RETROSPECTIVE SURVEY OF THE CHARACTERISTICS OF IN-PATIENT GERIATRIC TRAUMA PATIENTS TREATED AT MINHUANG HOSPITAL SHANGHAI, PEOPLE'S REPUBLIC OF CHINA DURING 2022-2023

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Abstract. Geriatric trauma is a major cause of morbidity in an aging population. In this study, we aimed to retrospectively determine the types of injuries among trauma in-patients aged ≥60 years hospitalized at Minhang Hospital, Shanghai, People's Republic of China during 1 June 2022-1 June 2023 in order to inform efforts to improve trauma care in this patient population. Inclusion criteria for study subjects were being aged ≥60 years and being admitted because of trauma to the study hospital during the study period. The exclusion criterion was having incomplete medical records. The medical records of each study subject were reviewed and the following data were recorded: selected demographic characteristics (subject gender and age), history of underlying disease, hospital department of treatment, admitting diagnosis, discharge diagnosis, ICD-10 codes, cause of the injury, location of trauma, whether or not surgery was conducted, whether or not the subjects were treated in the intensive care unit (ICU), whether the injuries involved multiple sites and the outcome of treatment. A total of 546 subjects were included in the study, 62.6% (n = 342) were females. The mean (± standard deviation) age of study subjects was 74 (± 9) (range: 60-101) years. Of the total of 546 subjects, 200 (36.6%) had a lower extremity injury, 80 (14.7%) had an upper extremity injury, 61 (11.2%) had a lumbar spine injury and 47 (8.6%) had a cranial injury. Surgery was performed on 307 patients (56.2%), and 31 (5.7%) were admitted to the ICU. A total of 17 patients (3.1%) died, with 13 deaths (76.5%) due to multiple injuries. Age (p = 0.605), surgery (p = 0.439) and ICU treatment (p = 0.635) were not significantly associated with survival. In summary, the most common injuries in our study subjects were lower extremity injuries, followed by upper extremity, spine and cranial injuries. We found no factors significantly associated with mortality in this cohort, including surgeries and ICU care. We conclude that non-surgical,

non-ICU management of the elderly trauma patients in this study population is reasonable. Further studies are needed to determine which subjects should have surgery, which should be managed non-surgically, which should be managed in the ICU and which do not need ICU management. A larger, multi-center study involving a larger number of subjects might better answer these questions and allow applicability to other populations.

Keywords: elderly people, trauma, clinical characteristics, injury profile

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INTRODUCTION

Trauma is becoming significantly more common among the elderly as the percentage of the population who are elderly increases (Duan *et al*, 2024; Nayak Rao, 2016; Gioffrè-Florio *et al*, 2018; Wang *et al*, 2018). United Nations Development Program defines the elderly as individuals aged ≥60 years (UNDP, 2017). The incidence of trauma-related injuries increases with advancing age due to age-related physiological changes, such as reduced bone density and the associated increase in fracture risk (Su *et al*, 2022; Wang *et al*, 2023), muscle weakness (Perdue *et al*, 1998; de Vries *et al*, 2019) and impaired balance (Ma *et al*, 2022; Aslaner *et al*, 2022, Chen and Pan, 2022), increasing fall risk (Chandra and Rajawat, 2021). Common geriatric problems include sarcopenia, visual and hearing impairments, dementia, diabetes and cardiovascular disease (Nishikawa *et al*, 2021; Hou *et al*,

2019, Lopez-Otin *et al*, 2013; Zheng *et al*, 2022).

Previous studies have investigated the demographic factors associated with falls in the elderly (Wang *et al*, 2022; Jiang *et al*, 2020; Clare and Zink, 2021; Zhou *et al*, 2022; Chen *et al*, 2022) but there is little data from Shanghai regarding injuries in the elderly. In this study, we aimed to retrospectively determine the types of injuries among in-patients aged ≥60 years hospitalized at Minhang Hospital, Shanghai, People's Republic of China in order to inform efforts to improve trauma care in this patient population.

MATERIALS AND METHODS

General information

Data for this study were obtained retrospectively from the inpatient database of Minhang Hospital during 1 June 2022-1 June 2023.

