A presumptive case of adrenal insufficiency following a single dose of etomidate for induction of anesthesia in a cardiac surgery patient.

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Citation

J Grabarczyk, T Papadimos, M Almasri, A Chiricolo, L Snyder. *A presumptive case of adrenal insufficiency following a single dose of etomidate for induction of anesthesia in a cardiac surgery patient.*. The Internet Journal of Anesthesiology. 2008 Volume 21 Number 1.

Abstract

Use of the sedative/hypnotic agent etomidate as an anesthetic induction agent may cause adrenal suppression postoperatively. Here we present the case of an 85 year old male who had hypotension due to presumed adrenal insufficiency secondary to a single anesthetic intravenous induction dose of etomidate before coronary artery bypass grafting. Postoperatively he was unresponsive to fluids, blood, vasopressors, or inotropes, but did respond to the administration of hydrocortisone.

BACKGROUND

Etomidate, a hypnotic agent with no analgesic activity, is administered intravenously (IV) for induction of general anesthesia. A dose of 0.2-0.3 mg/kg provides rapid onset hypnosis lasting three to five minutes. The use of the agent in surgical patients may cause failure of an appropriate neurohumoral responses leading to insufficient cortisol release. This may lead to the clinical picture of vasopressor-dependent refractory hypotension. Although single-dose etomidate is often chosen for its hemodynamic stability as an induction agent in patients with cardiovascular instability, cases of subsequent adrenal insufficiency have been reported [12]. Etomidate inhibits the enzyme 11 -hydroxylase, thus suppressing the final step in adrenal formation of cortisol [3]. Cases of adrenal suppression as assessed through an ACTH stimulation test following a single dose of etomidate for intubation of the trachea in critical care unit and emergency department patients have been reported [45]. A case addressing adrenal insufficiency following induction of anesthesia with single-dose etomidate was recently reported [6]. Additionally, the use of etomidate in the critically ill septic patients who receive steroids may lead to an increased mortality [78]. Here we report a case of suspected adrenal insufficiency following the administration of a single dose of etomidate for induction of anesthesia in a cardiac surgery patient.

CASE PRESENTATION

An 85-year-old gentleman, 90 kg and 187 cm in height, presented to the Emergency Department with a chief complaint of chest pain. His past medical history was significant for essential hypertension, right bundle branch block, sinus tachycardia, colon carcinoma, gout, and gastroesophageal reflux disease. His past surgical history included partial colectomy, cholecystectomy, and cataract surgery. The patient denied allergies. Physical examination revealed a pulse of 86 beats per minute, a blood pressure of 121/67, a respiratory rate of 18 breaths per minute. The electrocardiogram revealed left axis deviation and a right bundle branch block. Chest roentgenogram demonstrated no pathological findings. Laboratory examination revealed sodium 137 mmol/L, potassium 3.5 mmol/L, chloride 103 mmol/L, glucose 111 mg/dl, blood urea nitrogen 18 mg/dl, creatinine 1.0 mg/dl, hemoglobin 13.0 g/dl, hematocrit 38.3%, white blood cells 7200/cm3, and platelets 163,000 cm3. A myocardial infarction was also diagnosed: troponin I 9.92 ng/ml, CK 569 U/L, CKMB 101.6 ng/ml, and CKMB index 17.9. An echocardiogram revealed a 30% ejection, anterior wall hypokinesis, mild mitral regurgitation, and mild aortic regurgitation. Coronary artery catheterization was performed and demonstrated severe five-vessel disease (left main artery 60%, left anterior descending artery 90%, right coronary artery 80%, circumflex artery 70% and diagonal artery 90%), and emergent coronary artery bypass grafting (CABG) was undertaken.

