Correspondence

An unusual case of hemolysis

To the Editor:

A 55-yr-old ASA I miner presented with chronic arthritis of the left hip with failed implant *in situ* and non-union of the fractured neck of the femur. He had undergone two previous surgeries performed elsewhere with no available documents. From the patient's account, they were uneventful and he did not require any transfusion of blood. He was admitted in our institution for a total hip replacement. Clinical examination was unremarkable except for the stiff and painful left hip. His preoperative investigations were normal with hemoglobin of 120 g·L⁻¹. Perioperative blood transfusion was anticipated and a blood sample for cross-match was sent. The blood bank technologist reported that the sample had hemolyzed. Another sample, sent on the day of surgery was also reported to have hemolyzed.

The surgery was postponed, until further tests were performed to rule out any underlying serious hematological condition that was causing the hemolysis of the samples.

The laboratory tests revealed a normal peripheral blood smear. The reticulocyte, total and differential leukocyte counts were normal. The bleeding time, prothrombin time, activated partial thromboplastin time; thrombin time and the D-dimer were within normal limits. The liver and renal function tests did not show any abnormality. These tests ruled out the common bleeding and clotting abnormalities. Another cross-match sample was sent in a similar reusable bottle, which did not exhibit any evidence of hemolysis. The patient underwent surgery, which was uneventful and did not warrant any transfusion.

Hemolysis of cross-match and other clotted blood samples commonly occurs in the presence of disseminated intravascular coagulation and drug-induced hemolysis. In many developing countries cross-match and other blood samples are collected in reusable bottles. A review of the case pointed towards the possibility of contamination of the reusable bottles in which the cross-match sample was collected, since two other incidents were reported in the hospital on the same day.

Contaminants such as detergent are likely to have been the cause in this case. The mechanism by which detergents cause hemolysis has been described.¹

Careful screening of reusable bottles and strict quality control measures could prevent this from occurring.

Nevertheless, this case highlights the need for vigilance and investigation into incidents when cross-match or other clotted blood samples undergo spontaneous hemolysis. This may indicate serious underlying condition, which would require appropriate perioperative blood component therapy² and modification of anesthetic technique.³

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A bizarre end-tidal carbon dioxide waveform

To the Editor:

A 37-yr-old woman was scheduled to undergo partial gastrectomy for gastric tumour. Anesthesia was induced using fentanyl, thiopental and succinylcholine and maintained with isoflurane, 50% oxygen in air, morphine and cisatracurium. Mechanical ventilation settings consisted of 10 mL·kg⁻¹ tidal volume, respiratory rate of 10, I: E ratio of 1:2 and fresh gas flow of 2 L. The ET_{CO}₂ waveform (Figure) was thought to be the patient starting to breathe and cisatracurium was administered. There was no change in the peak inspiratory pressure. Correct placement of the endotracheal tube (ETT) was again verified by listening to breath sounds and observing for bilateral chest movement. The ETT was suctioned to ensure there was no

FIGURE The initial, small rise in ETCO_2 (1st arrow) during expiration results from entrainment of room air at the loose connection between the distal end of the ETCO_2 sampling line and the port of the capnograph machine. This air dilutes the expired carbon dioxide resulting in a smaller than normal rise in the ETCO_2 .¹ The secondary upsloping of the ETCO_2 (2nd arrow) is noted at the onset of the next positive pressure ventilation (PPV). We hypothesize that less entrainment of room air occurs at that time because of increased pressure secondary to PPV. Less entrainment of air results in less dilution of carbon dioxide and, therefore, the ETCO_2 rises.

kinking or secretions that may have caused partial obstruction. Fiberoptic bronchoscopy ruled out movement of the ETT endobronchially during expiration (theoretically, both conditions could produce the observed waveform). The bellow of the ventilator was moving appropriately (a colleague suggested that a similar waveform is produced if the respiratory bellow stops at the middle of the expiratory cycle for few instants). There was no visible obstruction in the ETCO_2 sampling port or in the anesthesia circuit. To eliminate a potential problem in this area, the ETCO_2 side port sampling line and the capnograph (Datex Capnomac Ultima) were changed. At that time, it was noted, however, that the distal end of the ETCO_2 sampling line (luer-lock-fitting) attached to the capnograph was slightly loose. Upon tightening, the ETCO_2 waveform returned to normal. The abnormal oxygen waveform also returned to normal. Upon loosening again, the same ETCO_2 and oxygen waveform were reproduced. We were able to duplicate the same ETCO_2 waveform on a different patient.

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An unusual cause of respiratory distress and hypotension following removal of a pheochromocytoma

To the Editor:

Pheochromocytomas account for 0.1–1% of all causes of hypertension¹ and their surgical removal successfully cures hypertensive episodes. Although a vast body of literature is available concerning perioperative problems and management,^{2,3} we report an unusual cause of respiratory distress with hypotension in the immediate postoperative period.

A 17-yr-old male, weighing 50 kg was diagnosed with pheochromocytoma. The hypertension was controlled with doxazosin, amlodipine and atenolol. After fulfillment of Roizen's criteria,⁴ surgery was planned. Antihypertensives were continued until the day of the procedure. Routine monitoring was augmented by direct arterial and central venous pressure (CVP) monitoring. Induction with midazolam, fentanyl and thiopentone was followed by maintenance with vecuronium, oxygen, nitrous oxide and isoflurane. Intraoperative hypertension was managed with a nitroglycerine infusion. Transient hypotension after tumour excision required volume expansion with saline, plasma and hydroxyethyl starch. After reversal of neuromuscular blockade and extubation, the patient was moved to recovery.

Thirty minutes later, the patient became incoherent, tachypneic with shallow respiration and desaturation (SpO_2 80%). Blood gas analysis revealed a PaO_2 58 mmHg and PaCO_2 47 mmHg. Simultaneously, hypotension (80 mmHg systolic) required treatment with *iv* fluids, noradrenaline and dopamine. CVP, however, remained elevated (15 cm H_2O). The patient was reintubated and ventilation controlled. Reduced chest expansion and excessive peak airway pressure (60 cm H_2O) were observed. Persistent hypotension suggested the possibility of intra-abdominal bleeding, as confirmed by a four-quadrant tap. Re-exploration of the abdomen revealed the collection of blood clots (approximately 1 L) close to the diaphragm and inferior vena cava (IVC). After removal of the clots, blood pressure returned to 130/80 mmHg, CVP decreased to 9 cm H_2O and inotropes could be withdrawn gradually. Chest expansion improved and the peak airway pressure decreased to 20 cm H_2O . The patient remained hemodynamically stable and was extubated uneventfully after ventilation overnight.

Respiratory distress after excision of a pheochromocytoma is not routinely anticipated. The diagnosis