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The elderly patient with spinal injury: treat or transfer?

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ARTICLE INFO

Article history:
Received 9 May 2015
Received in revised form
23 November 2015
Accepted 22 December 2015
Available online 30 December 2015

Keywords:
Spine injuries
Elderly
Trauma centers
Outcomes
Mortality
Transfers

ABSTRACT

Background: The purpose of this investigation was to delineate whether elderly patients with spinal injuries benefit from transfers to higher level trauma centers.

Methods: Retrospective review of the National Trauma Data Bank 2007 to 2011, including patients > 65 (y) with any spinal fracture and/or spinal cord injury from a blunt mechanism. Patients who were transferred to level I and II centers from other facilities were compared to those admitted and received their definitive treatment at level III or other centers.

Results: Of 3,313,117 eligible patients, 43,637 (1.3%) met inclusion criteria: 19,588 (44.9%) were transferred to level I–II centers, and 24,049 (55.1%) received definitive treatment at level III or other centers. Most of the patients (95.8%) had a spinal fracture without a spinal cord injury. Transferred patients were more likely to require an intensive care unit admission (48.5% *versus* 36.0%, $P < 0.001$) and ventilatory support (16.1% *versus* 13.3%, $P < 0.001$). Mortality for the entire cohort was 7.7% (8.6% *versus* 7.1%, $P < 0.001$) and significantly higher, at 21.7% for patients with a spinal cord injury (22.3% *versus* 21.0%, $P < 0.001$). After adjusting for all available covariates, there was no difference in the adjusted mortality between patients transferred to higher level centers and those treated at lower level centers (adjusted odds ratio [95% confidence interval]: 1.05 [0.95–1.17], $P = 0.325$).

Conclusions: Transfer of elderly patients with spinal injuries to higher level trauma centers is not associated with improved survival. Future studies should explore the justifications used for these transfers and focus on other outcome measures such as functional status to determine the potential benefit from such practices.

1. Introduction

Spinal trauma including spinal cord injuries, constitute a critical burden on health-care resources, with recent data estimating an incidence for spinal cord injuries approaching 40 cases per million population in the United States [1–3]. Although the overall incidence appears to be decreasing throughout the years [4,5], this decrease does not appear to

The findings from this study were presented at the 2015 American Surgical Congress, Las Vegas, NV

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http://dx.doi.org/10.1016/j.jss.2015.12.032

apply to elderly patients. The incidence of fall-induced spinal cord injuries in the elderly increased 131% from 1970 to 2004 in Finland with projected increase of 100% by the year 2030 [6]. It is well established that elderly patients remain at a high risk for death after traumatic injury [7,8]. Spinal fractures in the geriatric population can be associated with a mortality risk that approaches 9% [9], whereas for spinal cord injuries in particular, the mortality rate in this patient population has been reported to be as high as 26% [9,10].

Due to this high risk for mortality, the threshold for transferring trauma patients to higher level trauma centers designated by the American College of Surgeons is low, potentially resulting in secondary overtriage [11]. This overtriage might be justified based on findings indicating that higher level centers have higher survival rates [12,13]. However, these findings are not consistent when specific groups of trauma patients are studied [14,15]. In addition, the value of interhospital patient transfers to higher level centers is put into question when survival rates are compared [16]. Therefore, identifying the patient population that will benefit most from such costly and resource-demanding interfacility transfers remains a pressing issue. Elderly patients sustaining a spinal injury after blunt trauma is a subgroup of patients with expected high mortality risk who could potentially benefit from such transfers aiming for a higher level of care.

Our objective was therefore, to determine whether elderly patients with traumatic blunt spinal fractures and/or spinal cord injuries have improved outcomes when transferred to level I or II trauma center compared to receiving their definitive treatment at level III or other centers. We hypothesized that transfer of these patients to higher level centers would result in a higher survival compared to treatment at lower level trauma facilities.

