

Forensic Head Trauma in Elderly Patients Accompanying Comorbidities

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Abstract

Aim: To evaluate the characteristics and accompanying comorbidities of patients aged 65 years and older who presented to the emergency department with head trauma and were evaluated as forensic cases.

Materials and Methods: The study was conducted with a retrospective evaluation of 157 patients aged 65 years and over who were admitted to the emergency department and evaluated as forensic cases.

Results: The most common cause of head trauma was a fall. Of the patients, 38.9% were hospitalized for follow-up, 14% were followed up in the intensive care unit (ICU), and 14% died. Falling from a height, the presence of accompanying thoracic trauma, and an increased number of requested consultations were statistically associated with hospitalization ($p<0.001$). There was a statistically significant relationship between mortality and the presence of falling from a height as the cause of trauma, accompanying pelvic trauma, hemorrhage on brain computed tomography, ICU follow-up requirement, and active partial thromboplastin time among the coagulation parameters ($p<0.001$).

Conclusion: Trauma has become the most important socioeconomic problem due to its consequences, such as death and disability in elderly patients. Intracranial bleeding, the presence of accompanying conditions, increases mortality; therefore, a multidisciplinary approach is required in the emergency care of this patient.

Keywords: Forensic case, 65 years and over, head trauma, comorbidities

Introduction

The changing demographic structure of the global population has increased the number of elderly patients exposed to trauma (1,2). The physiological structure that changes with age can make individuals over 65 vulnerable and fragile to even traumas of low severity (3). The management of this patient group varies according to their physiological status and injury mechanisms (4).

With their high mortality and morbidity rates among patients aged 65 years and over, head traumas are especially prevalent in emergency services. With increasing age, cerebral atrophy, decreased autoregulation, aging mitochondria, and increased superoxide production, as well as comorbidities and related medication use, have increased the frequency of intracranial

pathologies that may occur after trauma (5,6). The risk of exposure to trauma further increases with the addition of the reckless or negligent behaviors of society to the changing physical and mental states. Although falling is the most common cause of trauma, it may have different underlying etiological factors, such as falling from a height, standing height, or a ladder, or while working in the garden, depending on the area where an individual lives. Motor vehicle accidents, battery, gunshot wounds, stab wounds, and elder abuse, which are considered forensic cases, should also be kept in mind in the etiology of trauma. This study aimed to evaluate the characteristics and accompanying comorbidities of patients aged 65 years and older who presented to the emergency department with head trauma and were evaluated as forensic cases.



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Materials and Methods

Study Design and Population

The study was conducted by retrospectively examining patients aged 65 years and over who presented to the emergency department of a tertiary hospital with head trauma and were evaluated as forensic cases between January 2021 and December 2022. Approval was obtained from the Recep Tayyip Erdoğan University of Local Ethics Committee (decision no: 2023/130, date: 01.06.2023).

The local computer-based hospital information management system (HIMS), in which patient records are kept, was used to collect data on the patients included in the study. Patients younger than 65 years, non-forensic cases, patients without head trauma, and those with incomplete data were excluded from the study. Using HIMS, the patients' trauma mechanisms, demographic characteristics, Glasgow Coma Scale scores, brain computed tomography (BCT) findings, emergency department outcomes, discharge status, and final diagnoses were recorded.

Statistical Analysis

All statistical analyzes were performed using the Jamovi software version 1.6 (Jamovi Project Computer Software version 1.6. Sydney, Australia). A type 1 error of 1% was adopted in all comparisons. Normally distributed continuous variables were expressed as mean plus standard deviation, and non-normally distributed variables as median and interquartile range (IQR) values. Categorical variables were expressed as frequency (n) and percentage (%). The normality of the data distribution was evaluated using the Shapiro-Wilk test. The t-test was applied in the comparison of continuous variables in the case of a normal distribution and the Mann-Whitney U test in the case of a non-normal distribution. The chi-square test was used to compare categorical variables between the groups.

