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Appropriateness of patients transferred with orthopedic injuries: experience of a level I trauma center

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Abstract

Background Trauma patients are frequently transferred to a higher level of care for specialized orthopedic care. Many of these transfers are not necessary and waste valuable resources. The purpose of this study was to quantify our own experience and to assess the appropriateness of orthopedic transfers to a level I trauma center emergency department.

Methods A retrospective review of orthopedic emergency department transfers to a level I trauma center was performed. Data collected included time of transfer, injury severity score (ISS), age, gender, race, orthopedic coverage at transfer institution, and insurance status. Two orthopedic trauma surgeons graded the appropriateness of transfer. A weighted logistic regression model was used to compare dependent and independent variables.

Results A total of 324 patient transfers were reviewed; 65 (20.1%) of them were graded as inappropriate. There was no statistically significant relationship between appropriateness of transfer and age, availability of orthopedic coverage, night/weekend transfer, or insurance status. Regression analysis showed that only ISS (OR 1.130, $p = .008$) and "polytrauma" (OR 25.39, $p < .0001$) designation were associated with increased odds ratio of appropriate transfer. The kappa coefficient for inter-rater reliability between the two raters was 0.505 (95% CI, 0.388–0.623) reflecting moderate agreement.

Conclusion Inappropriate transfers create a significant medical burden to our health care system using valuable resources. Our study found similar results of inappropriate transfers compared to previous studies. However, we did not find a relationship between insurance status or nights/weekends and transfer appropriateness.

Keywords Trauma center · Transfer · Appropriateness

Introduction

In the USA, with the development of specialized trauma care, the American College of Surgeons (ACS) recognized established trauma centers with level of care designations. The centralization of trauma care has improved outcome in the severely injured trauma patient [1–3], despite lack of clearly defined guidelines for patient transfer. Similarly, the Emergency Medical Treatment and Active Labor Act (EMTALA) was enacted in 1986 and only broadly defined guidelines regarding inter-hospital transfer and has been generally interpreted as a mandate that higher level centers must accept all "appropriate" transfers. Indeed, level I trauma centers provide trauma expertise, subspecialized care, and more advanced technology than smaller hospitals [4] and are commonly and appropriately used as tertiary referral centers for patients with complicated medical problems.

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If the community or lower designated medical center has the appropriate resources, based on EMTALA, these centers are required to provide that care. Adherence to this aspect of the law is rarely scrutinized. In fact, despite a broad spectrum of Orthopedic practitioners outside of Level 1 trauma centers, transfer for specialized orthopedic care is common. Inappropriate transfer of orthopedic patients utilizes and exhausts limited tertiary resources and increases the burden and strain on the trauma system. Prior publications have demonstrated that 16–52% of all transfers fall into this category [5, 6]. While there are penalties for EMTALA violations, the definition of "inappropriate" transfer is vague. Several studies have used the term "patient dumping" [4, 5] and have implicated many factors including insurance status, inconvenient timing, and orthopedic surgeon availability [6].

The goal of this study was to assess the appropriateness of transfer in a sample of adult patients with orthopedic injuries sent to our level I trauma center emergency department from surrounding hospitals. We evaluated patient characteristics and identified risk factors for the inappropriate transfer. We hypothesized that there would be excessive inappropriate transfers of uninsured/underinsured patients and patients transferred during the nights and weekends to our tertiary care center.

Methods

After obtaining Institution Review Board approval, we retrospectively reviewed all emergency department (ED) transfers to our level I trauma center from January 1, 2010 to June 23, 2011. All adult patients (18 or older) transferred to the ED with orthopedic injuries were analyzed ($n = 324$). The reasons for transfer were documented as well as associated injuries and need for operative intervention from the orthopedic team. Other data collected included time of transfer, age, gender, race, and insurance status. Friday, Saturday, and Sunday were categorized as "weekends." Transfer time was divided into 6:00 AM–5:59 PM (day) and 6:00 PM–5:59 AM (night).

Two orthopedic trauma fellowship-trained surgeons were provided with a blinded list with only the presenting injuries of the patients. They chose from one of four categories regarding the appropriateness of transfer (see Table 1). They were not provided with any other patient information. Each transferring hospital was contacted to determine whether there was orthopedic coverage available during the time of patient transfer. Each patient was also deemed to be a "polytrauma" if there were other non-orthopedic injuries discovered in their emergency department evaluation and an injury severity score (ISS) was calculated.

