Isolated hypotension after the induction of general anesthesia refractory to fluids and vasopressors: An indicator of anaphylaxis

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SUMMARY

Differentiating between anaphylaxis and hypotension during general anaesthesia is difficult, especially when patients present with only hypotension and without any of the other classical features of anaphylaxis. We report the successful management of an anaphylactic reaction to rocuronium that presented as isolated hypotension in a 45-year-old Indonesian man presented with lacerations on the scalp and right pinna caused by an assault to the head after the induction of general anaesthesia, refractory to fluids and high doses of vasopressors. This case highlights that a possible indicator of anaphylaxis can be the presence of isolated hypotension during general anaesthesia, refractory to vasopressor agents.

INTRODUCTION

Intraoperative hypotension during general anaesthesia is a more common problem than perioperative anaphylaxis, whose incidence is estimated to be 1:10000.[1,2] Failure to differentiate between the two can lead to a delay in definitive treatment, which is a risk factor for mortality. Our case highlights the importance of identifying isolated refractory hypotension after the induction of general anaesthesia, as this may be the only indicator of anaphylaxis. We report a case of isolated hypotension during general anaesthesia who are refractory to fluids and repeated doses of vasopressors, anaphylaxis should be suspected, and a test dose of intravenous adrenaline can be administered earlier for better clinical outcome.

CASE REPORT

A 45-year-old Indonesian man presented with lacerations on the scalp and right pinna caused by an assault to the head. He was scheduled for emergency wound debridement, toilet, and suturing of the scalp. A computed tomography (CT) brain scan revealed no intracranial bleeding. Multiple facial bone fractures were observed and conservative management of these was recommended.

The patient had no history of diabetes mellitus, hypertension, myocardial infarction, heart failure or any other medical problem. He had no known history of any surgery. He did not smoke cigarettes and had no known allergies. His functional status was good. His peripheries were warm, his vital signs were normal with blood pressure of 134/75 mmHg and there were no signs of active bleeding, anaemia or electrolyte imbalance. He was mildly dehydrated, with a coated tongue, and capillary refill time of 2 seconds. Pain was tolerable with pain score of 3.

Electrocardiography showed a sinus tachycardia of 120 beats per minute. Chest radiography was normal, with no signs of pneumothorax. Other preoperative assessments were within normal range. Renal profile revealed a urea of 5.1 mmol/L and creatinine of 85 micromole/L. Six hours prior to the operation, an intravenous dose of ceftriaxone (50 mg/kg) was administered in the emergency department.

General anaesthesia was induced with the intravenous administration of fentanyl (2 mcg/kg), propofol (2 mg/kg), and rocuronium (1 mg/kg). The patient was intubated, and general anaesthesia was maintained with 2.5% sevoflurane in an oxygen/air mixture. He was ventilated on pressure control ventilation, inspiratory pressure of 14, rate 12, Fio2: 0.4, Peep 6.

After 5 minutes of general anaesthesia, the patient developed hypotension (65–80/40–50) based on the first reading from non-invasive blood pressure monitoring. The operation had not yet started and skin preparation with chlorhexidine was not applied on the patient. Differential diagnoses such as pneumothorax, sepsis, and myocardial infarction were ruled out. The patient displayed a tachycardia of 105 beats per minute, a decrease, compared to the rate measured prior to the induction of general anaesthesia. No obvious ischemic changes were observed in the electrocardiographic readings. A carotid pulse was present. Peak pressure from the ventilator was 20 cm H_20 with similar initial ventilator setting and the end tidal carbon dioxide measurement was 25 mmHg. There was no decrease in oxygen saturation or signs of fever, flushing, urticaria, or bronchospasm. A measurement of venous blood gases 30 minutes into anaesthesia indicated a state of metabolic acidosis with pH 7.15, bicarbonate level 15.5 mmol/L, potassium level 4.0 mmol/L, and haemoglobin level 10.8 g/dL.

