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Epidemiological and clinical characteristics of head trauma patients admitted to the emergency department: A prospective study

Rahime Sahin Turan[1], Onur Incealtin[2]

1. Department of Emergency Medicine, Ordu University Training and Research Hospital, Ordu, Turkey
2. Department of Emergency Medicine, Istanbul Medeniyet University, Prof. Dr. Suleyman Yalcin City Hospital, Istanbul, Turkey

Correspondence
Onur Incealtin, Department of Emergency Medicine, Istanbul Medeniyet University, Prof. Dr. Suleyman Yalcin City Hospital, Istanbul, Turkey.

e-mail
onur-incealtin@hotmail.com

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ORCID ID of the author(s):
RST: 0000-0002-8067-2944
OI: 0000-0001-6335-674X

Abstract

Objective: Head trauma is a significant reason for emergency department admissions. In this study, we prospectively examined head trauma cases admitted between October and December 2011, aiming to identify risk factors and contribute to the epidemiological database in our country.

Materials and methods: Head trauma cases admitted to the emergency department between 08:00 and 17:00 during October-December 2011 were evaluated. Data collected included admission time, gender, vital signs, Glasgow Coma Scale (GCS) score, mechanism of injury, associated organ injuries, comorbidities, substance or alcohol use, neuroradiological findings, interventions performed in the emergency department, neurosurgical consultations, and surgical requirements. Statistical analysis was performed to determine the patients' epidemiological characteristics, discharge rates, hospitalizations, and mortality rates, providing results specific to our institution.

Results: A total of 206 patients were included. Among the patients, 59.22% were admitted due to domestic accidents, while 21.84% were brought in after traffic accidents. Of the 206 patients evaluated, 149 had normal findings on computed tomography (CT), while pathological findings were detected in 10 patients. Twelve patients were hospitalized, 3 underwent emergency surgery, and 191 were discharged from the emergency department.

Conclusions: In our study, domestic falls were more common than traffic accidents as a cause of head trauma; however, traffic accidents were associated with a higher risk level based on GCS scores. Patients aged 60 years and older demonstrated a higher prevalence of pathological findings on CT, identifying advanced age as a significant risk factor. The most frequently observed pathology was traumatic subarachnoid hemorrhage (SAH).

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Introduction

Head trauma is a common condition frequently encountered by emergency physicians. Approximately 56-60% of all trauma patients experience mild to severe head trauma. Furthermore, 50% of trauma-related deaths are attributed to head injuries (1-4). Falls are the most common cause of head trauma, particularly in children and the elderly. In adults, head trauma is often associated with alcohol consumption or assault (5,6).

In the 1970s, the development and clinical implementation of CT by Hounsfield marked a revolutionary advancement in the evaluation of cranial pathologies (7). Studies have revealed that cellular death can occur even hours after primary brain injury, and more importantly, the effects of the injury are not necessarily irreversible. This understanding led to the recognition that traumatic injury is not solely a result of the initial impact but also involves secondary injuries that contribute to the progression of the condition. Traumatic intracranial lesions are classified into two main categories: primary and secondary lesions. Primary traumatic lesions include neuronal injuries (contusion, diffuse axonal injury, and primary brainstem injuries), primary hemorrhages (epidural, subdural, intracerebral hematoma, and diffuse hemorrhages), traumatic pia and arachnoid injuries (subdural hygroma, post-traumatic arachnoid cyst), primary vascular injuries, and cranial nerve injuries (8,9). Secondary traumatic lesions encompass infarction, diffuse hypoxic damage, diffuse brain swelling and edema, pressure necrosis due to herniation, secondary brainstem injuries, and other conditions such as pneumocephalus, cerebrospinal fluid (CSF) fistula, and delayed hemorrhage.

The objective of this study is to prospectively analyze head trauma cases admitted to the emergency department between October and December 2011. By evaluating the collected data, the study aims to identify risk factors in head trauma patients and contribute to the development of an epidemiological database, which is currently insufficient in our country.

