Assessment and Treatment of the Trauma Patient in Shock

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KEYWORDS

• Trauma patient • Shock • Nonoperative management • Solid organ injury

KEY POINTS

- High-volume crystalloid resuscitation is associated with increased length of stay, ICU and ventilator days, and organ failure and infection rates.
- Rapid evaluation of a hemodynamically unstable trauma patient is vital to diagnosis and treatment of the cause of shock.
- CT scanning should be used liberally in trauma patients to effect decreased mortality.
- Nonoperative management (NOM) and catheter-based interventions are becoming the standard of care in appropriately selected patients with solid organ injuries.

INTRODUCTION

The presentation of a critically ill trauma patient demands the quick response and diagnostic savvy of an emergency medicine–trained physician. As with all critically ill or injured patients, the physician should begin an evaluation by addressing airway, breathing, and circulation (ABCs), after which further assessment of a patient's injuries can occur. Advanced Trauma Life Support guidelines establish a specific sequence of events when examining a trauma patient, including the ABCs and primary and secondary surveys. These sequences should be both familiar and routine to every emergency physician.

Trauma patients often present with signs and symptoms of shock, with or without obvious cause. Patients with polytrauma may have more than 1 injury contributing to hemodynamic instability, which may further complicate the picture when attempting to determine the cause of shock.

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RESUSCITATION

In spite of historic recommendations to administer 1 to 2 L of fluid for resuscitation,[1] recent literature has suggested that high-volume crystalloid resuscitation after injury is associated with significant morbidity, including increased ventilator days, longer ICU and hospital length of stay, development of acute respiratory distress syndrome, and multisystem organ failure and increased infection rates.[2,3] Crystalloid infusion, in the setting on ongoing hemorrhage, promotes bleeding and hemodilution, and perpetuates acidosis, hypothermia, and coagulopathy.[4] This belief has led many centers to use blood products earlier in resuscitation in patients with ongoing hemorrhage. Recent data have suggested benefit from transfusion of red blood cells (RBCs), plasma, and platelets in even ratios.[3,5,6] This practice, often referred to as "1-1-1," has become standard practice in many trauma centers and is currently being studied in a large multicenter prospective trial.[6]

For patients who require resuscitation but do not have ongoing hemorrhage, the ideal fluid for resuscitation remains unknown. Normal saline and lactated Ringer solutions have been the traditional choices. Aggressive resuscitation with crystalloid solutions, however, has been associated with negative clinical outcomes in blunt trauma patients.[2,7,8] When comparing crystalloid and colloid resuscitation, colloids have been associated with a trend toward increased mortality in trauma patients.[9] When the study excluded patients with traumatic brain injury, however, there was no difference in mortality. PlasmaLyte, a crystalloid balance solution, has also been used as a resuscitative fluid. With several different formulations, it is similar to plasma and has been termed, *physiologic solution* or *balanced solution*. PlasmaLyte has some advantages over Ringer lactate and normal saline in that it corrects both volume and electrolyte deficits without causing a hyperchloremic acidosis. Despite these advantages, studies evaluating its use after injury have shown no evidence of superiority to other crystalloids for the management of traumatic hypovolemia.[10]

Hypertonic saline has also been used as a resuscitative fluid. Due to its oncotic quality, it augments perfusion through volume expansion.[11] This is beneficial for patients with traumatic brain injury to help decrease elevated intracranial pressure. Additionally, animal models have shown that hypertonic saline helps minimize the inflammatory response after traumatic and hemorrhagic shock.[11–15] Unfortunately, no clinical trial has demonstrated benefit for the use of hypertonic saline after injury, except possibly for patients with traumatic brain jury[11] (see the neurotrauma chapter elsewhere in this issue).

Permissive hypotension is the practice of targeting a lower systolic blood pressure in the setting of hemorrhagic shock. The landmark study by Bickell and colleagues[16] demonstrated a survival benefit for patients with penetrating torso trauma who received delayed (once in the operating room) resuscitation compared with those who received fluid administration in the field. Due to significant differences in injury and mechanism patterns, subsequent studies have not been able to duplicate this work.[11,17,18] Despite this, permissive hypotension in the setting of hemorrhage, specifically penetrating torso trauma, is practiced at many high-volume trauma centers. A specific blood pressure has not been elucidated in the literature; however, based on the current available studies, a systolic blood pressure goal of 70 to 100 mm Hg is reasonable.[17,18]

ASSESSMENT OF BODY COMPARTMENTS

Head/Neck

Examination

Patients who have sustained head trauma can present with a mental status ranging from severely obtunded and unresponsive to essentially normal, depending on the