Trauma Systems

Origins, Evolution, and Current Challenges

Danielle A. Pigneri, MD[a], Brian Beldowicz, MD[a,b], Gregory J. Jurkovich, MD[c,*]

KEYWORDS

- Trauma systems • Regionalized care • Governmental oversight
- Trauma as major cause of death

KEY POINTS

- Trauma is a major cause of death and major cause of life-years lost.
- Outcomes within trauma systems are markedly improved compared with areas without trauma systems.
- The growth and development of trauma systems is reliant on governmental oversight, financial support, and public interest.

Trauma is the leading cause of death in the United States for people younger than 45, and more children die of injuries than all other causes combined. Trauma is the fifth leading cause of death overall, and accounts for 25% of all life-years lost, more than cancer and heart disease combined. More than 130,000 Americans die every year in our communities from injury, and the combination of health care expenditure and loss of productivity due to injury is estimated to be $675 billion per year.[1] Trauma systems are an effort to address a real and pressing need, and the trauma system effectiveness is a key determinant of the health of a community. Not only does injury happen at unpredictable moments, but the elapsed time from injury to definitive care dramatically affects outcomes. For these reasons, a system that is organized, prepared, and has dedicated providers is of paramount importance. The ideal trauma system design is often referenced to a document published by the Health Services Research Administration in 1992.[2,3] Hallmarks of that report were the recognition that a well-functioning trauma system must integrate all phases of care to allow for

[a] Division of Trauma, Acute Care, and General Surgery, Department of Surgery, UC Davis Health, 2315 Stockton Boulevard, Room OP 512, Sacramento, CA 95817, USA; [b] Division of Trauma, Acute Care, and General Surgery, Department of Surgery, Uniformed Services University of Health Sciences, 4301 Jones Bridge Road, Bethesda, MD 20814, USA; [c] Division of Trauma, Acute Care, and General Surgery, Department of Surgery, UC Davis Health, 2221 Stockton Boulevard, Cypress #3111, Sacramento, CA 95817, USA
* Corresponding author.
E-mail address: gjjurkovich@ucdavis.edu

Surg Clin N Am 97 (2017) 947–959
http://dx.doi.org/10.1016/j.suc.2017.06.011
surgical.theclinics.com

smooth management of and transitions between recognition, stabilization, transport, treatment, and rehabilitation of the injured. There must be appropriate availability of specialists without overcrowding the system. A wide breadth of specialists should be concentrated in the centers that deal with the most gravely injured patients, and a network of lower severity hospitals should expediently transfer severely injured patients, once stabilized, to these centers. The location of these centers with various capabilities should be based on need, meaning it is to some extent an exclusionary system. Standards of care must be defined, adhered to, and constantly reexamined for opportunities for improvement. Injury prevention outreach should be instituted to decrease the total burden of injury within a community. The ideal trauma system would enable data sharing to effectively analyze care, identify shortcomings, and provide a mechanism for continued improvement in quality.

Although organized civilian trauma systems and the designation of a trauma center are fairly new, the concept of triaged trauma care is as old as war. Many of the lessons learned regarding treatment of traumatic injury were first learned on the battlefield. The Civil War is attributed with being the first time that resources, including anesthetics, were organized to support the surgeon at the scene. The first and second World Wars are credited with the first use of blood transfusions and the first recognition of the effect of time to treatment on outcomes.[4,5] With further scientific advancement in pharmacology, antisepsis and surgical technique available in each successive war of the nineteenth, twentieth, and now twenty-first century, the systematic application of triage, evacuation, and resource allocation exerted as much influence on mortality as the weapons of war themselves. A 1961 study of Army personnel highlighted the prevalence of delayed diagnosis and inappropriate treatment in soldier deaths, calling for improved organization of military medical care for the injured. The high concentration of complex injuries observed in war demanded time-sensitive transportation of injured soldiers to strategically distributed medical assets with specialized capability. Inadequate supply or inefficient use of such assets could be detected by a measurable, and preventable, loss of lives.

As advances were made on the battlefield, the value of applying these principles to the care of injured civilians was recognized. The first formalized civilian trauma center is commonly recognized as the Birmingham Accident Hospital and Rehabilitation Center located in Birmingham, United Kingdom, which opened its doors to the injured in 1941. This hospital was the first to separate injured patients from medically ill patients and structured treatment plans to include all phases of care, from initial resuscitation to rehabilitation.[6]

The first organized civilian US committee dedicated to the care of the injured was the Committee on Fractures, founded in 1922 and chaired by Charles L. Scudder. This was later merged with the American College of Surgeons (ACS) Committee on Industrial Medicine and Traumatic Surgery in 1939 to create the Committee on Fractures and Other Trauma. Over time, the focus of this committee expanded to include visceral injuries in addition to the continued attention to skeletal injuries. Reflecting this change, in 1950 the committee was given its current name, the ACS Committee on Trauma (COT).[7] The ACS COT has defined national standards for the care of the injured. The Optimal Hospital Resources for Care of the Seriously Injured was first published by the ACS COT in 1976 and defined the hospital-based resources for the care of the injured.[8] A seemingly subtle name change to this document occurred in 1990, renaming the iteration as *Resources for Optimal Care of the Injured Patient* in an effort to account for more than just the hospital resources needed.[9] This “bible” of trauma center resources is now in its eighth edition (2014). The first trauma unit in the United States was opened at the University of Maryland by Dr R. Adams Cowley in