Published in final edited form as:

Am J Surg. 2006 December ; 192(6): 732–737.

Has the Trauma Surgeon Become House Staff for the Surgical Subspecialist?

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Summary

The general surgeon's growing disinterest in trauma is fueled by lack of surgical opportunity and high burden of non operative responsibilities. The majority of care provided by the trauma surgeon supports other procedure oriented specialties. This is a major deterrent surgeon participation in trauma care and must be addressed in the evolution of the Acute Care Surgeon.

Background—The role of the trauma surgeon is perceived to be mostly supportive of other procedure oriented specialties. We designed this study to characterize the operative and nonoperative responsibilities of the contemporary trauma surgeon.

Methods—Trauma patients admitted to an urban academic Level I Trauma Center were studied using trauma registry data for 2004.

Results—The large majority of patients admitted to trauma service have mild single system injuries to one or two anatomic regions. Most (57%) did not have injuries to the neck, chest, or abdomen. Head and extremity injuries were present in 45% and 46% of patients respectively. Operations were performed by orthopedists in 28%, trauma surgeons in 11% and neurosurgeons in 6% of patients respectively.

Conclusions—The contemporary trauma surgeon has little operative opportunity and provides a disproportionate amount of nonoperative care in supportive of consultant specialists. This is a major deterrent to general surgeon interest in trauma care and must be addressed as the Acute Care Surgeon evolves.

Keywords

Trauma Surgeon; Acute Care Surgery; Emergency Surgeon

Background

Care of the trauma patient has changed dramatically in the past 15 years. Decreased penetrating trauma, better noninvasive diagnostic imaging, non-operative management of solid organ injuries, development of endovascular therapy, and evolutions in postinjury critical care have clearly been beneficial to the trauma patient, but have also reduced the operative potential of the trauma surgeon. Conversely, trauma remains a multidisciplinary disease requiring

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Presented at the 58th Meeting of the Southwestern Surgical Congress, April 3–7, 2006, Kauai, HI

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participation of consultant specialists including orthopedic surgeons, neurosurgeons, maxillofacial, and reconstructive surgeons. While the trend in non-surgical and minimally operative strategies has reduced the frequency of trauma surgeon performed operations, other specialties continually introduce new operative techniques to treat the trauma patient. Orthopedic trauma is largely operative and the advent of damage control orthopedics and neurosurgery has further increased the operative potential for these services. Thus, as the opportunity of the trauma surgeon has dwindled, and that of the consultant specialist has increased, the trauma surgeon has experienced a shift of primary responsibilities towards non-operative management strategies and interdisciplinary care coordination. It is exactly this shift in practice that has driven graduating residents and practicing general surgeons away from trauma as a career and interest in trauma as part of general surgery practice.

Efforts to prevent the extinction of the trauma surgeon are centered on reestablishing operative domain in non-trauma general surgery and expanding into select emergent procedures that are traditionally performed by consultant specialists. [1] This offers an attractive alternative to the largely non-operative practice that many professional trauma surgeons experience today. However, the solution must also consider the role of the trauma surgeon in non-operative patient care. The paradigm shift to Acute Care Surgery must be founded not only on increasing the opportunities for complex operative procedures, but also on addressing the other aspects of trauma care that deter interest in this vital field of medicine. To develop a viable evolutionary strategy, we must first have an honest and accurate assessment of the duties currently assumed by the trauma surgeon. The purpose of this study was to describe the current role of the trauma surgeon in the multidisciplinary care of the trauma patient at an urban Academic Level I Trauma Center. We hypothesized that, despite a near optimal environment for the acute care surgeon, the trauma service at DHMC provides an unreasonably high proportion of non-operative care support to procedure oriented consultant specialists. [2]

Methods

The Rocky Mountain Regional Trauma Center at Denver Health Medical Center (DHMC) is an American College of Surgeons Committee on Trauma (ACS/COT) verified and state certified urban academic Level I Trauma Center. DHMC also serves as the safety net hospital for the city and county of Denver. A tiered trauma team response is triggered by pre-hospital or emergency department personnel on injured patients arriving to the emergency department (ED). The trauma team consists of multidisciplinary health care providers, including physicians (from a variety of services), nurses, health care technicians, radiology personnel, and others depending on the level of response required. The attending trauma surgeon has ultimate responsibility and authority for the initial evaluation and management of the injured patient. The response system is flexible and can be upgraded or down graded at the discretion of the trauma team leader. Patients requiring admission to the trauma/acute care service are admitted under the attending surgeon. The general surgeons at DHMC participate equally in trauma call and provide comprehensive elective and non-elective general surgery services that include thoracic and vascular services.

