The Intensive Care Unit Perspective of Becoming a Level I Trauma Center: Challenges of Strategy, Leadership, and Operations Management

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Abstract

The primary purpose of this narrative is to elucidate the numerous significant changes that occur at the intensive care unit (ICU) level as a medical center pursues becoming a Level I trauma center. Specifically, we will focus on the following important areas: (1) leadership and strategy issues behind the decision to move forward with becoming a trauma center; (2) preparation needed to take a highly functioning surgical ICU and align it for the inevitable changes that happen as trauma go-live occurs; (3) intensivist staffing changes; (4) roles for and training of advanced practice practitioners; (5) graduate medical education issues; (6) optimizing interactions with closely related services; (7) nursing, staffing, and training issues; (8) bed allocation issues; and (9) reconciling the advantages of a “unified adult critical care service” with the realities of the central relationship between trauma and surgical critical care.

Keywords: Accreditation Council for Graduate Medical Education, administration, intensivist, nursing staffing, operations management, patient throughput, resident training, surgical intensive care unit, table of organization, trauma center

Introduction

As in all businesses, a clear strategic vision is critical for the viability of an academic medical center. Part of good business strategy is the ability to rapidly change and adapt as the situation warrants. After over 100 years of community service, it was determined that our hospital, a 711-bed academic medical center in a major metropolitan area (New York City), should attempt the daunting process of becoming an American College of Surgeons (ACS) designated Level I trauma center. Although there are multiple publications separately describing the administration and organization of intensive care units (ICUs)1-9 or trauma centers,10-22 there is a paucity of articles focusing specifically on the significant changes required from an ICU perspective as a medical center migrates from the inchoate phase to becoming an official ACS Level I trauma center.

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the realities of the central relationship between trauma and surgical critical care. Although our primary focus is on the impact becoming a trauma center has on the structure and organization of adult critical care, we also will address some issues as they relate to the pediatric ICU (PICU) as well. We believe this article will be valuable and could potentially help guide ICU medical directors, chief medical officers (and other physician leadership), as well as administrative leaders of nursing departments; it will also be of value to residency training program leaders in hospitals contemplating the pursuit of a Level 1 trauma designation.

**WHY CHOOSE TO BECOME A TRAUMA CENTER?**

The decision to become a trauma center can be based on several principles. The clearest one is when there is no trauma center to support a community, resulting in prolonged transport times, and poorer outcomes after injury. This scenario is present in many rural areas around the country. In the more urban environment, this is rarely an issue. Many larger cities have several trauma centers that serve large but condensed populations. Here, more than one trauma center may be needed to avoid overwhelming a single center. The current conundrum for trauma systems is how to determine the optimal number of trauma centers for any particular community. Too many centers will result in many low-volume centers that never see enough patients to develop expertise with less common injuries. How physicians, nurses, and related providers in these low-volume centers maintain important skill sets is unclear. While simulation may help, it cannot replace the experience for caring for a badly injured patient. Too few centers will result in overcrowding and delays in care due to inability to care for multiple patients simultaneously. Currently, the ACS Committee on Trauma is working on the creation of a metric to assess the need for a trauma center based on many of these parameters.

Our decision to become a trauma center originated from the former problem. Brooklyn, a borough in New York City, has over 2.5 million residents, of which more than 600,000 are children. Financial considerations forced the only pediatric trauma center in the borough to eliminate its pediatric trauma program; this, in turn, led to injured children being transported extended distances to other boroughs to receive trauma care. This resulted in two problems. The first is that there are data suggesting that children who are transferred from one center to a pediatric trauma center do not do as well as those admitted directly to a pediatric trauma center. The second is the burden placed on families when they should travel large distances to visit their children. Based on these concerns, our center—with a robust children’s hospital but no formal trauma designation—decided to become the pediatric trauma center for the region. As many of the requirements for a pediatric trauma center are also required for an adult trauma center, our center also decided to pursue adult trauma designation.

