COMMENTARY

Correspondence &

A Brief History of Triage

Glenn W. Mitchell, MD, MPH, FACEP

The principles of triage (from the French *trier*, to sort) have been in use for centuries. From its purported origins in sorting coffee beans[1] and other produce to its first recorded applications on Napoleon's battlefields to today's urban mass casualty situations, the triage process assigns a category to individuals from a large group to facilitate grouping and decision making. The story of medical triage in the United States and its contributions to the survival of injured people is in great measure tied to military conflicts. The crucible of combat often provided the focus and the impetus for major medical and surgical advancements that drove the evolution of triage techniques to contribute to optimized medical care.

Baron Dominique-Jean Larrey (1766–1842), Napoleon's surgeon,[2] is often credited with establishing both an ambulance corps—the *ambulances volantes*—and a classification system for the wounded on the field that allowed the setting of priorities for evacuation[3] (Fig. 1). Earlier military triage placed the most value on soldiers who could be returned quickly to the line of engagement, so the highest priority wounded were those who could be patched up and returned to duty.[4] At the time, warfare depended upon large numbers of troops lined up opposite one another, and the larger force was most often victorious. Those wounded soldiers who were expected to recover were next to be treated and those who were probably doomed were often left on the field with their already dead comrades.[5] The mortally wounded were a priority for Florence Nightingale, as she combed the battlefields in the relative safety of the night for those still alive and in need of whatever comfort she could provide them. Larrey altered the established pattern by going forward, often personally, during battles to pick up the wounded who could survive with potentially lifesaving surgery (eg, amputation). His surgeons performed these battlefield surgical procedures while medical assistants dressed and bandaged soldiers who could return to fight.[6]

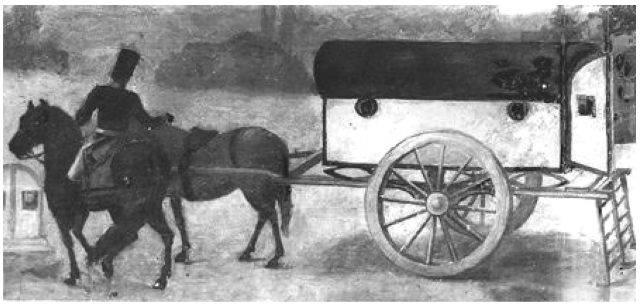
Larrey's principles developed further during the middle years of the US Civil War, with the formal establishment of a military field ambulance service and forward aid stations through the efforts of 2 famous Union Army surgeons, Charles Tripler and Jonathan Letterman.[7] At the beginning of the war, as in the past, wounded soldiers on both sides were most often cleared from the field after the fight. Again, the medics rapidly returned the nonseriously injured men to their units, but with Tripler's and Letterman's innovations, teams of dedicated personnel went forward whenever they could to retrieve soldiers who could benefit from amputations of shattered limbs and other emergent treatments of the times. Clara Barton, who established the American Red Cross after the war, focused on the humanity of returning disabled soldiers to their families rather than leaving the wounded on the field to die of their wounds.

Advances in medical and surgical treatment and a major improvement in public health measures occurred during World War I. Surgeons now had available to them well-developed anesthesia methods, but shock and sepsis were still consistently lethal. Tetanus antiserum was widely available. Gunshot wounds were now irrigated with antiseptic fluid (Carrel-Dakin treatment), which helped prevent gangrene. Victims who survived were able to benefit from better reconstruction and prosthetic techniques, but without antibiotics, the died-of-wounds rate could not be dramatically improved. Ambulances, staffed by civilian volunteers, were prominent just behind the front lines, and many wounded soldiers were evacuated during the actual fighting (Fig. 2). The advent of chemical warfare and machine guns increased the number of casualties and forced medics to use triage techniques to sort larger numbers of wounded. Forward aid stations now had surgeons who could provide a wider range of operations, but major changes in battlefield mortality were not yet realized. With war now routinely involving civilian population centers, triage extended into the entire medical community and medical personnel had to prioritize treatment of wounded civilians.

