Prehospital Care from Napoleon to Mars: The Surgeon's Role

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Trauma is a surgical disease from beginning to end.

Today I'm honored to present the 71st Oration on Trauma and the 31st Scudder Oration. This is the oldest such oration of the American College of Surgeons (ACS), established in 1922. I feel humbled, proud, and lucky. Thank you for this distinction.

Today we honor our recently departed trauma surgeon, educator, advocate for the prehospital provider, and friend, Scott B Frame, MD, FACS (1952–2000).

Charles L Scudder (Fig. 1) was born on August 7, 1860 in Kent, CT. He died in 1949. Among his many accomplishments was being one of the founders of the ACS and the first chairman of its Committee on Trauma (COT). Dr Scudder[1] himself gave the first Oration on Fractures 74 years ago last week, on October 16. No oration was presented during the war years, 1942 to 1945. In 1952, the title changed from the Oration on Fractures to the Oration on Trauma. Sumner L Koch[2] delivered this lecture, but the subject was still fractures.

We usually think of the COT as dating from 1922 because this was the year that the first Committee on Fractures was appointed at a meeting of the Board of Regents in Washington, DC. At the 1912 meeting of the American Surgical Association in Montreal, 1 year before the formal founding of the ACS, interest in the care of the injured was very low. Too few beds were available for those who had sustained injuries to the skeletal system and work with such patients was considered an outpatient endeavor. A visit to the United States and Canada by Arbuthnot Lane, in 1909, helped focus on the problem. In 1911, the Presidential Address of the American Surgical Association provided the stimulus for better trauma care. So in Montreal on May 31, 1912, the following resolution was prepared: "Resolve that the President of the American Surgical Association appoint a committee ad hoc of five to prepare a statement to the relative value of operative versus nonoperative treatment of fractures of the long bones to which shall be added an opinion as to the value of radiography and its determination of the method of treatment."

The chairman of this committee from 1912 through 1914 was John B Roberts, the chairman from 1915 through 1918 was William L Estes Sr. Dr Scudder became a fellow of the American Surgical Association in 1909, but was not on the original committee of five. He became an associate member in 1914, and established the first fracture service in the country at Massachusetts General Hospital in 1917. The fracture committee was organized in Boston in 1923 by Ashurst, Blake, Cotton, Darrach,[3] Scudder, Sherman, and others. Leadership in the care of the injured patient, both in the hospital and before, truly began with the surgeon whom we honor with this oration each year, Charles Lock Scudder, MD, FACS.

The title of this Scudder Oration,"Prehospital Care from Napoleon to Mars: The Surgeon's Role," has a double meaning: the role that the surgeon has played throughout history and the role and responsibility of the surgeon to direct and control the prehospital care of the trauma patient. The theme of this, the 71st Oration on Trauma and the 41st Scudder Oration is that, as surgeons, we started this fight in the prehospital care of the trauma patient more than 300 years ago, when Baron Larrey, a surgeon in France, developed for Napoleon a system of emergency response to trauma that we still use today. We have continued it through a large part of its history until this point, but now we seem to be losing interest. It is my goal to emphasize to you, the current leaders in trauma, that this trend must be turned around and that we must assume our rightful responsibility in the total care of the trauma patient.

To achieve this goal, we will review some of this surgical history and the Scudder Orations that have addressed prehospital care, point out some of the impor-

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Abbreviations and Acronyms

ACS = American College of Surgeons
ATLS = Advanced Trauma Life Support
COT = Committee on Trauma
EMS = emergency medical service
EMT = emergency medical technician
EMT-P = emergency medical technician-paramedic
GCS = Glasgow Coma Scale
NREMT = National Registry of Emergency Medical Technicians
PHTLS = Prehospital Trauma Life Support

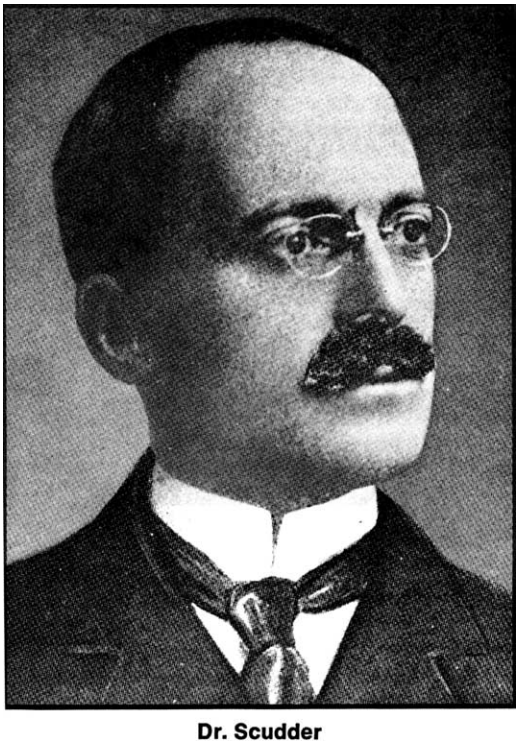
tant contributions that surgeons have made, and emphasize what we, as surgeons, must continue to do for the benefit our patients. The importance that prehospital care has played over the years in the care of the trauma patient is underlined by the fact that one-third of the Scudder Orators have taken a portion of the Oration to indicate their concern about the treatment of the patient before arrival at a hospital.

Trauma is a surgical disease from beginning to end. Trauma begins when the incident occurs. Trauma care begins when the first emergency medical technician (EMT) or first responder arrives on the scene, *not* when the patient arrives in the hospital.

In the first "Oration on Fractures," Dr Scudder[1] discussed unsolved problems of that day. Substituting the term *prehospital care* for *fractures*, they still apply today: clinical observations for dependable conclusions; relationship of emergency medical services (EMS) to the industry; and new methods and treatments.

Fraser B Gurd, MD, FACS,[4] in his Scudder Oration in 1939, discussed the importance of training individuals in the management of trauma (Fig. 2). At least half the care provided in the golden hour is in the hands of the EMTs. This should be in ours hands as well. We should be involved in the education and ongoing care provided to the injured patient. Trauma is a team effort; EMS is part of that team. Surgeons should be the captains and coaches of these teams.

We must regain control of the care in that first 30 minutes of management of the trauma patient, that we have given away. I said *control* because I meant it. The EMTs are the eyes, ears, and hands of the surgeons. That control must assure proper care for our patients. We must not abandon our patients at the time of their greatest need. Surgeons understand the totality of trauma



Dr. Scudder

Figure 1. Charles L Scudder, MD. (Reprinted courtesy of the American College of Surgeons.)

Figure 2. Fraser B Gurd, MD, FACS. (Reprinted courtesy of the American College of Surgeons.)