**THE SURGICAL INTENSIVE CARE UNIT**

Intensivist staffing and unanticipated logistical challenges

From an intensivist staffing perspective, the transition to Level I trauma center designation was somewhat complex. Before arrival of the acute care surgeons (AcuteCSs), our SICU was a de facto eight-bed SICU managing critically ill general surgical as well as neurosurgical patients. The SICU had a medical director (0.75 of a full-time employee [FTE] clinical time) as well as two other FTE intensivists. The clinical backgrounds of the three intensivists in the SICU were heterogeneous: the medical director had board certification in internal medicine, critical care medicine, and neurocritical care; one intensivist was a recent graduate with training in internal medicine, critical care medicine, and pulmonary medicine; the remaining intensivist was a surgeon with a formal fellowship in surgical critical care/trauma and 10 years of experience. With intensivist turnover and arrival of the AcuteCSs, the total attending staff in the SICU was as significantly modified with a total of five physicians rotating through the SICU: the prior medical director (0.75 FTE); 1 FTE intensivist; two trauma/AcuteCSs (~0.5 FTE); and the Trauma Medical Director (TMD) (~0.3FTE). This was a total of approximately 3 FTE intensivists to cover our SICU during the day.

As per the ACS, the TMD should also be the director of the SICU. This led to a potential conflict of leadership of the SICU as our SICU already had a medical director. A decision was made before the arrival of the TMD that on arrival of the TMD, the SICU director would be given the role of oversight of adult critical care services, allowing there to be a seamless transition of leadership in the SICU itself, as well as continued integration of critical care services among ICUs. In addition, after an initial overlap period, this clinician would have their clinical time reallocated in the development of a hospital-wide “critical care outreach service.” Although we do not feel our solution will be applicable in detail to every hospital, it is our opinion that spending the necessary time and effort to transparently clarify the critical care physician table of organization is an important, complex, and mandatory component of moving forward with becoming an ACS designated Level I trauma center.

Multiple complex issues arise when switching to a trauma ICU model. One is that the intensivist scheduling for the SICU can become somewhat more problematic. As an example, the AcuteCS can have numerous clinical roles at the medical center; being the SICU intensivist attending is only one of them. By way of illustration, an AcuteCS may be: covering the trauma/emergency general surgery service, attending in the SICU, seeing outpatients, being on call for adult or pediatric trauma, and potentially on backup call for trauma. In addition, let us not forget the trauma/AcuteCSs may be in the operating room. As the AcuteCS service becomes even more mature, trauma and emergency general surgery are often separated into distinct services, with the associated increase in scheduling challenges.
In addition, our NPs completed a 12-week orientation with multiple components: (1) formal rotations in our SICU, our SDU, as well as time on our stroke neurology service; (2) weekly trauma/critical care journal club; (3) simulation training for relevant ICU procedures;[26] and (4) weekly didactic sessions with NP presentations and use of the Society of Critical Care Medicine’s Fundamental Critical Care Support course textbook as an initial knowledge base.[27] In addition, our NPs completed an Advanced Trauma Life Support course (website https://www.facs.org/quality-programs/trauma/atls) as part of their trauma orientation.

Three of our four NPs had previous experience as bedside nurses in our SICU. Although this is an excellent background for them to have, the transition from RN to NP – especially in an ICU where the nurse had previously worked – can be fraught with difficulty.[28] Specific areas that we found were of particular importance included: learning to provide clinical service for an entire unit (rather than one or two patients), rapidly developing an appropriate differential diagnosis for various critical care scenarios, interfacing and communicating properly with the attending surgeon as needed, and gaining proper technical skills for procedures. As such, we have found our orientation, with its combination of clinical mentoring, simulation training, and formal didactics to be of value to enhance confidence in our APPs as they transitioned from bedside critical care nurse to critical care NP. To provide continuous feedback and determine the optimal length of the orientation for each NP, we performed periodic clinical assessments with milestones throughout the orientation period.