Materials and methods

Patient selection

The study protocol received approval from the Istanbul Medeniyet University non-interventional local ethical board numbered 16/I/2011. All patients provided written informed consent for the procedures performed. This prospective study was conducted on patients admitted to the emergency department due to head trauma between October and December 2011, during the hours of 08:00-17:00. A total of 206 patients, aged between 1 and 90 years, were included in the study. Data collected included age, gender, method of hospital admission, time of admission, mechanism of injury (assault, domestic accidents, occupational accidents, falls from height, traffic accidents, sports injuries), clinical findings, and GCS scores. Additional information regarding comorbidities, associated systemic injuries (extremities, abdominal, spinal, maxillofacial injuries), and neuroradiological findings (linear fractures, depressed fractures, epidural hematoma, subdural hematoma, traumatic subarachnoid hemorrhage, contusion, pneumocephalus) was also recorded. The observation duration in the emergency department and patient outcomes (discharge, surgery, hospitalization, or death) were thoroughly evaluated.

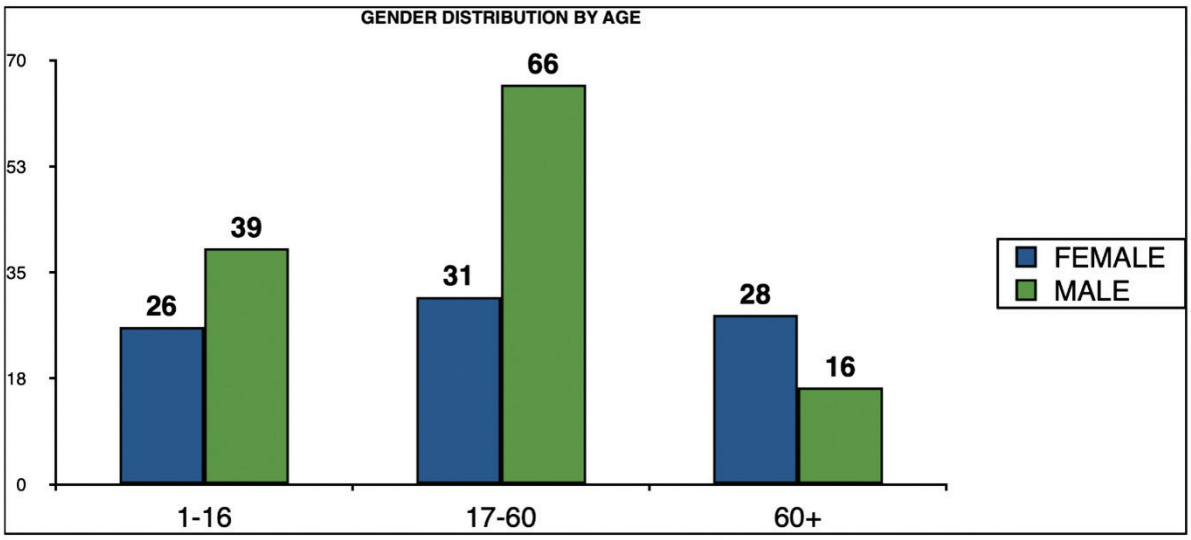

Figure 1: Gender distributions by age

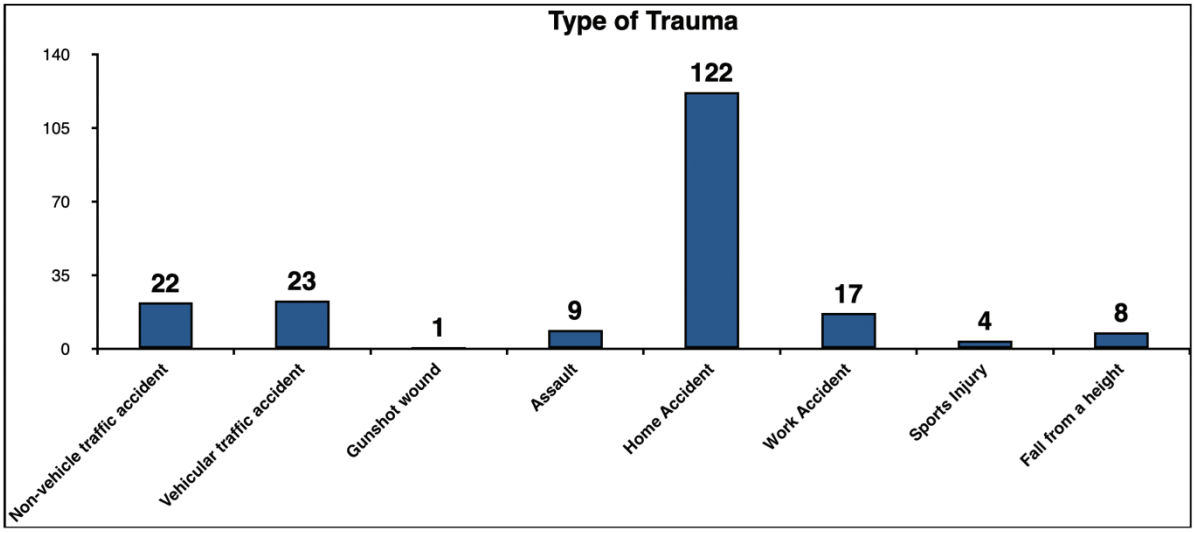

Figure 2: Etiologic evaluation

Statistical analysis

For data analysis, SPSS (Statistical Package for Social Sciences) for Windows 17.0 software was used. Descriptive statistical methods (mean, standard deviation, frequency, percentage) were applied, and the chi-square test was utilized for intergroup comparisons. Results were evaluated within a 95% confidence interval, with a significance level of $p<0.05$.

Results

A total of 206 patients were included. The analysis of patients in our study group revealed that the mean age was 33.44 years. The most frequently affected age group was 17–60 years, accounting for 47% of cases, followed by those aged 16 years or younger at 31.5%, and finally, patients aged 60 years or older, who represented 21.5% of the cases (Figure 1).

Regarding the etiology of head trauma in our study group, domestic accidents were the leading cause, accounting for 59.22% of cases. Traffic accidents ranked second; however, no significant difference was found between pedestrian vehicle accidents (PVA) and motor vehicle accidents (MVA), which accounted for 10.67% and 11.17% of cases, respectively. When classifying trauma mechanisms into traffic accidents and other causes (e.g., assault, domestic accidents, falls from height, firearm injuries, sports-related injuries), traffic accidents accounted for 21.84% of