Trauma team activation is the highest level response for patients at risk of critical injury. It is triggered prior to or upon patient arrival by emergency medical services (EMS) or the emergency physician for patients with 1) blunt and penetrating injuries with a pre-hospital systolic blood pressure less than 90mmHg, 2) penetrating gunshot wounds to the torso 3) stab wounds to the torso requiring endotracheal intubation, 4) amputation proximal to the wrist or ankle, 5) a Glasgow Coma Scale (GCS) less than 8 or respiratory compromised with presumed thoracic, abdominal or pelvic injury, 6) inter-hospital transfers requiring blood transfusion to maintain vital signs or 7) when the emergency medicine attending or chief surgical resident suspects the patient is likely to require urgent operative intervention. The attending surgeon

leads the trauma team during the trauma activation and is expected to be present in the ED prior to arrival of the patient or within 15 minutes when notification is short.

Trauma team alert is a moderate response required for patients transported to DHMC Code 10 (EMS lights and sirens) but who do not meet criteria for trauma activation. In this case the chief surgical resident and attending emergency physician lead the trauma team during the evaluation and resuscitation of the patient. The attending surgeon is notified and responds based on the initial evaluation and is expected to evaluate all trauma alerts within 6 hours of patient arrival.

A trauma consult is reserved for patients that do not meet activation or alert criteria, but have the potential for serious injury based on an initial evaluation performed by the emergency physician. It is required on any patient with a recent history of trauma that is to be admitted to the obstetric, pediatric, or medicine services from the ED or at the discretion of the emergency physician. The evaluation is performed by the surgical house staff under the supervision of the attending surgeon.

Patients that are admitted to the hospital for greater than 12 hours or die upon arrival with a principal diagnosis of acute trauma are entered into the Colorado Trauma Registry. Data for this study was abstracted from the trauma registry maintained at Denver Health Medical Center for patients injured between January 1st and December 31st, 2004. Injuries were classified using the abbreviated injury scale (AIS) regions. The cervical, thoracic, and lumbar spine regions were pooled into a spine category. External (skin and integument) injuries were excluded when calculating the number of systems involved in multisystem injuries. Operative interventions were defined as procedures performed in the operating room and classified according to the service that performed the operation.

Data are presented as mean $\pm$ standard error unless otherwise noted. Statistical analyses were performed using SAS for Windows (SAS Institute, Cary NC). Categorical variables were analyzed using a Chi square test with the Yates' correction for continuity or the Fisher Exact test when expected cell values were < 5 . For continuous variables with normal distribution, ANOVA or Student t-tests (with the appropriate Welch modification when the assumption of equal variances did not hold) were used. Spearman's rank correlation was used for comparison of ordinal categorical values. Data are represented as mean $\pm$ standard error (SE) unless otherwise noted. A p value < 0.05 was considered significant

Results

In 2004 there were 2791 patients with trauma diagnoses evaluated in the ED. Registry data were not recorded on 561 patients that were discharged alive within 12 hours of admission. Data on 2230 patients was used in this study; 1612 (72%) were male and the average age was 37.4 ± 0.4 years. Most patients (1934, 87%) were victims of blunt trauma with an average ISS of 12.8 ± 0.3 . The admission status according to trauma team response is shown in table 1, 480 (22%) patients were transported directly to the operating room before admission to the SICU or ward. The length of stay for all trauma patients was 5.8 ± 0.2 days for a total of 12,916 days.

The trauma team was activated in 159 (7%) patients. All 116 survivors were admitted to the acute care surgery service; 27 (23%) were admitted to the ward, 87 (75%) were admitted to the SICU, and 63 (54%) required urgent or emergent operations. Only 38 (24%) trauma activations had an ISS less than 16, and 46 (28%) patients had an injury to one AIS region mostly located in the head, 27 (17%) did not have any injuries to the neck chest or abdomen. Seventy nine patients (50%) required operations, 63 required urgent or emergent operations.