Study subject inclusion criteria

The inclusion criteria for study subjects were: being aged ≥60 years and being admitted to the study hospital during 1 June 2022-1 June 2023 with a diagnosis of trauma. The definition of trauma for this study was having one or more of the International Classification of Diseases,10th revision (ICD-10) codes (WHO, 2019) as follows: S00-S99 (injuries to specific body parts), T07 (unspecified multiple injuries), T14 (injury of unspecified body region), T20-T28 (burns and corrosion), T30-T32 (frostbite), P79 (certain early complications of trauma) and A1-T79 (various traumatic injuries).

Study subject exclusion criteria

Exclusion criteria for study subjects were having incomplete medical records or not having one of the above ICD-10 codes. All out-patient trauma cases were also excluded.

Data collected

The data collected from patient medical records were: subject gender, age, history of underlying disease, hospital department of treatment, admitting diagnosis, discharge diagnosis, ICD-10 codes, cause of the injury, location of trauma, whether or not surgery was conducted, whether or not the subjects were treated in the intensive care unit (ICU), whether the injuries involved multiple sites and the outcome of treatment.

Research methodology

Study subjects were placed in one of 4 age groups in order to determine age-associated trauma outcomes: 60-69, 70-79, 80-89 years and 90-101 years.

Statistical calculations

We used the Chi-square test to conduct univariate analysis, with a *p*-value <0.05, to identify factors significantly associated with survival. We used the Fisher's exact test where the sample size was small to identify factors significantly associated with survival. Statistical calculations were made using the Statistical Package for Social Sciences (SPSS), version 27.0 (IBM Corp, Armonk, NY). A *p*-value <0.05 was considered statistically significant.

Ethical approval

This study was approved by the Ethical Review Board, Minhang Hospital, Fudan University (Approval No.2022-009-01X).

RESULTS

Demographic data

A total of 546 subjects were included in this study, 62.6% (*n* = 342) females (Table 1). The mean (±standard deviation) age of study subjects was 74 (± 9) (range: 60-101) years. 218 subjects (39.9%) were aged 60-69 years, 180 subjects (33.0%) were aged 70-79 years, 117 subjects (21.4%) were aged 80-89 years, and 31 subjects (5.7%) were aged 90-101 years (Table 1).

Underlying disease among study subjects

177 subjects (32.4%) had ≥2 underlying conditions (Table 2). Hypertension was the most common underlying disease (*n* = 224, 41.0%), followed by diabetes mellitus (*n* = 104, 19.0%), respiratory disease, (*n* = 27, 5%), tumors (*n* = 14, 2.6%), cerebrovascular disease (*n* = 12, 2.2%) and atherosclerotic coronary artery disease (*n* = 11, 2.0%) (Table 2).

Injured sites and treatments

The lower limbs were the most frequently injured site (*n* = 200, 36.6%), followed by the upper limbs (*n* = 80, 14.7%), the lumbar spine (*n* = 61, 11.2%) and the head (*n* = 47, 8.6%) (Table 3). 111 subjects (20.3%) had injuries of ≥2 sites (Table 3). 307 subjects (56.2%) had surgical treatment, and thirty-one subjects (5.7%) were treated in the ICU (Table 3). Seventeen subjects (3.1%)

died (Table 3). The causes of death were multiple injuries (n = 13, 76.5%) and complications due to pre-existing conditions (n = 4, 23.5%).

Univariate analysis

On univariate analysis, we found no significant association between studied factors and death (Table 4).