The anesthetic was induced using 1 mg midazolam IV, 18 mg of etomidate (0.2 mg/kg) IV, and 5 mg fentanyl IV. Intubation of the trachea was facilitated by the administration 100 mg succinylcholine IV. Anesthesia was maintained with isoflurane in oxygen, and intermittent IV doses of fentanyl and midazolam. Maintenance of neuromuscular blockade was maintained with intermittent IV pancuronium. On arrival to post anesthesia care the patient's blood pressure was 82/42 mmHg, mean arterial pressure (MAP) was 55 mm Hg, and epinephrine was infusing at 0.04 mcg/kg/min. He also received intermittent boluses of 5% albumin. Six hours later the patient continued to have an intermittent MAP of 50-55 mm Hg. The epinephrine infusion was increased to 0.05 mcg/kg/min and a vasopressin infusion at 2 units/hour was initiated and titrated to 4 units/hour. The cardiac output (CO) and systemic vascular resistance (SVR) ranged from 5-6.8 L/minute and 450-780 dynes/sec x cm-5, respectively. He received 2 units of packed red blood cells for a hemoglobin level of 8.8 g/dl. His arterial blood gas (ABG) was pH of 7.27, PaCO2 32, PaO2 122, base excess -11.1 mmol/L, HCO3 14.2 mmol/L on the following ventilator settings: synchronized intermittent mandatory ventilation rate of 10, tidal volume 700 ml, positive end expiratory pressure 10 cm H20, pressure support of 10 cm H20, and an inspired fraction of oxygen of 40%. The patient also had an increased lactic acid level of 2.9 mmol/L and acute renal insufficiency with a serum creatinine of 1.7 mg/dl. Persistent acidemia secondary to hypoperfusion resulted in the initiation of a bicarbonate infusion. Eighteen hours postoperatively adrenal insufficiency secondary to etomidate administration was considered. However, neither a serum cortisol level nor an cosyntropin stimulation test was ordered. Hydrocortisone 100 mg IV was administered and the MAP rose to 75 mmHg. Concurrently, the CO dropped to 4.4 L/minute and the SVR increased to over 1000 dynes/sec x cm5. The ABG normalized. The vasopressin and bicarbonate infusions were discontinued after several hours, and mechanical ventilation was discontinued 24 hours postoperatively. The epinephrine infusion was weaned over 48 hours. The steroids were also successfully discontinued.

DISCUSSION

Etomidate has been used as an anesthetic induction agent for cardiac surgery cases because of its favorable hemodynamic profile [9]. Practitioners must understand that etomidate's effect on adrenal physiology is dose dependent and cumulative. Although adrenal suppression with one dose of etomidate can last 24 hours, its effect on patient outcomes has not been clear. However, in sepsis, there are subsets of septic patients that had poor outcomes after receiving etomidate [78].

Lundy et al [6], addressing adrenal insufficiency after a single dose of etomidate for induction of anesthesia, documented hemodynamic instability six hours following surgery. Lundy's patient failed to respond to atropine, intravenous fluids, vasopressors, inotropes, and required use of a pacemaker to keep blood pressure and heart rate at acceptable levels. A low random cortisol level of 17.6 mcg/dl led to the diagnosis of adrenal insufficiency. The patient was rescued using hydrocortisone 100 mg IV every 8 hours. Six hours after the first dose of hydrocortisone (12 hours after surgery), the patient improved and pacing was discontinued.

We did not perform an ACTH stimulation test or random cortisol level on our patient. The recommendations for the diagnosis and management of corticosteroid insufficiency in critically ill patients were published in the American College of Critical Care Medicine in 2008 [10]. Cortisol, the major endogenous corticosteroid is secreted by the adrenal gland. It has many effects, most notable to our findings, the abilitly to increase blood pressure. In particular, cortisol is necessary for catecholamines to be effective in vasoconstriction of vascular smooth muscle. Ninety percent of cortisol is bound to corticosteroid- binding globulin (CBG). The remaining ten percent is unbound and the active form. In acute illness, CBG is decreased by approximately 50%, leading to an increase in unbound cortisol. The half-life of cortisol is approximately 100 minutes and cortisol is not stored in the adrenal gland. The task force also addressed the recommendations of diagnosis of adrenal insufficiency and stated that the cosyntropin stimulation test was the best means for evaluation. However, this recommendation was given a strength level of 2B (weak with a moderate quality of evidence). Thus, due to the urgency of our patient's condition his hypotension was addressed in prompt fashion with hydrocortisone once the administration of etomidate was identified as a potential issue.

The patient's hypoperfusion and acidemia after fluid and blood product administration, the need for vasopressors and inotropes, and the fact that he responded to hydrocortisone in the setting of etomidate administraton, support our presumed diagnosis. We ask our colleagues to be vigilant in their use of etomidate, even in the non-septic patient, and to consider

it in the differential diagnosis of the hypotensive postoperative patient.

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