Table 1. Pathophysiology of Trauma

Energy exchange	→	Tissue damage, organs are torn loose	→	Hemorrhage begins
Airway and ventilation compromise	→	Reduction gas exchange	→	Anoxia begins
Perfusion reduced	→	Anaerobic metabolism begins		
ATP production drops	→	Energy production plummets	→	Shock begins
Patient begins to die				

from beginning to end. You would not call a nonsurgeon to fix a gunshot wound of the aorta for you. Why then, would you let one with less than your understanding of the pathophysiology of trauma direct the early trauma management of the patient? *Trauma is a surgical disease, from beginning to end.* We must not abandon the care of trauma patients for 30 minutes or more before we see them.

The uniqueness of trauma and the surgeon's role in its management

The pathophysiologic process of the condition that we call trauma begins at the time of the initial energy exchange between the human body and an object.[5] They are moving at different rates, with an energy force differential. Impact between them transfers energy from the hardest object to the softest one. The soft one is usually the body of our soon-to-be patient. Because energy can be neither created nor destroyed, this interaction of motion with the human body exchanges the energy and produces tissue damage.

Cells are damaged, organs are torn loose from their attachments, and hemorrhage begins. If this impact affects the brain and the driving force of ventilation, the lungs' ability to exchange gases, or the size or position of the airway, anoxia begins. If hemorrhage continues, there is volume loss from the cardiovascular system and the delivery of oxygenated red blood cells is reduced. This is loss of the first two components of the Fick principle. Anaerobic metabolism begins. The onset of anaerobic metabolism shifts the cellular ATP production from 38 to 2 mmol. This change results in a major reduction of the body's ability to produce the necessary energy for organ performance and, ultimately, for survival. It is the beginning of the condition that we call shock. At the instant of the energy exchange, the human body begins to die (Table 1).

If we, as physicians, are to intervene, it has to be shortly after the impact, not when the patient arrives at the hospital, or, even worse, in the operating room 30 to 90 minutes later. Our intervention must start in the field and continue through transportation, in the resuscitation suite, the operating room, the ICU, to discharge, and beyond. Both short- and longterm outcomes are influenced by the care provided in the field before arrival in the hospital. Patient survival is a reflection of how well we have trained the EMTs to function when we are not present.

Prehospital care is the beginning of surgical patient care

The running man is the symbol of the PreHospital Trauma Life Support (PHTLS) program (Fig. 3). It represents rapid access to the scene, swift and efficient assessment and packaging of the patient, and speedy transportation to the hospital. The main philosophy is judgment based on knowledge. EMS personnel are professionals. They are experts in managing patients in the field, achieving extrication as necessary, making appropriate field diagnoses, and using that information to make decisions necessary to maintain physiology in the best possible condition during transport to the hospital. The PHTLS program teaches that a strong fund of knowledge will allow correct decisions during the chaotic minutes at the scene.[6] This is all very important, but it does no good if surgeons do not interact with the EMTs when they bring patients to the hospital, to critique their care, to teach them better ways to provide such care, to bring them up to date on the latest information on prehospital conditions such as shock, and to emphasize the importance of carrying the patient to the

Figure 3. The Running Man, the symbol of The PreHospital Trauma Life Support program. (Reprinted with permission from Mosby, Elsevier.)

Figure 4. Dr JD "Deke" Farrington. (Reprinted courtesy of the American College of Surgeons.)

trauma center if available. Ask yourself, when was the last time you taught an EMT something in the emergency department? *Trauma is a surgical disease from beginning to end.*

Dr JD "Deke" Farrington[7] spoke of the "Seven Years War" in his Scudder Oration in 1973 (Fig. 4). This was the war against shoddy trauma care in the field. "We have been at war with sudden death and disability for 7 years now, and must decide if we have lost, or are still in the fight. If we are still in the fight, what must we do to ensure victory?"

My personal concern is that 30 years after this plea by Dr Farrington, surgeons are not "still in the fight"; we have abdicated even more of our responsibility for the care of the trauma patient in this critical half hour or more before the patient arrives in the resuscitation suite. I urge you, the current leaders in trauma, resume your duty: the responsibility of the total care of the trauma patient.

Some recent studies have found a delay in getting the patient to the hospital, and this delay has an associated increased mortality rate. These studies are correct. Where are the surgeons in those communities? Why are surgeons not in control of the EMS system to prevent such patient delay? Who is at the EMS quality assurance meeting? We stand back and criticize the EMT but we do nothing about it. Have we lost the guts to fight for our patients? *Trauma is a surgical disease from beginning to end.*

By way of definition, we will use EMT as Dr Farrington described it: emergency medical technician. This is a generic term, encompassing the basic, intermediate, or paramedic. It is not meant to identify the basic level alone.

The four stages of EMS development, in the United States, have been:

1. Throw the patient into the back of a vehicle and run like hell to the hospital providing no care en route. This is the "Grab 'um and Run" approach.
2. Deke Farrington taught the importance of airway management, control of the hemorrhage, stabilization of fractures, and rapid but safe delivery of the patient to the hospital.
3. Cardiologists and anesthesiologists got involved with cardiac patients to provide definitive care in the field. Surgeons stepped back and let the EMTs treat trauma patients the same as cardiac patients (the stay and play approach), with scene times up to 40 to 45 minutes. Trauma patients did not do well.
4. Researchers and surgical leaders such as Frank Lewis and Donald Trunkey produced data and talked about field delay. RA Cowley talked about the golden hour. Surgeons got more involved. We taught, and still teach, as PHTLS developed, the importance of two types of definitive care: one that works for the cardiac patient and one for the trauma patient who needs hemorrhage control in the operating room.

The fourth phase is: Definitive trauma field care or "stabilize and transport." The steps involved in this are: to keep the scene time as short as possible; to establish an airway and initiate ventilation; to control hemorrhage as well as possible; to stabilize fractures; to continue this care en route to the trauma center while starting the appropriate IVs for fluid replacement; and to transport the patient to the trauma center if available.

Definitive trauma field care is short but efficient scene times, ventilation, stabilization of fractures, and continued care en route to a trauma center if available. These are all part of the teachings of the PHTLS course. *Trauma is a surgical disease from beginning to end.*

Current management is definitely not "stay and play" nor is it "load and go." It is quickly providing necessary life-saving care in the field and en route to the appropriate hospital.

William Estes Jr, MD, FACS,[8] as the second Orator after the title had changed from fractures to trauma, in 1953, pointed out the importance of considering the entire body when managing a trauma patient. In his

Figure 5. William Estes Jr, MD, FACS. (Reprinted courtesy of the American College of Surgeons.)

oration, entitled "Present Day Problems in Nonpenetrating Abdominal Trauma" (Fig. 5), he listed several points to improve patient care: importance of a trauma center; transportation to trauma center; surgeons frequently manage trauma; and a hospital should have resources and personnel who have the knowledge to care for these patients.