The patient did not respond to the usual boluses of vasopressors such as phenylephrine (total dose 2 mg) and ephedrine (total dose 30 mg). A total of 30 mL/kg of Ringers lactate was administered as fluid resuscitation; noradrenaline infusion was started up from an initial dose of $0.1_{mcg/kg/min}$, titrated up to $0.8_{mcg/kg/min}$ as shown in Figure 1. Despite these measures, a mean arterial pressure of 65 mmHg could not be achieved. Anaphylaxis was suspected and the

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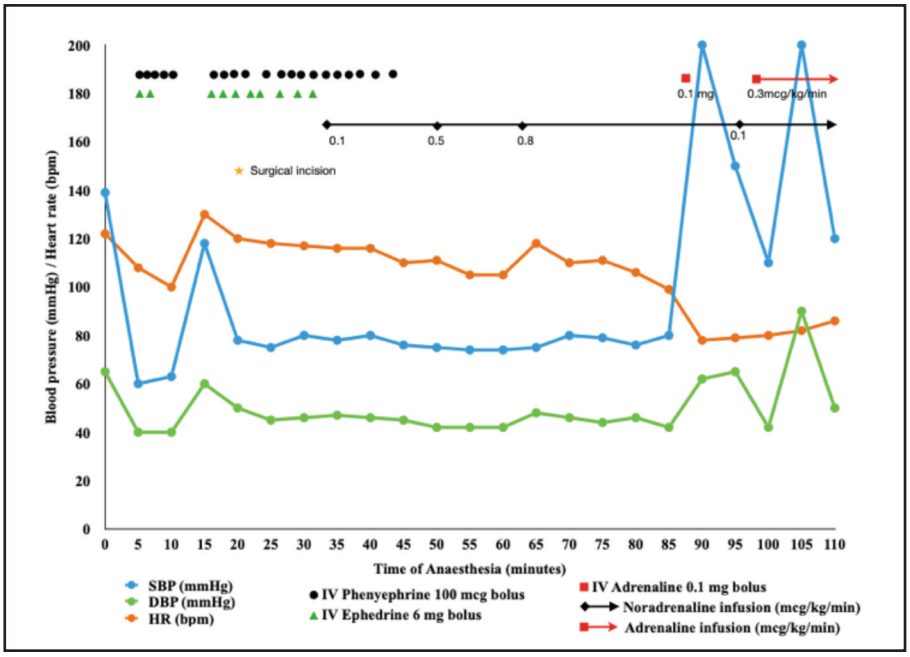

Fig. 1: Intraoperative vital signs and drug administration over time during anaesthesia.
Hypotension refractory to vasopressors commenced 5 minutes into anaesthesia. An improvement in blood pressure was noted after a single bolus dose of intravenous adrenaline. [SBP: systolic blood pressure; DBP: diastolic blood pressure; HR: heart rate]

patient was given a single bolus dose of adrenaline 100 mcg (1:10000). The blood pressure responded to this bolus dose, with a surge in blood pressure up to 200/70 mmHg. Intravenous adrenaline was then initiated up to an infusion rate of 0.28mcg/kg/min through a newly inserted femoral central venous line. The patient's blood pressure was maintained at a range of 140–200/60–90 mmHg. Intravenous hydrocortisone (200 mg) and chlorpheniramine (10 mg) were administered intraoperatively as part of the anaphylaxis treatment.