Another potential issue that can arise with an increase in the number of intensivists (as a full complement of AcuteCS is hired) is that each intensivist potentially spends less time each month as the attending in the ICU: this has the possibility of limiting the experience for the surgeon as well as consistency and continuity of care for the unit as a whole.

**Role and Training of Advanced Practice Practitioners**

**Providing 24/7 coverage in our surgical stepdown unit**

As we moved forward with the Level I trauma designation, hospital administration was able to provide the resources for recruitment of the five nurse practitioners (NPs) required for 24/7 coverage in our surgical progressive care unit. Before trauma implementation, there was one NP designated for daytime work in our SICU and one physician’s assistant assigned to our surgical stepdown unit (SDU). Given the predicted increase in patient volume and acuity (and limitations of resident coverage of surgical patients), there was consensus agreement among clinical leadership that having 24/7 advanced practice practitioner (APP) would be a crucial component to our global trauma plan, specifically with regard to quality and patient safety. Along the same lines as the group from Memorial Sloan Kettering Cancer Center,[23] we developed a 12-week orientation with multiple components: (1) formal rotations in our SICU, our SDU, as well as time on our stroke neurology service; (2) weekly trauma/critical care journal club; (3) simulation training for relevant ICU procedures;[26] and (4) weekly didactic sessions with NP presentations and use of the Society of Critical Care Medicine’s Fundamental Critical Care Support course textbook as an initial knowledge base.[27] In addition, our NPs completed an Advanced Trauma Life Support course (website https://www.facs.org/quality-programs/trauma/atls) as part of their trauma orientation.

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**Allocation of Resident Resources and Other Graduate Medical Education Issues**

On arrival of the new TMD – in collaboration with the erstwhile SICU medical director – a plan was put in place to reorganize the resident physician structure in our SICU. The resident organization before going live with trauma was as follows: usually between three and four residents with training level of postgraduate year (PGY) 2 from the departments of surgery, anesthesia, and emergency medicine would rotate in the SICU each month. On any given day, one resident would be on call, in-house, for 24 h and was the first call for all clinical issues in the SICU. The resident would be in telephone communication with one of the SICU attending intensivists (who was available to come into the hospital for emergencies) as needed overnight. From a teaching standpoint, the SICU rotation rated highly with the residents, and there was great anticipation of being able to integrate trauma education into our SICU curriculum.[29]

As part of the trauma reorganization, two major changes were made to the SICU resident structure. First, rather than have each resident do a 24-h in-house call, the plan was to switch this to a “night float” system, where one resident would be assigned to work nights for any particular week. The concept – fairly common for residencies in general – was that this approach could provide more patient continuity for both days and nights. Interestingly, the informal feedback from our residents was that they preferred doing the 24-h call and specifically found the challenges of doing this 24-h call to be some of the more important and educational parts of their SICU rotation. From an attending perspective, in contradistinction, having the same daytime staff present during the week was associated with a greater degree of continuity of care.[30]

The second major change to the residency structure was to add a new position. In close coordination with the surgery residency program director and chair of surgery, a decision was made to add a PGY-3 “SICU chief resident” position. It would be this resident’s job to provide overall clinical supervision to the other residents and help to act as a primary interface with the attending intensivist in SICU. Both of these changes occurred simultaneously with the official commencement of our trauma center go-live. The benefits of the “SICU Chief” included: (1) provision of more senior house officer supervision; (2) more consistency of care; and (3) all services had a “go-to” person for SICU issues. The potential risks included: less autonomy for the 2nd-year surgery residents rotating in the ICU (who were accustomed to having direct interactions with intensivists) and the potential possibility of work-hour violations.

