Empiric Stress Dose Steroids in Trauma Patients: A Case Report of Hypopituitarism in Traumatic Hemorrhage

Marissa Haberlach, Cy Cedar1, Andrew McCague1
Touro University California, Vallejo, 1Department of Surgery, Natividad Medical Center, Salinas, CA, USA

Abstract

Trauma patients experience relative adrenal insufficiency or critical illness-related corticosteroid insufficiency (CIRCI) in majority of 60% of patients. It has been shown that both septic shock and trauma cause dysfunction of the hypothalamic–pituitary axis and, in some cases, structural damage to the adrenal glands themselves through hemorrhage or infarction. Empiric steroids are used commonly in patients with septic shock for patients who are refractory to fluids and vasopressors. Here, we present a unique case of a 40-year-old male with multisystem trauma who developed adrenal crisis treated by empiric stress-dose steroids. His history later revealed a history of hypopituitarism. Although data do not support the use of empiric steroids for trauma patients, this case illustrates an example where considering steroid use and keeping adrenal insufficiency and CIRCI in the differential can influence outcome.

Keywords: Steroids, trauma, hypopituitarism

Introduction

In the United States, one person dies from an injury every 3 min.[1] Approximately one-half of the 3 million inpatient hospitalizations due to trauma result in death secondary to blood loss.[2] In managing severe sepsis or septic shock, fluid resuscitation and vasopressor support are the standard of care. The Surviving Sepsis Campaign (SSC) recommends the continuous infusion of 200 mg of intravenous hydrocortisone over 24 h to treat septic shock patients if fluid resuscitation and pressor support have failed.[3] However, there is limited evidence to support or refute the benefit of empiric glucocorticoid treatment in the setting of trauma. The following case supports the use of empiric steroids in refractory hypotension among trauma patients. This patient was later found to have a known history of hypopituitarism.

Case Report

A 40-year-old male presented to our hospital after a motorcycle collision where he was traveling approximately 75 mph and collided with a guardrail. He was hypotensive but alert and required a left needle thoracostomy for decreased breath sounds. On arrival, he remained hypotensive with blood pressures 60 mmHg systolic. He was intubated and a massive transfusion protocol was activated. He was found to have left chest deformity, and a left chest tube was placed with an initial return of >2000 cc blood.

He was taken to the operating room emergently for a left thoracotomy where he was found to have multiple comminuted rib fractures, multiple large pulmonary lacerations, a left diaphragm injury, and bilateral hemothoraces. A fragment of bone was found abutting the pericardium, and the thoracotomy was converted to a clamshell thoracotomy to better evaluate the heart. The pericardium was incised and the heart was found to be intact. A tractotomy was required to control pulmonary hemorrhage and the left chest packed. An exploratory laparotomy was performed which was negative except for superficial splenic lacerations. His other injuries include a left humerus fracture and left scapula fracture.

Postoperatively, he remained hypotensive with systolic blood pressures in the low 80s mmHg and hypoxic despite massive...
transfusion including 38 packed red blood cells, 36 plasma, and 4 units of platelets. A this point, we had exhausted our hospital’s blood supply and prognosis remained poor. He was started on vasopressors and resuscitation continued.

While in the intensive care unit, he failed to respond to additional fluid resuscitation and hemorrhage was felt to be controlled. He was given a dose of empiric hydrocortisone at 100 mg and continued every 8 h. Over the next few hours, the patient stabilized with systolic blood pressures into the 150s mmHg systolic. Vasopressors were weaned and fluids decreased.

The patient’s family was contacted later in the night and provided his medical history. The patient had a history of hypopituitarism from previous head trauma and has been taking levothyroxine and hydrocortisone for several years.

The patient was returned to the operating room 2 days later for washout, rib fixation, and closure of his left chest. He was later extubated on posttrauma day 6.