DISCUSSION

In our study, 36.6% of injuries involved the lower extremities, 14.7% involved the upper extremities, 11.2% involved the lumbar spine and 8.6% involved the head. This contrasts with the National Trauma Data Bank (NTDB) Annual Report of

Table 1

Demographic characteristics of study subjects (N = 546)

Demographic characteristic	Frequency n (%)
Sex	
Male	204 (37.4)
Female	342 (62.6)
Age	
60-69 years	218 (39.9)
70-79 years	180 (33.0)
80-89 years	117 (21.4)
90-101 years	31 (5.7)
History of chronic diseases	
Yes	350 (64.1)
No	196 (35.9)
History of surgeries or trauma	
Yes	97 (17.8)
No	449 (82.2)

Table 2

Underlying diseases among study subjects (N = 546)

Underlying disease	Frequency n (%)
Hypertension	224 (41.0)
Diabetes mellitus	104 (19.0)
Respiratory disease	27 (5)
Tumor	14 (2.6)
Cerebrovascular disease	12 (2.2)
Atherosclerotic coronary artery disease	11 (2.0)
Atrial fibrillation or other arrhythmias	9 (2.0)
Renal failure	8 (1.5)
Liver failure	7 (1.3)
Dementia	5 (0.9)
Parkinson's disease	4 (0.7)
Epilepsy	4 (0.7)
Psychiatric disorder	4 (0.7)
Hypoproteinemia	4 (0.7)

2016 in the United States (American College of Surgeons, 2016), where head injuries accounted for 35.8% of the cases, higher than the 8.6% seen in our study. In 2016, the most common injury sites among elderly trauma patients in the United States were the lower limbs (40.1%), head (35.8%), upper limbs (31.7%), face (24.9%), and chest (22.6%) (American College of Surgeons, 2016). The difference in findings between the study from the United States and our study may be attributed to variations in trauma mechanisms by population and differences in study design.

In our study, multi-site injuries were observed in 20.3% of subjects and the total death rate was 3.1%.

Table 3

Injuries among study subjects (N = 546)

Category	Frequency *n* (%)
Injury site	
Head	47 (8.6)
Neck	3 (0.6)
Left upper extremity	35 (6.4)
Right upper extremity	45 (8.2)
Both upper extremities	80 (14.7)
Left lower extremity	101 (18.5)
Right lower extremity	99 (18.1)
Both lower extremities	200 (36.6)
Chest	38 (7)
Abdomen	5 (0.9)
Pelvis	1 (0.18)
Lumbar spine	61 (11.2)
Multiple site involvement	
Yes	111 (20.3)
No	435 (79.7)
Surgical intervention	
Yes	307 (56.2)
No	239 (43.8)
Admitted to ICU	
Yes	31 (5.7)
No	515 (94.3)
Clinical outcome	
Died	17 (3.1)
Survived	529 (96.9)

ICU: Intensive Care Unit

Table 4

Univariate analysis of factors associated with death among study subjects (N = 546)

Categories	Died	Survived	*p*-value
Sex			
Male	12	193	0.040
Female	5	336	
Age			
60-69 years	5	213	0.605
70-79 years	8	172	
80-89 years	3	114	
90-101	1	30	
Surgical intervention			
Yes	8	299	0.439
No	9	230	
Admitted to ICU			
Yes	1	30	0.635
No	16	499	

ICU: Intensive Care Unit

A previous study from Italy reported among elderly patients with multi-site injuries, the death rate was 36% (Gioffrè-Florio *et al*, 2018). In our study, 5.5% of subjects were treated in the ICU. This suggests we may have had less serious neurological conditions resulting in a lower death rate and fewer ICU admissions.

A strength of our study was the relatively large sample size. A weakness of the study was its retrospective nature preventing us from determining causality and only allowing us to determine associations. Another weakness of the study was that it was conducted at a single institution over a relatively short period of

time. We did not control for factors, such as preexisting conditions, making associations more difficult to identify.

In summary, we found no significant association between surgical treatment and outcome and between ICU management and outcome. Unfortunately, we did not find any significant associations between studied factors and outcomes that would guide interventions or changes in practice that could improve outcomes. We conclude surgery and ICU management may not be necessary for the majority of elderly neurosurgical patients presenting to our hospital. Our results did not identify interventions or management practice changes that would improve outcomes in this patient population. Future larger studies that include multiple centers may help to identify associated factors that could be evaluated to determine if changing them could lead to improved outcomes. A prospective study would help us identify causality and help control confounding factors, such as the presence and types of underlying diseases and variations in care protocols. Future studies could also benefit by evaluating subject frailty and its effect on outcomes.

CONFLICT OF INTEREST DISCLOSURE

The authors declare no conflict of interest.

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