cases, while other causes accounted for 78.15% (Figure 2). Of the 206 patients in our study group, cranial CT was performed in 77.18%, while 22.82% did not undergo CT imaging. Among the patients who underwent CT, 72.33% had normal findings, while 4.86% presented with pathological findings (Table 1). The pathological findings included traumatic SAH in four patients, epidural hematoma in two patients, cerebral edema in two patients, contusion in one patient, and pneumocephalus in one patient. Traumatic SAH was the most commonly detected pathology, accounting for 40% of cases with abnormalities on CT. In comparison, Masson et al. identified cerebral contusion as the most frequent pathology (5), while Kleiven et al. reported subdural hematoma as the most common lesion (6).

When analyzing the relationship between age and the prevalence of pathological findings on CT, a statistically significant difference was observed ($p=0.005$). Patients aged 60 years or older had a higher prevalence of pathological findings (9.1%) compared to other age groups, highlighting advanced age as a significant risk factor for intracranial pathology.

Table 1: Computed tomography imaging results

CT Imaging	Frequency (N)	Percentage (%)
Normal	149	72.33%
No imaging	47	22.82%
Cerebral edema	2	0.97%
Epidural hematoma	2	0.97%
Contusion	1	0.49%
Pneumocephalus	1	0.49%
Traumatic SAH	4	1.94%
Total	206	100%

SAH: Subarachnoid hemorrhage, CT: Computed tomography

Of the total patient cohort, twelve individuals required hospitalization for further monitoring and treatment. Among these hospitalized patients, three underwent

emergency surgical interventions due to the severity of their conditions. The remaining 194 patients were evaluated, treated, and subsequently discharged directly from the emergency department after their acute needs were addressed.

Discussion

In this prospective study of 206 patients aged 1 to 90 years who presented to the emergency department with head trauma, we found that the majority of cases involved individuals aged 17–60 years, with domestic accidents being the leading cause of injury. While 77% of patients underwent cranial CT, pathological findings were detected in only 4.9% of cases, with traumatic subarachnoid hemorrhage emerging as the most frequent pathology among these. Importantly, advanced age (≥60 years) was associated with a significantly higher prevalence of abnormal CT findings (9.1%), underscoring the increased vulnerability of older patients to intracranial injuries. These findings highlight domestic accidents as the predominant cause of head trauma and emphasize the value of age-based risk stratification in the evaluation of patients with head injury.

