Chapter 4
Organization of an Acute Care Surgery Service and Patient Safety Management

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4.1 Introduction

The term "acute care surgeon" has multiple implications. In general, the designation refers to an in-house, broadly trained general surgeon with expertise in the management of trauma, emergency general surgery, and surgical critical care. Anecdotally, many surgeons argue that this definition represents nothing but a new title reflective of a standard twentieth century general surgery. By contrast, a more rigid approach

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S. Di Saverio et al. (eds.), *Acute Care Surgery Handbook*,
DOI 10.1007/978-3-319-15341-4_4

would restrict the definition of acute care surgeons to those who have completed a dedicated and accredited fellowship (most commonly by the American Association for the surgery of Trauma/AAST). Regardless of the title or training of surgeons who provide acute care, the primary goal of this service is to muster rapidly available, unencumbered, highly skilled surgeons to deal with surgical emergencies. Successfully implementing such a service requires an understanding of several basic principles that are broadly described in this chapter.

4.2 Scope of Coverage

The first task of an institution that considers adoption of a designated acute care surgery service is to define the scope of practice. This scope will be highly dependent upon existing services, and thus a critical analysis of such services and their desire to implement an acute care mode is imperative. Traditional disease processes that fall into the purview of acute care surgery are listed in Table 4.1. Also listed in this table are specialty surgeons who may already be managing these problems. Thus, an initial determination of stakeholders and their desire to abrogate coverage of these issues before implementation of an acute care surgery service will maximize success.

Moreover, coverage of surgical emergencies need not be an "all or nothing" event. For example, it may be decided that, by default, all cases of empyema will be managed by the acute care surgery service. However, the acute care surgeon may exercise his or her judgment to involve a thoracic surgery for complicated cases (e.g., persistent air leak, bronchopleural fistula). In this case, whereas some acute care surgeons may feel comfortable managing complex cases, there exists a "bail

Table 4.1 Typical disorders within the scope of the acute care surgery paradigm, and responsible service lines

Disease process	Specialty service lines
Trauma	General surgery
Surgical critical care	General surgery, pulmonary, anesthesia, emergency medicine
Appendicitis	General surgery, colorectal surgery
Diverticulitis	General surgery, colorectal surgery
Cholelithiasis, choledocholithiasis, cholecystitis	General surgery, hepatobiliary, gastroenterology
Pancreatitis	General surgery, hepatobiliary
Bowel obstruction	General surgery
Acute limb ischemia	General surgery, vascular surgery, interventional radiology, cardiology
Empyema	General surgery, interventional radiology, thoracic surgery

out" option for more complicated cases. In some cases, specialty services may be reluctant to relinquish management of certain disease processes. Such discussion are highly specific to local political environments and should involve, whenever possible, both medical and hospital executive staff. In general, the goal of the acute care surgery service is not to impinge upon the elective volume of either general or specialty services. Rather, it is to provide streamlined, protocolized, 24/7 coverage of surgical emergencies. When this concept is presented in such a way, many busy elective surgeons will be relieved to have dedicated and skilled colleagues in house and available 24/7. Indeed, there is little else more stressful to the surgeon (and unfair to the elective patient) than a distracting call involving a surgical emergency during a complex elective operation.

4.3 Models of Coverage

Once the decision to create an acute care surgery service has been made, key stakeholders identified, and scope of practice delineated, the next step is to specify a model of coverage. Although several successful models exist, the following aspects should be preserved: In general, coverage is split into emergency general surgery, trauma, and surgical critical care. Whenever possible, a separate individual should be "on call" for each of these three aspects of care. This approach will both minimize over-commitment and enhance patient safety. One common model that illustrates this point involves an on call "surgeon of the week." This individual is on emergency general surgery call during the day, performing both new urgent operations and any other urgent operations from prior emergency general surgery call (e.g., open abdomen takebacks, urgent cholecystectomies, tracheostomies). A second surgeon is on call for trauma, and a third covers the surgical intensive care unit. None of these individuals is responsible for either elective clinic or operating during their time on acute care surgery call.

Such a model does not preclude the acute care surgeon from maintaining an elective practice. In fact, it is our contention that a busy elective practice is essential to the development and professional well-being of the acute care surgeon. Specifically, knowledge of anatomy from elective surgery (e.g., hiatal hernia repair) translates readily into the trauma realm (e.g., gunshot to the gastro-esophageal junction) and vice-versa. Table 4.2 illustrates an example of a call schedule for a group of six acute care surgeons. Notice that each has unencumbered call, elective, and academic/teaching time, as well as leave time.

