RESEARCH

Nonsurgical Admissions With Traumatic Injury: Medical Patients Are Trauma Patients Too

Laura Nelson, MS, RN ■ Sally Kuzniewski, MA, RN ■ Michael Grossman, MD ■ Jay A. Yelon, DO ■ Lisa Szydziak, MS

ABSTRACT

Nontrauma service (NTS) admissions are an increasing problem as ground-level falls in elderly patients become more common. The admission and evaluation of trauma patients to nontrauma services in trauma centers seeking American College of Surgeons (ACS) verification, must follow the ACS mandates for performance improvement requiring some method of evaluating this population when admitted to services other than trauma, orthopedics, and neurosurgery. The purpose of this study and performance improvement project was to improve our process for the definition and evaluation of trauma patients who were being admitted to nontrauma services. We designed an algorithm to evaluate appropriateness of NTS admission and evaluated outcomes for NTS admissions utilizing that algorithm.

We created a scoring algorithm and evaluated appropriateness of NTS admission over 2 years in a community-teaching ACS Level II trauma center. We reviewed trauma registry data using χ^2 and Fisher exact tests to determine differences in outcome for NTS versus trauma service (TS) admissions.

From December 2014 to December 2016, NTS admission rate fell from maximum of 28% to 4% stabilizing between 8% and 10%. Mortality and overall complication rate between NTS and TS were similar ($p = .40$ and .66, respectively), but length of stay was lower for TS admissions ($p < .0001$).

A scoring system of algorithm can be used to determine appropriateness of NTS admissions, and validity of the tool can be confirmed using registry-based outcome data for TS versus NTS admissions.

Key Words

Algorithm, Mortality and complication rates, Nontrauma service admissions, Performance improvement, Rationale for admission to nonsurgical service

BACKGROUND

The ACS Committee on Trauma's "Resources for Optimal Care of the Injured Patient" (ACS, 2014) includes evaluation of the rate of nontrauma service (NTS) admissions among the required performance improvement and patient safety (PIPS) measures. Trauma services (TSs) are defined as surgical services including General, Orthopedic, and Neurosurgery, and if the rate of admission to NTSs exceeds 10%, trauma programs must be "subjected to individual case review." The optimal resource document allows exclusion of those who have had consultation by trauma or other surgical service, have same height falls (ground level), or mechanisms including drowning, poisoning, and hanging or an Injury Severity score (ISS) of less than 9 (ACS, 2014), but for practical purposes, some level of review is necessary to determine whether these criteria have been met.

The rationale for this metric as a measure of trauma center quality is to ensure the active involvement of surgeons in the evaluation and care of trauma patients. Because trauma patients older than 75 years are increasing and the most frequent mechanism of injury reported to the National Trauma Data Bank (NTDB) is falls with ISS of 1–8 (ACS, 2016), this metric and its evaluation by PIPS programs have become even more relevant.

Despite data demonstrating an increase in minimally injured elderly trauma patients (Kozar et al., 2015), information regarding admission service and/or outcomes by service is generally lacking. In addition to demographic changes, trauma centers are increasingly staffed by full-time TSs that admit a significant proportion of all trauma patients (Bugaev, Arabian, & Rabinovici, 2013) as opposed to the specialty services, Orthopedics and Neurosurgery. These data indicate that admission patterns for single system injury have changed in the direction of TS admission. Additional studies have described the use of geriatric fracture and fragility services that (Kozar et al., 2015; Prestmo et al., 2015) may or may not involve substantial input from surgical services.

Given the considerations noted previously, it is not surprising that many trauma centers have NTS admission rates exceeding 10% and PIPS programs expend

Author Affiliation: Southside Hospital/Northwell Health, Department of ACS/Trauma, Bay Shore, New York; Zucker School of Medicine at Hofstra Northwell, Hempstead, New York.

The authors declare no conflicts of interest.

Correspondence: Laura Nelson, MS RN, Southside Hospital/Northwell Health, Department of ACS/Trauma, 301 East Main St, Bay Shore, NY 11706 (lanelson@northwell.edu).

DOI: 10.1097/JTN.0000000000000367

considerable time and energy to review process and outcome of care for these patients. We sought to determine whether an objective scoring system might improve our ability to assess appropriateness of admission to NTS and whether admission to those services was associated with any adverse outcome compared with TS admission.

