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APSA Presidential Address

Redefining Ladd's path☆,☆☆

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ABSTRACT

Inspiration and innovation go hand in hand. Throughout history tragedies, including those personal and life altering, have inspired susceptible minds to find innovative ways to educate and tackle difficult problems. This address is first about origins. It weaves the story of how incredible individuals and events have shaped similar circumstances into not only our profession of pediatric surgery beginning with William E. Ladd, but also the emergency and trauma care system in this country. The address circles back to look at the past and future of our profession of pediatric surgery. Predictive models forecast that we are training too many pediatric surgeons in the traditional sense. The address describes how we might envision a paradigm shift in training using a different model and capitalizing on the talents of more young surgeons who want to take care of children. We are an incredible profession, but many have abdicated a need to include trauma patients and critical care in their practice of pediatric surgery. The model would include different pathways of training, enable more surgeons to be capable in aspects of children's surgical care, and provide optimal general surgical care for more children in the United States. This is an opportunity to redefine Ladd's path.

1. A history lesson: Appreciating our roots

Trauma and emergency care for children are inextricably linked to the discipline of pediatric surgery, as are the three distinct parts of this address. I will strive to define some of the historical highlights that defined emergency care, originating with the roots of our profession as defined by William E Ladd. I will provide a snapshot of the current landscape of children's emergency healthcare. Last, I will share some of the unmet needs of children's surgical care and opportunities that may help frame a paradigm shift in how we consider training the pediatric surgeons of the future.

Abbreviations: ACGME, Accreditation Council for Graduate Medical Education; ATLS, Advanced Trauma Life Support; ACA, Affordable Care Act; AAP, American Academy of Pediatrics; AAST, American Association for the Surgery of Trauma; ABS, American Board or Surgery; ACS, American College of Surgeons; ACS COT, American College of Surgeons Committee on Trauma; Pediatric National Surgical Quality Improvement Program (Pediatric NSQIP), American College of Surgeons and its Verification Programs for Trauma and Optimal Resources for Children's Surgical Care and companion quality programs; APSA, American Pediatric Surgical Association; APSTPD, Association of Pediatric Surgery Training Program Directors; CHA, Children's Hospital Association; CSH, combat surgical hospitals; HHS, Department of Health and Human Services; DOT, Department of Transportation; EDs, Emergency Departments; EMS, Emergency Medical Services; EMSC, Emergency Medical Services for Children Program; FICEMS, Federal Interagency Committee on EMS; FST, forward surgical teams; HRSA, Health Resources and Services Administration; IOM, Institute of Medicine; KID, Kids' Inpatient Database; MASH, mobile Army surgical hospital; MTSPE, Model Trauma System Planning and Evaluation; NASEM, National Academies of Sciences, Engineering, and Medicine; NEMSAC, National Emergency Medical Services Advisory Council; NHTSA, National Highway Traffic Safety Administration; NRMP, National Resident Matching Program; NICU, neonatal intensive care unit; PALS, Pediatric Advanced Life Support; PTC, pediatric trauma center; RRC, Residency Review Committee; SCORE, Surgical Council on Resident Education; Pediatric TQIP, Trauma Quality Improvement Program.

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1.1. The origins of pediatric surgery

Seminal events in history have shaped our surgical care of children, often involving the care of the injured. Many of these events did not specifically consider children at the outset. Inevitably the fate of children was affected and addressed, often in retrospect.

The origin of pediatric surgery in North America is attributed to William E Ladd, following his medical trip to aid the citizens of Halifax, Nova Scotia after the explosion of the SS Mont Blanc on December 6, 1917 [1]. This French freighter was carrying TNT in the holds simultaneous with carrying metal drums of aviation fuel on the decks. The Mont Blanc collided with a Norwegian freighter, the SS Imo, in the straits of Halifax harbor near a crowded tenement district, causing the gasoline to catch fire. The inferno brought families to their windows just before the TNT exploded, obliterating 2 ½ miles of the northern slope of Halifax. Many died instantly, but a number of the survivors, including children, were blinded or had severe facial injuries, providing the impetus for Ladd to become interested in children's surgery as well as plastic and reconstructive surgery. Twenty years later, Ladd became a founding member of the American Board of Plastic Surgery and a charter member of the American Board of Surgery. Following the Halifax explosion, Ladd began to spend more time at Boston Children's Hospital and ultimately became committed to children's surgery. Widely regarded as the "Father of Pediatric Surgery in North America", he trained Dr. Herbert Coe of Seattle as the first trainee in pediatric surgery. Dr. Robert E Gross, another pioneer in pediatric surgery, came to work as a full-time associate of Dr. Ladd in 1939.

