

STATEMENT OF PRINCIPLES: TRAUMA ANESTHESIOLOGY

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Introduction

Trauma is a serious bodily injury or shock caused by an external source. Trauma anesthesiology is a subspecialty of anesthesiology that focuses on the comprehensive care of patients who have endured traumatic injury. A significant percentage of patients who present with trauma require emergent resuscitation, surgical management for temporary stabilization or definitive treatment of injuries, and perioperative critical care management. Organized trauma systems have been created that designate and verify trauma centers with multidisciplinary trauma teams. Anesthesiologists play an essential role on these teams. This position paper describes trends in trauma anesthesiology and defines its importance to the specialty of anesthesiology illustrating why subspecialty training in trauma anesthesiology should be a vital part of anesthesia practice. It specifically addresses the following issues:

- Defining the discipline of trauma anesthesiology and the services provided by trauma anesthesiologists
- Identifying the benefits of trauma anesthesiology
- Identifying why trauma anesthesiology is important to the specialty of anesthesiology and medicine at large
- Describing a strategy for ASA to adopt to ensure that trauma anesthesiology is an integral practice of anesthesiology

What is Trauma Anesthesiology?

Trauma is a complex disease that involves direct injury to tissues as well as systemic disturbances that may alter and affect the entire body. Trauma is the leading cause of death for individuals up to the age of 45 years and the third leading cause of death overall for every age group. Globally, trauma is responsible for more than 5 million deaths per year. In the United States, trauma accounts for more than 180,000 deaths and for nearly one-third of all life years lost. Each year, over 3 million non-fatal injuries occur in the United States, and approximately 2.8 million people are hospitalized with injury.

In 1990, Congress passed the Trauma Care Systems Planning and Development Act that led to the development of organized statewide trauma systems. These systems allow rapid and coordinated patient care at centers with capabilities to provide comprehensive trauma care. The American College of Surgeons Committee on Trauma classifies trauma centers as Level I to Level V. All levels of trauma centers are critical to the trauma system. The care of patients who have sustained traumatic injury requires a multidisciplinary approach that involves multiple medical specialties: anesthesiology, emergency medicine, trauma and acute care surgery, orthopedic surgery, neurosurgery, ophthalmology, otolaryngology, plastic surgery, general surgery, urology, critical care, radiology, and blood banking. Anesthesiologists play an integral role on these multidisciplinary teams.

Trauma anesthesiologists must be prepared to emergently care for a patient with any form and severity of injury, who may have an unknown or suboptimally managed pre-existing conditions, and who may require any kind of operation regardless of the time of day, even when resources are not readily available. Trauma anesthesiologists must have a broad, evidence-based knowledge of the specialties of both anesthesiology and of trauma surgery in order to understand the nuances of traumatic injury management, the unique pathophysiological processes observed in trauma, and the pharmacological modifications that may be necessary to provide anesthesia quickly, efficiently, and effectively. Trauma anesthesiologists must provide airway management and resuscitation in an environment that may be in constant flux due to the instability of severe bleeding or brain injury. Trauma anesthesiologists manage difficult airways due to blood, vomitus, or severe facial fractures. They also provide massive blood and fluid resuscitation, treat coagulopathies, obtain vascular access, prevent hypothermia, optimize mechanical ventilation, and ensure adequate anesthesia and analgesia.

Trauma anesthesiologists offer a unique expertise and skill set that is significantly different from those offered by other medical specialties and complementary to those provided by general anesthesiologists. Trauma anesthesiology cuts across all subspecialties of anesthesiology. For example, an understanding of critical care, regional anesthesia, and pain management is of paramount importance throughout the perioperative period. Moreover, the work of trauma anesthesiologists is not limited to the operating room; rather their diverse knowledge and skills allow them to care for patients with both medical and surgical emergencies pre-hospital, in the emergency department, interventional radiology suite and hospital wards. In this way they are established as perioperative physicians in an acute care setting.

The European and other international models of pre-hospital trauma care regard the anesthesiologist as a member of the first responder team. In the United States, the specialty of emergency medicine has largely taken over this role. With the exception of a few large trauma centers, participation of the anesthesiologist in the care of a trauma patient in the trauma bays is often limited. However, when the anesthesiologist is present in the emergency department upon arrival of a trauma patient, the greatest benefit is achieved in that the anesthesiologist can enable early airway management, initiate precise resuscitation, provide effective analgesia and sedation, and allow seamless transfer of the patient to the operating room without delay and with ongoing resuscitation.

Some of the services required of specially trained trauma anesthesiologists include the following:

- Clinical leadership in the management of resuscitation from the pre-hospital setting to the trauma bay, to the operating room and/or interventional radiology suite, and in the intensive care unit
- Effective airway management, establishing adequate breathing and ventilation.
- Circulatory resuscitation, including establishment of an adequate venous access, administration of blood components in optimal ratio to enhance oxygen delivery and to ensure adequate coagulation.
- Administration of massive transfusion in effective ratios of component therapy – with coagulation adjuncts – to the patient in hemorrhagic shock.

