

REVIEW

Acute Care Surgery in the US – A Review and Personal Experience

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ABSTRACT

Acute care surgery is a new specialty created in response to the erosion of traditional general surgery and trauma surgery models. Multiple surgical societies have successfully developed the definition, designation, and training of an Acute Care Surgeon over many years. These are applicable worldwide. In the US, most larger hospital systems have successfully implemented acute care surgery, but rural and economically challenged areas remain underserved. Acute care surgeons in the US are generally employed either by the Hospital or a medical group. The profession provides a perfect work-life balance and, therefore, has become very attractive for the younger generations and surgeons who want to step down from exhausting full-time practices at the end of their careers. In the US, it is an entirely accepted specialty with dedicated and verified fellowship training.

Keywords: acut care, trauma surgery, critical care, emergency surgery.

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Introduction

About 4 million patients undergo emergency general surgery procedures annually in the US, representing about 11% of all surgical procedures and accounting for almost a quarter of overall inpatient costs according to the American College of Surgeons¹. How these patients are cared for, how the surgeons train to do so, and how they organize patient care in the hospital setting have fundamentally changed over the last 20 years and have led to the creation of a new surgical specialty: the acute care surgeon. In the United States, Acute Care Surgery is a specialty that focuses on the immediate surgical treatment of patients with acute, life-threatening injuries and conditions. It encompasses three key areas: trauma surgery, critical care, and emergency surgery²⁻⁴.

- Trauma Surgery: This aspect of Acute Care Surgery is concerned with the surgical treatment of injuries caused by impact forces, such as those resulting from motor vehicle accidents, falls, or acts of violence. Often working in trauma centers specially equipped for the treatment of severe trauma, trauma surgeons train to treat complex and multi-system injuries.
- Surgical Critical Care: This involves the care of surgical patients who are critically ill. Surgeons in this specialty manage complex physiological problems and life-supporting systems in the intensive care unit. They work closely with other specialists to provide comprehensive care to patients who are critically ill because of surgery, trauma, or other medical conditions.
- Emergency Surgery: This field involves the surgical treatment of urgent and emergent, non-trauma-related conditions, such as acute appendicitis, perforated bowel, or blocked blood vessels. Emergency surgeons must quickly diagnose and treat a wide range of conditions requiring immediate surgical intervention.

The subject of this paper is the evolution that led to the creation of the Acute Care Surgery specialty and

what the practice of a single surgeon in that specialty might look like today.

Evolution of the Acute Care Surgery specialty

By the early 2000s, the American Association for the Surgery of Trauma and others recognized the convergence of trauma surgery, emergency general surgery, and surgical critical care. In response to challenges such as increasing nonoperative management of trauma and work-hour restrictions for trainees, they proposed the establishment of Acute Care Surgery as a unified specialty⁵⁻¹². It would take nearly 20 years to implement the new surgical specialty.

The initial impetus came from significant changes in trauma surgeon practice. These changes reflected advances in medical knowledge, technology, and healthcare systems. The following are some of the most important developments:

Integration of surgery for the acutely ill patient: Trauma surgery underwent integration with emergency general surgery and surgical critical care into a unified model known as Acute Care Surgery. This change has catalyzed a more comprehensive approach to patient care.

Minimally Invasive Techniques (MIS): There has been an increased use of minimally invasive surgical techniques, such as laparoscopy and thoracoscopy, in the evaluation and treatment of trauma patients. The advent of MIS has forced trauma surgeons to change their skill set to resemble that of a general surgeon and, ultimately, of a minimally invasive surgeon^{13,14}.

Damage Control Surgery: The concept of damage control surgery, which performs the minimum necessary procedures to stabilize a critically injured patient before definitive surgery, has been increasingly adopted.

Trauma Systems and Protocols: There has been a greater emphasis on developing regionalized trauma systems that ensure prompt patient transport to facilities that provide the required level of care. Specific

care protocols have facilitated patient care alignment between trauma-, emergency-, and general surgeons.

Education and Training: Reflecting the increasing complexity of the specialty, trauma surgeons now receive more formalized training in trauma and critical care during their residencies and fellowships, allowing them to broaden their practice to include emergency general surgery.

