Trauma Team Activation: Not Just for Trauma Patients

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Abstract

Specialized trauma teams have been shown to improve outcomes in critically injured patients. At our institution, an the American College of Surgeons Committee on trauma level I Trauma center, the trauma team activation (TTA) criteria includes both physiologic and anatomic criteria, but any attending physician can activate the trauma team at their discretion outside criteria. As a result, the trauma team has been activated for noninjured patients meeting physiologic criteria secondary to nontraumatic hemorrhage. We present two cases in which the trauma team was activated for noninjured patients in hemorrhagic shock. The utilization of the TTA protocol and subsequent management by the trauma team are reviewed as we believe these were critical factors in the successful recovery of both patients. Beyond the primary improved survival outcomes of severely injured patients, trauma center designation has a “halo effect” that encompasses patients with nontraumatic hemorrhage.

Keywords: Hemorrhagic shock, postpartum hemorrhage, trauma protocol, trauma team activation

INTRODUCTION

Care by specialized trauma teams at designated trauma centers has been shown to improve survival, especially in critically injured patients. This survival benefit has been extended to acute, noninjured patients requiring immediate operative intervention such as patients hospitalized with ruptured abdominal aortic aneurysms (AAAs). Utter, et al. termed this the “halo effect” of trauma center designation. Here, we report the use of the trauma team activation (TTA) for two noninjured patients presenting in class four hemorrhagic shock at a recently verified American College of Surgeons Committee on Trauma (ACSCOT) level I trauma center. The successful management of both cases of massive hemorrhage by the trauma team is described as we believe the TTA activation was critical in the salvage of both patients.

CASE REPORTS

Case 1

A 30-year-old obese woman with no medical history presented to our emergency department (ED) complaining of 3 h of right flank pain radiating to her groin. On arrival, the patient was hemodynamically stable but in acute distress, writhing in pain from presumed renal colic. Three hours after arrival to the ED, the patient was noted to be lethargic with systolic blood pressure (SBP) in the 60 s. Emergent computed tomography of her abdomen/pelvis revealed a ruptured 9.2 cm suprarenal AAA with active extravasation. The alpha TTA, the highest level of activation at our institution, was initiated by the emergency medicine attending which mobilized the operating room (OR) supervisor to halt scheduled cases to hold one OR open, the blood bank to activate the massive transfusion protocol (MTP), and the in-house acute care surgeon and anesthesiologist to the trauma bay. The attending surgeon coordinated resuscitation efforts with the OR staff set up the room. Within 38 min of the alpha activation, the patient was in the OR with the open abdominal repair of her ruptured AAA. Emergent open AAA repair was performed with the left renal and inferior mesenteric artery sacrificed. Her abdomen was packed and an ABThera™ (KCI, San Antonio, TX, USA) open abdomen negative pressure device was placed with plans for a second look operation as the patient was severely acidotic, coagulopathic, and hypothermic. An hour after transfer to bay and administered 2 L of normal saline with SBP up to the 100 s. Emergent computed tomography of her abdomen/pelvis revealed a ruptured 9.2 cm suprarenal AAA with active extravasation. The alpha TTA, the highest level of activation at our institution, was initiated by the emergency medicine attending which mobilized the operating room (OR) supervisor to halt scheduled cases to hold one OR open, the blood bank to activate the massive transfusion protocol (MTP), and the in-house acute care surgeon and anesthesiologist to the trauma bay. The attending surgeon coordinated resuscitation efforts with the MTP as the OR staff set up the room. Within 38 min of the alpha activation, the patient was in the OR with the on-call vascular surgeon for open repair of her ruptured AAA.

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the surgical Intensive Care Unit, the patient was noted with bright red blood per rectum with associated hypotension. Bedside colonoscopy revealed ischemic pancreatitis. The patient returned to the OR with the on-call acute care and vascular surgeons for exploration, subtotal colectomy, and ABThera™ replacement. Her remaining hospital course was complicated by acute kidney injury which resolved without the need for hemodialysis. The patient underwent ileostomy creation with abdominal closure on postoperative day 5 and was discharged home on postoperative day 22. Subsequent history revealed that although the patient did not manifest typical Marfan phenotype, she carried an unknown diagnosis of Marfan syndrome with only aortic manifestations of the disease.

**Case 2**

A 27-year-old patient (gravida I, para 0) at 38-week gestation presented to the obstetrics ED with spontaneous rupture of membranes. She subsequently underwent a primary low transverse cesarean section after she was noted with arrest of descent. A viable baby was delivered without issue, and the patient was transferred to the postanesthesia care unit in stable condition. Thirty-five minutes later, the patient was noted to be hypotensive with SBP in the 70 s after vaginal passage of several small blood clots followed by passage of approximately 1 L of clot on bimanual examination. Uterine atony was noted and persistent despite administration of uterotonic agents including misoprostol, oxytocin, carboprost, and mephtergine.

The patient was taken emergently to the OR for Bakri (Cook Medical, Bloomington, IN, USA) postpartum balloon placement. Despite this, the patient continued to have significant vaginal bleeding with persistent hypotension on multiple vasopressors, so the anesthesiologist intubated the patient and activated the alpha trauma team for exsanguinating hemorrhage. The trauma team, led by the in-house acute care surgeon, coordinated the resuscitation effort. The MTP was activated and aggressive, coordinated resuscitation was initiated.

