Injury, Int. J. Care Injured xxx (2016) xxx–xxx

Contents lists available at ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

# Geriatric assault victims treated at U.S. trauma centers: Five-year analysis of the national trauma data bank

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ARTICLE INFO

*Article history:*
Accepted 1 September 2016

*Keywords:*
Violence
Assault
Elder abuse
Geriatric trauma

ABSTRACT

*Introduction:* While geriatric trauma patients have begun to receive increased attention, little research has investigated assault-related injuries among older adults. Our goal was to describe characteristics, treatment, and outcomes of geriatric assault victims and compare them both to geriatric victims of accidental injury and younger assault victims.

*Patients and methods:* We conducted a retrospective analysis of the 2008–2012 National Trauma Data Bank. We identified cases of assault-related injury admitted to trauma centers in patients aged ≥60 using the variable "intent of injury."

*Results:* 3564 victims of assault-related injury in patients aged ≥60 were identified and compared to 200,194 geriatric accident victims and 94,511 assault victims aged 18–59. Geriatric assault victims were more likely than geriatric accidental injury victims to be male (81% vs. 47%) and were younger than accidental injury victims (67 ± 7 vs. 74 ± 9 years). More geriatric assault victims tested positive for alcohol or drugs than geriatric accident victims (30% vs. 9%). Injuries for geriatric assault victims were more commonly on the face (30%) and head (27%) than for either comparison group. Traumatic brain injury (34%) and penetrating injury (32%) occurred commonly. The median injury severity score (ISS) for geriatric assault victims was 9, with 34% having severe trauma (ISS ≥ 16). Median length of stay was 3 days, 39% required ICU care, and in-hospital mortality was 8%. Injury severity was greater in geriatric than younger adult assault victims, and, even when controlling for injury severity, in-hospital mortality, length of hospitalization, and need for ICU-level care were significantly higher in older adults.

*Conclusions:* Geriatric assault victims have characteristics and injury patterns that differ significantly from geriatric accidental injury victims. These victims also have more severe injuries, higher mortality, and poorer outcomes than younger victims. Additional research is necessary to improve identification of these victims and inform treatment strategies for this unique population.



## Introduction

The substantial growth in the population of older adults, who are living longer with more active lifestyles, is anticipated to lead to a rise in geriatric patients with serious traumatic injuries [1–3]. Geriatric trauma patients have begun to receive increased attention from clinicians and researchers, who have recognized this important demographic shift, identified that older adults differ in important ways from younger trauma victims, and developed new management strategies [1,4–9]. Despite this progress, little research has investigated assault-related injuries among older adults. These injuries are common, accounting for at least 6.5% of trauma admissions in patients aged ≥60 years [10]. An estimated 33,026 geriatric patients were treated in US emergency departments for assault-related injuries in 2001 [11], which will likely increase as the population of older adults grows. Many of these injuries may be due to physical or sexual elder abuse, defined

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http://dx.doi.org/10.1016/j.injury.2016.09.001
0020-1383/

specifically as when the perpetrator is a person in a position of trust with the victim [11–15]. Geriatric assault and elder abuse are under-recognized by health care providers [16–19], which can lead to inadequate treatment and unsafe discharge. Improved understanding of violence-related injuries in older adults is critically needed to support more effective therapeutic efforts.

While most geriatric assault injuries do not need extended treatment [11], some are severe enough to require hospitalization and management on a trauma service. Little is known about the injury patterns, treatment, and outcomes for these severely-injured patients [10,20]. In addition, no national description of injury patterns in severe geriatric assault injury exists. Beginning to identify characteristics and injury patterns in geriatric assault may give health care providers tools to aid in detection and treatment. Our goal was to describe injury patterns, treatment, and outcomes of geriatric assault victims treated at US trauma centers and to compare them to both geriatric victims of unintentional injury and younger adult assault victims. We hypothesized that these patterns, treatment, and outcomes in geriatric assault victims would differ meaningfully from geriatric accidental injuries and younger victims of violence-related injury.

## Patients and methods

This study used data from the National Trauma Data Bank (NTDB) v7.2 from 2008 to 2012. The NTDB, which is sponsored by the American College of Surgeons, includes data from >700 participating US trauma centers [21]. The NTDB includes comprehensive information about injuries, pre-hospital and emergency care, in-patient treatment, and outcomes, and has been used successfully by other researchers to analyze assault injuries in other populations [22] and penetrating injuries in older adults [23].