The surgery commenced 15 minutes post induction as patient was initially treated as usual post general anaesthesia hypotension. Estimated blood loss was minimal and a total fluid of 3 litres were given intraoperatively (2500 ml of Ringer lactate plus 500 ml of Albumin 5%). The patient was admitted to the intensive care unit (ICU) postoperatively, where he was placed on a ventilator for 1 day. He was also supported haemodynamically with Noradrenaline 0.1mcg/kg/min and Adrenaline of 0.4mcg/kg/min. Measurement of his blood gases on entry into the ICU indicated a more severe metabolic acidosis with pH of 7.0 and bicarbonate of 7.0 mmol/L. With no evidence of diabetic ketoacidosis, the metabolic acidosis was managed according to standard treatment guidelines. His postoperative haemoglobin level was 10.5 g/dL while his kidney function showed a deterioration with creatinine level 111 micromole/L and urea level 5.3 mmol/L. Clinically, he was not dehydrated with the initial inferior venous cava scan of 1.6 cm. Transthoracic echocardiography indicated the absence of valve and regional wall motion abnormalities. All the cardiac chambers were of normal size with good right and left ventricular function. Ejection fraction was more than 60%.

On day 2 of ICU admission, the patient showed significant clinical improvement; he was fully conscious and on low setting pressure support ventilation. He was weaned off from inotropic support with resolved tachycardia. His blood gases and kidney functions returned to normal, with good urine output. He was extubated and discharged after 2 days and given an allergy card, indicating his possible rocuronium allergy. The patient refused to undergo any allergy skin testing after receiving advice regarding its risks and benefits.

DISCUSSION

Anaphylaxis has always posed a diagnostic challenge. One study reported that up to 40% of all patients who died because of anaphylaxis, did not receive any adrenaline.[3] Our diagnosis of anaphylaxis was based on clinical observations. These include the responsiveness of the patient's hemodynamic to a single bolus dose of adrenaline, the resistance to vasopressors, and the relatively short recovery time in the ICU.

Only 5.6% of patients with anaphylaxis present with isolated cardiovascular features.[1] Hypotension after induction of general anaesthesia is more common, especially when propofol is used for induction. Except for tachycardia, which our patient had prior to the operation, there was no evidence of the other classical features of anaphylaxis. The anomalous presentation of the anaphylaxis resulted in a delay in the implementation of treatment plan.

The first limitation of this study was our inability to obtain the patient's serum tryptase levels. However, since not all anaphylactic situations produce an elevation of tryptase level, a normal tryptase level does not exclude the diagnosis.[4]

The second limitation was our inability to persuade the patient to undergo allergy skin tests, mainly due to his cost constraints. Thus, the aetiology of anaphylaxis in this case remains unknown. The administration of antibiotics 6 hours prior to the operation was uneventful. The use of propofol and fentanyl was less likely to be the cause.[1] The 6th National Audit Project has showed that the drugs most commonly involved in anaphylaxis are antibiotics (48%) followed by neuromuscular blocking drug (NMBD) (25%).[1] Another study on anaphylaxis in anaesthesia also found that NMBDs (61%) were most responsible for anaphylaxis.4 Additionally, around 95% of reactions involving NMBD presented within 5 minutes.[1] Therefore, based on the evidence and timing of the event the cause of the anaphylaxis in this study was presumed to be rocuronium.

Although the patient had no previous anaesthetic history, evidence has shown that anaphylaxis can still occur as the quaternary ammonium group of the NMBD is found in many foods and over the counter drugs. Cross-sensitization through exposure to the ammonium group may explain why allergic reactions to NMBD can occasionally occur upon initial exposure to rocuronium.[5]

Adrenaline is the first-line treatment for anaphylaxis as it offers greater physiological benefits. In our case, the patient's deterioration could have been avoided if adrenaline had been administered first instead of noradrenaline. After the administration of adrenaline, noradrenaline was weaned off without any lowering of the blood pressure. The triggering threshold based on the total dose of vasopressor given before the single bolus dose of adrenaline is unknown. This provides a basis and direction for future research.

In conclusion, our case highlights the importance of identifying isolated refractory hypotension after the induction of general anaesthesia, as this may be the only indicator of anaphylaxis. We also recommend that intravenous adrenaline be administered earlier to such hypotensive patients who are refractory to fluids and repeated doses of vasopressors. This early identification will enable early administration of adrenaline and hence, improve morbidity and mortality.

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