Research and Evidence-Based Practice: Trauma-related research leading to evidence-based practice guidelines that improve patient outcomes has increased significantly.

Resilience and Prevention: There is a growing focus on injury prevention strategies and public health approaches to reduce the incidence and severity of trauma.

Advances in Technology: The adoption of electronic medical records, telemedicine, and improved imaging technologies have changed the workflow and increased the efficiency of trauma care. It also has allowed general and emergency surgeons to quickly adopt and integrate trauma and acute care of patients into their practice.

Multidisciplinary Collaboration: Trauma care has become more collaborative, with teams often consisting of surgeons, emergency physicians, anesthesiologists, nurses, and other healthcare professionals working closely together.

These changes have collectively improved survival and outcomes for trauma patients and continue to shape the evolving field of acute care surgery.

Changes in Surgical Decision-Making:

The increased awareness that patient outcomes may improve by delaying or declining surgical intervention has transformed the landscape of trauma and emergency surgery. The decision between operative and nonoperative treatment in managing trauma and other surgical conditions relies on several factors, including the type and severity of the injury, the patient's overall health, and the potential risks and benefits of surgery. Here

is an overview of each driver of the operative versus nonoperative approach:

Operative Treatment:

Indications:

- Life-threatening conditions that require immediate surgical intervention (e.g., internal bleeding, perforation of an organ).
- Injuries with a high risk of complications if they are left untreated (e.g., complex fractures).
- Conditions where surgery significantly improves patient outcomes.

Advantages:

- It can be lifesaving and is often the quickest way to stabilize a critical condition,
- It allows direct and definitive repair of anatomical injuries.
- It may decrease the risk of future complications or secondary procedures.

Disadvantages:

- Risk of surgical and anesthetic complications.
- It involves recovery time and may result in a more extended hospital stay.
- It may cause postoperative pain and require rehabilitation.

Nonoperative treatment:

Indications:

- Injuries that can heal naturally with time (e.g., minor fractures, specific abdominal trauma).
- High-risk patients with comorbidities or poor overall health.
- The risks of surgery outweigh the potential benefits.

Benefits:

- Eliminates surgical risks and possible anesthetic complications.

- Likely shorter hospital stays and faster return to regular activity.
- More often associated with reduced pain and discomfort.

Disadvantages:

- Some injuries may take longer to heal or not heal properly.
- Failure to detect other surgically treatable injuries.
- Need for close monitoring and follow-up to ensure proper healing.

Whether or not to operate is complex and often involves a multidisciplinary team. Factors to consider include:

Clinical guidelines: Evidence-based protocols that suggest the best course of action for specific injuries or conditions.

Patient preferences: Some patients prefer to avoid surgery, if possible, while others want a rapid resolution even if surgery is required.

Surgeon's expertise: The surgeon's experience and judgment are critical to determining the most appropriate course of treatment.

Imaging and diagnostic tests: These tests provide critical information about the nature and extent of injury.

Risk assessment: Evaluating potential risk of operative and nonoperative approaches.

Ultimately, the choice between surgical and non-surgical treatment is individualized, considering the specifics of each case to optimize patient outcomes and align with the patient's values and goals for recovery.

When confronted with an urgent acute surgical need, medical decision-making has become significantly more complex due to the availability of specialized perioperative care tailored to an aging population and the recognition that the timing of surgery or its

postponement is an essential determinant of patient outcome. As the population ages, physicians will increasingly face patients with multiple comorbidities, increasing the complexity and risk of surgery. These patients require comprehensive perioperative care that addresses not only their surgical condition but also their broader health issues. With growing disparities in health care and the health care systems increasingly pushed to their limits, patients who present later in the course of their disease are not uncommon. Delayed presentation can complicate treatment options and outcomes and narrow the window for safe and effective surgical intervention. Recognizing when not to operate has become a critical surgical skill. Understanding nuances of surgical indications and patients' ability to withstand surgery has replaced traditional views where surgery appears as the only and primary solution to many medical problems. Modern medicine now emphasizes patient-centered care, shared decision-making, and carefully weighing the risks and benefits of surgical intervention, especially for high-risk procedures. This changing approach requires a better understanding of selecting patients for surgery, with a greater emphasis on nonsurgical management when appropriate. To ensure the best possible patient outcomes, a multidisciplinary approach to care is needed, involving surgeons, geriatricians, anesthesiologists, and other specialists. Nonsurgical decision-making is thus a reflection of the more conservative and judicious use of surgery, with a focus on quality of life and individual goals of care for each patient. The recognition that neither the trauma surgeon, emergency physician, or general surgeon could provide that level of care alone led to the development of the specialty of acute care surgery. This development is seen mainly in trauma surgery. The advent of non-operative therapy for trauma patients has enticed trauma surgeons to start treating patients with critical non-trauma surgical needs in the Hospital and emergency room, with mixed outcomes due to their unfamiliarity with general surgery procedures. The landscape of general surgery practice has changed.