**Interfacing with Closely Related Services**

**Acute care surgery and neurosurgery**

One important issue to be mindful of in the process of creating the incipient trauma ICU in a nontrauma academic medical center is the integrated nature of the relationship between the AcuteCS team and the SICU. We needed to clarify early on...
in the process that if the attending of record in the SICU was one of the AcuteCS attendings, they make sure to continue to coordinate closely with the SICU intensivist on important clinical issues. Other areas of clarification included when a trauma surgery attending may be in house at night that they properly notify the SICU attending should there be major changes in clinical status in a patient; it was also important that the SICU attending communicate with the in-house trauma attending regarding relevant clinical issues in the ICU before leaving the hospital campus.

We also put protocols in place to clarify issues, regarding which patients with head injury would go directly to the neurosurgical service, which would go to the trauma service, and which would go to the service for 24 h and then be transferred to the neurosurgical service. Working out as many of these issues before the go-live is preferable and reasonably anodyne; nevertheless, ensuring a continual dialog among the attendings from the relevant services is crucial to prevent internecine conflict, confusion, misunderstandings, and potentially suboptimal patient care.

**Nursing Staffing and Training Issues**

Nursing staffing remains a perpetual challenge for ICUs across the country. Specifically as it relates to trauma, any medical center working toward becoming a Level I trauma center should be completely prepared to devote significant resources to appropriate and flexible nursing staffing ratios for the nascent surgical/trauma ICU, any SDUs that may exist as well as the regular surgical floor beds that already are present. The nurses will be required to take certain trauma-specific courses, specifically the Trauma Care After Resuscitation (TCAR) course (for adult patients) and Pediatric Care After Resuscitation (PCAR) course (for children) (website http://www.tcarprograms.org). In addition, education will be required on cervical collar management, pelvic binders, external fixators, as well as enhancing the skills to best serve trauma patients with their particular socioeconomic needs. As part of the preparation for trauma, it was made clear to the nursing staff that trauma patients, as a rule, could not dwell in the emergency department for a prolonged period of time. Our mantra for the entire staff became “when trauma calls, just take the patient.”

**Bed Allocation and “Downstream” Throughput**

Managing rapid expansion and variability in demand

Our trauma volume rapidly increased following our initial go-live. We also simultaneously noted an increase in volume of patients from interventional neuroradiology requiring management in our SICU. This was causing some problems with patient flow in our emergency department as well as our postanesthesia care unit. Our average daily ICU census increased from 8 to around 12. This required a series of meetings with senior members of hospital administration in addition to nursing and physician leadership to come up with rapid, real-time options to manage these intricate, multifaceted problems of patient flow and variability in demand. Although it could easily be argued that these “problems” are actually markers of a successful start to our trauma program, creating solutions to these problems of operations management continues to be a work in progress. Each academic medical center will inevitably approach and solve these problems using their own unique toolbox. Nevertheless, we felt this was a crucial point to emphasize for an academic medical center as it contemplates the challenges of Level I designation.

There are a couple of other key points to make regarding trauma, patient flow, and increased volume. The majority of patients who present to the emergency department as “trauma” do not require admission, and of those who do require admission, only a minority of those require admission to the ICU. However, as the total volume of surgery admissions increases, the ability to get patients out of the ICU becomes more difficult unless the length of stay is kept low on the floors, or more general floor beds are created. We have also noticed that for our particular hospital, the patients being admitted with trauma diagnoses tended to have less family member support and less of a socioeconomic support network than our average patient population overall. We were starting to notice our surgical length of stay being impacted. As such, it is our recommendation to have increased allocation of case management and social work to the group of patients admitted with trauma to provide them the resources they require so that they are able to move efficiently and safely through the inpatient component of their trauma care.

**Impact on the Pediatric Intensive Care Unit**

We found that the go-live with Level I trauma was much less impactful on the PICU than it was on our adult SICU. Although the nurses were required to take the PCAR course (vide supra), the overall volume increase seen in the SICU was not manifest in the PICU. The one significant change that was required was one of the organizational structures from an intensivist perspective. The PICU in our medical center was one where the pediatric intensivist was the attending of record while the patient was in the ICU, including surgery patients. This paradigm was changed for patients who were admitted to the trauma service, where (again as part of the ACS Level I designation mandate) the trauma attending was the attending of record. After some initial adjustment (primarily at the level of the pediatric house staff), the relationship between the trauma attendings and the pediatric intensivists has become (and remains) an extremely cordial, collaborative, and productive one.