The trauma team was alerted on 1030 (46%) patients, 9 (1%) died in the emergency department, 561 (54%) were admitted to the SICU, 363 (35%) were admitted to the ward, 86 (8%) were admitted for 23 hour observation, 11 (1%) were discharged. Two hundred thirty patients (22%) required urgent or emergent operations. Almost all trauma alerts (947, 92%) were admitted to the acute care surgery service; 639 (62%) had an ISS less than 16, and 494 (48%) had injuries isolated to one AIS region, 583 (56%) did not have any injuries to the neck, chest, or abdomen. Four hundred fifty nine patients (45%) required operations, 308 (70%) of these patients required operations performed by an orthopedic surgeon, 69 (15%) by a neurosurgeon, and 99 (22%) by an acute care surgeon. 230 (22%) patients required urgent or emergent operation, 125 (54%) were performed by an orthopedic surgeon.

The trauma service was consulted after initial evaluation by an emergency physician on 478 (21%) patients that did not meet activation or alert criteria; 233 (49%) were admitted to the SICU, 191 (40%) were admitted to the ward, 54 (11%) were admitted for 23 hour observation. 74 (15%) required urgent or emergent operations. The most frequent indication for ICU admission was neurologic observation for occult intracranial hemorrhage. Nearly all trauma consults (469, 98%) were admitted to the acute care surgery service, 368 (76%) had an ISS less than 16, 333 (70%) had injuries isolated to one AIS region, and 350 (73%) did not have injuries to the neck, chest or abdomen. One hundred seventy two patients (36%) required operations, 123 (72%) of these patients required operations performed by an orthopedic surgeon, 25 (15%) by a neurosurgeon, and 24 (14%) by an acute care surgeon.

Five hundred sixty three (25%) injured patients did not meet trauma activation or alert criteria and did not require a trauma consult after initial evaluation by an emergency physician; 482 (85%) were admitted to the ward, 58 (10%) were admitted for 23 hour observation and 22 (4%) were discharged. The majority (432, 77%) were admitted to the orthopedic surgery service, 555 (99%) had an ISS less than 16, and 522 (93%) had injuries isolated to one AIS region, 350 (73%) did not have any injuries to the neck, chest, or abdomen. Three hundred twenty nine patients (58%) required operations, 305 (93%) of these patients required operations performed by an orthopedic surgeon.

Overall, the trauma service evaluated 1667 patients, 1532 (92%) of which were admitted to the trauma service. Of the patients admitted to the acute care service, 1416 (92%) did not meet trauma activation criteria, 963 (63%) had an ISS less than 16 (Figure 1), 794 (52%) had an injury limited to one AIS region (Figure 2). The spectrum of injuries of those admitted to the trauma service is shown in table 2, 45% of patients had injuries to the head and 46% of patients had injuries to the extremities, 877 (57%) did not have any injuries to the neck, chest or abdomen. Trauma surgeons performed operations on only 11% of patients admitted to the trauma service while neurosurgeons operated on 6% and orthopedic surgeons operated on 28% (table 3). The length of stay for patients admitted to the trauma service was 7.3 ± 0.3 days totaling 6224 SICU days and 11209 hospital days.

Discussion

Disaffection with trauma patient care and trauma surgery as a career has been recognized among general surgeons since 1991. [3,4] Reasons cited for this declining interest have included the unpredictable schedule that disrupts elective responsibilities, the demanding lifestyle with excessive night and weekend call, the poor compensation relative to the amount of work required, the decreasing operative opportunities for the general surgeon in trauma care, and the enlarging burden of non-operative responsibilities assigned to the trauma surgeon.[5, 6] Indeed, the trauma surgeon is often viewed as a “non-surgical” surgeon primarily concerned with the intensive care unit,[4] a perception bolstered by the non-operative mandates in surgical critical care training. Once considered “master surgeons”, trauma surgeons at many centers are

now relegated to “second class” status with limited general surgery opportunities. As a result, surgeons willing to participate in trauma call have become scarce.