Estes was one of the first to recognize the importance of a trauma center and that EMS systems should transport all trauma patients to such a facility. He believed that abdominal trauma as a single patient care interest should be changed to the whole of the trauma patient rather than only fractures. The reason was that with the growing interest in automobiles, the increasing speed of automobiles, and the improvement of roads, automotive trauma involving the total body was on the upswing. He reported that 84 consecutive patients with nonpenetrating abdominal trauma were admitted to his clinic from 1935 to 1953. This was a total of 145,733 hospital admissions. This is roughly an incidence of 1 trauma patient in 1,750 admissions. He noted that in civilian life, nonpenetrating abdominal trauma is not frequently encountered by the individual surgeon. Unless a surgeon has had more experience in the management of abdominal trauma, it is difficult to avoid the pitfalls of successful management or successful treatment of these lesions. Estes was describing the trauma surgeon of today.

The mortality rate among the 84 consecutive patients was 17.8%; 4 died of hemorrhage, 3 of peritonitis, 4 of concomitant lung injury, and 1 of cerebral trauma. He pointed out that the factors involved in the mortality included multiple injuries, failure to recognize the abdominal emergency, multiple abdominal regions, late recognition of ruptured viscus, delay in onset of hemorrhage, and delay in signs of perforation. He also noted the importance of observation 24 hours a day and frequent checking and rechecking of all patients when, at first examination, indication for operation was not clear.

These observations are the first indications in the Scudder Orations of the importance of the trauma center and the transportation of injured patients to a hospital where surgeons frequently see these types of injuries. Such hospitals should have the resources, both within the hospital and within the fund of knowledge of the surgeons, to appropriate care for such patients. Estes also recognized the importance of appropriate resuscitation of the patient in shock using plasma and blood, and the appreciation of blood pressure as one indication of the severity of blood loss.

Surgical leadership as advocated by Dr Estes is still required. His recommendations, as of 2003, have not been achieved. Today, in less than half of our cities is the EMS system required to take severely injured patients to the trauma center. The choice of hospital still remains with the patient in far too many places. Surgeons what are you going to do about this where you live? When are you going to force the change? *Trauma is a surgical disease from beginning to end.* Have we forgotten that?

Preston Wade, MD, FACS,[9] was a proponent of prevention and of appropriate prehospital care (Fig. 6). In the 29th Oration on Trauma in 1961, he discussed the importance of seat belt use in producing a reduction of 60% in the frequency of moderate to fatal injuries. This was early in restraint use. Only lap belts were used at that time.

Dr Wade also pointed out the importance of one physician caring for all of the traumatic injuries and not "fragmentation of surgery." This should include appropriate prehospital care "when an accident patient will be transported carefully . . . by qualified personnel . . . to a well equipped specialized trauma facility where he will be properly cared for by surgeons trained in all phases of trauma care." He advocated once again as many orators before him had: *Trauma is a surgical disease from beginning to end.*

Figure 6. Preston Wade, MD, FACS. (Reprinted courtesy of the American College of Surgeons.)

David Hoyt, MD, FACS, discussed this problem in his presidential address at the 62nd meeting of the American Association for the Surgery of Trauma (AAST) in 2003. He created a committee headed by Gregory Jurkovitch, MD, FACS, to solve it. The acute care surgeon may be the new general surgeon of the future. Prehospital care of the surgical patient will be the responsibility of this new surgeon.

For the last 300 years, surgeons have almost single handedly run the medical component of EMS. Only in the last 20 to 25 years have other portions of prehospital care become as prominent as trauma and have physicians from other specialities become involved. Initially, this was the domain of the anesthesiologist and cardiologist and lately, the emergency physicians. We, as surgeons, have given up almost everything, including the trauma patient. This must not continue to happen. I am not suggesting that everyone in this audience should spend as much professional time involved in EMS as I have, as I hope Jeff Salomone will, or as our friend, Scott Frame was doing before his untimely death. I am strongly suggesting that you spend a portion of your time involved. Do not neglect the trauma patient during this critical time. There is much you can do: teach PHTLS, ask questions of the EMTs when they bring the patient into the resuscitation bay, give them lectures, ride with the EMS service a few hours every month or so. They will appreciate it. You will learn a lot, and most importantly, your patients will benefit.

Prehospital care cannot be improved if we stay on the sidelines and in the operating room and criticize. We must get into the game. Involvement also means understanding the world in which EMTs practice. It is rain, snow, cold, hot, life-threatening situations when someone has a gun in your face, a dog charging at you while you are starting an IV, intubating a patient while lying flat on your belly in a mud puddle. I have been in all of those situations, but any EMT can tell you much, much more. If you understand the conditions, you can teach better.

Richard Bell, MD, FACS, put it very clearly, "It is easy for us to practice our craft in the warmth, when it is cold outside; dry, when it is raining; cool, when the sidewalk could fry an egg. Prehospital providers are not so lucky. The floor of my resuscitation bay or my operating room does not bump and sway over pot holes or rounding curves, as I am trying to start an IV, put in an endotracheal tube, or to provide CPR."

Most of you today know the history of surgical involvement since the mid 1980s. Many of you are included in this group. We will bypass that part today and talk about contributions not so familiar to some of you.

The history of EMS can be broken down into several periods for easier understanding: Pre-EMS (3000 BC–1790); Larrey era (1790–1865); military, hospitals, and mortuaries (1865–1950); Farrington era (1950–1970); modern EMS (1971–2010); and low earth orbit and beyond (2000–2050).

Pre-EMS (3000 BC–1790)

Perhaps this journey began with the Egyptians, as indicated in Edwin Smith's Papyrus, or maybe it was the Turks, who had a good EMS system for their military campaigns. We know a little of this history, but minimal prehospital advances occurred or were passed down; wounded lay on the battle field for days. If they lived, they lived; if they died, they died. We do know that the father of modern prehospital care was Baron Larrey, who espoused and began rapid response to the injured soldier for field care by trained medical personnel and rapid return to the hospital.

Larrey era (1790–1865)

Before Larrey, during Napoleon's campaign, it was usual for wounded soldiers to remain in the field 7 to 10 days while the battle raged and until someone got them without providing care and carried them back to a facility.[10]

With his flying ambulance and his trained medical personnel, Larrey went into the battlefield, applied what medical technology was available at the time in the field to control hemorrhage and other conditions, put the patients in the ambulance, and took them to a nearby field hospital to provide care.

Dominique-Jean Larrey[11] was born in Abidjan, France, July 8, 1766. He went to the Alexus School of Surgery in Toulouse. He signed on in Paris as an assistant surgeon to Napoleon's Army and walked 350 miles to Breast to embark. He wrote a medical care book for this 2 year voyage. In 1779, he studied surgery under Desault at Hôtel Dieu Hospital in Paris. He wrote at Lemberg "the remoteness of our ambulances deprive the wounded of the requisite attention . . . . I was authorized to construct a carriage which I called The Flying Ambulances." These vehicles carried one or two individuals lying side by side, they were drawn by one to four horses on a spoked wheel carriage with springs to reduce the jostling of the patient. Attendants could ride with the patients.

His improvements are the foundation of EMS today, which, like flying ambulances, provides rapid response to the field; care provided on scene and en route by training personnel; rapid transport while providing aid; early transport to aid stations; physician involvement in field care; EMS system directed by surgeon; and quality assessment of the care given. Additional improvements were front line hospitals.

