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Shock is a life-threatening condition of circulatory failure leading to inadequate organ perfusion and tissue oxygenation. In a trauma patient, shock may be due to hypovolemia, cardiogenic, obstructive or distributive causes individually or in combination. The physiological response to major hemorrhage is dependent on a variety of autonomic reflexes, mechanism of injury, bleeding source, and baseline physiology of the patient. This article discusses the common causes of shock and the accompanying physiology, how clinical assessment can support the diagnosis and effective treatment of shock, and the common pitfalls in trauma patients.	
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Traumatic brain injury (TBI) continues to be a leading cause of morbidity and mortality worldwide with older adults having the highest rate of hospitalizations and deaths. Management in the acute phase is focused on preventing secondary neurologic injury from hypoxia, hypocapnia, hypotension, and elevated intracranial pressure. Recent studies on tranexamic acid and continuous hypertonic saline infusion have not found any difference in neurologic outcomes. Care must be taken in prognosticating TBI outcomes, as recovery of consciousness and orientation has been observed up to 12 months after injury.	
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Blunt and penetrating vascular injuries to the neck represent a significant burden of mortality and disability among trauma patients. Blunt cerebrovascular injury can present with signs of stroke either immediately or in a delayed fashion. Most injuries are detected with computed tomography angiogram and managed by antiplatelet agents or unfractionated heparin. In contrast, for patients presenting with penetrating neck injuries, assessment for hard signs of vascular and aerodigestive injury should be done and prompt emergent surgical consultation if present. Overall management priorities for penetrating neck injuries focus on airway management, hemorrhage control, and damage control resuscitation before definitive surgical repair.	

Massive Hemorrhage Protocol: A Practical Approach to the Bleeding Trauma Patient 51

Andrew Petrosioniak, Katerina Pavenski, Luis Teodoro da Luz, and Jeannie Callum

Damage-control resuscitation is the standard of care for the hemorrhaging trauma patient. This approach combines rapid hemostasis and early-ratio-based blood product administration. These patients often require initiation of a massive hemorrhage protocol to support the systematic and coordinated delivery of care during this critical phase of resuscitation. Emerging evidence supports that this includes more than blood product administration alone but rather a comprehensive suite of treatments. In this article, we review the existing evidence and provide a pragmatic framework, the 7 Ts of massive hemorrhage protocol, to guide the care of patients with life-threatening traumatic hemorrhage.

Resuscitative Endovascular Balloon Occlusion of the Aorta: A Practical Review 71

Zaffer Qasim

Hemorrhage, in particular, noncompressible torso hemorrhage, remains a significant contributor to mortality in trauma cases. Despite many advances in resuscitation, noncompressible sites of bleeding have presented a particular challenge. Resuscitative endovascular balloon occlusion of the aorta (REBOA) is one technique that can be used to temporarily stop hemorrhage from these sites to allow transfer to definitive care. Although the technique is relatively straight-forward, it carries significant risk, in particular, from ischemia due to aortic occlusion. This article describes the role and considerations for the use of REBOA in the critically injured patient.

Extracorporeal Life Support for Trauma 89

Joseph Hamera and Ashley Menne

The utilization of extracorporeal membrane oxygenation (ECMO) in trauma mirrors wider trends toward increased utilization of ECMO throughout various forms of critical illness. ECMO can safely be performed on trauma patients with or without anticoagulation. Most of the trauma ECMO cases are for the management of post-traumatic respiratory failure, but they can be used for certain cases of circulatory failure as well. Cannulation of patients for ECMO is technically feasible in the hands of surgeons and intensivists involved in the care of trauma patients. A sound understanding of the ECMO circuit components can help troubleshoot system malfunctions. Emerging technologies may combine extracorporeal circulatory support with endovascular hemorrhage control to prolong the viable survival of exsanguinating patients.