Results

Demographic Characteristics

During the two-year study period, 157 patients aged 65 years and over presented to the emergency department due to head trauma of a forensic nature. The ages of the patients ranged from 65 to 98 (median, 73, IQR: 68-77) years, and 63.1% (n=99) were male.

Considering comorbidities, 54.8% of the patients had only hypertension, and 44% had an additional comorbidity accompanying hypertension (Table 1).

Trauma Causes and Emergency Management

The most common trauma mechanism leading to presentation to the emergency department was a fall (n=69, 43.9%), followed by

a traffic accident (n=57, 36.3%) and battery (n=22, 14%). Falling from a height was the most common cause of falls (n=24, 15.3%), and most traffic accidents occurred with the patients inside the vehicle (n=30, 19.1%). When the pathologies of other systems accompanying the head trauma were evaluated, 47.1% (n=74) of the patients presented with extremity trauma and 36.3% (n=57) with thoracic trauma. There was trauma-induced hemorrhage in 20.4% (n=30) of the BCTs taken, while no pathology was found in 73.2% (n=115) (Table 1).

After the necessary trauma follow-up, 43.3% (n=68) of the patients were discharged from the emergency department, while 38.9% (n=61) were referred to an inpatient clinic and 14% (n=22) to the intensive care unit (ICU) for treatment and follow-up, depending on their pathologies (Table 2). Of the patients, 6.4% (n=10) were operated on and treated by the neurosurgery clinic. Fourteen percent (n=22) of the patients who were followed up and treated in the hospital had a fatal outcome.

In the patient group requiring hospitalization, the most common causes of trauma were traffic accidents (n=22) and falls from a height (n=14) (Table 3). Additional pathologies accompanying the head trauma were mostly observed in the thorax (n=32), and the relationship was statistically significant ($p<0.001$). The rate of hospitalization increased as the number of consultations requested increased according to the present pathologies ($p<0.001$).

Mortality

Of the patients with head trauma, 1.9% (n=3) died in the emergency department and 14% (n=22) died in the hospital while being followed up and treated. In these patients, the most common reasons for emergency department presentation were falls from a height (n=10) and traffic accidents (n=6). There was a statistically significant relationship between mortality and falls as the trauma mechanism ($p=0.001$). In addition, the presence of accompanying pelvic trauma (n=7) had a significant relationship with mortality ($p<0.001$) (Table 4). The detection of hemorrhage on BCT (n=18), the number of consultations requested, and the ICU treatment requirement (n=15) were also statistically significantly associated with mortality ($p<0.001$). Since the patients were 65 years and older and most did not know or remember the names of the medications they used, coagulation tests were evaluated at the time of first presentation. While mortality had no significant correlation with the international normalized ratio ($p=0.007$) and prothrombin time ($p=0.002$), it was statistically significantly correlated with active partial thromboplastin time ($p<0.001$).

Discussion

Brain injuries after trauma are a common cause of morbidity and mortality in all age groups. Especially in individuals aged 65 years and over, the changing physiology and accompanying comorbidities result in an increase in hospitalization and mortality rates (7). Therefore, there is a need for studies evaluating these cases to take the necessary medical and social protective measures for geriatric head trauma.

In geriatric individuals, age is directly related to mortality in the presence of head trauma and is important in determining management strategies when patients present to the emergency department (8,9). In the current study, the ages of the patients

ranged from 65 to 98 years, with 63.1% being categorized as “youngest-old” (65-74 years) and 63.1% being men. When the obtained data were compared to the literature, similar results were observed (10,11). The rate of head trauma being higher in the youngest-old group and the predominance of the male gender can be explained by the reduced mobility of these patients despite their desire to take part in social life.