His remaining hospital course was complicated by left bronchopulmonary fistula, pulmonary embolism, and heparin-induced thrombocytopenia. He was discharged on the 47th day of hospitalization. At 1-year follow-up, he has continued to recover and he has returned to work and has not got respiratory difficulty.

**Discussion**

This is a unique case where empiric glucocorticoid treatment was used in a trauma patient. Although resuscitation was ongoing, the addition of steroids and including the adrenal crisis in the differential is felt to have improved this patient’s outcome. When the patient’s history of hypopituitarism was known, his steroids were continued and additional home medications started.

With this case, we raise the question for the role of empiric glucocorticoid treatment in trauma patients. Endogenous glucocorticoids, such as cortisol, are involved in the regulation of metabolism, maintenance of vascular tone, and the inflammatory response. Trauma, surgery, or critical illness upregulate the hypothalamic–pituitary–adrenal (HPA) axis, which causes an increase in plasma ACTH and cortisol. In addition, plasma cortisol levels remain elevated following trauma. A study by Wang et al. involved modeling hemorrhage and severe hypotension in rats, and corticosterone levels remained elevated for up to 4 h following resuscitation; this was further verified by reduced hepatic 11-β-hydroxysteroid dehydrogenase activity which metabolizes cortisol.

Trauma patients experience relative adrenal insufficiency or critical illness-related corticosteroid insufficiency in 60% of cases. Both septic shock and trauma cause dysfunction of the HPA axis and, in some cases, structural damage to the adrenal glands themselves through hemorrhage or infarction. In the setting of adrenal crisis and secondary adrenal insufficiency, glucocorticoids should be replaced until the HPA axis has recovered. The current recommendations for dosage are based on extrapolations from the normal stress response. However, there is negligible risk to start hydrocortisone therapy in any patient suspected of adrenal crisis and treatment should not be delayed to confirm the diagnosis.

The use of empiric steroids in patients suffering from septic shock is well supported and is widely used. Despite this, the improvement in mortality with steroid use remains controversial. The Corticosteroid Therapy of Septic Shock trial showed that there was no difference in mortality at 28 days in septic shock patients who received hydrocortisone. In the group receiving steroids, reversal of shock was hastened; however, there were increased rates of hyperglycemia and hypernatremia as well as superinfection compared to the placebo group.

Similarly, a retrospective review of the University of Virginia Trauma Registry and the ADRENAL trial showed no difference in mortality in patients who received steroids compared to placebo. However, in the ADRENAL trial, ventilated patients on pressor support who received hydrocortisone required ventilator support for fewer days, stayed fewer days in the ICU, and had shortened length of shock compared to placebo group. The secondary outcomes are supportive of steroid use, as recommended by the SSC.

Interestingly, a single-center retrospective study of 94 patients noted reduced mortality in patients who received the combination of Vitamin C, thiamine, and hydrocortisone, which they attributed to a synergistic effect and effort to prevent subsequent organ damage.

Although data do not support the use of empiric steroids for trauma patients, this case illustrates an example where considering steroid use and keeping the adrenal crisis in the differential can influence the outcome.

**Conclusion**

There is insufficient evidence to advocate for the empiric use of glucocorticoids in all trauma patients. Previously published studies have been underpowered and limited by inconsistent testing for adrenal insufficiency. There is support for the use of steroids in patients with refractory hypotension, as demonstrated in the ADRENAL trial and in our patient. Thus, the SSC recommendations should be upheld as the standard of care. Given the multifactorial nature of the case patient’s injuries and the number of interventions from injury to administration of the stress-dose steroids, we cannot draw causation of the patient’s hemodynamic stability to receipt of the steroids. We will require additional multicenter, randomized control trials to study the benefits and risks of expanding the use of glucocorticoid therapy in trauma patients and assessing the addition of Vitamin C and thiamine to this guideline.

**Declaration of patient consent**

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have
given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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**Conflicts of interest**
There are no conflicts of interest.

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