The progressive devaluation of the traditional general surgery practice model and fundamental changes in the expectations towards the professional core of general surgery also drove the motivation to create the specialty of acute care surgery. Several factors contributed to its decline: Surgeons are increasingly subspecializing, allowing them to focus on specific areas of interest and become highly skilled in certain procedures. Because of their focused expertise, specialized surgeons may provide better outcomes for complex procedures. As more surgeons specialize, fewer surgeons may have the broad skills traditionally associated with general surgery or are willing to perform a wide range of general surgery and at the same time be available for emergencies. Particularly in rural or underserved areas, the reluctance to be on call 24 hours a day may create challenges in providing continuous emergency surgical care. The traditional general surgery model, where a surgeon performs a wide range of procedures and is on call 24/7, is replaced by increased specialization and changing work-life expectations.

Hospitals and health systems have adapted by hiring more surgeons to cover the same on-call schedule or using hospital-based general surgeons to handle emergencies. Some health systems responded by developing in-hospital surgical teams that work in shifts to cover emergencies 24/7. These hospital-based surgeons represented the blueprint for creating the acute care surgeon specialty. The advent of telemedicine and surgical collaboratives can support general surgeons by bringing in specialists as necessary, especially in remote areas; in rural areas with unique challenges to hiring surgeons, new models of care are being explored, including the use of advanced practice providers, such as surgical physician assistants and nurse practitioners, to extend the reach of surgeons. In conclusion, the landscape of general surgery has changed due to the trend toward specialization and a focus on work-life balance¹⁵. Innovative solutions are necessary to ensure that all patients receive high-quality surgical care, including those in emergencies. While this may appear to “devalue” the traditional model of general surgery, it could

also lead to an evolution of the field towards a more modern, sustainable, and patient-centered approach to surgical care.

Societal factors driving the new specialty of acute care surgery

Broader factors are also responsible for the challenges to the disappearance of the traditional general surgery model in the US. These factors are generally affecting all medical care delivery but need to be mentioned in the context of acute care surgery^{3,16,17}.

Economic pressures: Financial considerations, including reimbursement rates, malpractice insurance costs, and hospital and insurance business models excluding independent physicians, have much reduced the viability of a general surgery practice.

Regulatory and administrative burdens: Surgeons often face significant administrative obligations and compliance requirements that overwhelm the management abilities of single independent practices.

Technological advancements: Rapid technological changes, particularly the MIS and robotic revolution, require constant learning and adaptation, which is challenging for general surgeons who must maintain a broad knowledge base.

Patient expectations: Patients often expect specialized care, which can lead to a preference for specialists, even for procedures that fall within the scope of general surgery.

Education and training requirements: Changes in surgical training, including limits on resident work hours, have resulted in less experienced surgeons completing their training. These limits have contributed to the need for specialized training for surgeons providing trauma and emergency care.

Competition from nonsurgical modalities: Many conditions that once required surgery now respond favorably to medical treatment alone or are treatable with less invasive interventional procedures, thus reducing the demand for traditional surgery.

Consolidation of healthcare systems: Consolidation of hospitals and clinics has led to centralized specialty services, reducing the role of general surgeons in specific settings.