METHODS

In accordance with institutional and health system guidelines, IRB approval for this study was obtained. This project was carried out in a community Level II trauma center utilizing a core group of 6 trauma surgeons staffing full-time TS. Orthopedic and Neurosurgery do not routinely admit patients in our hospital; single-system injuries were admitted either to the TS or to the hospitalist medical service. Our trauma center previously utilized an administrative data set to identify all trauma patient admissions regardless of admitting service, and those admitted to NTS were flagged for review by the trauma medical director (TMD) and performance improvement coordinator (PIC).

In accordance with the Optimal Resource guide (ACS, 2014), we tracked specific metrics regarding surgical service consultation and then evaluated appropriateness of NTS admission on a case-by-case basis. These evaluations occurred on a weekly basis, tended to be time consuming, and in our view were somewhat arbitrary. In providing feedback to colleagues who were responsible for triage and admission service determination, we could not provide consistent objective criteria that could be used before the fact in determining the need for TS admission.

As a response to these concerns, we developed a tool (Table 1) to objectify the evaluation of NTS admissions that incorporated two of the metrics identified in the Optimal Resource guide (same height falls, ISS of ≤9) but expanded beyond that by adding variables we felt reflected acuity/severity of injury and potential need for TS admissions. By definition, these criteria are somewhat arbitrary and reflect the overall philosophy of our trauma program. For example, the decision to include intensive care unit admission and surgical procedure as criteria reflects our belief that such patients have potentially higher potential for complications and problems related to their injury at any level of preexisting disease. Conversely, we felt that age and comorbidities (>65, 3 or more major comorbidities) might be common in patients whose severity of injury was a less significant problem than their preexisting medical conditions. We felt that patients with low ISS, advanced age, and comorbidity who did not require operation or admission to the intensive care unit might be better served by admission to an NTS. We intentionally excluded isolated hip fractures from ground-level falls because these have traditionally been admitted to our medical service. Hip fractures from other mechanisms and all fractures of the femur in the elderly were included. The trauma program Performance Improvement Coordinator (PIC) was able to employ the tool independently to rate appropriateness of admission and determine an adjusted NTS admission rate. The PIC determinations were "over-read" by the Trauma Medical Director (TMD) on a monthly basis.

TABLE 1 Tool for the Evaluation of Nontrauma Service Admissions

Algorithm/Criteria	Points
Age >65 years	1
3 or more comorbidities	1
ISS < 10	1
MOI GLF	1
No ICU admission	1
No need for surgical intervention	1
No blood products	1

Note. MOI GLF = mechanism of injury, ground level fall; ICU = intensive care unit; ISS = Injury Severity score.

The evaluation score provides a maximum of 7 points; all patients with 7 points were considered as definitely appropriate for NTS admission. Patients with 4 or 5 points were subject to review and determination; patients with fewer than 4 points were considered inappropriate for NTS admission.

The tool was implemented and the rate of NTS admissions as well as the outcomes for NTS versus surgical service admissions was tracked concurrently. In addition, we measured outcomes (mortality and major complications), length of stay, and disposition differences between trauma and NTS admissions to determine whether there were differences based upon admitting service.

RESULTS

The peak unadjusted rate for NTS admissions in our trauma center was 28% in December of 2014. The evaluation scoring system was implemented in January of 2015 and adjusted NTS admissions fell to 4% by November of 2015 (Figure 1). Episodic increase in NTS admissions above the 10% threshold was observed in fluctuating time periods, was not consistently sustained, and returned to subthreshold levels within 2 months. There were no significant differences in outcome including mortality and major complications or resource utilization for TS versus NTS admissions; these results are displayed in Table 2.

DISCUSSION

The discussion of TS versus NTS admission should begin with clear understanding of whom or what constitutes