Central to this coverage model is a strong commitment to teamwork. Because both the volume and complexity of surgical emergencies is highly variable, a fair amount of surge capacity must be built into the model. In the aforementioned example,

Table 4.2 Example model of acute care surgery coverage schedule

Surgeon	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
A	EGS	Trauma	SICU	Elective	Admin	Off
B	Off	EGS	Trauma	SICU	Elective	Admin
C	Elective	Admin	Off	EGS	Trauma	SICU
D	Admin	Off	EGS	Trauma	SICU	Elective
E	SICU	Elective	Admin	Off	EGS	Trauma
F	Trauma	SICU	Elective	Admin	Off	EGS

EGS emergency general surgery call, *SICU* surgical ICU call

the trauma, EGS, and SICU surgeons back each other up, such that when one is inundated with several simultaneous emergencies, the others may "flex up" to provide support. A similar adjustment is made when multiple members of the group are offsite for either academic purposes or personal vacation. Finally, a rotating night and weekend coverage schedule is made among the members of the group.

A second coverage model may prove useful when the average census of acute care surgery patients is too large for one surgeon to manage. This alternative model involves dividing the acute care surgeons into multiple teams, with each team managing their own inpatient census comprised of the patients admitted to their service while on call. Surgical ICU, night, and weekend call remains divided up equally among the group.

4.4 Resource Allocation

Creation of an acute care surgery service requires an initial investment in additional resources. Essential to the profitability of the service line is a dedicated, around-the-clock operating room. In high volume centers, two to three dedicated operating rooms may be required. The existence of a dedicated team that is ready to operate at any given time will prove futile in the

absence of operating room availability. Similarly, the operating room must be both staffed and equipped to handle common surgical emergencies.

Adequate, 24/7 coverage must extend beyond the operating room. Dedicated house staff or advanced practice providers must be present and wedded to the acute care surgery team, such that their responsibilities are not split between several services. Ideally, research staff should be hired to create and maintain a data repository of acute care surgery patients, and assist to researching common problems in emergency general surgery. Finally, much in the sense of trauma care, both in-reach and outreach efforts should be made to surrounding facilities to advertise the additional expertise afforded by an acute care surgery service. In general, many surgeons at smaller both rural and community hospitals welcome the opportunity to transfer complex emergency general surgery patients to a "center of excellence." Such outreach efforts have been successful in specific disease processes including chronic enterocutaneous fistulae, chronic pancreatitis, and chronic pain from rib fractures.

4.5 Patient Safety Concerns

There are many intuitive advantages to the acute care surgery paradigm. In-house call will increase attending response time to surgical emergencies and improve the likelihood that urgent operations are performed in a timely fashion, even off hours on nights and weekends. Alleviation of call from primarily elective general and specialty surgeons can improve both efficiency and job satisfaction. Finally, management of most surgical emergencies by a single group of providers can streamline standardized care of these vulnerable patients.

In the past few years, several reports have emerged corroborating these hypothetical advantages. Specifically, time from consultation to operating room, percentage of operations happening at night and weekends, time from operation to discharge, and overall hospital costs have consistently been improved following adoption of an acute care surgery model [1–3]. These findings have been observed in both pre/post study designs, as well as contemporaneous comparisons of two hospitals systems, one with a traditional general surgery call structure and the other with an acute care surgery service. There are, however, disadvantages, risks, and shortcomings of the acute care surgery that require recognition and mitigation.

1. *Surgeon expertise*.
   Most of the aforementioned studies involve relatively common and straightforward surgical diseases, such as acute appendicitis or cholecystitis. Far fewer studies have addressed technically complex emergent operations, such as laparoscopic colectomy for acute diverticulitis, or laparoscopic omental patch for perforated duodenal ulcer. Fundamental to the acute care surgery model is the notion not to compromise the quality of patient care. Acute care surgery fellowships have addressed this concern with standardized case requirements (Table 4.3), which include a wide range of operations of varying frequency and complexity. These case requirements continue to evolve based on the changing scope and complexity of emergency general surgery cases. Furthermore, acute care surgeons should, if needed, maintain competency in advanced techniques through continuing medical education courses, or shadowing specialty surgeons at their own institution. Finally, as mentioned previously, the ideal acute care surgery program involves close collaboration with specialty services such that surgical specialists may be consulted by the acute care surgeon when needed (e.g., ruptured abdominal aortic aneurysm).