Intimate Partner Violence and Human Trafficking: Trauma We May Not Identify 101

Kari Sampsel, Julianna Deutscher, and Emma Duchesne

Intimate partner violence and human trafficking commonly affect patients presenting to the emergency department including the trauma bay. Although these forms of violence and exploitation are not always the underlying cause of that particular emergency department encounter, screening is important regardless of the presenting condition because this presentation may be the only opportunity to receive help and

ultimately plants the seed for future access to help regardless of what a patient chooses to do following this first encounter. There are important medical care considerations in these patients beyond trauma bay procedures that can make the difference in saving a life.

Management of Pain and Agitation in Trauma 117

Reuben J. Strayer

Polytrauma patients often require medications to treat pain, treat agitation, and facilitate painful procedures. Though analgesia will be deferred in obtunded patients in profound shock, reduced-dose opioids or ketamine should be administered to unstable patients with severe pain with good mental status. Agitation commonly complicates polytrauma presentations, and is treated according to the danger it presents to patient and staff. Severe agitation can be effectively managed with dissociative-dose ketamine, which facilitates ongoing resuscitation, including CT. Severely painful procedures can be effectively facilitated by propofol or dissociative-dose ketamine, with continuous attention to ventilation and application of a step-by-step response to hypoventilation.

Advances in Trauma Ultrasound 131

Samuel Austin, Daniel Haase, and Joseph Hamera

Bedside ultrasound assessment has become a routine aspect of care in trauma resuscitation and the critical care setting. Although early research was focused on its role in blunt trauma, it has shown utility in the assessment of penetrating trauma by rapidly identifying hemopericardium and facilitating appropriate intraoperative management. In addition, ultrasound is a reliable test in identifying hemopneumothorax or diaphragmatic injuries. The Rapid Ultrasound in Shock and Hypotension and the Focused Rapid Echocardiographic Examination can diagnose etiologies of shock and guide resuscitation in the critically ill patient. Finally, the role of transesophageal echocardiography is expanding in the trauma setting as more research emerges.

Minor Procedures in Trauma 143

Jesse Shriki and Sagar B. Dave

Procedures such as central access and tube thoracostomy are integral in the care of the injured patient. However, both increasing life span and patient complexity of comorbidities can hinder procedural success. Careful forethought should be completed before, simply, charging ahead with a procedure. This article covers the details needed to be successful in carrying out these 2 procedural “staples” in trauma. From anatomy to pain control to postprocedural management, this article will be the building block for technical success. Understanding what you are doing and careful planning ahead are now more than ever crucial to patient care.

The Big Five—Lifesaving Procedures in the Trauma Bay 161

Sagar B. Dave and Jesse Shriki

Although resuscitation in trauma requires a multidisciplinary and multifaceted approach, one of the “Big Five” procedures may need to be performed as lifesaving and improving intervention. Understanding, timing,

and techniques of these elusive and difficult-to-master procedures can be the difference between life and death. This article focuses on and reviews these five critical procedures: cricothyroidotomy, burr hole craniotomy, resuscitative thoracotomy, emergent hysterotomy, and lateral canthotomy. Prepare the team, system, and yourself when performing any of these procedures. It is important to be facile with your equipment and familiar with the steps to maximize success.

Trauma in the Aging Population: Geriatric Trauma Pearls

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Lorraine Lau, Henry Ajzenberg, Barbara Haas, and Camilla L. Wong

The relative proportion of trauma patients who are older adults continues to rise as the population ages. Older adults who experience trauma have unique needs compared with their younger counterparts. There are specific considerations that must take into account. Treating older adults with traumatic injuries requires specific skills, knowledge, and specialized protocols to optimize outcomes. This article reviews the most important aspects of geriatric trauma care. We focus on presentation and initial resuscitation, triage guidelines and the issue of undertriage, the importance of multidisciplinary and specialized geriatric care, and common injuries and their management.

Pediatric Trauma

205

Jennifer Guyther and Rachel Wiltjer

Emergency department response to the pediatric trauma patient starts with the basics—ABCDE. Certain important differences in pediatric patients, such as airway physiology and drug dosing, must be considered but standardized resources are available. Pediatric blunt and penetrating trauma treatment also have mechanisms and nuances that distinguish them from adult cases. Pediatric literature is slowly growing which can shape evidence-based practice for care including blood transfusions, medications, and procedures.