A weighted logistic regression model is used in this project to measure the relationship between the categorical dependent variable and independent variables by estimating probabilities using a logistic function. A weight based on the disagreement of appropriateness degrees from two doctors is assigned to each of the observations. If two doctors provided the same appropriate grade to a patient, this observation is weighted by 4. If not, the observation is weighted by the absolute difference divided by 4. Before fitting the final model, the data were randomly split into a training (90% observations) and a test set (10% observations) which were used for model cross-validation.

Results

There were a total of 324 patient transfers reviewed; 65 (20.1%) of them were graded as inappropriate by our panel. Descriptive statistics are seen in Table 2. Thirty-seven percent (37%) ($n = 121$) of all transfer were uninsured or underinsured (Medicare/Medicaid). Of those transferred without insurance or underinsured, 23.14% were inappropriate. Furthermore, 17.24% of weekend transfers were inappropriate, while 21.12% of night transfers were inappropriate. Of those transferred with orthopedic coverage at the transferring hospital, 9.75% (23/236) were inappropriate versus 47.72% (42/88) without orthopedic coverage. A large majority of patients (70.17%) were transferred from hospitals

Table 2 Descriptive statistics of study population

Coefficients	Odds ratio (success)	*p* value
ISS	1.130	0.00815
Polytrauma	25.39	< 0.0001

Table 1 Grading scale for transfers

Grade	Definition	Clarification
1	Completely inappropriate—care should have been provided by referring ED without further consultation	Within the scope of a physician working in a community ED
2	Appropriate for referral but on an outpatient basis	Needs outpatient follow-up by a specialist, but not during current admission
3	Appropriate based on coverage	Within the scope of a community general orthopedic consultant if available. If no coverage, then deemed appropriate for transfer
4	Appropriate	Patient required urgent treatment by an orthopedic specialist at a level 1 trauma center, or necessitated other services at level 1 trauma center

with orthopedic coverage on call. Looking at patients that required orthopedic operative intervention, only 12.17% (23/189) of transfers were inappropriate.

Focusing on the subset of patients with a low ISS (< 15) showed that 23.14% (28/121) of patients without insurance coverage were graded as inappropriate. Of the patients that had a low ISS, only 37.28% (85/228) were underinsured/uninsured. Furthermore, 16.67% of weekend and 21.12% of night transfers in patients with a low ISS were inappropriate transfers.

We did not find a statistically significant relationship between appropriateness of transfer and age, availability of orthopedic coverage, night/weekend transfer, or insurance status. Multivariate regression analysis showed that only injury severity score (ISS) and "polytrauma" designation were associated with increased odds ratio (OR) of appropriate transfer. Patients with high injury severity score (> 15) were 1.130 times more likely to be transferred appropriately ($p = 0.00815$). Furthermore, a polytrauma patient was 25.39 times more likely to be transferred appropriately ($p < .0001$) (Table 3).

We compared the inter-rater agreement using Cohen's Kappa coefficient according to the method of Koch [7]. The Kappa test was performed to test the null hypothesis that the ratings from the two surgeons were random. The p value of the Kappa test was 1.34e−11 which proves that the results were not random; however, the estimated Cohen's Kappa coefficient was 0.505 (95% CI, 0.388–0.623) reflecting moderate inter-rater agreement.

Discussion

The establishment of EMTALA provides loose guidelines for inter-facility transfer and protects patients requiring transfer to higher level of care hospitals. However, this provides opportunities for less desirable patients to be transferred to a level I trauma center as a result of insurance status, comorbidities, and or time/date of presentation. This has become to be known as "patient dumping" [4, 5]. In addition, this issue is compounded by the loss of emergency room coverage by surgical subspecialists in lower-level trauma centers and community hospitals.

Our study identified that 20.1% of all orthopedic transfers were inappropriate to our level I trauma center as determined by a subjective grading scale by attending orthopedic surgeons. We did not find a statistical relationship between inappropriate transfers and the timing of transfer (weekend or nights) or insurance status. However, we did find that appropriateness was statistically associated with high injury severity score and polytrauma status as these patients were typically deemed appropriate for care at a level I trauma center.

In a retrospective review of transfers to a level I trauma center, Esposito noted the prevalence of orthopedic injury increased 25% while orthopedic transfers increased by 48% [8]. Prior studies have shown the rate of inappropriate transfers to range from 16 to 52% [1, 4, 6, 9–11]. Our study suggests that we are on the lower end of this spectrum.

