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Original Contribution

Elderly fall patients triaged to the trauma bay: age, injury patterns, and mortality risk☆,☆☆

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ABSTRACT

Background: Falls in the elderly are a significant cause of morbidity and mortality. We sought to better categorize this patient population and describe factors contributing to their falls.
Methods: This is a retrospective review of geriatric patients presenting to a level 1 community trauma center. We queried our trauma database for all patients 65 years and older presenting with fall and triaged to the trauma bay from 2008 to 2013. Researchers reviewed the patients' trauma intake paperwork to assess mechanism, injury, and location of fall, whereas discharge summaries were reviewed to determine disposition, morbidity, and mortality.
Results: A total of 650 encounters were analyzed. Five hundred thirty-nine resided at home (82.9%), 110 presented from nursing homes or assisted living (16.9%), and 1 came from hospice (0.15%). Ninety-five patients died or were placed on hospice as a result of their falls (14.7%), of which 88 came from home. Controlling for Injury Severity Score, living at home was an independent risk factor for fall-related mortality (odds ratio, 3.0).
Comparing the elderly (age 65-79 years; n = 274) and the very elderly (age ≥80 years; n = 376), there were no differences in Injury Severity Score ($P = .33$), likelihood of death ($P = .49$), likelihood of C-spine injury ($P = 1.0$), or likelihood of other axial or long bone skeletal injury ($P = .23$-1.0). There was a trend for increased likelihood of head injury in very elderly patients ($P = 0.06$).
Conclusion: Prevention measures to limit morbidity and mortality in elderly fall patients should be aimed at the home setting, where most severe injuries occur. Very elderly patients may be at increased risk for intracranial fall-related injuries.

1. Introduction

Falls are the leading cause of trauma-related mortality in the geriatric population, the majority of which is secondary to intracranial injury (ICI). In the United States, falls accounted for nearly 135 000 deaths from 2008 to 2013 in patients aged 65 years and older. Medical care related to fall injuries in the elderly exceeded US $35 billion for both fatal and non-fatal falls in the same period [1]. The elderly are at increased risk for falls due to age-related comorbidities such as visual impairment, gait abnormalities, degenerative joint disease, and cognitive impairments [2]. In addition, many of these patients are on numerous medications including antiplatelet agents and/or anticoagulants [3].

Approximately one-third of elderly patients living independently fall at least once every year [4]. Many of these patients fall more frequently [5,6]. Most of these are ground-level falls; however, more recent literature suggests that the current elderly population is more active and therefore may have a higher incidence of non-GLF as well [7]. Falls in the elderly are associated with a high rate of traumatic injury, specifically head and orthopedic injuries. Between 2000 and 2010, the US elderly population aged 65 years and older increased by 15.1%. The population aged 85 years and older increased by 29.6% [8]. Both of these age groups experienced greater expansion compared to the rest of the population. As the elderly population in the United States increases, traumatic injuries due to falls will undoubtedly increase as well [2].

We sought to better describe the geriatric population presenting to the emergency department (ED) with high-acuity falls triaged to the trauma bay. We further sought to determine whether there were differences in injury patterns or presentations between the elderly population (age 65-79 years) and the very elderly population (age 80 years and older), including anticoagulation status.

2. Materials and methods

2.1. Study design

This study is a retrospective cohort of elderly fall patients triaged to the trauma bay. The research protocol was reviewed by the institutional review board at the study facility and found to be exempt.

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Table 1
Adult trauma alert criteria for falls

Vital signs	Anatomy of injury	Mechanism	Head trauma in anticoagulation	Physician/EMS judgment
GCS <14 or combative	Flail chest	Fall >20 ft	Abnormal neurologic examination	
SBP < 90 mm Hg	Suspected pneumothorax		Loss of consciousness	
RR <10 or >29	2 or more long bone fractures		Amnesia	
Intubated	Amputation proximal to wrist/ankle		Headache	
Physiologic deterioration en-route	Mangled extremity		Nausea/vomiting	
	Pelvis fracture			
	Open/depressed skull fx			
	Paralysis			

Abbreviations: GCS, Glasgow Coma Scale; SBP, systolic blood pressure; RR, respiratory rate.