During World War II significant medical advances improved survival for soldiers wounded on the battlefield. Effective antibiotics became available, surgical technique advances made the abdomen and chest accessible, and far-forward aid stations provided plasma and blood as well as hemorrhage control. The concept of "buddy care" emerged and every soldier was given a package of medical supplies and a tourniquet for first aid for himself or his squad mates. The medic was an integral part of each combat unit and ran forward under fire whenever the cry "Medic!" was heard during the action. With only the contents of a small medical aid bag, the medic was able to maintain life in many soldiers who previously would have died of blood loss or chest wounds. Badly injured soldiers were brought to the nearby aid station for hemorrhage control, dressings, splinting, intravenous fluids,

FIGURE 1

The ambulance corps of Baron Dominique-Jean Larrey, circa 1809.



and analgesia. Surgical hospitals were sited not far from the front and provided emergent surgery for many previously fatal injuries. The nonseriously injured were often brought back by comrades to receive aid or even came by themselves so they could return to the battleline as quickly as possible.[8] The tension over priority treatment for return-to-duty soldiers extended to the early use of scarce penicillin, when the drug was given to soldiers with gonorrhea rather than used on wound infections.[9] Triage was focused on taking care of the most seriously injured men, but who were judged to have a chance of survival.[10] The chance of dying of combat injuries had decreased during World War II to 30%. With a global war, however, many seriously injured soldiers simply could not survive the delays in transportation to an aid station or a surgical hospital. That would begin to change in the next conflict.

The Korean War engendered a change in survival expectations for soldiers wounded on the battlefield. Shock, including fluid and electrolyte balance and other critical postinjury physiology, was beginning to be understood. Interventions included early techniques to repair and replace injured major blood vessels leading to improved outcomes in limb salvage

FIGURE 2

Red Cross ambulances being loaded with stretchers in front of the 1st Line Hospital at the foot of Monte Grappa on the Italian front, circa 1914–1918.

efforts. Surgeons were moved even farther forward to mobile army surgical hospitals to reduce time to surgery. However the critical advance was in transportation: With the deployment of a helicopter, a wounded soldier could be evacuated in minutes to a hospital that would be hours away by road travel[11] (Fig. 3). This aviation technology was in its infancy, but its salutary effects on survival and morale were obvious. In this conflict, mortality rates for soldiers sustaining wounds during combat decreased to less than 30%. In many engagements, triage on the scene had solidly changed to prioritize those who needed urgent intervention to save their lives or limbs, but the climate and geography of the area coupled with early air transportation technology and the massed forces of the enemy resulted in many instances of reversion to earlier triage concepts.

During the Vietnam War, rotary wing transportation developed to its present potential. This development also drove the civilian world to change its concepts of triage of the injured. The maturation of helicopter evacuation in the setting of a frontless war revolutionized combat medical care. Time from wounding to surgical care decreased from hours to minutes, saving soldiers who would have died of their wounds on the field in earlier conflicts.[12] Helicopter medics provided massive fluid resuscitation during transport, often under direct enemy fire. A soldier's chance of dying after receiving a battlefield injury in Vietnam was less than 24%. In the Iraq and Afghanistan wars, the troop mortality rate is less than 10%. With modern ratios of medical staff to troops, modern transportation, and military medicine's organizational doctrine and force structure, triage clearly had changed to treating the most severely wounded people first. Those planners discussing the theoretical outcomes of a nuclear war or a major chemical/biological assault were among the few who continued to address older priorities.

FIGURE 3

Personnel, equipment, and a Bell H-13 helicopter needed to save a man's life are assembled at the 8225th Mobile Army Surgical Hospital, Korea, 1951. Photograph by Cpl Charles Abrahamson (Army), from *www.defenselink.mil, Commemorating the Korean War* (*http://www.defenselink.mil/specials/koreanwar/warvets.html*).

The major advances in transportation of the wounded and in stabilization by medics with advanced capabilities migrated from Vietnam to the home front. These advances fomented a revolution in prehospital care. In the mid-1960s, Dr R Adams Cowley started one of the first civilian helicopter ambulance services in Baltimore with the assistance of Maryland state troopers.[13] Other physicians became involved in the development and operation of emergency medical technician and paramedic services to extend the benefits of military field medical skills to the civilian public. The concepts of dedicated ambulances and standardized medical equipment spread rapidly after the publication of the groundbreaking 1966 National Research Council report *Accidental Death and Disability: The Neglected Disease of Modern Society*.[14] Victims of illness and injury in nonurban areas of the United States began to be triaged by trained, skilled medics, rather than the local hearse drivers who had provided civilian medical transportation services.

After Vietnam, triage took on its modern form. Treatment was extended from the hospital to the ambulance for patients with chest pain or other heart problems. Pulselessness became a call to action rather than an irreversible sign of death. In the context of a few casualties at any one scene, the most severely ill or injured people were prioritized for care and evacuation to the nearest hospital. Methods to handle mass casualties in civilian settings, other than in its Cold War form, began to be organized. Disaster medicine developed rapidly into a systems approach and away from "doing our best in a bad situation."