Cases of assault-related injury admitted to trauma centers were identified using the variable "injury intentionality," which is automatically generated within the NTDB from International Classification of Patients Diseases – Revision 9 (ICD-9) E-codes in the medical record using the Centers for Disease Control and Prevention matrix for injury intentionality [24,25]. Options for intentionality are: assault, unintentional, self-inflicted, other, or undetermined. Assault injuries were those with an "intent of injury" coded as "assault" and accidental injuries as those coded as "unintentional." Patients with injury intentionality coded as self-inflicted, undetermined, or other were excluded from the current analysis. We included all trauma types in this analysis: blunt, penetrating, burn and other/unspecified. Trauma type for each patient is automatically generated based on the mechanism of injury using the primary ICD-9 E-code from the medical record [25].

Older adults were defined as patients aged ≥60. Though no consensus exists in the epidemiologic literature about the appropriate age cut-off for older adulthood, elder abuse and other violence-related statutes in most states have been written to protect adults aged ≥60. In addition, age ≥60 is the criterion used in the Older Americans' Act for eligibility for additional services and protections [26]. Also, much of the limited literature on this topic uses this cut-off [10,11]. Notably, patients aged ≥90 are included in NTDB without age further specified. We have included all of these patients in the analysis.

We examined injury data including: total number and type of injuries, anatomic location(s) of injury(ies), and the Injury Severity Score (ISS). Injuries were identified using ICD-9 code. Given its clinical importance, we closely examined traumatic brain injury (TBI), defined by ICD-9 codes 850–854.1, as has been done by previous researchers [27]. We evaluated patient demographic characteristics. For analysis, we converted age into categorical strata: 60–64, 65–74, 75–84, and 85+. We also examined the presence of as many as 20 co-morbidities, which are coded by registrars from the medical records. Co-morbidities included, for example, bleeding disorder, congestive heart failure, CVA/residual neurological deficit, diabetes mellitus, disseminated cancer, and hypertension requiring medication. To characterize the population, we dichotomized this variable into patients with and without ≥3 co-morbidities. Functionally dependent health status is included as a co-morbidity within NTDB, but we also reported on it separately given its importance for the geriatric population. Because dementia was only evaluated within the NTDB beginning in 2012, we did not include it in this analysis. We evaluated alcohol use by trauma victims, which is assessed in NTDB via formal testing rather than clinician suspicion. Rather than using a threshold value to determine potential intoxication, we report here on the presence of any alcohol when tested. We also evaluated drug use, which is also assessed in NTDB via formal testing rather than clinician suspicion and excludes drugs used for medical therapy. Outcomes of interest included in-hospital mortality, length of hospital stay, treatment in an intensive care unit, and surgical procedures performed.

Adults age 18 years and older (n = 743,384) were eligible for inclusion in the current analysis. Adults with isolated hip fractures were excluded (n = 26,576) to avoid bias, as these patients are included in NTDB for some, but not all, participating hospitals. Because the focus of this study was to compare intentional and unintentional injuries, adults with self-inflicted (n = 14,443), other (n = 1780), or undetermined/missing (n = 6505) injuries were excluded. This analysis included 203,758 adults age ≥60 and 490,322 adults age 18–59 with an intentional or unintentional injury.

Data analysis was conducted using Stata, version 12 (StataCorp, College Station, TX). Results are presented as frequencies with proportions, mean with standard deviation (SD), or median with interquartile range (IQR). Comparisons between subgroups (e.g., older adult assault vs. older adult unintentional injury) were performed using Chi-square test, *t*-test, and Kruskal-Wallis test, as appropriate. Logistic regression was used to evaluate the independent association between older adult vs. younger adult assault and outcomes of interest (e.g., in-hospital mortality) adjusting for injury severity. All *P* values are two-tailed, with $P < 0.05$ considered statistically significant.

This study was determined to be exempt from review by the Weill Cornell Medical College Institutional Review Board.

## Results

3564 victims of assault-related injury aged ≥60 were identified. The characteristics of these victims are described in Table 1 in comparison with geriatric victims of unintentional injury (n = 200,194) and assault victims aged 18–59 (n = 94,511). Geriatric assault victims were more likely than geriatric unintentional injury victims to be male and were typically younger than unintentional injury victims. Significantly more geriatric assault victims tested positive for alcohol or drugs than geriatric unintentional injury victims. Among geriatric assault victims, 11% had ≥3 co-morbidities and only 0.3% had functionally dependent health status, a significantly lower percentage in both as compared to geriatric unintentional injury victims. In-hospital mortality for geriatric assault victims was similar to unintentional injury victims, but assault patients more commonly required intensive care unit-level treatment than unintentional injury patients and were more likely to need laparotomy, thoracotomy, or craniotomy. Injuries for geriatric assault victims were most commonly on the face and head than for geriatric unintentional injury victims, and more than half of the assault victims had injuries on ≥3 body regions. Notably,

Please cite this article in press as: T. Rosen, et al., Geriatric assault victims treated at U.S. trauma centers: Five-year analysis of the national trauma data bank, Injury (2016), http://dx.doi.org/10.1016/j.injury.2016.09.001