2.2. Study setting and population

The study site is a level 1 community trauma center that hosts a trauma/critical care fellowship accredited by the American Board of Surgery. Patients were eligible for enrollment if they were age 65 years or older and were triaged to the trauma bay for fall. This included falls from standing/sitting/lying, falls down stairs, falls from a height, and patients “found down.” Determination for trauma bay triage was made by medical command physicians at the receiving facility based on standard criteria posted in a prominent location next to the command radio (Table 1). Our facility does not currently use a trauma algorithm specific to geriatrics. Patients were excluded from the study if they were transferred from an outside facility for trauma evaluation or if they were triaged to the main ED and then were later found to have injuries requiring trauma service consultation.

2.3. Study protocol and measurements

Patients eligible for this study were identified by query of the electronic trauma registry at the study site. The registry was queried from May 2008 to May 2013. These dates were chosen because there was an institutional change in the standard trauma documentation forms in May 2008.

Data obtained from the trauma registry included age, mechanism, Injury Severity Score (ISS), Glasgow Coma Scale, hospital length of stay, and intubation days. Three trained research associates reviewed each patient's electronic medical record to populate other data fields. The physician trauma documentation form was reviewed to determine physical examination findings and antiplatelet/anticoagulant medications. All radiology reports from the trauma evaluation were reviewed to determine the presence of other injuries, and discharge/death summaries were reviewed to determine additional injuries that may have been missed in the trauma bay but found during hospitalization. Significant traumatic injuries such as visceral injuries or bony injuries were noted. Soft tissue injuries such as abrasions, contusions, skin tears, and lacerations were not reported. Case management records were reviewed to determine each patient's residence at time of injury and ultimate disposition from the hospital.

Data were entered by trained research associates into a standardized Microsoft Excel 2007 spreadsheet (Microsoft Corporation, Redmond, WA).

Table 2
Baseline characteristics of enrolled patients

	Total (N = 650)
Median age (IQR)	81 (74-87)
Sex (%)	
Male	312 (48)
Female	338 (52)
Living environment (%)	
Home	539 (82.9)
Assisted living and nursing home	110 (16.9)
Hospice	1 (0.15)
Position before fall (%)	
Standing/sitting/lying	375 (57.7)
Down stairs	162 (24.9)
From height	36 (5.5)
Found down	77 (11.8)
Unknown	30 (3.8)

2.4. Data analysis

Descriptive statistics were used to assess demographic factors and presence and absence of injury. χ^2 Test was used to compare elderly patients (age 65-79 years) to the very elderly population (age 80 years and older) in terms of categorical injuries and outcome. Mann-Whitney *U* test was used to do intergroup comparisons for continuous data. Logistic regression was used to control for confounding buvariables. Data were analyzed using MedCalc (©1993-2013, Ostend, Belgium) and VassarStats: Website for Statistical Computation (vassarstats.net, author Richard Lowry, PhD, Professor of Psychology Emeritus, Vassar College, Poughkeepsie, NY, © 1998-2013).

3. Results

3.1. Demographics

A total of 660 elderly patients with fall events were triaged to the trauma bay during the 5-year period. Medical records could not be located for 10 patients, leaving 650 for analysis. Most patients resided in private residences at the time of fall. Standing was the most common position at time of fall. The characteristics of enrolled patients are found in Table 2.

3.2. Injuries

Traumatic brain injuries or death believed secondary to massive head trauma were by far the most common injuries in this population (26.8%, n = 174), followed by rib fractures (8.5%, n = 55) and cervical spine injuries (7.7%, n = 50). Other spine and pelvis injuries (5.7%, n = 37), upper extremity long bone fractures or dislocations (5.5%, n = 36), and lower extremity long bone fractures or dislocations (2.9%, n = 19) were less common. Injury patterns between the elderly and very elderly are shown in Table 3.

A total of 602 patients had ISS documented in the trauma database. Injury Severity Score ranged from 1 to 75, with a median of 6 (interquartile range [IQR], 6-9). There was no difference in ISS between the very elderly (median, 6; IQR, 6-9) and the elderly (median, 6; IQR, 5-9; *P* =

Table 3
Traumatic injuries in the elderly and very elderly

	65-79 y, n = 274	80+ y, n = 376	*P*
Traumatic brain injury	63 (23.1%)	111 (29.5%)	.06
Rib/injury	19 (6.9%)	36 (9.6%)	.23
Neck injury	21 (7.7%)	29 (7.7%)	1.0
Spine or pelvis injury	15 (5.5%)	22 (5.9%)	.84
Upper extremity injury	14 (5.1%)	22 (5.9%)	.68
Lower extremity injury	8 (2.9%)	11 (2.9%)	1.0