- Proper placement of perioperative lines and invasive monitors including arterial line, central venous or pulmonary artery catheter (when indicated). Providing data interpretation of these monitoring modalities and other intraoperative diagnostic studies such as transesophageal echocardiography and laboratory data such as arterial blood gases, thromboelastogram/thromboelastometry, platelet function assay, etc. Fluid and electrolyte administration to optimize end organ perfusion, at the same time avoiding over-and under-hydration; precise titration of inotropic agents and vasoactive drugs.
- Optimization of cerebral and spinal cord perfusion in order to minimize adverse neurologic outcome associated with traumatic brain and spinal cord injury.
- Comprehensive perioperative pain management including intravenous, neuraxial and regional anesthesia, which may involve placement of single shot and continuous peripheral nerve blocks and/or administration of adjuvant medications.
- Leadership in data management, outcomes appraisal, quality improvement, and clinical research trials.

What is the clinical benefit of Trauma Anesthesiology?

Specialized trauma centers have been established nationwide and their implementation has led to a decreased mortality and improvement of functional outcomes and economic value. Trauma systems have been created with centers existing in most states. In a large national sample of trauma patients, research has shown that receiving care at a Level I trauma center decreases the risk of death among seriously injured patients by 25 percent compared to a non-trauma center. Furthermore, both in-hospital mortality and 1-year mortality rates were reported to be significantly lower in trauma patients, particularly those with severe (i.e., operative) injuries, receiving care in trauma centers versus non-trauma centers. The incremental savings in cost per life-year for treatment at a trauma center versus non-trauma center has been estimated to be approximately \$36,000.

Because designated verified trauma centers provide emergent resuscitation and acute surgical treatment for both the temporary stabilization and definitive injury repair, the need for anesthesiologists specialized in trauma care has been particularly emphasized. However, there is no data suggesting a benefit of specialty-trained trauma anesthesiologists impacting these outcomes. Trauma patients are complex and require utilization of a unique set of knowledge and skills in a highly stressful setting.

Thus, the ACS Committee on Trauma is suggesting optimal requirements for anesthesiology services specifically at a Level I Trauma Center:

- Anesthesiology services should be promptly available for emergency operations and for airway problems. Anesthesia services in Level I trauma centers must be available 24 hours a day 7 days a week.
- When anesthesiology chief residents or CRNAs are used to fulfill availability requirements, the staff anesthesiologist on call should always be advised and promptly available at all times, and present for all operations.

- A designated anesthesiologist liaison to the trauma program is required to participate in both a Trauma Program Operational Process Performance Improvement Committee and a Multidisciplinary Peer Review Committee. The liaison should be involved in continuously evaluating the trauma program processes and outcomes to ensure optimal and timely care.
- The trauma center has a responsibility to meet criteria for research, education and scholarly activity, and the anesthesiology service should contribute to these endeavors to fulfill these requirements.

The ASA COTEP suggests that for Level I trauma centers, there should be IN HOUSE presence of an anesthesiologist trained in the management of trauma care, and that every Level I trauma center has a designated Director of Trauma Anesthesiology.

What does Trauma Anesthesiology mean to the practice of Anesthesiology?

Nearly 45 million Americans do not have access to a Level I or II trauma center within one hour of being severely injured. A need exists for trained trauma anesthesiologists at all designated trauma centers, but especially at Level I trauma centers. Currently, apart from some academic medical centers, patients who sustain traumatic injury are often cared for by anesthesiologists who are fulfilling "on call" responsibilities. This is despite the complexity of trauma patient management and the need for a unique knowledge and skill set in a high acuity setting. Few anesthesiologists in the United States have specialized in trauma anesthesiology; however, anesthesiologists are expected to participate as part of a multidisciplinary trauma team in designated trauma centers around the country. Therefore, trauma anesthesiology as a subspecialty adds an essential presence of anesthesiologists in the critical management and treatment of patients who have endured trauma. The specialty delineates our crucial role in the initial management and subsequent definitive surgical interventions for patients with traumatic injury. Our anesthetic management and peri-operative care directly affects patients in a critical period of trauma resuscitation, plausibly influencing patient morbidity and mortality.

What does the future hold?

Trauma may affect anyone, regardless of age or socioeconomic factors. Trauma is predicted to become the third largest contributor to the global burden of disease by 2020. Currently, the estimated economic burden, including both healthcare costs and lost productivity, in the United States is \$406 billion per year. Approximately 85,000 patients hospitalized with traumatic brain injury subsequently live with long-term disability. Early intervention by trained trauma anesthesiologists may have a substantial impact on future morbidity and mortality. Research examining trauma anesthesia practice will be essential to prove this notion; however, the presence of a trauma anesthesiologist as an intrinsic leader in a trauma team is the initial necessary professional obligation of the specialty of anesthesiology.

Conclusion

Trauma remains a major cause of hospitalization, morbidity, and mortality. Trauma systems and trauma centers with multidisciplinary trauma teams have become a well-recognized entity in the management of patients with traumatic injury. This organizational structure has led to decreased mortality and improved functional outcomes. Trauma anesthesiologists work synergistically with surgeons and other imperative healthcare providers to provide expert management of patients who have sustained traumatic injuries. The pervasiveness of trauma and its impact both nationally and globally demands the attentive focus of the ASA and the specialty of anesthesiology so that anesthesiologists, along with other medical specialties, may continue to mitigate the burden of traumatic injury on the individual patient and society at large.