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Admission patterns in pediatric trauma patients with isolated injuries

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ABSTRACT

Background: Pediatric trauma patients presenting with stable, isolated injuries are often admitted to the trauma service for initial management. The purpose of this study was to evaluate admission patterns in trauma patients with isolated injuries and compare outcomes based on admitting service.

Methods: The institutional trauma registry was retrospectively reviewed for patients presenting from January 2007–December 2012. A total of 3417 patients were admitted to a surgical service and further reviewed. Patients with isolated injuries were further stratified by admission to the general trauma service (GTS, $n = 738$) *versus* admission to the subspecialty surgical trauma service (STS, $n = 2251$).

Results: When compared to patients admitted to GTS, patients admitted to STS with isolated injuries were significantly younger, were more likely to present with injury severity scores ranging from 9–14, Glasgow coma scale ≥13, had shorter emergency room length of stay, were more likely to undergo surgery within 24 h, and had fewer computed tomography scans performed. There were no missed injuries in patients with isolated injuries admitted to STS (with 5% having a GTS consult) compared with one missed injury in those admitted to GTS. Patients with isolated injuries admitted to an STS were found to have significantly lower complication rates (0.6% *versus* 2.2%, $P < 0.01$).

Conclusions: Pediatric trauma patients presenting with stable, isolated injuries may be efficiently and safely managed by nontrauma services without an increase in missed injuries or complications.

1. Introduction

Trauma remains the leading cause of death in children with over 6000 deaths from intentional and unintentional injuries in children under the age 15 y reported in 2012 [1]. Six million nonfatal intentional and unintentional injuries occur in this patient population per year [1]. According to the Center for Disease Control's National Hospital Ambulatory Medical Care

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Survey (2011), less than 7% of patients aged 1–14 presented as an immediate or emergent triage designation. whereas the majority (47%) presented as semiurgent designation, based on a five-level triage scale [1]. Therefore, although trauma is the single greatest cause of morbidity and mortality in children, most presenting injuries can be classified as mild to moderate in nature.

The triage of injured trauma patients to a trauma center best equipped to manage their injuries in a timely manner is the central premise of the trauma system and has been shown to have a profound impact on survival [2,3]. There is also evidence to support improved outcomes when pediatric trauma patients are evaluated and treated at specialized pediatric trauma centers [4–7]. This may be because of the unique physiology and particular needs of pediatric patients. However, admission practices for trauma patients may differ significantly between different trauma centers as there are no clear admission guidelines.

Pediatric trauma patients are often admitted to the pediatric general trauma service (GTS) for management after injury. Many of these patients, however, are hemodynamically stable and present with isolated injuries. There exist no clear guidelines in the literature regarding the admission of stable trauma patients with isolated injuries to subspecialty surgical trauma services (STSs). It remains unclear as to whether admission to a GTS results in direct patient benefit, optimal management, or improved resource utilization. The purpose of our study was to evaluate admission patterns of trauma patients with isolated injuries presenting to our pediatric trauma center and compare outcomes with regard to the admitting service. We hypothesize that stable trauma patients with isolated injuries admitted to surgical subspecialty trauma services have similar outcomes when compared with those admitted to the general surgery trauma service.

2. Methods

After Institutional Review Board approval (IRB # 13-0653), the All Children's Hospital Johns Hopkins Medicine pediatric trauma registry was queried for all patients presenting to our institution from January 2007–December 2012. This included all pediatric trauma patients presenting with a trauma diagnosis. The institutional trauma registry database consists of extensive demographic, injury, and trauma outcome information. Patients who were admitted to a surgical service were selected for further review. Surgical services included trauma surgery, orthopedic surgery, neurosurgery, maxillofacial surgery, plastic surgery, ophthalmology, otolaryngology, and urology. Patients were grouped into isolated or nonisolated injuries. Isolated injuries consisted of injuries limited to one body system. Allocation of trauma patients to isolated or nonisolated groups was based on their injury, which was determined by review of the trauma registry injury codes, injury code descriptions, and review of the electronic medical record. Patients were then further stratified into GTS or subspecialty STS admission.

General admission, demographic, and outcome data were collected from the trauma registry and analyzed for patients with isolated injuries. This included age, injury severity score (ISS), Glasgow coma scale (GCS), abbreviated injury scale (AIS), mechanism of injury, emergency room length of stay (LOS), need for surgery within 24 h, number of computed tomography (CT) scans obtained, intensive care unit (ICU) admission, ICU LOS, hospital LOS, missed injuries, and complications. Data for patients with isolated injuries were then compared between patients admitted to the GTS to those admitted to subspecialty STSs. Primary outcome measures included complications and missed injuries, which are variables that are collected in the institutional trauma registry. Missed injuries are defined as those found during the tertiary trauma survey or found >24 h after initial trauma assessment. Therefore, patients have already been admitted to a specific service before finding these injuries, and analysis was base on the patient's initial diagnostic findings and initial admitting service.

Patients admitted to the ICU are co-managed by a critical care team and, therefore, all have a critical care consult while under the service of the admitting team. These patients have been included and analyzed under the admitting service. For patients who were discharged directly from the emergency department, the admitting team analysis was based on the service that was consulted to evaluate the patient and ultimately made the decision to clear the patient for discharge.

Demographic and clinical characteristics are summarized as counts (percentages) for categorical variables and mean (with standard deviation) or median and range for continuous variables. The global comparisons were performed using χ^2 test, and the pairwise comparisons between levels of categorical variables were done by comparing the respective proportions using proportional test in R statistical software (The R Foundation for Statistical Computing, Vienna, Austria). A P value ≤ 0.05 was considered as statistically significant.

3. Results

A total of 3417 pediatric trauma patients were admitted to a surgical service during the study period. Of these, 2989 patients (87.5%) were found to have isolated injuries, whereas 428 (12.5%) presented with nonisolated injuries. Patients with isolated injuries were further stratified by admitting service. The number of patients (2251; 75.3%) admitted to a subspecialty STS was higher than the number (738; 24.7%) admitted to the pediatric GTS. The distribution of patients with isolated injuries admitted to STS included orthopedic (54.4%), neurosurgery (38.3%), plastic surgery (3.6%), ophthalmology (2.1%), and other (1.6%).

Table 1 summarizes demographic and outcome data for patients with isolated injuries admitted to the GTS *versus* those admitted to subspecialty STSs. Compared to patients with isolated injuries admitted to the GTS, patients admitted to STS were significantly younger (7.3 *versus* 9.1 y, $P < 0.0.001$), were more likely to have ISSs ranging from 9–14, GCS ≥13, had a shorter emergency room LOS (2.7 *versus* 3.3 h, $P < 0.001$), were more likely to be discharged from the emergency room or placed in observation status (16% *versus* 20.3%, $P = 0.024$), were more likely to undergo surgery within 24 h (58.3% *versus* 33.6%, $P < 0.001$), and had significantly fewer CT scans performed (15.5% *versus* 58.3%, $P < 0.001$). There was no significant difference between the groups for ISS ≥15. Patients with