In 2016, the American College of Surgeons distributed a survey to its Governors exploring the impact of acute care surgery on the surgical landscape¹⁸. It found that acute care surgery services positively affected healthcare delivery, such as quicker ER and inpatient consults, and improved patient outcomes. However, there were concerns about continuity of care and the quality of care due to less experienced acute care surgeons; the survey revealed that income for most non-acute care surgeons remained relatively the same with the implementation of acute care surgical services. The survey also suggested that the presence of acute care services, with their more appealing and predictable lifestyle without frequent on-call duties, could entice medical students and residents to choose a career in general/acute care surgery. Half of the surgeons participating in the survey reported being a specialist, and 36% were both a specialist and a general surgeon. Only 14% viewed themselves as being only general surgeons. Of those responding to the survey, almost half (49%) were in full academic practice, 23% in private practice, and the Hospital or a medical group employed 15%. Over two-thirds of the responders (68%) worked in hospitals with an acute care surgery team on duty.

Lastly, undeniable demographic changes in the population and workforce have raised the need for acute care surgery as a specialty in the US. The US population growth of 30% from 1981 to 2006 has far outstripped that of trained general surgeons (only 4%). These demographic changes have led to many hospitals lacking surgical coverage for acute care, and in a 2005 survey by the American College of Emergency Physicians 75% of emergency medical directors in the US reported inadequate surgical coverage. Almost one-third (29%) of the approximately 3000 counties in the 48 states do not have a general surgeon, thus creating “surgical deserts”. In 2013, 44.5% of general surgeons were aged 55

or older. Decreased reimbursement, unpredictable administration, and hostile professional liability push surgeons into early retirement¹⁹.

Acute care surgery training and certification

Acute Care Surgeons require a robust knowledge base and technical skills that enable them to manage a wide range of urgent surgical conditions. These skills include assessing and managing critically ill patients, performing emergency surgery, and providing comprehensive postoperative care. This dual competency ensures that Acute Care Surgeons can provide timely and effective care to patients facing acute surgical emergencies. The following timeline describes the process and the involved medical societies that led to the creation of an Acute Care Surgery fellowship program^{20,21}:

- 2003** Joint meeting of the American College of Surgeons, American Association for the Surgery of Trauma (AAST), Western Trauma Association, and Eastern Association for the Surgery of Trauma.
- 2005** AAST to reorganize the specialty of Trauma, Surgical Critical Care, and Emergency Surgery
- 2006** AAST renames committee - Acute Care Surgery Committee
- 2007** Institute of Medicine confirms a shortage of on-call specialists.
- 2008** AAST develops curriculum, competency tools, case registry, certification criteria, and site visits.
- 2014** First AAST Acute Care Surgery Fellowship Program
- 2018** Establishment of a longitudinal/experiential model with case minimum requirements

The establishment of the Acute Care Surgery fellowship program in 2014 responded to the need for a specialized approach to emergency surgical

care, including trauma and critical care. Acute care surgery has become a defined specialty with dedicated training programs, fellowships, and a focus on improving patient outcomes for emergent surgical conditions. The model has been widely adopted and integrated into US healthcare systems to ensure that high-quality, timely care is available for patients with urgent surgical needs. The benefits of acute care surgeons are essential to the functioning of Hospital-based medicine and include immediate availability of surgeons in emergencies, expertise in managing complex trauma and critical care cases, optimal coordination for the care of acutely ill surgical patients, improved patient outcome through efficient care, and 24-hour surgical support for other departments in Hospitals.

With the formalization of the specialty, training programs were developed. Initially, surgeons interested in ACS would typically complete a general surgery residency followed by trauma surgery and surgical critical care fellowships. However, newly developed integrated ACS fellowships offer comprehensive training in all aspects of the discipline.

Figure 1 describes the five pillars of Acute Care Surgery conceived by the American College of Surgery. Of note is the fifth pillar: surgical rescue. Taking care of hospitalized surgical patients with acute post-operative complications is an undervalued benefit of having a hospital-based team available². The Acute Care Surgeon is vital in supporting other providers and directing patient care in the ‘surgical rescue’ of complications.