Archdeacon et al. [1] reviewed all transfers for femur fractures to a level I trauma center and found 47% of transfers met appropriate transfer criteria. Of the transferred patients, 58% were uninsured, while all of the patients who had not been transferred were insured. Forty-seven percent of the transferred patients came from hospitals that lacked 24-h orthopedic call coverage [1]. This was not supported by our study as 70.17% of patients were transferred from hospitals with orthopedic coverage though we were unable to determine how many of these were evaluated by the surgeon prior to transfer. We were also unable to evaluate patients not transferred to our hospital system and treated in the community to see whether insurance status differed between the two groups.

Goldfarb et al. [4] noted that only 42% of patients transferred from a facility with on call coverage were evaluated by an orthopedic surgeon prior to transfer. In our study, inappropriate transfers occurred in 9.75% of cases when an orthopedic attending was on call versus 47.72% of times when no coverage was available. This shows that evaluation or even just communication with an orthopedist can save many unnecessary transfers. However, our multivariate regression analysis was not able to show that orthopedic coverage had a statistically significant ability to predict appropriate transfers. This need for communication is stressed by both EMTALA and ACS guidelines for transfers.

Goldfarb et al. [4] also noted that 76% of patient transfers to a level I trauma center indicated the need for complex care. Furthermore, of patients with low complexity injuries, over 75% were uninsured or underinsured. This was not supported in our study as patients transferred with low ISS (< 15) had insurance in 62.7% of the cases.

Nathens also showed that insurance status influenced the decision to transfer to higher level of care [11]. In a more recent study by Vallier et al. [12], over one-fourth of those

Table 3 Results of the multivariate analysis of variable associated with appropriateness of transfer

Males/females	Mean age (years)	Ortho coverage available (%)	Polytrauma (%)	Mean ISS	Uninsured/underinsured (%)	Weekday (%)	Night/weekend (%)
204/123	40.82	72.17	31.8	22.28	37	42.50	57.50

transferred had low injury severity scores and a significantly higher incidence of no insurance. Other factors including inconvenient hours, injury severity, and orthopedic surgeon availability have been shown to affect the decision to transfer to a level I trauma center [6]. Koval reviewed over 20,000 patients transferred to a tertiary care center and found that gender, age, race, insurance status, time of day, and medical comorbidities all influenced the transfer [10].

Thakur et al. [6] noted 112 inappropriate transfers during a 5-month window at a level I trauma center, which was a much higher rate than what we found in our study (65 patients over a 6-month time period). However, this could be influenced by volume of center and the community being served. Another study at a level I trauma center had 90 inappropriate transfers in 1 year [5]. If one combines all these inappropriate transfers across the country, one can realize that the economic impact is astronomical. However, the decision to transfer is clearly complex and appropriateness is relatively subjective. While our trauma surgeons graded 65 patients as inappropriate, 23 (35%) of these patients were still operated on at our institution. Many of these surgeries would be classified as non-urgent or even elective but were completed during the same hospitalization. This trend has increased at our institution after a dedicated orthopedic trauma room improved OR access. This allows even elective or non-urgent trauma cases to be completed in a timely fashion and spare the need for another hospital encounter in the future.

There are several limitations to this retrospective study. First, it is possible that patients were transferred on the basis of information that was not available in the databases and were only discussed by phone and not documented in the electronic medical record. Secondly, the diagnoses were classified as appropriate or inappropriate subjectively by orthopedic trauma surgeons at our tertiary care institution. Their assessments of appropriateness of the transfer may be different from other orthopedic surgeons. However, both surgeons independently decided appropriateness with extremely high concordance and moderate inter-rater reliability with a Kappa coefficient of .505. It should be noted that by the nature of Kappa coefficient, an unbalanced sample like ours (45 patients both graded as inappropriate, and 224 in both graded as appropriate) will have a lower Kappa value compared to more balanced samples even though the observed proportionate agreements are the same.

Conclusion

Though one in five transfers at our institution were considered inappropriate, we did not find a significant relationship between insurance status or nights/weekends and transfer appropriateness.

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Compliance with ethical standards

Conflict of interest Author F reports conflict of interests including contracted research from Axogen Inc, Cook Biotech Inc, and Polyganics Inc. Author G reports a conflict of interest for sitting on the editorial board of the European Journal of Orthopaedic Surgery and Traumatology.

Informed consent For this type of study, formal consent is not required.

Ethical approval This article does not contain any studies with animals performed by any of the authors.

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