Table 4.3 Case requirements of acute care surgery fellowship

Area/procedure	Essential	Desirable	Comment
Airway			
Tracheostomy, open and percutaneous	X		
Cricothyroidotomy	X		
Nasal and oral endotracheal intubation, including rapid sequence induction	X		
Head/face			
Nasal packing	X		For complex facial fracture bleeding
ICP monitor		X	
Ventriculostomy		X	
Lateral canthotomy		X	
Neck			
Exposure and definitive management of vascular and aerodigestive injuries	X		
Thyroidectomy		X	Essential if inadequate prior experience
Parathyroidectomy		X	
Chest			
Exposure and definitive management of cardiac injury, pericardial tamponade	X		
Exposure and definitive management of thoracic vascular injury	X		
Repair blunt thoracic aortic injury: open or endovascular		X	
Partial left heart bypass		X	
Pulmonary resections	X		

Table 4.3 (continued)

Area/procedure	Essential	Desirable	Comment
Exposure and definitive management of tracheo-bronchial and lung injuries	X		
Diaphragm injury, repair	X		
Definitive management of empyema: decortication (open and VATS)	X		
Video-assisted thoracic surgery (VATS) for management of injury and infection	X		
Bronchoscopy: diagnostic and therapeutic for injury, infection, and foreign body removal	X		
Exposure and definitive management of esophageal injuries and perforations	X		
Spine exposure: thoracic and thoraco-abdominal	X		
Advanced thoracoscopic techniques as they pertain to the above conditions	X		
Damage control techniques	X		
Abdomen and pelvis			
Exposure and definitive management of gastric, small intestine, and colon injuries	X		
Exposure and definitive management of gastric, small intestine, and colon inflammation, bleeding, perforation, and obstructions	X		
Gastrostomy (open and percutaneous) and jejunostomy	X		

(continued)

Table 4.3 (continued)

Area/procedure	Essential	Desirable	Comment
Exposure and definitive management of duodenal injury	X		
Management of rectal injury	X		
Management of all grades of liver injury	X		
Hepatic resections	X		
Management of splenic injury, infection, inflammation, or diseases	X		
Management of pancreatic injury, infection, and inflammation	X		
Pancreatic resection and debridement	X		
Management of renal, ureteral, and bladder injury	X		
Management of injuries to the female reproductive tract		X	
Management of acute operative conditions in the pregnant patient		X	
Management of abdominal compartment syndrome	X		
Damage control techniques	X		
Abdominal wall reconstruction following resectional debridement for infection, ischemia	X		

2. *Handovers in patient care*
Shift work and workhour restrictions for surgical trainees represent the clear and present danger for patient safety related to the imminent risk of communication breakdown and errors in patient handover [4]. Ironically, workhour restrictions were originally implemented as a patient safety measure to mitigate the risk of surgical complications originating from overworked and fatigued residents. Contrary to the original intent, years of international experience with resident workhour restrictions revealed that patients are not safer, but rather more susceptible to harm originating from handovers of care, equivocal physician accountability, and breakdowns in communication within the team [5, 6]. These underlying challenges represent a threat to the safety and quality of an acute care surgery service, as in essence most models of acute care surgery involve "shift work." As such, there will be by a necessity for recurring patient handovers. Increased regulation of resident duty hours makes it more likely that house staff will also be relatively unfamiliar with inpatients. As such, a robust and standardized system for patient sign out is imperative to the successful implementation of an acute care surgery service. One of the most widely used and successful systems involves the "morning report," in which the post call and on call team gather for presentation of the new admissions, review of pertinent radiographic studies, and expression of the patient plan. All members of the care team, including the medical students, house staff, and attendings, are present. An open and non-judgmental atmosphere is promoted such that anyone with concerns may raise questions. Patient handovers must also be addressed in the elective practice. Specifically, as shown in Table 4.2, depending on OR availability, surgeons who are scheduling cases in clinic may not necessarily be the ones eventually performing the operations. Mitigation of the risk

of breakdown in communication and errors in handovers rely on standardized proformas, proactive and transparent communication, and impeccable documentation [7].

4.6 Verification, Accreditation, and Quality Assurance

Many surgical programs, such as bariatric and transplantation, have the potential for either verification or accreditation by governing bodies. The process of verification typically involves demonstration of organizational delegation, minimum volume requirements, protocolized care, outcomes review, and quality improvement. Recent US data indicate that provision of emergency general surgery coverage at academic hospitals is highly variable, with specific discrepancies in operating room availability, call sharing between general and acute care surgeons, patient hand offs, and data collection [8]. Based on this variability, it is likely that, moving forward, individual acute care surgery services should and will require verification.

4.7 Conclusion

An acute care surgery service is typically charged with care of the sickest surgical patients, including trauma, emergency general surgery, and surgical critical care. The success of such a service begins with identification of key stakeholders to the care of such patients, followed by a clear delineation of the scope of practice. The acute care surgery team must then be organized such that each surgeon is unencumbered, surge capacity is possible, and patients are made aware that transitions in caring surgeons occur frequently. Although additional resources,

including dedicated operating room time, 24/7/365 coverage, and data registries, are required initially, the majority of data suggest that the net effect of implementation of an acute care surgery service is to improve patient safety and provide satisfaction.

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