As triage became a focus, business opportunities emerged. Disaster tagging systems, vests for rescue personnel, software management and decision support packages, and more flood the marketplace. These aids suffer the same problem as many innovative triage schemes that have been put forward: There are few scientifically sound randomized clinical trials in disaster medicine.

Many authors have espoused "improved" triage schemes, but few have actually been used in disaster situations. The scientific approach to triage was slow in its advancement, but it was well under way even before the stimulus of September 11, 2001. The US government's response to the tragedy included focus on improvement of triage systems designed to provide mass care to the population. Educational approaches for frontline providers of many backgrounds evolved, and triage was a central part of the medical sections of most plans. Even the issue of returning lightly wounded individuals to duty before treating more severely injured people resurfaced with firefighters and police, who needed to be back on the streets as soon as possible. Treatments and mortality results have come a long way, but the fundamental practical and ethical issues of triage have remained basically unchanged. Of course, during many actual events, responders never fully implement their triage functions because bystanders and victims most often find their way to nearby medical facilities by themselves before a formal response structure has been set up.[15]

Multiple authors in the past 20 years have devised triage schemes designed to improve the outcomes of victims, but few have been tried in real situations with mass casualties.[16–19] That is where we stand presently: standardizing and strengthening a coordinated, multidisciplinary medical approach to mass casualties and the effective triage functions that are demanded by those circumstances. The National Disaster Life Support Educational Consortium, formed by the American Medical Association and the National Disaster Life Support Foundation, is playing a leadership role in catalyzing this national effort.[20]

About the Author

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REFERENCES

1. Winslow GR. *Triage and Justice*. Berkeley: University of California Press; 1982: 169.
2. Blagg CR. Triage: Napoleon to the present day. *J Nephrol*. 2004;17: 629–632.
3. Wengert JW. Jean Dominique Larrey (1766-1842): surgeon of the guard. *Mil Med*. 1979;144:414–417.
4. Bradley A. *Ethical Models for Battlefield Triage*. Washington, DC: Board on Military and Veterans Health–Institute of Medicine; 2007.
5. Watt J. Doctors in the wars. *J Royal Soc Med*. 1984;77:265–267.
6. Iserson KV, Moskop JC. Triage in medicine: I. Concept, history, and types. *Ann Emerg Med*. 2007;49:275–281.
7. Letterman J. *Medical Recollections of the Army of the Potomac*. New York: D. Appleton & Co; 1866.
8. Dolev E. Ethical issues in military medicine. *Israel J Med Sci*. 1996;32:785–788.
9. Beecher HK. Penicillin. In: Freund P, ed. *Experimentation With Human Subjects*. New York: George Braziller; 1970: 70–72.
10. Trueta J. *Principles and Practice of War Surgery*. St Louis: C.V. Mosby; 1943: 178.
11. Neel SH. Medical evacuation in Korea. *US Armed Forces Med J*. 1955; 6:691–702.
12. Eiseman B. Combat casualty management in Vietnam. *J Trauma*. 1967; 7:153–163.
13. R Adams Cowley Shock Trauma Center. University of Maryland Medical Center Web site. *http://www.umm.edu/shocktrauma/history.htm* . Accessed June 20, 2008.
14. National Research Council. *Accidental Death and Disability: The Neglected Disease of Modern Society*. Washington, DC: National Academy of Science; 1966.
15. Auf der Heide E. Principles of hospital disaster planning. In: Hogan DE, Burstein JL, eds. *Disaster Medicine*. Philadelphia: Lippincott Williams & Wilkins; 2002:57–89.

16. Super G. *START: A Triage Training Module*. Newport Beach, CA: Hoag Memorial Hospital Presbyterian; 1984.
17. Burkle FM Jr, Sanner PH, Wolcott BW. *Disaster Medicine: Application for the Immediate Management and Triage of Civilian and Military Disaster Victims*. New Hyde Park, NY: Medical Examination Publishing; 1984.
18. Mitchell GW. The triage process. *Top Emerg Med*. 1986;7:34–45.
19. Kennedy K, Aghababian RV, Gans L et al. Triage: techniques and applications in decision making. *Ann Emerg Med*. 1996;28:136–144.
20. American Medical Association. AMA National Disaster Life Support. *http://www.ama-assn.org/ama/pub/category/13567.html*. Accessed June 20, 2008.