widening of the QRS complex was observed (Figure). Her blood pressure (BP) decreased from 110/70 to 80/50 mmHg. Ephedrine 10 mg *iv* was given with a transient increase in HR and BP. The QRS complex continued to widen, P waves disappeared, and the patient's BP fell to 60/40 mmHg. Intravenous boluses of atropine (total 0.8 mg), phenylephrine (total 1 mg), and ephedrine (total 45 mg) were given, but again with only transient effect. At this point, the OR was notified that the serum potassium on the arterial blood gas (ABG) was 7.4 $mmoL \cdot L^{-1}$. We immediately treated the hyperkalemia with 10 mL of 10% calcium chloride *iv*, 10 units of insulin *iv* with an intravenous glucose bolus, and furosemide 20 mg *iv*. Within minutes of calcium administration, the QRS complex began to narrow and both BP and HR increased. An intravenous infusion of dopamine was started at 5-10 $ug \cdot kg^{-1} \cdot hr^{-1}$ and titrated to BP. Serial intraoperative ABGs showed a progressive decline in serum potassium over 50 min (from 7.4 to 6.9 to 6.4 $mmoL \cdot L^{-1}$). This decline correlated with hemodynamic stabilization and the return of P waves and a normal QRS width on the ECG. Review of the patient's laboratory investigations showed concomitant hyperuricemia (706 $\mu moL \cdot L^{-1}$), hyperphosphatemia (1.79 $mmoL \cdot L^{-1}$), and hypocalcemia (0.88 $mmoL \cdot L^{-1}$), suggesting acute tumour lysis syndrome (TLS) as the cause of hyperkalemia.

In this patient, TLS was heralded by acute bradycardia, loss of P waves, and a widened QRS complex, which are all consistent with hyperkalemia.[1] The differential diagnosis of the arrhythmia, apart from electrolyte abnormalities, included structural heart disease, myocardial ischemia, hypoxemia, hyper/hypocarbia, acid/base disturbances, and hypothermia, none of which was evident from the patient's history or clinical condition at the time. The finding of acute hyperkalemia was unexpected; succinylcholine had not been used, and in our opinion, the administration of only

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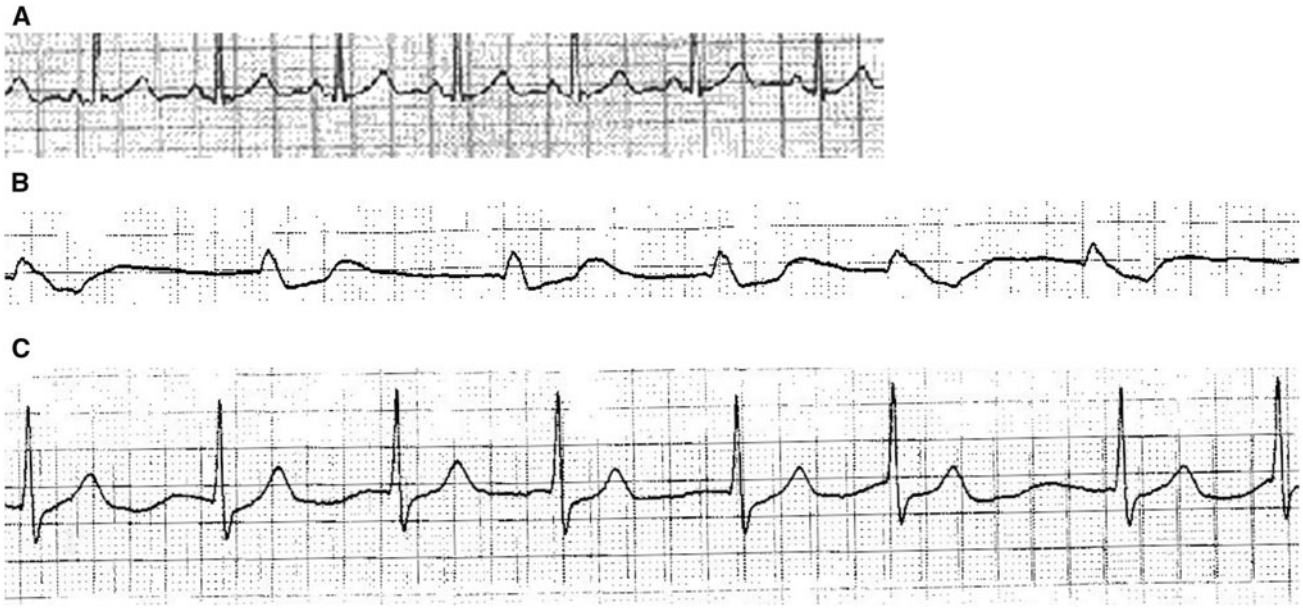

Figure Intraoperative electrocardiogram tracings revealing the transition from a normal sinus rhythm (Panel A) to a bradycardia with widened QRS complexes and absent P waves during the phase of acute hyperkalemia (Panel B), and the return to a more regular junctional rhythm with narrow QRS complexes following treatment (Panel C)

10 mmoL of potassium *iv* and four units of packed red blood cells in the context of pre-existing hypokalemia did not adequately explain the rapid and dramatic rise in serum potassium. The diagnosis of TLS, on the other hand, is consistent with both the patient's history and biochemical results. Tumour lysis syndrome characteristically occurs after initiation of cytotoxic chemotherapy in patients with rapidly-growing tumours, particularly acute leukemias, and high-grade non-Hodgkin lymphomas.[2,3] As in this case, the onset of TLS is usually within 12-72 hr after initiation of chemotherapy. The underlying pathophysiology is the destruction of neoplastic cells and release of intracellular ions, notably potassium, phosphate, and nucleic acid purines. Hyperphosphatemia causes hypocalcemia due to precipitation of calcium phosphate in soft tissues. Conversion of nucleic acid purines to uric acid results in hyperuricemia. The major end-organ complication is acute renal failure, resulting from acute tubular obstruction by uric acid or calcium phosphate crystals.[2] Arrhythmias secondary to hyperkalemia are the most common cause of death.[3]

This case illustrates the need to be vigilant for TLS in patients who have recently started cytotoxic chemotherapy. At-risk patients must be monitored for ECG and serum electrolyte changes in the perioperative period. Hydration and diuresis is important, as hypovolemia is a risk factor for both TLS and acute renal failure.[3] The management of TLS centres on correction of electrolyte abnormalities and the prevention of acute renal failure. Acute hyperkalemia causing ECG changes should be treated with intravenous calcium gluconate or chloride; however, excessive calcium supplementation may increase precipitation of calcium phosphate crystals in renal tubules. Elimination by forced diuresis is useful, but hypovolemia should be avoided. In severe cases, hemodialysis may be needed to correct electrolyte abnormalities.[2]

Conflict of interest None declared.

References

1. *Abe R*, *Yonemura K*, *Takahashi T*, *Watanabe H*, *Sano K*, *Hishida A*. Marked bradycardia associated with profound hyperkalemia in patients with end-stage renal disease. Nephron 1998; 80: 355-6.
2. *Coiffier B*, *Altman A*, *Pui CH*, *Younes A*, *Cairo MS*. Guidelines for the management of pediatric and adult tumor lysis syndrome: an evidence-based review. J Clin Oncol 2008; 26: 2767-78.
3. *Hande KR*, *Garrow GC*. Acute tumor lysis syndrome in patients with high-grade non-Hodgkin's lymphoma. Am J Med 1993; 94: 133-9.