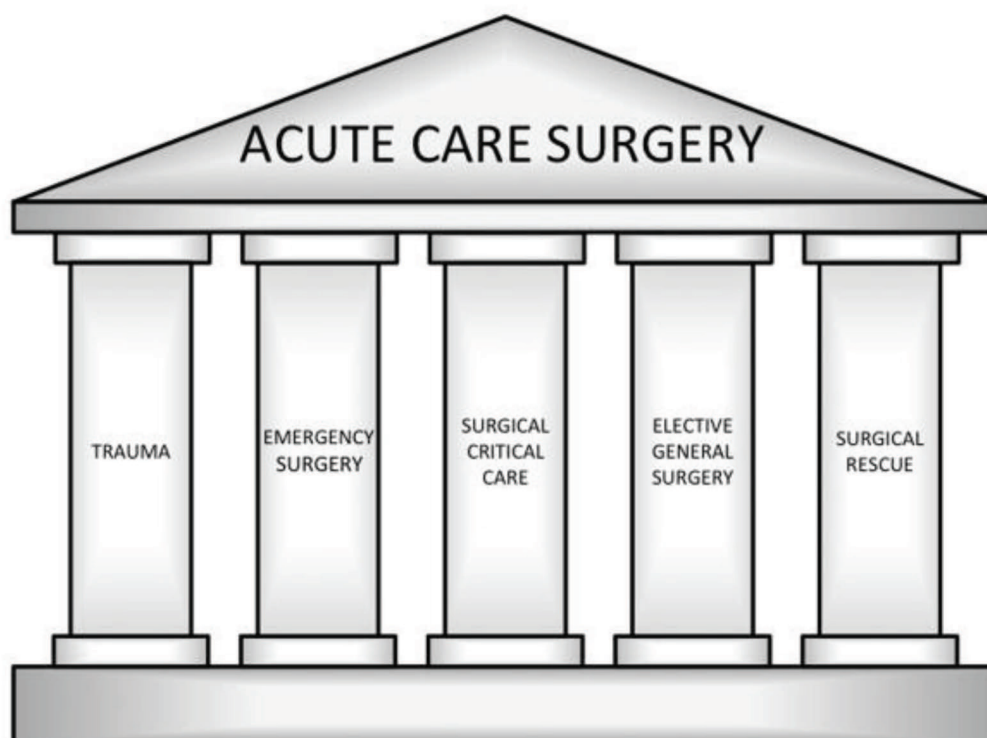


Figure 1. This figure shows the five pillars of Acute Care Surgery. Note the fifth pillar, named “surgical rescue”. Surgical rescue is an essential and often underrecognized aspect of Acute Care Surgery.

Acute Care Surgery Fellowship

The Acute Care Surgery Fellowship is an advanced training program after completing a general surgery residency. The fellowship usually includes traumatology, surgical critical care, and public emergency surgery. Fellows receive extensive clinical experience, often in high-volume centers, to hone their skills in managing critically ill and injured patients. In addition to research and teaching opportunities, the curriculum typically includes rotations in critical care, trauma, and emergency surgery. The fellowship aims to prepare surgeons for leadership roles in acute surgical care.

As a specific example, here is a description from the University of Texas Houston Acute Care Surgery fellowship program²²:

Year One: Trauma and Acute Care Surgery. Rotations in Trauma, Emergency General Surgery, HPB/transplant, Interventional Radiology and Cardiovascular. Complex abdominal wall reconstruction, EMS/pre-hospital trauma systems, and research months. Additional vascular and thoracic experience is available.

Year Two: Traditional Critical Care. 4 to 6 months in Shock-Trauma ICU and one month in the Burn ICU, MICU, Advanced Airway with Anesthesia, Advanced Trauma/Critical Care Ultrasound, and Research. IVC filters, bronchoscopy, endoscopy, percutaneous tracheostomy, transesophageal echocardiography for resuscitation, and other ICU procedures.

The study by Van der Wee et al. describes worldwide Acute Care Surgery models²³. Specific to North America 18 studies describing Acute Care Surgery models are listed, most of which identify a dedicated service with daytime on-site attending coverage supported by trainees. Most models provide trauma and critical care. Eight studies describe protected operating room time. Less than half also provided emergency department coverage.