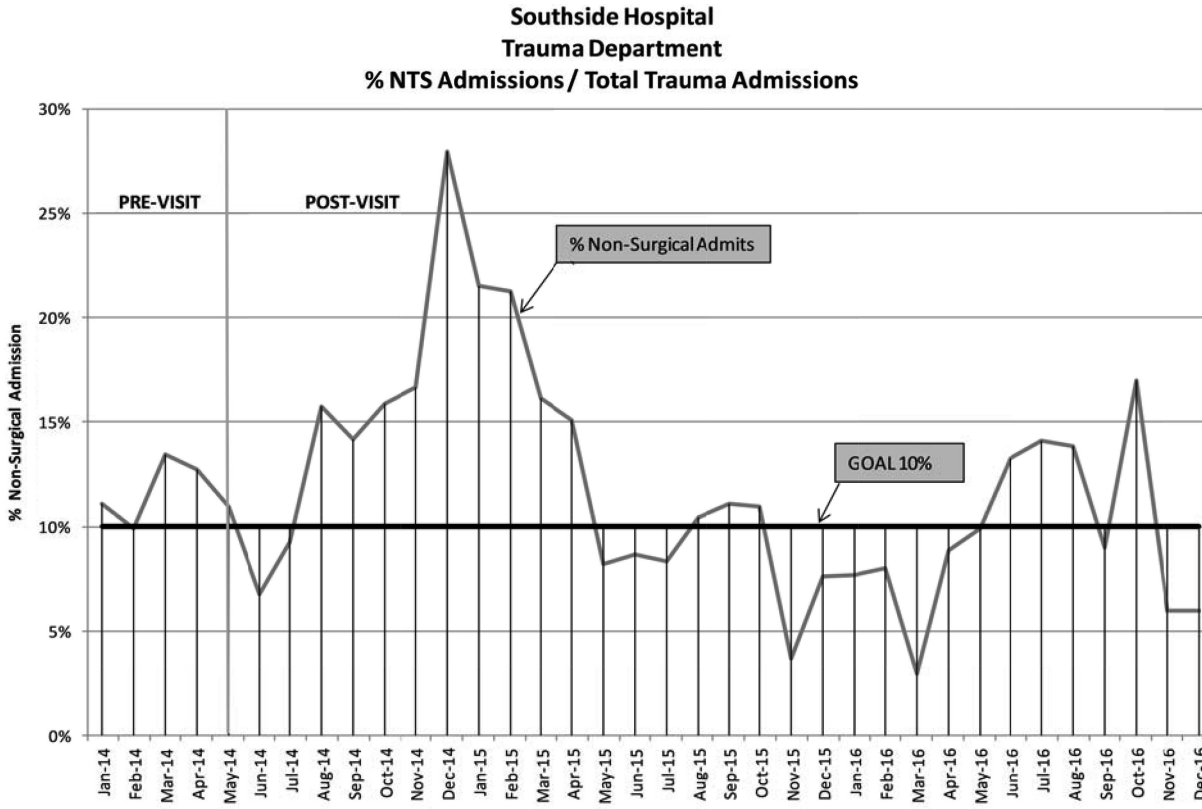

Figure 1. Nontrauma service admission rates. NTS = nontrauma service.

a trauma patient. These definitions have changed over time but are now standardized for the purposes of ACS trauma center verification. Patients meeting the NTDB inclusion criteria who are admitted to the trauma center are defined as trauma patients. Exclusions are isolated hip fracture from same surface fall, drowning, hanging, and poisoning. Patients with minor mechanism and single system injury with low severity will meet inclusion criteria if admitted to the hospital. This includes many patients who would be discharged and therefore not counted were it not for the contribution of comorbidities, frailty, and functional dependence all of which are independent predictors of poor outcome (Joseph et al., 2016; Kozar et al., 2015).

Given these considerations, the evaluation of NTS admission rates presupposes that admission to NTS may be associated with process or outcomes that are less desirable than would be achieved following TS admission. A theoretic basis for this assumption relates to potential for delay in diagnosis or treatment of injuries and/or failure to recognize injury-specific complications. For patients whose reason for admission is a major injury mechanism, a significant single system injury, or multiple injuries, the assumption seems valid. For patients in whom the

TABLE 2 Outcomes for Trauma Versus Nontrauma Service Admissions

	Admission Type			
Variables	**Trauma**	**NTS**	**N**	***p***
Mortality	2.1%	1.2%	2,862	.4002[a]
Complications	6.1%	5.5%	2,859	.668[b]
LOS (days)	5.1	6.2	2,861	<.0001[c]

Note. LOS = length of stay; NTS = nontrauma service.
[a]*Fisher exact test.*
[b]χ^2 *test.*
[c]*Nonparametric Wilcoxon test.*

principal reason for admission is evaluation and management of decompensated comorbidities, or complications related to frailty, these assumptions may not be valid.

We are aware of a single previous study that reported an algorithm or tool intended to discriminate between appropriate medical versus surgical admitting services for trauma patients (Salottolo et al., 2009). In this retrospective study, patients who met algorithmic criteria for NTS admission were identified both before and after such a service existed. The "before" group was admitted to a TS, subspecialist service, or medical service; the after group primarily to a hospitalist service ("TMED"). No differences in any outcomes were identified though there was a slight trend toward a reduction in aggregate complications for patients in the second time period admitted to the NTS.