The front line hospitals of today are closer to the battlefield than ever before. They are transportable in a Humvee (or Hummer) and can be set up and ready to receive patients within 4 hours. These mobile units can move along with highly mobile military services, as seen in the conflict in Iraq. Much of these improvements in front line care have been led by surgeons. Unfortunately, little happened in EMS development between Larrey's innovations and the time of the War between the States in 1861. When that war started, at least on the Yankee side, prehospital care was not as sophisticated as Larrey's "Ambulance Volantes." In the first battle of Bull Run, fought in August 1862, the wounded lay in the field for days: 3,000 for 3 days, and 600 for a week. The photographer James Brady and the writer Walt Whitman said facilities were primitive and many wounded died in agony. Medical care at that time was provided by the Quartermaster Corps. William Bowditch, MD, led an inspection and noted the atrocities of poor prehospital care. There was poor equipment, the dregs of the quartermaster corps were assigned as ambulance drivers, no care was provided in the field, and they drank most of the medicinal alcohol.

A physician and surgeon, Jonathan Letterman was appointed as surgeon general.[12] A medical corps was created as an independent organization. Letterman inaugurated the same kind of field care Larrey had advocated; by the end of the war good field care was provided. He planned an ambulance service for each army corps with adequate well disciplined personnel, under the sole control of the medical director. His scheme was first used in the battle of Antietam in September 1863. The efficiency of Letterman's plan was in sharp contrast to the haphazard management of the casualties of the earlier battle of Bull Run. Letterman used 300 ambulances, and collected and sheltered 10,000 wounded in 24 hours.[12] *Trauma is a surgical disease from beginning to end.*

The battle ambulance developed by Letterman and by Major General Rucker for the Union Army bore a remarkable significance to the flying ambulance of 1799 developed by Larrey. The ambulance service, or ambulance train as it was frequently called, was equipped to provide this kind of care. Ken Mattox, MD, FACS, one of our previous Scudder orators, assisted Burton Kaplon, MD, in developing the Pneumatic Anti-Shock Garment while working at Ft Rucker in Georgia. Another example of good work done by a surgeon in EMS.

John Henry Durant, Dr Louis Appia, and Dr Théodore Maunoir, in France, believed that the medical corps should be separate from the combatants.[13] Their leadership, at the Geneva Convention of 1864, produced agreements that were adopted by all of the European countries. The document recognized medical neutrality for the hospitals for sick and wounded, for all individuals involved, for ambulances, and it provided for safe passage. The badge chosen was the Swiss flag in reverse: a red cross on a white background. So began the International Red Cross because of surgical leadership.

Military, hospitals and mortuaries (1865–1950)

In the period from 1865 to 1950, the ambulance service became fairly well founded in many cities. In rural areas, development was slow. Most of the changes during this period were surgeon directed. The first civilian ambulance service in the United States was developed in Cincinnati, OH in 1865 at Cincinnati General Hospital. The oldest ambulance

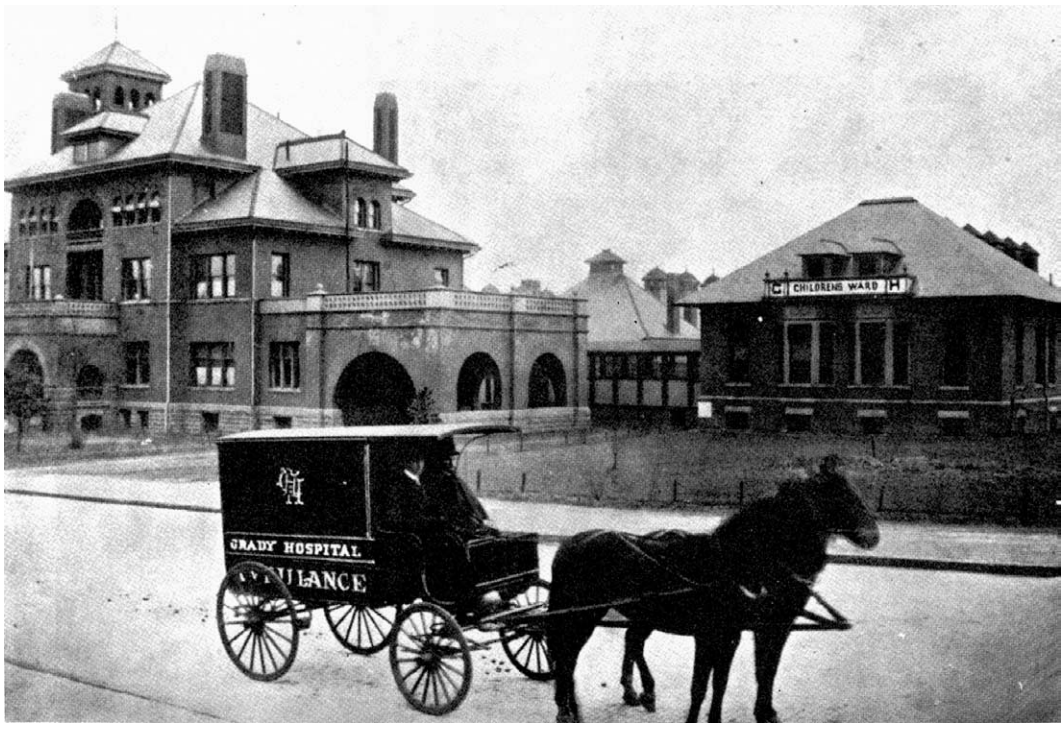


Figure 7. First civilian ambulance service in the United States, Grady Hospital, 1865.

service in the United States, which has been continuously operating as a hospital-based service is at "Mr Grady's Hospital" in Atlanta (Fig. 7).

The first ambulance service in the city of New York was developed in 1869 under Edward Dalton. He was the sanitary superintendent of the New York Metropolitan Board of Health, but had extensive experience as a surgeon during the War between the States. He, as well, understood that *trauma is a surgical disease, from beginning to end.* The ambulance service was based at the Free Hospital of New York (Bellevue).[14] During the first month there were 74 calls. The first full year of operation (1870) there were 466 calls. By the year after, this citywide service ran 4,392 calls. This service was under control of the police, public service, charities, and the private institutions themselves. The trauma box was beneath the seat of the two surgeons who were assigned to the ambulance. It contained a quart of brandy, two tourniquets, six bandages, six small sponges, splint material, blankets, and a 2 oz vial of persulphate of iron. In addition, there was a stretcher, handcuffs, and a strait jacket for the insane.

An early dispatch system worked something like this: the surgeon and driver slept in the barn with the ambulance and the horses. A call came in from the hospital as the ringing of a bell. At the same time a weight was triggered to fall, a gas lamp was lit, which woke the physician and the driver. The harness, saddle, and collar all dropped onto the horse and opened the stable doors. The physician and the driver quickly tightened the straps, and they were off.