In 2023, the American College of Surgeons launched a program to verify Acute Care Surgery training programs based on Optimal Resources for Emergency

General Surgery standards and the ACS National Surgical Quality Improvement Program registry (NSQIP)^{1,16,11}. This Emergency General Surgery Verification Program (EGS-VP) establishes emergency general surgery standards and ensures necessary resources and protocols to provide quality hospital care. The program includes a rigorous evaluation process verifying hospitals using specific criteria related to patient care, surgical resources, and quality improvement measures in emergency general surgery. The proposed review process to audit verification criteria would be like that currently in place for the certification of trauma centers. The requirements discussed include triaging patients across the spectrum of needs, standards for both timeliness and team availability, and the record of clinically relevant Emergency General Surgery (EGS) data to drive quality improvement. In addition, a new EGS-focused NSQIP-targeted registry module and a multidisciplinary approach to care and quality are being developed.

The Hospital of the University of Pennsylvania, the University of Kansas Health System, the University of Wisconsin UW Health, Riverside University Health System Medical Center, California, and the JPS Health Network, Texas, are the first five certified EGS-VP programs in the US.

Despite the clear advantages of Acute Care Surgery teams in the care of hospitalized patients and the perceived inadequacy in providing emergency care in the US, penetration of the acute care surgery model is not perfect. Figure 2 shows that many Hospitals, especially in rural regions of the US, lack 24-hour access to critical surgical care²⁰. A survey of 1690 acute care hospitals on implementing acute care surgery published in 2018 showed that only 272 hospitals had implemented acute care surgery by 2-15. Rural and less educated areas were especially underserved¹³.

In summary, Acute care Surgery has become a recognized and respected specialty. It fulfills an essential role in patient care of trauma centers, emergency departments, and intensive care units across the



Figure 2. US acute care general hospitals that do (red circles; 1355) and do not (green squares; 279) provide 24-hour critical care surgery.

spectrum of academic centers and rural hospitals. Further refinement of Acute Care Surgery training, research, and best practices is needed to improve outcomes for acutely ill surgical patients. These refinements are particularly pertinent for surgical access in rural areas.

Personal Experience as an Acute Care Surgeon

I have worked as an acute care surgeon in 5 different small-town critical care hospitals across California and Texas.

Most emergencies that require an acute care surgeon are abdominal conditions including, but not limited to, acute appendicitis, cholecystitis, diverticulitis, pancreatitis, intestinal obstruction, intestinal ischemia, intra-abdominal sepsis, incarcerated hernias, and perforated internal organs.

Our acute care team of 3 full-time and one part-time acute care surgeon comes from very different training backgrounds: trauma, general surgery, colorectal,

and oncologic surgery. We average 500-600 cases per year, of which approximately 30% are appendectomies, 30% cholecystectomies, and 10% hernias of all kinds; in addition, 10% deal with complex wounds/abscesses, and 5% each with colectomies, intestinal perforations, and trauma. Other procedures, such as thoracic drainage and lysis of adhesions, comprise the remaining 10%. The case types range from simple abscess drainage to emergent en bloc resections for perforated cancer in general surgery and from chest tube drainage to gunshots to the heart, liver, or pancreas in trauma. Each acute care surgeon covers approximately ten 24-hour monthly shifts to cover the hospitalized patients and the emergency department for consultations and surgical emergencies. The on-call surgeon might call in a colleague for help at any time. Excellent collegiality and flawless patient sign-outs are essential for this model to function. Any communication breakdown is potentially disastrous for the patient.

A successful acute care surgeon must make good decisions based on poor information, whether from a doctor or a nurse. He also needs to be able to

make life and death decisions without help and with limited information and be ok with the outcomes, adapt his skills to the ability of the Hospital to care for patients, always consider transfer to a higher level of care, and recognize the urgent need for timely surgical intervention at any time of day or night. Furthermore, the surgeon must excel at problem-solving, think quickly, be confident in his skills and knowledge, and be humble enough to know when to call for help. Trusting another colleague who takes over the care of a personal patient is essential. So is skillful professional communication and managing expectations by colleagues and patients. An acute care surgeon should learn to work closely, be helpful to Medical Hospitalists and other consultants, and feel comfortable with rescue surgery and management of surgical complications.

Conflict of interests

The author has no relevant financial or non-financial interests to disclose.

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