Considering the general distribution of the trauma mechanism in the elderly, the highest rates belong to falls and traffic accidents (12,13). In our study, we found that falls constituted the most common trauma mechanism in geriatric patients (43.9%), followed by traffic accidents (36.3%). Falls from a height were most frequently seen, and this group also included patients

Variables	n (%)
Gender, male	99 (63.1%)
Age, median (IQR) (years)	73 (68-77)
Age group	
65-74 years	99 (63.1%)
75-85 years	45 (28.7%)
85 years and over	13 (8.3%)
Comorbidities	
Hypertension	86 (54.8%)
Hypertension and another comorbidity	63 (44%)
Trauma mechanism	
Fall	69 (43.9%)
From a height	24 (15.3%)
From standing height	18 (11.5%)
From a ladder	9 (5.7%)
While gardening	9 (5.7%)
From a tree	9 (5.7%)
Traffic accident	57 (36.3%)
Inside a vehicle	30 (19.1%)
Outside a vehicle	27 (17.2%)
Battery	22 (14%)
Work accident	5 (3.2%)
Trapped in wreckage	4 (2.5%)
Other accompanying system trauma on CT	
Extremity	74 (47.1%)
Thoracic	57 (36.3%)
Vertebral	23 (14.6%)
Pelvic	16 (10.2%)
Abdominal	11 (7%)
Brain CT findings	
No pathology	115 (73.2%)
Hemorrhage	30 (20.4%)
Subdural hemorrhage	9 (5.7%)
Subdural hemorrhage and SAH	8 (5.1%)
Intraparenchymal hemorrhage	7 (4.5%)
SAH	6 (3.8%)
Epidural	2 (1.3%)
Facial bone fracture	6 (3.8%)
Cranial fracture	4 (2.5%)

CT: Computed tomography, SAH: Subarachnoid hemorrhage, IQR: Interquartile range

who fell from a tree or while working in the garden, since the study was conducted in a hospital that provides health services for the population living in rural areas and actively engaged in agriculture. Many factors that emerge with increasing age prepare the ground for such falls, including vision and hearing disorders, reduced balance coordination, and weakness in the musculoskeletal system (14,15). In the current study, which included forensic cases, battery and work accidents were also identified as the causes of trauma in terms of etiology, albeit at a lower rate. We consider that this is due to the elderly being less involved in work and social life.

The most frequently injured body areas in geriatric trauma patients are known to be the extremities and the head and neck region (16). In our study, the extremities were involved in 47.1% of the cases as a secondary injury area. When the diagnoses of the patients after their evaluation in the emergency department

were examined, soft tissue disorders were found in 35.7% of the cases and fractures of any extremity in 19.1%. This is consistent with the literature.

In elderly patients, post-traumatic brain injury results in at least twice the rate of hospitalization and mortality compared with any younger age group (7). In the geriatric population, the highest mortality and morbidity rates are seen among those with subdural hematomas (17). Approximately half (52.9%) of our patients required inpatient treatment due to pathologies caused by trauma. Fourteen percent of the patients in this group had a fatal outcome, and the most common cause of mortality was intracranial pathologies, especially subdural hematomas detected on BCTs. The treatment strategy differs according to the clinical status of the patient. In the literature, there are surgical treatment recommendations and approaches that adopt conservative treatment (7,18). In our study, 6.4% of the patients

Variables	n (%)
Emergency department outcome	
Ambulatory discharge	68 (43.3%)
Inpatient clinic admission	61 (38.9%)
ICU admission	22 (14%)
Referral to another center	3 (1.9%)
Mortality	3 (1.9%)
In-hospital outcome	
Discharge	60 (38.3%)
Mortality	22 (14%)
Referral to another center	1 (0.6%)
Surgical intervention unit	
Orthopedics and traumatology clinic	11 (7%)
Neurosurgery clinic	10 (6.4%)
Ophthalmology clinic	4 (2.4%)

