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## Beyond emergency surgery: redefining acute care surgery

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### ABSTRACT

**Background:** Considerable debate exists regarding the definition, skill set, and training requirements for the new specialty of acute care surgery (ACS). We hypothesized that a patient subset could be identified that requires a level of care beyond general surgical training and justifies creation of this new specialty.

**Materials and methods:** Reviewed patient admissions over 1-y to the only general surgical service at a level I trauma center—staffed by trauma and/or critical care trained physicians. Patients classified as follows: trauma, ACS, emergency general (EGS), or elective surgery. ACS patients are nonelective, nontrauma patients with significantly altered physiology requiring intensive care unit admission and/or specific complex operative interventions. Differences in demographics, hospital course, and outcomes were analyzed.

**Results:** In-patient service evaluated approximately 5500 patients, including 3300 trauma patients. A total of 2152 admissions include 37% trauma, 30% elective, 28% EGS, and 4% ACS. ACS and trauma patients were more likely to require multiple operations (ACS relative risk [RR] = 11.5; trauma RR = 5.7,  $P < 0.0001$ ), have longer hospital and intensive care unit length of stay, and higher mortality ( $P < 0.0001$ ). They were less likely to be discharged home (ACS RR = 0.75; trauma RR = 0.67,  $P < 0.0001$ ) compared with that of the EGS group. EGS and elective patients were most similar to each other in multiple areas.

**Conclusions:** ACS and EGS patients represent distinct patient cohorts, as reflected by significant differences in critical care needs, likelihood of multiple operations, and need for postdischarge rehabilitation. The skills required to care for ACS patients, including ability to rescue from complications and provide critical care, differ from those required for EGS patients and supports development of ACS training and regionalization of care.

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## 1. Introduction

The specialty of acute care surgery (ACS) was initially proposed by the American Association for the Surgery of Trauma

(AAST) in 2005 to address increasing subspecialization, decreasing resident interest in trauma careers, and increasing surgical workforce shortages [1]. As envisioned by the AAST, the specialty would create practitioners who could combine

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and wield the skill sets inherent to trauma, critical care, and emergency general surgery (EGS). To date, however, there has been considerable variation in the models of “ACS” or “EGS” that have actually been adopted [2–7]. The models presented as “ACS” have included everything from a simple call pool covering urgent and emergent surgical cases all the way to the AAST ideal of a comprehensive surgical, critical care, and trauma service [2–7]. These disparities have resulted in several professional groups claiming ACS as their purview including general surgeons, surgical hospitalists, and board-certified critical care and trauma practitioners.

Although the AAST has defined a fellowship curriculum for acute care surgeons, the current variation in practice patterns and practitioners has created significant ambiguity regarding the demographic, physiologic, and pathologic characteristics of the “ACS” patient population and the skill set required to adequately manage them. We hypothesized that those patients with emergent surgical conditions have distinct characteristics based on the complexity and severity of illness that separates them into two distinct groups—which we define as ACS and EGS. Although these terms are often used interchangeably, we believe that ACS and EGS should be defined separately because ACS patients possess greater pathologic and physiologic complexity that exceeds the standard scope of general surgery practice. We hypothesize that a more rigorous treatment of the pathology and physiology that define these groups will better inform the training and staffing needs required for their care. The purpose of this study was to clearly define these two groups of patients and to highlight their differences in complexity, resource utilization, and outcomes.

## 2. Material and methods

We performed a retrospective review of all inpatients treated by the surgical service from January 1, 2011–December 31, 2011 at San Francisco General Hospital. San Francisco General Hospital is an American College of Surgeons verified level I trauma center and the only level I center serving the entire city and county of San Francisco. In addition to trauma, all surgical patients were managed by the hospital’s only general surgical service consisting of a group of seven trauma and critical care trained physicians. These surgeons provide all the trauma, critical care, elective, and ACS interventions. The service’s structure and scope of practice has not changed significantly for over 20 y. As this faculty provides essentially all surgical (trauma and nontrauma) services and management, we believe that this provides the most comprehensive view of the breadth of patients, pathology, and service needs.

Following institutional review board approval, data were obtained from hospital billing, operating room, trauma, and intensive care unit (ICU) databases. Data were compiled into a single database of unique patient visits. Patients were classified as: trauma, ACS, EGS, or elective general surgery patients. Trauma patients were defined as those patients admitted directly through the emergency department for management of injuries secondary to a traumatic event. Elective patients were defined as patients scheduled for an operation after outpatient evaluation that were admitted specifically for the

procedure. EGS patients were those patients admitted for nontraumatic causes (including inpatient referrals) who required operative or nonoperative management by the surgical service. ACS patients were defined as any EGS patient with significant potential for or presence of altered physiology requiring ICU admission and/or requiring a complex operative intervention beyond the scope of routine general surgical practice (Table 1). The operations included as ACS were based on the case-mix reported at various institutions with an ACS service [3–6,8] and a consensus agreement by at least two highly experienced attending surgeons. By definition, any EGS patient requiring ICU admission was classified as an ACS patient. This did not include ICU admission for a diagnosis unrelated to the surgical issue (eg., pneumonia). Classifications were assigned based on individual review of the operative cases and not based on ICD-9 codes.

Based on these categories, the groups were then compared. We examined patient demographics, total admissions, need for operative intervention, need for multiple operations, ICU admission, ICU length of stay (LOS), hospital LOS, mortality, and discharge location. Data was analyzed with Chi-square, Fishers-exact, and Kruskal–Wallis tests using STATA-12 (College Station, TX).

## 3. Results

Over 12 months, the trauma/general surgery service evaluated an estimated 5500 patients, including 3334 trauma patients. Nontrauma patients were inpatient or emergency department referrals and elective surgical patients. We did not include patients in our analysis who were evaluated in the emergency department and discharged home or those patients admitted to other services (i.e., neurosurgery, orthopedics) for isolated injuries. Patients seen in the outpatient clinic were not included unless they were admitted directly from clinic.

In total, 2152 were admitted to or operated on by the trauma/general surgery service. The most common EGS procedure was appendectomy (Table 1). The most common ACS procedure was bowel resection for perforation or ischemia. The majority of the patients were male (60.6%) with a mean age of 45.9 years. Age varied significantly among groups ( $P = 0.0001$ ). 60% of patients required a general surgical intervention and 19.7% required ICU admission (Table 2).

Of the 2152 patients, 37% were classified as Trauma, 4% ACS, 28% EGS, and 30% elective (Table 3). 67.4% of all patients required an operation by a surgical service: 85.5% of ACS patients, 64.1% EGS patients, 42.1% trauma patients. 60% underwent an operation specifically by the trauma/general surgery service: 85.5% of ACS patients, 63.8% EGS patients, 22.6% trauma patients ( $P < 0.0001$ ). When compared to EGS patients, ACS and Trauma patients were more likely to require multiple operations (ACS relative risk [RR] 11.5 (6–22.1,  $P < 0.0001$ ); Trauma RR 5.7 (3.2–10,  $P < 0.0001$ )). ACS and Trauma patients also had significantly longer hospital LOS and higher mortality when compared to EGS and elective patients (Table 3). ACS and Trauma patients were significantly less likely to be discharged directly home, reflecting higher care needs at discharge (ACS RR = 0.75 (0.65–0.85),  $P < 0.0001$ ;

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