**Conclusion**

Reconciling the “unified adult critical care service” with trauma

We have elucidated some of the preparations required at the strategic, leadership, and operational level should a
nontrauma academic medical center decide to move forward with attempting to become an ACS designated Level I trauma center [Table 1]. If a careful strategic and business analysis concludes that it makes sense to do so, obtaining the designation requires a significant allocation of resources in many areas in the medical center. It also mandates complete “buy in” at all levels, most importantly from members of the departments of surgery, emergency medicine, anesthesia, and nursing. From a critical care perspective, our largest issues were to make sure that the hospital was aware of the potential rapid increase in volume in SICU and surgical stepdown and to ensure that nursing staffing budgets took into account these important and likely increases in staffing.

ACS rules mandated a change in the physician leadership in our SICU, and trauma surgeon recruitment led to significant changes in the intensivist staffing of our SICU and stepdown. Our medical center had been working for the 3 years before trauma implementation on the development of a unified adult critical care service. Although this service continues to exist, the tight relationship between the SICU and the trauma team has led to the reshuffling of, as well as thoughtful changes to, the overall organization of our adult critical care service. Nevertheless, the advantages of such a service – the sharing of ideas, protocols, guidelines, continuous quality improvement initiatives, and equipment – can still exist at a medical center that transitions to a trauma center. However, in order for a unified Critical Care Medicine service to remain successful, there needs to be abundant open communication, mature leadership, mutual respect, and emotional intelligence. Although it is easy to sometimes get caught up in the minutiae and details of the complex, dynamic, cross-departmental strategic plan when attempting to become a Level I trauma center, if we as clinician leaders[33] stay laser-focused on one question – “what is the best thing to do for patient care?” – it makes the decision as to which path to choose a much more obvious one.

Table 1: Issues to prepare for as intensive care unit goes from nontrauma to trauma

| Category             | Issue                                                                 | Outcome                                                                 |
|----------------------|-----------------------------------------------------------------------|------------------------------------------------------------------------|
| Strategy/leadership  | SICU leadership                                                      | TMD is SICU director as per ACS                                        |
|                      | SICU table of organization                                           | Will most likely require reevaluation                                   |
|                      | Hospital-wide critical care                                          | May require reengineering                                              |
| Operations management| Primary team admission criteria                                       | Predetermined clarification as to which patients get admitted           |
|                      |                                                                      | AcuteCS service (vs. neurosurgery etc.) is key                        |
|                      | Trauma throughput                                                    | Preparations should be made to manage a sustained increase in capacity, |
|                      |                                                                      | both in SICU and downstream                                            |
| Organizational issues| Critical care lines of communication                                 | SICU team and AcuteCS team become closely interconnected               |
|                      | SICU intensivist scheduling                                          | Nonsurgeon intensivists not in surgery call schedule                   |
| Education/organizational issues | House officer allocation                        | May require reassessment with the creation of AcuteCS team            |
| Education            | Resident trauma experience                                           | Must be developed within and compliant with ACGME regulatory environment |
| Education/ training/ organizational issues | Increased demand for clinical resources   | If necessary, rapid implementation of advanced practice practitioners may be required |
| Training             | Ancillary staff trauma skill set                                      | Will need to develop trauma-specific skills: for example, TCAR and PCAR courses |
|                      | Nursing workflow                                                     | Trauma patients may sometimes have to come quickly to SICU            |
|                      |                                                                      | from ED, often with little history                                    |
| Operations management| Needs of new patient population                                     | Trauma patients can require increased case management/social work resources |
| Leadership/organizational issues | PICU organizational changes                         | Had to start allowing surgeons to be attending of record for certain cases |

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