ICU: Intensive care unit

Variables	n (%)	p*
Trauma mechanism		
Fall	29 (18.5%)	0.023
Traffic accident	22 (14%)	
Battery	6 (3.8%)	
Work accident	4 (2.5%)	
Other accompanying system trauma on CT		
Extremity	34 (21.6%)	0.085
Thoracic	32 (20.4%)	<0.001
Vertebral	9 (5.7%)	0.976
Pelvic	8 (5.1%)	0.334
Abdominal	7 (4.5%)	0.080
Final diagnosis in emergency department		
Intracranial hemorrhage	30 (19.1%)	<0.001
Rib fracture	24 (15.3%)	
Hemopneumothorax	12 (7.6%)	
Extremity fracture	14 (8.9%)	

*Pearson's chi-square test.
CT: Computed tomography

Table 4. Factors affecting mortality		
Variables	n (%)	p*
Trauma mechanism		
Fall	15 (9.5%)	<0.001
Traffic accident	6 (3.8%)	
Battery	1 (0.6%)	
Other accompanying system trauma on CT		
Thoracic	14 (8.9%)	0.004
Extremity	13 (8.3%)	0.226
Pelvic	7 (4.5%)	<0.001
Abdominal	4 (2.5%)	0.027
Vertebral	2 (1.3%)	0.427
BCT findings		
Hemorrhage		<0.001
Subdural hemorrhage	6 (3.8%)	
Subdural hemorrhage and SAH	7 (4.5%)	
Intraparenchymal hemorrhage	3 (1.9%)	
SAH	2 (1.3%)	
Final diagnosis in emergency department		
Intracranial hemorrhage	18 (11.5%)	<0.001
Rib fracture	6 (3.8%)	
Hemopneumothorax	6 (3.8%)	
Extremity fracture	5 (3.2%)	
Follow-up unit		
ICU	15 (9.5%)	<0.001
Orthopedics and traumatology clinic	2 (1.3%)	
Thoracic surgery clinic	1 (0.6%)	
Urology clinic	1 (0.6%)	
Surgical intervention unit		
Neurosurgery	3 (1.9%)	0.205

*Pearson's chi-square test.
BCT: Brain computed tomography, SAH: Subarachnoid hemorrhage, ICU: Intensive care unit

underwent surgery at the neurosurgery clinic, while conservative treatment was the preferred strategy in the remaining patients.

Elderly patients use antiaggregant or anticoagulant medications that can cause hemorrhagic complications from head trauma. The use of these drugs increases mortality rates in trauma patients (19). Because our patients were unable to fully describe the medications they used and their comorbidities, coagulation tests were requested at the time of their presentation to the emergency department. We found that active partial thromboplastin time was associated with mortality.

Study Limitations

The most important limitation of the study is that it was retrospectively conducted in a single center with a limited number of patients. In addition, some basic characteristics of the patients, such as their long-term functional outcomes and quality of life after trauma, were not evaluated, which can also be considered a limitation.

Conclusion

In conclusion, trauma has become a crucial socioeconomic problem due to its consequences, such as increased mortality and morbidity in elderly patients. Since falls and traffic accidents are the first mechanisms of trauma, it is important to take precautions against these etiological factors. In the geriatric patient population, the presence of accompanying problems, especially pelvic or thoracic trauma, as well as intracranial hemorrhage, can cause a further increase in mortality. Therefore, a multidisciplinary approach is necessary in the emergency care of elderly patients. In addition, rehabilitation measures should be taken in social life areas to provide positive changes.

Ethics

Ethics Committee Approval: The study was approved by the Recep Tayyip Erdoğan University of Local Ethics Committee (decision no: 2023/130, date: 01.06.2023).

Informed Consent: Retrospective study.

Peer-review: xxxxx

Authorship Contributions

Surgical and Medical Practices: M.Ç., Concept: M.Ç., Ö.B., G.E., Design: M.Ç., Ö.B., G.E., Data Collection or Processing: M.Ç., Ö.B., G.E., Analysis or Interpretation: G.E., Literature Search: Ö.B., G.E., Writing: M.Ç., Ö.B.

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