Our data show that there are no significant differences between mortality in patients admitted to TS versus NTS though there is a slight trend toward increased mortality in the TS group. We compared a group preselected by our own criteria as having lower injury burden but higher age and comorbidity burden (NTS) with *all* patients admitted to the TS, so there may be inherent differences in these populations related to injury severity or mechanism of injury (penetrating vs. blunt). Nonetheless, our "burden of proof" with respect to NTS admissions requires that we demonstrate that outcomes are no worse for patients admitted to NTS. We did observe differences in length of stay (LOS) that are significant and again may reflect inherent, uncontrolled differences between the two groups versus differences in the process of care on TS versus NTS. We are currently attempting to identify whether such differences exist by analyzing specific process measures between these services such as numbers of consultants called, test ordering, and utilization of rehabilitative services.

Our scoring system allows us to provide some of the same discrimination between admission groups as was reported in the study by Salottolo et al. (2009). In addition, the use of concurrent and registry-based retrospective review allows us to measure outcomes between the two groups as required by the Optimal Resource guide. However, it does have weaknesses. Although a score of 7 seems to be a good predictor of appropriate NTS admission, the system does not allow discrimination of which variables are most predictive of the need for TS admission. An analysis using multiple logistic regression is currently under way in an effort to address this question. The methodology of our scoring system excludes isolated hip fracture from ground-level falls essentially assigning these as "appropriate" NTS admissions when there might be some (intensive care unit, blood products) who would have benefited from surgical admission with medical consultation.

Despite these limitations, the NTS score may provide trauma programs an opportunity to establish baseline objective criteria (with or without modification) that will facilitate discussions with other providers and allow for more efficient evaluation of NTS admission rates. It is reasonable to assume that there will be some anticipated reduction in the rate of NTS admissions with implementation of this tool as was shown by Salottolo et al. (2009), but with the changing demographics of trauma care, it seems likely that NTS admission rates will continue to meet or exceed the 10% threshold in many trauma centers.

KEY POINTS

- The changing demographics of trauma care will require trauma performance coordinators and program directors in ACS-verified trauma centers to evaluate large number of patients who are admitted to nontrauma services (NTS) in order to establish that care is appropriate.
- As an alternative to case-based reviews for all such patients, a scoring system or algorithm was developed that defined a group of patients considered as reasonable or appropriate for admission to NTS.
- Validity of the scoring system in defining appropriateness of NTSD admission was tested by comparing outcomes for the two patient populations. Mortality and complication rates did not differ though length of stay was shorter for the TS group.

REFERENCES

American College of Surgeons. (2014). Chapter 16: Performance improvement and patient safety. *Resources for optimal care of the injured patient* (pp. 114-133). Chicago, IL: Committee on Trauma. American College of Surgeons.

American College of Surgeons. (2016). *National Trauma Data Bank 2016 [PowerPoint slides].* Retrieved from American College of Surgeons website: https://www.facs.org/~/media/files/quality%20programs/trauma/ntdb/ntdb%20annual%20report%202016.ashx

Bugaev, N., Arabian, S., & Rabinovici, R. (2013). Admission patterns of stable patients with isolated orthopedic or neurosurgical injuries. *Journal of Trauma and Acute Care Surgery, 74*(4), 1151–1155. doi:10.1097/ta.0b013e3182827191

Joseph, B., Phelan, H., Hassan, A., Jokar, T. O., O'Keeffe, T., Azim, A., … Rhee, P. (2016). The impact of frailty on failure-to-rescue in geriatric trauma patients. *Journal of Trauma and Acute Care Surgery, 81*(6), 1150–1155. doi:10.1097/ta.0000000000001250

Kozar, R. A., Arbabi, S., Stein, D. M., Shackford, S. R., Barraco, R. D., Biffl, W. L., … Luchette, F. (2015). Injury in the aged: Geriatric trauma care at the crossroads. *Journal of Trauma and Acute Care Surgery, 78*(6), 1197–1209. doi:10.1097/ta.0000000000000656

Prestmo, A., Hagen, G., Sletvold, O., Helbostad, J. L., Thingstad, P., Taraldsen, K., … Saltvedt, I. (2015). Comprehensive geriatric care for patients with hip fractures: a prospective, randomised, controlled trial. *The Lancet, 385*(9978), 1623–1633. doi:10.1016/s0140-6736(14)62409-0

Salottolo, K., Slone, D. S., Howell, P., Settell, A., Bar-Or, R., Craun, M., & Bar-Or, D. (2009). Effects of a nonsurgical hospitalist service on trauma patient outcomes. *Surgery, 145*(4), 355–361. doi:10.1016/j.surg.2008.12.010