The landscape of trauma care has change dramatically over the last decade.[7] The introduction of routine computed tomography and surgeon performed ultrasound has facilitated non-operative management of blunt solid organ injuries. In a multi-institutional Eastern Association for the Surgery of Trauma (EAST) study, Fakhry and Watts estimated that the average surgical resident would have to care for more than 500 blunt trauma victims before having the chance to participate in one operative liver or spleen repair.[8] The decrease in penetrating trauma observed in most centers since 1993 has also reduced the need for trauma surgeon intervention to a historic low[9,10] and the emergence of surgical sub-specialists has diverted thoracic and vascular procedures away from the trauma surgeon at many centers. Concurrently, the demand for trauma surgeon presence in the ED has increased. Trauma centers verified by the American College of Surgeons Committee on Trauma (ACS/COT) require that the trauma surgeon “be present in the ED upon patient arrival in all patients meeting the hospital specific guidelines for defining a major resuscitation.”[11] These changes have triggered a seismic shift in trauma surgeon responsibilities towards a minimally operative support role in care of the injured patient.

Several authors have addressed the negative aspects of trauma care in an effort to change current practice patterns and hopefully avoid the eventual inevitable disappearance of the trauma surgeon. Some have proposed rational approaches to increasing physician compensation based on strategies used by the trauma center to improve facility reimbursement,[12] while others have focused on dispelling the impression of a litigious, non paying patient population. [13] [14] The heart of the issue however remains the clinical responsibilities of trauma surgeon. [15] The central effort, championed by the American Association for the Surgery of Trauma (AAST) Committee to Develop the Reorganized Specialty of Trauma, Surgical Critical Care, and Emergency Surgery, is to redefine the trauma surgeon as the Acute Care Surgeon, incorporating comprehensive trauma care, non-trauma surgical emergencies, and surgical critical care.[1] Centers that instituted such an approach have demonstrated an increase in the operative potential and satisfaction of participating surgeons while preserving trauma outcomes and improving elective productivity of the services relieved of emergency responsibilities. [2,16–19] These reports have demonstrated the viability of modern comprehensive acute care surgical service.

Increasing operative potential addresses only part if the issue however. Equally as important is the perception by practicing trauma surgeons and graduating residents that the trauma surgeon has become housestaff for the consultant specialist. It is well recognized that trauma is a multisystem disease that requires the interest and participation of many specialty services including emergency medicine, interventional radiology, orthopedics, neurosurgery, otolaryngology, oromaxillofacial surgery, plastic surgery, and anesthesiology. The trauma surgeon has been identified as the “captain of the ship” for multisystem problems and has historically assumed the responsibility for coordination of interdisciplinary care in addition to the acute resuscitation and general surgical operative care. In principle, this ensures that there is one individual responsible for managing the “big picture” while specific injuries are addressed by consultant specialists.

In the present study we found that the majority of all trauma patients evaluated by the trauma service had mild or moderate injuries limited to single systems. Most of these evaluations were triggered by prehospital personnel and did not meet trauma activation criteria. Of the patients admitted to the trauma service, 57% had injuries located outside the neck, chest, and abdomen, regions where nearly all non vascular injuries are treated by consultant specialists. Yet admission of the mildly injured patient with single system disease to specialty services was

almost nonexistent. Few of the patients evaluated or admitted to the acute care service required operative treatment by an acute care surgeon while many required an operation by an orthopedic surgeon. In fact, 1092 (38%) of all 2884 orthopedic procedures at DHMC in 2004 were performed on patients admitted to the acute care service. It could be argued that a trauma surgeon must evaluate 10 trauma patients, admit 9, and provide up to 65 days worth of inpatient care for every one that needs an acute care operation. These findings further the perception that the care provided by the trauma surgeon is largely in support of the subspecialist.

Having one service dedicated to coordinating treatment of complex multiple injuries is clearly advantageous to the patient. The benefits of the trauma surgeon acting as the patient's primary care giver once the acute trauma surgical issues have resolved however, is best argued by the subspecialist. Inpatient care in the ICU and on the ward and is time consuming and detracts from potentially more advantageous endeavors such as maintaining an elective general surgery practice. Additionally, it is often left to the trauma service to explain the complex of neurologic and orthopedic recovery issues to the patient and family after these services have "signed off". One can only speculate how much the trauma surgeon has enabled other services to concentrate time in the operating room by assuming these non-operative duties. If we accept that these responsibilities are a contributing factor to the growing disinterest in trauma care, then they must be considered when moving forward in the evolution of acute care surgery where the major efforts are currently focused on expanding operative domain.