Other units of the period had different medications, such as those for poisoning and overdose, anesthetics, morphine, amynitrate, and various other drugs and appropriate equipment. The ambulance surgeons were subjuniors on the hospital staff. They had their MD degrees. Being on the ambulance service was an extremely sought-after position. To get on it, physicians had to take a competitive examination. The services weren't paid because of the education and experience gained by these physicians. Despite medications and equipment, treatment was frequently limited to first aid, and definitive care was performed in the hospital. Interns continued to ride the ambulances well into the latter half of the 20th century. The last interns to ride as ambulance attendants may have been at Charity Hospital, New Orleans in 1969.

Realizing the importance of prehospital care in the management of trauma, the ambulance service at Charity Hospital in New Orleans was started by a surgeon, AB

Table 2. Charity Hospital, New Orleans, Ambulance Service Equipment List, 1885

Chloroform
Sulphuric ether
Whiskey
Brandy
Carbonic acid
Syrup morp
Tr. Opii camph
Hypodermic tablets and syringe
Water
Complete pocket case of instruments
Extra Langenbeck's forceps
Set of three tourniquets
Folding fracture box
Oakum
Surgeon's lint
Sponges
Tracheotomy tube
Water bucket
Liston's long splints (2)
Wooden and tin splints
Bandages
Carpie
Carbolized gauze
Cotton wadding
Pillows
Nelaton's catheter
Pus pans

Miles.[15] This was discussed in a letter to the *New Orleans Medical and Surgery Journal*, in June of 1885. The service was organized by a resolution of the Board of Administrators on February 2 of that year. On the interior, there were the medicine chests, boxes for surgical apparatus, hooks for lines, and easy bed "litter" that could be trundled in and out, and there were separate springs for the bed to provide comfort for the patients (Table 2). Fourteen residents were charged with the special duty as "ambulance surgeons."

Undertakers got into the EMS business very early. In 1880, the Board of Health operated such an ambulance service in Cleveland, OH. In *JAMA* in 1897, the statement appeared "a hospital without ambulance is a hospital without patients." This philosophy is still used today by both ground and air ambulances to attract patients to their hospitals.

The first motorized ambulance operated out of Michael Reese Hospital, in Chicago, beginning February 4, 1899. It achieved a breakneck speed of 16 mph. When President McKinley was shot at the Buffalo Exhibition in 1901, he was transported in a such a motorized ambulance.

The military has played an important role in the development of the civilian ambulance services. Many returning physicians saw the benefits of the military organization of medical care and adapted it to civilian medical care. Most likely, the initial emergency rooms were developed for this reason. Some of the important war-time steps in the improvement of prehospital care included:

Napoleon Wars: Flying Ambulance and field care procedures

War Between the States: ambulance response to injured patients

World War I: Thomas splint

World War II: Corpsmen in the field

Korea: Helicopter transport

Viet Nam: IV fluids and improved field care; bypass of smaller facilities and transport to trauma centers; Military Antishock Trousers (MAST)–the use of a compression suit for restoration of blood pressure after hemorrhage was initially described in 1903 by Dr Cushing.

Farrington era (1950–1970)

"Deke" Farrington, MD, FACS, was the father of EMS in the United States. Almost all prehospital care today is based on his developments, his teachings, and his dedication to the plight of the injured patient.

"Deke" was short for "Deacon" after his father, who was a preacher in the poor south. His mother died of a preventable disease. He went to medical school to improve the situation. He attended the University of Alabama for 2 years and finished his last 2 years at Rush Medical School. In 1967, he published his famous article entitled "Death in a Ditch" describing the poor care provided at that time by emergency medical personnel; this was published in the *Bulletin of the American College of Surgeons*.[16] The article truly captures his personality and the aggressive and forceful way that he brought about major changes in the EMS system in the United States. It is a classic article. I would encourage you to read it. Along with another surgeon, Dr Sam Banks (Fig. 8), Farrington developed a training program for the Chicago Fire Department in 1957. This became the basis for what we now know as the EMT-Basic program and the format on

Figure 8. Dr Sam Banks. (Reprinted courtesy of the American College of Surgeons.)

which the EMT-P (EMT-paramedic) training program is developed.[17]

Dr Farrington was involved in all aspects of patient care in the field. The EMT training program, the *Essential Equipment List for Ambulances* published by the Committee on Trauma (COT), the National Academy of Sciences/National Research Council "White Paper,"[18] and the KKK 1822 standards of the Department of Transportation, for ambulance design. He, along with Rocco Morrando and others, formed the National Registry of EMTs (NREMT), and the National Association of EMTs (NAEMT).

The Star of Life was developed by the American Medical Association (AMA) to use as an alert of medical conditions for medical providers (MedicAlert). It symbolizes the crossing of the three rivers of life and the staff of Aesculapius. It was patented in 1967 by the AMA. When the American National Red Cross (ANRC) refused to allow the Red Cross symbol on ambulances, Dawson Mills, Robert Motley, and Leo Swartz of the Department of Transportation asked Deke and Rocco for use of the Star of Life, and it became the emblem of EMS. It is now used throughout the world.

"In 1968, the guidelines for the training of ambulance personnel were published by the National Academy of Sciences and the National Research Council, and a year later, the curriculum for the basic instruction of emergency care, consisting of 24 lessons, tested in a rural community for 2 years" (from Dr Farrington's Scudder Oration).[7] In all his modesty, what he neglected to say is that it was in his community of Minocqua, WI that this curriculum was tested and perfected under his leadership. In reading his Scudder Oration, one has a feeling that a lot of things were done at that time—and they were. What one does not get, however, is that Dr Farrington's hand was in each and every one of these organizations, their publications, and the use of these publications in revising the prehospital care in the United States. *Trauma is a surgical disease from beginning to end.* (A surgeon, 'Deke' Farrington was there).

In 1971, after 5 years of preparation, the American Academy of Orthopaedic Surgeons (AAOS) published the major textbook for education of EMTs titled *Emergency Care and Transportation of the Sick and Injured.* This effort was the brainchild of Walter Hoyt Jr, MD, FACS (Fig. 9). It is now in its eighth edition. It is the largest selling basic EMT book, and has brought more

Figure 9. Walter Hoyt Jr, MD, FACS.

Figure 10. Alan Dimick, MD, FACS. (Reprinted courtesy of the American College of Surgeons.)

than $35 million to the American Society of Orthopaedic Surgeons during the 32 years since it was first published. Dr Hoyt was the father of our immediate past chairman of the COT (David Hoyt, MD, FACS). David wrote, "I'm very proud of having been associated with efforts at our dinner table when I was in college. When I was away, at college, he sent me articles of the chapters to review." Other surgeons, such as James Hickman, MD, FACS, and Lenworth Jacobs, MD, FACS, have continued to edit the book.

Following are some of the highlights of surgical involvements in the development of prehospital care.

Surgeons saw the need for the emergency physician. The ACS refused to include them as a part of the College organization, so they founded the American College of Emergency Physicians. The American College of Emergency Physicians, and the American Association of EMS Physicians, although both organizations are mostly emergency physicians, have played an important part in EMS in the US.