Given her deteriorating clinical condition, damage control surgery with laparotomy, supracervical hysterectomy, and abdominal packing was performed jointly with the obstetrician and the attending surgeon. Seventy-four minutes after the TTA, the patient was transferred to the surgical Intensive Care Unit with an open abdomen for resuscitation and stabilization of her profound respiratory and metabolic acidosis. The next day, the patient returned to the OR with both services for exploration, removal of abdominal packing, and abdominal closure. Her remaining hospital course was uneventful. She was extubated postoperative day 2 and discharged home postoperative day 7 from her cesarean section.

**Discussion**

Utter, et al. showed that care of ruptured AAAs at verified and designated level I or II trauma centers is associated with decreased organ failure and death in a large, multistate retrospective study. This beneficial effect remained after adjusting for potential patient and hospital confounders such as hospital and physician volume or presence of a vascular surgery fellowship. They termed this the “halo effect” of trauma designation and hypothesized that the beneficial effects of trauma center resources including a commitment to surgical intensive care can extend to nontrauma patients.

Subsequent studies evaluating care of nontraumatic emergency general surgery patients at designated trauma centers have been inconsistent. Using the Nationwide Inpatient Sample administrative database, Khalil, et al.[9] found that emergency surgical patients managed at designated trauma centers had no difference in mortality compared to patients at nontrauma centers but did have significantly lower rates of in hospital complications. Ingraham, et al.[9] assessed the outcomes of the same population of emergency general surgery patients using the American College of Surgeons National Surgical Quality Improvement Program database and similarly found no difference in mortality but did find that trauma center status was a significant predictor of increased morbidity, contradicting the findings of Khalil, et al.

Nagarajan, et al.[7] proposed that these studies were limited by the fact that emergency general surgery patients were examined collectively with the wide case mix leading to comparisons of a variety of presentations in emergency general surgery. They used the Nationwide ED Sample database and looked specifically at emergent colectomy for diverticulitis to distinguish the impact of trauma center designation on outcomes in emergency general surgery patients. Their results found that trauma center status was associated with worse outcomes, specifically increased mortality.

The conflicting results in these recent studies demonstrate the need for further studies to determine whether the “halo effect” of trauma center designation exists. We speculate that the conflicting data may have to do with the specific disease processes evaluated in these studies. Specifically, these studies examined the role of trauma center designation in emergency general surgery patients. However, we believe the “halo effect” does not necessarily improve outcomes in emergency general surgery patients. Rather, the “halo effect” encompasses patients with nontraumatic massive hemorrhage from varying etiology including but not limited to obstetrical, vascular, and gastrointestinal hemorrhage. This benefit is illustrated in our two case presentations.

The benefits of the TTA at trauma centers in the care of major nontraumatic hemorrhage are multifactorial. First, trauma centers are equipped with the infrastructure needed for the immediate mobilization of physical and human resources involved in resuscitation and time to operative intervention.[9] In addition to infrastructure and resources such as the availability of OR and blood bank personnel and the presence of an in-house acute care surgeon and anesthesiologist, management of hemorrhagic shock often requires a team approach with other specialties.
Optimal management of hemorrhagic shock, regardless of etiology, requires effective coordination and communication between the surgical service and an array of specialties such as gastroenterologists and interventional radiologists. A coordinated team approach can lead to significant reduction in time to definitive therapy. In our institution, the trauma and acute care surgery service assume this role, but other types of protocol-driven multidisciplinary teams such as rapid response teams can expedite the diagnostic process and shared decision-making.

Most importantly, we believe the survival advantage at trauma centers is due to the training and experience of trauma teams in the management of hemorrhage and its sequelae. Patients in hemorrhagic shock can deteriorate quickly, and early and definitive intervention is paramount to improve the chances of survival in these patients much like in the severely injured patient. However, in the exsanguinating patient with little physiologic reserve, the principles of damage control resuscitation and laparotomy include abbreviating operative care to correct acidosis, hypothermia, and coagulopathy in the surgical Intensive Care Unit.[9] The role of the intensivist in this perioperative period is crucial. The use of these life-saving principles is illustrated in both case presentations.

Although we report only on two patients, our trauma and acute care surgery teams are now activated in our institution to manage massive vascular, gastrointestinal, obstetrical, and procedure-related hemorrhage. Further studies are needed to validate our proposition that noninjured patients admitted with hemorrhagic shock benefit from care at trauma centers. Given the nature of the disease, it is unlikely that a randomized controlled trial can be performed, but larger retrospective studies are warranted to examine the breadth of the “halo effect” of trauma centers.

Conclusion

Successful salvage and recovery of both patients suggest that the “halo effect” of trauma centers does encompass noninjured patients in hemorrhagic shock. This is important as it is a major endeavor to achieve ACSCOT verification, and we believe that beyond the primary improved quality of care to severely injured patients, patients with massive nontraumatic hemorrhage may have to be included in the assessment of the benefits of level 1 trauma designation.

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Conflicts of interest

There are no conflicts of interest.

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