2. Methods

The National Trauma Data Bank (NTDB) research data sets 2007 to 2011 were used for this analysis. Patients were included if they were aged 65 y and older, suffered a blunt mechanism of trauma, and had a diagnosis of a spinal fracture and/or spinal cord injury based on International Classification of Diseases—9th edition codes 805.0-805.9 and 806.0-806.9. Of these, patients were excluded if they were discharged from or died in the emergency department (ED), had an Abbreviated Injury Scale (AIS) of 6 or Injury Severity Score (ISS) of 75. In addition, patients admitted to centers reporting less than 80% of AIS scores and/or less than 20% of comorbid conditions and/or centers with less than 200 subjects in the NTDB during the 5-y study period were also excluded. Finally, patients directly admitted to level I or II trauma center were likewise excluded. Thus, only those patients admitted to level III or other centers and those transferred to level I and II centers from other institutions were available for analysis.

Patient, injury and hospital characteristics were included as follows: age (>89 *versus* ≤89 y, as for de-identification purposes in the NTDB, patients aged older than 89 y are coded separately without reporting of the exact age), gender, race, admission systolic blood pressure (<90 mm Hg *versus* ≥90 mm Hg), admission Glasgow Coma Scale (GCS, ≤8 *versus* >8), ED disposition to the operating room or the intensive care unit (ICU), need for mechanical ventilation, ISS (low ≤16; moderate 17–25, and severe >25), AIS body regions (≥3 *versus* <3 for head, chest, abdomen, spine, and lower extremities), level and type of spinal injury (cervical, thoracic, lumbar, spinal cord), trauma center level, hospital teaching status, hospital region, and number of neurosurgeons and orthopedic surgeons available at each center (>10 *versus* ≤10). Selected major comorbid conditions (cardiac diseases, pulmonary disease, liver disease, renal disease, bleeding disorder, and diabetes mellitus) were also included [17], with congestive heart failure, angina, and history of myocardial infarction grouped under “cardiac disease” and cirrhosis, ascites, and esophageal varices grouped under “liver disease”. Spinal surgical procedures were identified based on International Classification of Diseases–9 procedure codes 81.00 to 81.08, 81.30 to 81.39, 81.60 to 81.66, and 84.80 to 84.85. The time from admission (reported in hours) to surgery for spinal injury (≤48 *versus* >48 h, as an indicator for requirement for an urgent or emergent intervention) was also included in the database.

The primary outcome was inhospital mortality, and secondary outcome was discharge to home, with or without home health.

2.1. Analysis

Patients transferred to level I and II centers were compared to those admitted to level III or other centers using the chi-square test for dichotomous and *t*-test for continuous variables. *P* value <0.05 was considered as statistically significant. Primary and secondary outcomes were examined among all patients and separately in the subgroup of patients with a spinal cord injury, those who required a surgical intervention for the spinal injury, and those with an injury of the cervical spine. To adjust for confounding factors between the two groups, multivariate logistic regression model was used incorporating all available covariates. Adjusted odds ratios (AORs) with 95% confidence intervals and adjusted *P* values were obtained.

All statistical analyses were performed using the IBM SPSS Statistics for Windows, version 19.0 (IBM Corp, Armonk, NY).

3. Results

Over the 5-y study period, of 3,313,117 eligible patients, a total of 43,637 (1.3%) met inclusion criteria (Fig. 1). Of those, 19,588 (44.9%) were transferred to level I and II centers from other institutions, and 24,049 (55.1%) were admitted to level III or other centers after a blunt mechanism of injury resulting in a spinal trauma. Most of the patients had their injury as a result of a fall (68.6%) or a motor vehicle collision (22.5%). Overall, 7.6% of patients were older than 89 y, and 44.6% were male. ICU admission was required for 41.6% of patients, whereas 14.5% were placed on the ventilator for at least 24 h. Severe head trauma (defined as AIS head ≥ 3) was present in 17.1% of patients, and 9% suffered critical injuries (defined as ISS > 25). The most common comorbid condition was diabetes mellitus