In our study, 58.74% of the 206 patients were male, while 41.26% were female. Similarly, in a study conducted by Mirzai et al. involving 177 patients, the male-to-female ratio was approximately 3:1 (9). When examining age groups, males predominated in the 1–60 age range, whereas after the age of 60, the rate of head trauma was higher in females compared to males (63.6% female vs. 36.4% male). The higher proportion of males in the overall population can be attributed to the more active lifestyles of men in our society, which increases their exposure to trauma. Similar age group distributions and results were observed in the study conducted by Ökten et al. (8).

When the etiology of head trauma in our study group was examined, domestic accidents were found to be the leading cause, accounting for 59.22% of cases. In traffic accidents, which ranked second, no significant difference was observed between pedestrian vehicle accidents (PVA) and motor vehicle accidents (MVA), with rates of 10.67% and 11.17%, respectively. When trauma mechanisms were classified as traffic accidents or other causes (e.g., assault, domestic accidents, falls from height, firearm injuries, sports injuries), traffic accidents accounted for 21.84% of cases, while other causes accounted for 78.15%. In contrast, Mirzai et al. reported a traffic accident rate of 59.8% and other causes at 40.11%, indicating a notable difference from our findings (9).

Another clinical parameter evaluated in our study was the presence of amnesia in patients. When the relationship between amnesia and pathological findings on computed tomography (CT) was analyzed, the prevalence of amnesia was significantly higher in patients with pathological CT findings ($p=0.038$). Amnesia was observed in 20% of patients with pathological findings, compared to 8.1% in those with normal CT results.

Beyond acute hospital care, it is crucial to consider long-term cognitive and functional outcomes in head trauma patients. Studies have shown that even mild traumatic brain injuries may result in persistent neuropsychological impairments and reduced quality of life. Therefore, incorporating routine neurocognitive assessments and rehabilitation referrals into emergency department protocols could help identify subtle deficits early and promote recovery (10-12). Future multicenter, long-term studies are needed to validate these strategies and guide evidence-based improvements in head trauma management.

This study has several limitations. First, the sample was restricted to patients admitted during working hours (08:00–17:00), potentially excluding more severe cases presenting at night. Second, the three-month study period may not capture seasonal variations in head trauma incidence. Third, the relatively small sample size from a single center may limit the generalizability of the findings. Additionally, not all patients underwent cranial CT, which could have led to underdiagnosis of intracranial pathologies. Finally, the lack of long-term follow-up prevented assessment of outcomes beyond hospital discharge, such as delayed complications or functional recovery, which are important in head trauma research.

Conclusions

Head trauma cases constitute a significant portion of patients presenting to emergency departments. One of the most critical factors affecting morbidity and mortality in head trauma is the presence of complications that require surgical intervention. These complications include epidural, subdural, and intracerebral hematomas, as well as depressed skull fractures. Early diagnosis and treatment of these

complications are crucial for reducing morbidity and mortality.

Our study, consistent with the literature, demonstrated that patients involved in traffic accidents were significantly more likely to fall into the high-risk group based on GCS scores. Another important finding was that males aged 17–60 were more frequently exposed to head trauma. In contrast, the prevalence of pathological findings on CT was higher in patients aged 60 years and older, identifying advanced age as a risk factor. The most common pathology detected on CT in our study was traumatic SAH. Additionally, head trauma cases were frequently associated with extremity injuries. Since males are more actively engaged in the workforce, they are also more prone to occupational injuries. These risks can be mitigated by implementing stringent occupational safety measures in workplaces.

Conflict of interest

The authors report no conflict of interest.

Funding source

No funding was required.

Ethical Approval

Ethics approval was granted by Istanbul Medeniyet non-interventional local ethical board, dated 2011 (Decision No. 2011/16/I).

Informed consent

Informed consent was obtained from all participants for publication.

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None

Peer-review

Externally. Evaluated by independent reviewers working in at least two different institutions appointed by the field editor.

Data availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Contributions

Research concept and design: RST, OI

Data analysis and interpretation: RST, OI

Collection and/or assembly of data: RST, OI

Writing the article: RST, OI

Critical revision of the article: RST, OI

Final approval of the article: RST, OI

All authors read and approved the final version of the manuscript.

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