In 1954, Alan Dimick, MD, FACS, completed an EMS survey as the chair of the Prehospital Care Subcommittee. You can see where EMS stood at the time (Fig. 10). It was his insistence as the chair of the AMA Commission on EMS that an EMT-P accreditation committee was developed. Dr Dimick has been a major influence in my life, while I was a student at Alabama and throughout my career, as a mentor, as a door opener, and as a friend.

The JRC/EMT-P was formed to accredit the EMT-P programs in the United States. This committee was a major factor, along with the NREMT toward standardization of EMT-P training programs across the US. The ACS was one of the initial founding members, and surgeons have been leaders in the organization.

An article in the *Saturday Evening Post* in 1955 sought to inform the public that injured patients should not be moved at the scene, and should await the arrival of the ambulance personnel who were trained to care for such patients without inflicting additional harm. It was entitled, "Let those crash victims lie."

In May of 1957, *Reader's Digest* published an article that stated that physicians do not stop at road side crashes because of the multiple lawsuits against physicians for providing such care. Within the next 10 years, 37 states passed good samaritan laws protecting emergency medical workers from such lawsuits. All good and all important. But before this, not a single recorded court case of such legal action was to be found. *Reader's Digest* later acknowledged its error and printed a retraction. Our good samaritan laws are based on a fabrication of the press.

Modern EMS (1971–2010)

This period has produced an explosion of developments and changes in the care of the patient in the prehospital period.

Within the COT, the Emergency Care (Prehospital) subcommittee chairs assisted with strong EMS development. This committee interacted with other groups involved in prehospital care such as the NAEMT, NREMT, the American Association of Orthopaedic Surgeons, the American College of Emergency Physicians, and the EMS directors association. It was the liaison for the ACS to the EMS community.

The *Essential Equipment List for Ambulances* was developed by the COT. It has maintained the high standard initially developed by Dr Farrington and Dr Oscar Hampton. It continues to be a product of the Emergency Care (Prehospital) Subcommittee of the COT. Recently the ACS/COT and the American College of Emergency Physicians worked together to produce a combined document.

Although neglected by many EMS historians, the midsection of the country was involved with strong sur-

Figure 11. Left, first civilian helicopter service in the United States (reprinted with permission from Henry Cleveland, MD, FACS); right, Henry Cleveland, MD, FACS.

gical leadership. When I arrived in Kansas in 1973, I was surrounded by states with outstanding statewide EMS. This was very progressive for the early 1970s. In Nebraska, there was Kim Kimball, MD, FACS, and Robert Gillispie, MD, FACS, the ACS/COT chairman at the time; in Iowa was Don Boyle MD, FACS; in Missouri, a recent Scudder orator, Frank Mitchell, MD, FACS, was the state medical director and Oscar Hampton, MD, FACS, was active in NREMT with Deke Farrington and later Trauma Director for ACS; and on the western side, in Colorado, Cuthbert Owings, MD, FACS, was active as a leader and as an educator.

Others were also important: Curtis Artz, MD, FACS, contributed nationally to work in both burns and EMS, and Charlie Wolferth, MD, FACS, was an early EMS system innovator in Pennsylvania.

Helicopter transportation of patients from the scene has made a major contribution to prehospital care. The first civilian hospital-based ambulance was developed at St Anthony's Hospital in Denver, by a surgeon, Dr Henry Cleveland (Fig. 11). This technique has promoted controversy and there have been misuses and abuses, but in the long run, much has been accomplished. Much still needs to be done. To some hospitals it has become a flying billboard. Other hospitals have used it appropriately.

Dr Howard Champion added two parts to the puzzle of prehospital triage. These are the trauma score and Glasgow Coma Scale (GCS). Dr Tisdale, the inventor of the GCS, developed it not for use in the field, but at 12 to 24 hours postinjury. He was very unhappy when Dr Champion introduced it to EMS in 1973. We are not. EMTs are taught this important technique and it should be a part of their oral report to the trauma team. Surgeons, if your EMTs do not report the GCS from the field it is your fault for not being more involved. If you do not know whether they report GCS or not, then shame on you. *Trauma is a surgical disease from beginning to end.*

A surgeon, RA Cowley, MD, FACS (Fig. 12), the founder and director of Maryland Institute of Emergency Medical Services, left us with three important legacies: the trauma center, the statewide EMS system, and the concept of the golden hour.

He described the period from injury to definitive care as the golden hour, when patient care was the most critical. In most urban systems, the access time is around 8 minutes, with under 10 minutes of field care (as is taught in the PHTLS), and a transport time of 8 minutes. Almost half the golden hour has passed when the patient arrives in the hospital. The patient is just as dependent on us during this time as when we are with the patient in the operating room. When the 1973 EMS legislation was passed, David Boyd, MD, FACS, a trauma surgeon, accepted the job of running the program for Department of Health Education and Welfare (DHEW) and soon had the whole country organized in the provision of good trauma care. In a period of 6 years he put in place a system of patient care that stands as the

Figure 12. RA Crowley, MD, FACS.

prototype of our EMS systems. His 15 components continue today in our national EMS programs.

Low earth orbit and beyond (2000–2050)

The next big step in prehospital care will be the trip out of low earth orbit for an exploratory mission, perhaps to Mars. A possible window for such a trip would be in 2014, but with the problems with the shuttle program, 2020 is a more likely time. One of the first projects is to design and educate the physician who will be on the trip to provide medical care for the 30 to 36 months with preconditions of no return and no resupply. The initial design was undertaken in the spring of 2003. Several surgeons participated in the process. There will be more. Much will be involved in the education of this physician and surgeon. He or she will need to know many aspects of medicine and surgery.

Gadgets and equipment in EMS

Paul B Magnuson, MD, FACS,[19] discussed what continues to be present today: materials, equipment, and supplies used in the field that have no basis in science. They come only from the fertile imagination of a practitioner delivered to the greed of an entrepreneur, and sold without proper research. Do you know what gadgets are in use in your EMS service? Have you read the research on them? You would not allow an unproved suture to be used on your patients in the operating room. Why do you allow unproved gadgets to be used in the field?

Dr Magnuson[19] pointed out in his 1935 Oration that the concept of lower leg traction was initially described by Hippocrates, who pushed the foot away from the knee using elastic rods. Later, Galen used pulleys for the fractured femur. Hippocrates described reduction of a forearm fracture by placing an individual in a standing position with the arm over the rungs of a ladder and using pulleys to reduce the fracture (Fig. 13).

George Hare perfected traction for fractures of the lower leg in 1967. This was an improvement on the Thomas splint and the Thomas half ring splint developed by Owen Thomas of Liverpool in 1880. Credit has been given to this splint for reducing deaths from fractures of the femur by 80% in World War I. Vharus demonstrated this was only 31%, but nonetheless, it is good and it works.