The initial textbooks that considered surgical problems of children were often written by orthopedists, as the diseases encountered including tuberculosis involved bones and the spine. The first textbook devoted entirely to the surgical "affections" of children by an American writer was Surgical Diseases of Children written by Samuel W. Kelley and first published in 1909. [2] Doctor Kelley considered himself an orthopedist and pediatrist. In photos from his book, there are prototypes of the cervical collar and TLSO brace, which were used to treat tuberculosis of the spine. Dr. Kelley calls attention to a book of nearly 700 pages published in 1869 by Timothy Holmes, an English surgeon, titled "Surgical Treatment of Children's Diseases" [3]. Holmes was better known as the editor of the third through ninth editions of *Gray's Anatomy*[4]. Dr. Holmes text is regarded as the very first textbook to deal exclusively with pediatric surgery. There is little written about trauma as we currently describe it in these textbooks of the past, outside of burns and fractures. Dr. Ladd's vast experience in the surgical problems of infants and children was first published in 1941 [5]. This textbook references traumatic rupture of the spleen and trauma to the gallbladder and bile ducts. There is a chapter on foreign bodies in the gastrointestinal tract. Dr. Gross's book titled "the Surgery of Infancy and Childhood" published in 1953, addresses these topics again but adds a chapter on Wringer Injuries of the Arm, after the introduction of power-driven washing machines with an open ringer for partially drying clothes [6]. As opposed to the past, where injuries were more often the result of infectious diseases and ingestions, the traumatic injuries that we see in children today are largely the result of rapid technologic advances that outpaced the recognition that injury prevention would also be of paramount importance.

1.2. The origins of contemporary trauma and trauma systems

Perhaps one of the most important contributions to the creation of trauma as a discipline was the invention of the automobile. Nicholas-Joseph Cugnot built the first steam-powered automobile capable of human transportation in 1768 [7]. In 1807, François Isaac de Rivaz designed the first car powered by an internal combustion engine fueled by hydrogen [8]. The first recorded auto accident occurred in 1869; Irish scientist Mary Ward was riding in a steam-powered automobile, was ejected, one of the wheels rolled over her, and broke her neck, killing her instantly [9]. There were, of course, no seatbelts. In 1886, Karl Benz invented the first petrol- or gasoline-powered automobile [10]. In 1896 (London) and 1899 (New York City) were the first recorded pedestrian deaths due to motor vehicles [9]. The first reported driver fatality from a collision was reported in 1898 [9]. With increasing auto popularity in the 1920's and 1930's came more accidents and thus a need for emergency services. In 1960, President Kennedy announced that traffic accidents in the United States were a major public health problem needing attention [11].

The development of systems for trauma care in the United States has been aligned with lessons learned in wars, which by necessity led to salient contributions in an effort to save lives [12]. During the Revolutionary War, surgical procedures were limited for the most part to soft tissue injuries and amputations. The American Civil War was noteworthy for contributions made to the early development of systems for trauma care, including the need for an extensive infrastructure to support surgeons and care for the wounded [13]. This was the first armed conflict where anesthetics were used routinely. The use of blood for resuscitation became common in World Wars I and II (Fig. 1). During World War II, there was a reemphasis on the treatment and care of wounds. Between the Korean Conflict and the Vietnam War, the cellular effects of severe hemorrhagic shock were recognized and the treatment of patients with shock was altered. Survival improved during the Vietnam Conflict not only due to improved treatment, but also to improved triage and transport. Survival rates improved dramatically when patients were stabilized in the field and transported immediately to a well-equipped emergency facility. During the 1960s, civilian medical and surgical communities began to apply this principle to an EMS system. Operation Iraqi Freedom may be the last military campaign to utilize the services of a mobile Army surgical hospital (MASH) [14]. MASH units were designed as mobile, flexible, forward-deployed military hospitals, providing care for the wounded near the frontlines of the battlefield. These hospitals saved thousands of lives during war and greatly influenced the delivery of trauma and critical care in civilian hospitals. Now there are combat surgical hospitals (CSH) and forward surgical teams (FST). The recent report from the National Academies of Sciences, Engineering, and Medicine (NASEM), A National Trauma Care System: Integrating Military and Civilian Trauma Systems to Achieve Zero Preventable Deaths, confirms the need for stronger integration of lessons learned, particularly the need to more fully integrate military and civilian trauma systems as well as pre hospital and trauma center care [15].

1.3. Origins of emergency medical services

The parable of the Good Samaritan exemplifies the beginnings of Emergency Medical Services (EMS) [16]. It is a didactic story told by Jesus in Luke about a traveler who is stripped of clothing, beaten, and left half dead alongside the road. First a priest and then a Levite come by, but both avoid the man. Finally, a Samaritan comes by. Samaritans and Jews generally despised each other, but the Samaritan helps the injured man. The colloquial phrase "good Samaritan", meaning someone who helps a stranger, derives from this parable, and is fulfilled in the profession of EMS providers.

Napoleon Bonaparte's chief physician, Dominique Jean Larrey, was instrumental in the development of "scene runs" for ambulances. He was distressed that wounded soldiers were not picked up immediately

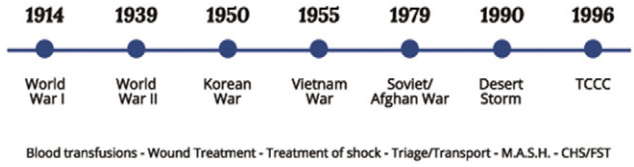

Fig. 1. Many noteworthy achievements in trauma care that resulted in enhanced survival were lessons learned from military experience. Abbreviations: M.A.S.H. (mobile Army surgical hospital); CSH (combat surgical hospitals); FST (forward surgical teams) Figure created by Krista Walker.