One solution is to redistribute emergency resources and concentrate skills unique to the trauma surgeon on patients most likely to need an acute care surgeon. [20] The structure of our system positions the emergency physician as the first responder for noncritically injured patients. This not only allows skilled early evaluation, but also promotes the efficient distribution of patients with mild single system injuries to subspecialty services. In this study, almost half (47%) of the patients arriving to the trauma center by EMS or private vehicle did not meet trauma alert or activation criteria, and over half of these did not require a trauma team consultation after initial evaluation by an emergency physician. Although the majority (86%) of these patients suffered only mild orthopedic injuries, 56% required operative fracture fixation. Thus, utilizing an emergency physician trained in trauma care avoided an unnecessary trauma consult in approximately 25% of the study population. This should not be considered abdicating control of the trauma patient to the ED but rather more appropriate patient selection for trauma consult.

Another option for is to distribute patients with significant injuries limited to a single system to the services that routinely care for those injuries. A policy of direct admission of isolated neurosurgical or orthopedic injuries to the specific subspecialty service after complete evaluation by the trauma service in the emergency department was instituted in Vermont and found to decrease admissions to the trauma service but not affect the overall complication rate or missed injury rate. [21] Concern for missed injuries can be further addressed by implementation of a mandatory tertiary survey performed by the trauma team 24 hours following admission to the primary service.[22]

This concept should be expanded beyond the initial postinjury period for patients with multisystem injuries once the acute general/trauma surgery issues are no longer a threat. Multiply injured patients are appropriately managed by the trauma service during the resuscitation and reconstruction phases, but frequently remain on the trauma service for prolonged inpatient care of complex orthopedic injuries and the sequelae of traumatic brain injury. Care during this recovery phase can greatly affect outcome but generally receives a lower priority than care of the more acutely ill patient in the SICU. Patient care needs during this phase of recovery might be better served by a non-surgical hospitalist or rehabilitation specialist. In theory, shifting these responsibilities could allow focus on the acute postinjury period, the phase of care that specifically requires the unique skills of the trauma surgeon.

It is vital to know the point of origin when planning any major adventure. In this study we present a critical evaluation of the current scope of practice for the modern trauma surgeon. While our experience may be unique to our center, the perception that modern trauma care requires a disproportionate share of non-operative responsibilities is universal. Consideration of these responsibilities is critical to planning the evolution into acute care surgery. Now is the time to either accept a role as housestaff for the subspecialist, or reestablish ourselves as master surgeons.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgements

Supported in part by NIH Grants P50GM49222, T32GM08315, U546M62119, Jourdan Block Trauma Foundation

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Figure I.
ISS distribution of trauma patients admitted to the Acute Care Surgery service.

Figure II.
Number of injured AIS regions in trauma patients admitted to the Acute Care Surgery service.

Table 1

Trauma team response and admission disposition of all trauma patients

Response	Admission Status					Total
	Dead	ICU	Ward	Obs	Discharge	
None	1	0	482	65	22	570
Consult	0	233	191	47	0	471
Alert	9	561	363	86	11	1030
Activation	43	87	27	2	0	159
Total	53	881	1063	200	33	2230

Table 2
Injury pattern of trauma patients admitted to the Acute Care Surgery service

Anatomic Region	n	%	Isolated	%
Head/Neck	690	45%	225	15%
Spine	243	16%	47	3%
Chest/Abd	608	40%	174	11%
Extremity	704	46%	264	17%

AIS Region	n	%	n	%
Head	492	32%	160	10%
Face	333	22%	46	3%
Neck	68	4%	19	1%
Chest	472	31%	97	6%
Abd	272	18%	77	5%
Spine	243	16%	47	3%
Arm	348	23%	74	5%
Leg	496	32%	190	12%
External	501	33%	84	5%

Table 3

Operative procedures in all patients and trauma patients admitted to the Acute Care Surgery service.

	All Patients		Trauma Admissions	
n	2230	%	1532	%
None	1191	53%	872	57%
Ortho	780	35%	433	28%
Trauma	171	8%	171	11%
Neursrg	99	4%	99	6%
Other	134	6%	99	6%