William Blaisdel, MD, FACS,[20] Scudder orator in 1982, was dedicated to prehospital care. He was involved in the development of a sternal screw for administration of fluids in the field. You will also remember that Alex Haller, MD, FACS,[21] in his Scudder Oration 2 years later, discussed intraosseous infusion as an important method of fluid replacement. Most prehospital units today use those techniques, but this is not new. The technique and the needles to carry out sternal puncture was discussed by the 13th Scudder orator in 1941, Walter Estell Lee, MD, FACS.[22] He noted Tocatins in Philadelphia did the procedure. The needles were 15 gauge and initially made by the George Piling Co in Philadelphia.

Education by surgeons in EMS

The first Scudder orator from New Orleans and Charity Hospital, Dr Isidore Cohn,[23] in 1938, pointed out "Surgeons should not hinder the progress, but should be actively involved in the management of patients during this critical time" (Fig. 14). A very critical time is before the patient arrives in the hospital (Table 3). George J Curry, MD, FACS,[24] orator in 1958, pointed out that it is our responsibility to improve prehospital care; it is vital and is the overture to definitive care. Walter Estell Lee, MD, FACS[22] (Scudder Oration 1941), pushed "the need for an educational program aimed at the improve-

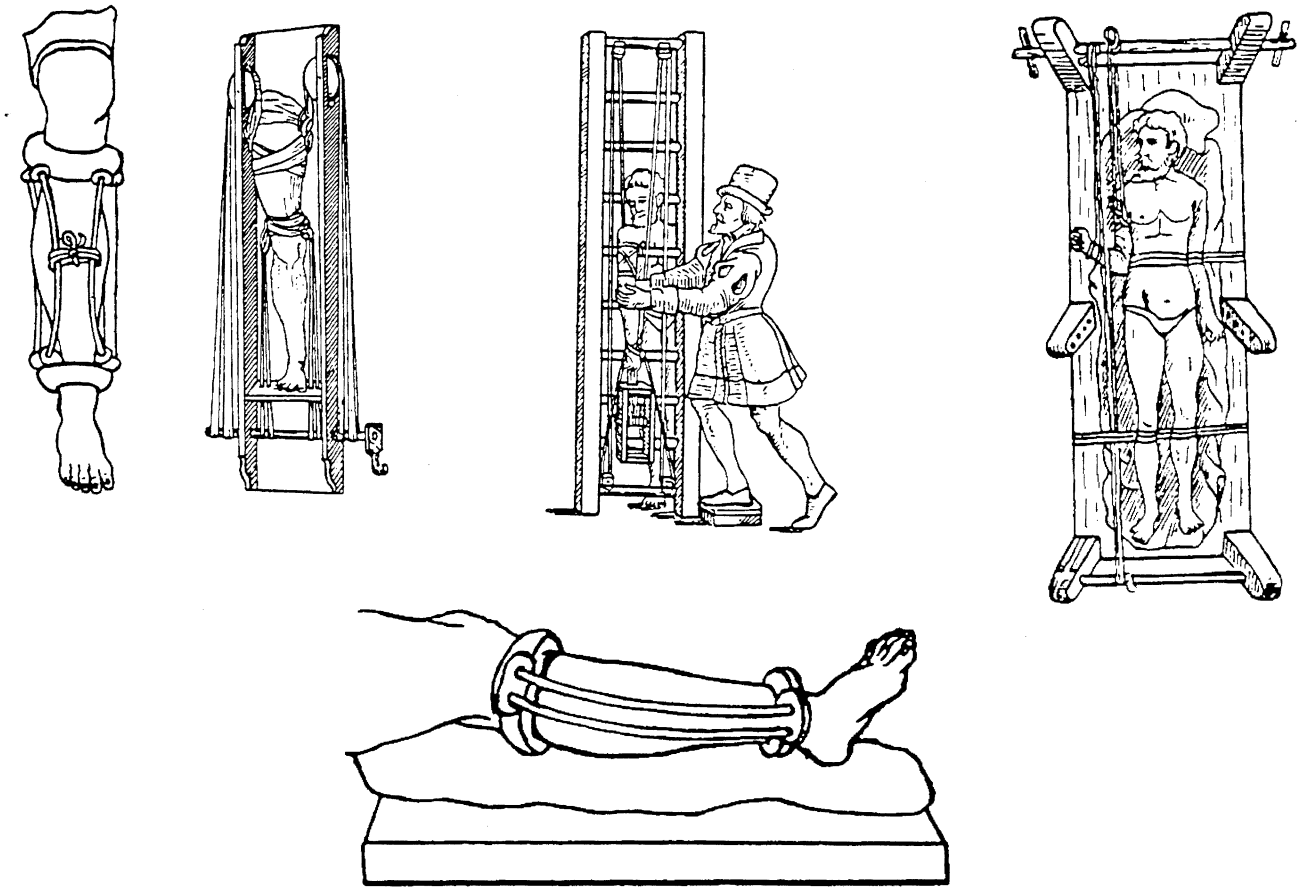


Figure 13. Concept of lower leg traction described by Hippocrates and developed by Galen.

ment in the care of trauma of all kinds." One can easily say that the Advanced Trauma Life Support (ATLS) and the PHTLS programs are the fulfillment of Dr Lee's advocacy.

Robert H Kennedy, MD, FACS,[25] in his 1954 oration, "Our Fashionable Killer," pointed out the relationship of automotive trauma to a major increase in trauma deaths in the United States (Fig. 15). He showed in his oration that at the scene of an accident, first was to determine whether the patient is breathing and if so, open an airway. Two or 3 minutes of oxygen deprivation to the lungs seemed to be an absolute limit before permanent damage occurred to brain tissues even if life was maintained. Methods of combating shock, the site of the accident are easily learned and carried out. Much time is spent by first aiders in memorizing pressure points to stop hemorrhage—they are practically useless. Every external hemorrhage can be stopped by pressure on the bleeding site by the finger or hand if that is achievable. He discussed the ABCs of trauma management, which are today part of the ATLS and PHTLS training programs. The ATLS and the PHTLS courses are founded on the principles that Dr Kennedy espoused. "All of the above factors in first aid concern also the personnel, all of the ambulances, Morticians, are responsible for most of the ambulances in this country with the remainder in charge of police and fire departments, industry volunteers, and hospitals in that order."

Dr Kennedy stated we must take seriously the education of the interns, residents, and the prehospital care personnel because the life you save thereby may be your own. Dr Kennedy went on to point out that whether effective life saving first aid and transportation are rendered depends largely on how much responsibility is accepted by the public, particularly by the medical profession, and to demand them in the local community. His *Early Care of the Injured Patient* was the forerunner of the ATLS and PHTLS programs.

Paul "Skip" Collicott, MD, FACS, and other surgeons from Nebraska initially developed the ATLS

Figure 14. Isidore Cohn, MD, FACS. (Reprinted courtesy of the American College of Surgeons.)

course. It has continued within the ACS/COT with the expert management of Irvene Hughes. It has progressed a long way from that cold day in January of 1980, when the course was started for the ACS. The program has trained about 400,000 physicians in 46 countries.

The PHTLS program, following in these footsteps, has trained almost 400,000 prehospital personnel in 35 countries. This could not have been done without the active support of the COT, the state, and the provincial COT chairmen, and the leadership of ATLS. This work needs to continue. I hope that each of the state and provincial committee chairs has appointed the PHTLS coordinator to your committee. If not appoint that person as soon as you return home.

In the mid 1980s, the negative effect of prolonged prehospital care for the trauma patient became apparent. Frank Lewis, MD, FACS, demonstrated that there was a loss of benefit of IV fluids, if starting the IV in the field delayed transportation to the hospital. This and other research lead to the realization that definitive care of the medical patient is different from that of the trauma patient. PHTLS teaches stabilization and transport, insisting that transportation must be initiated if at all possible within 10 minutes of EMS arrival. Each time a patient arrives in your emergency department, do you check to see that the field time was less that 10 minutes? Does your quality assurance process track this? What is the benefit of the excellent ACS teaching program for your EMTs (PHTLS) if you do not enforce its principles.

One of the major reasons that PHTLS is today what it should be is work of the chairman of the PHTLS committee, Fire Chief Will Chapleau. Jeffery Salomone has assumed the duties of the executive editor of the sixth edition. In addition, there have been 10,000 instructors in the United States and across the world working to provide education to those who deliver trauma care. In 1981, when the ACS decided that the ATLS course was for physicians only, a group from NAEMT took on the responsibility of the education of the prehospital provider in the field management of trauma. This was done "in cooperation with the Committee on Trauma of the ACS."

Trauma care is a true team effort. Many surgeons have not recognized prehospital trauma care as an important determinant of trauma outcomes. In his Trinidad and Tobago study, Jamal Ali, MD, FACS, and colleagues[26,27] reported that the ATLS program could influence hospital outcomes, but the overall outcomes for these countries was not improved until the prehospital care was upgraded through PHTLS (Fig. 16).

Dr Richard Bell, a past chair of the ATLS subcommittee noted:

1. PHTLS, like ATLS, has made a difference worldwide.
2. Definitive care is provided in the field and in the hospital. Delivering the patient to the correct hospital is part of that care.
3. Patients are arriving at the doorway of the hospital today who would not have survived the prehospital period several years ago.

"Rural mortality from trauma was 70% higher than urban. The overwhelming cause of this dismal difference was the near complete absence of prehospital care. With full-time well-trained ambulance personnel staffed 24/7, mortality has markedly declined in rural areas." (Richard Field, MD, FACS, 26 November 2002).

Jay Johnannigman, MD, FACS, added "PHTLS makes the EMT a part of the trauma team. Surgeons should be proud of this fact" (personal communication, 2000).

Table 3. Emergency Medical Services Learn from Your Attention and Teaching

When a patient is brought into you do you check to see if the splint was applied effectively?
If so did you congratulate the EMT for a job well done?
If not, do you quietly correct his technique and admonish him to do it correctly the next time?
Each time you teach the EMT, you help your next trauma patient.

EMT, emergency medical technician.

Figure 15. Robert H Kennedy, MD, FACS. (Reprinted courtesy of the American College of Surgeons.)

The motto of PHTLS is: "Extending the hand of education to those who care for the trauma patient." PHTLS teaches, "Patient care decisions are made based on a strong fund of knowledge," no parrot phrases. The EMT should not be a robot in the field blindly following a protocol that may not apply in the situation as it exists. Rather, the EMT should be a thinking individual, using knowledge and skill to provide the very best care possible based on condition and immediate situation at the scene.

After each patient is delivered to the emergency department, the surgeon should discuss with the EMT the care given, alternative pathways that could be followed, and the knowledge needed to make those decisions. After all . . . . . *Trauma is a surgical disease from beginning to end*.

Dead patients are dead and should not be transported by EMS. Valuable resources are lost and endanger the EMS personnel by this needless practice. The ACS/COT and the National Association of EMS Physicians have developed a combined position paper.[28] Surgeons should work actively within the EMS system to institute the process in your home EMS system. Protect your EMTs.

In conclusion, *trauma is a surgical disease from beginning to end.* I leave you with six goals as you return to your own EMS systems:

Goals

T- Time. Give a little. When you are on trauma call, talk to the EMTs after they offload the patient. Teach them something.

R - Review the run reports. Check field time, check procedures. Check patient care.

A - Assure that all trauma patients are brought to the trauma center. Not patient choice.

U - Understand what life is like in the field. Ride with the EMTs once every couple of months for just 4 hours.

M - Mortality. If patients are dead, leave them in the field. Do not allow EMS to transport with lights and siren. Too dangerous for the EMTs! Wastes resources!

A - Acquaint EMTs with trauma knowledge. Teach in one PHTLS course each year.

Jack Wickstrom, MD, FACS[29] (Fig. 17), the second Scudder Orator from New Orleans and Charity Hospital, pointed out that the word *doctor* comes from Middle English *doctour*, meaning "teacher," which, in turn, is derived from the Latin *docere*, to teach. We, as doctors, must be teachers.

Wickstrom identified three major areas that the surgeon must teach: undergraduate and graduate trauma education; education of paramedical personnel; and education of the public, particularly the public officials.

Tinsley Harrison, MD, the greatest teacher I have known, penned the following paragraph. It appeared as the opening of *Harrison's Textbook of Medicine*:

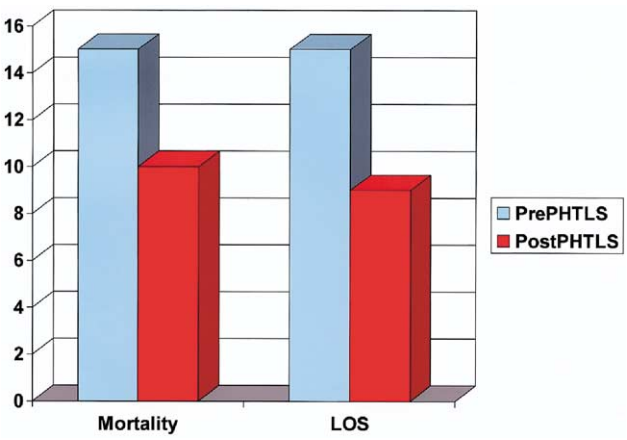


Figure 16. Overall outcomes for prehospital care in Trinidad and Tobago.[26,27] LOS, PHTLS, The PreHospital Trauma Life Support program.

Figure 17. Jack Wickstrom, MD, FACS. (Reprinted courtesy of the American College of Surgeons.)

> No greater obligation, opportunity or responsibility can fall to the lot of a human being than to become a physician.
>
> In the care of human suffering he needs technical skills, scientific knowledge, and human understanding.
>
> He who uses these with courage, with humility and with wisdom will provide a unique service for his fellow man and will build an enduring edifice of character within himself.
>
> The physician should ask of his destiny no more than this; he should be content with no less.[30]

Trauma is a surgical disease from beginning to end. Our obligation for trauma care starts when *our* EMTs first touch *our* patients. We are the teachers and supervisors of EMTs in trauma care.

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