

An Epidemiological Study of Head Injuries in Patients Referred to the Emergency Department

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ABSTRACT

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Background and Objective: Head injuries, with their detrimental consequences, can impose considerable costs on the health, treatment, and rehabilitation sectors for both patients and the healthcare system. Therefore, the implementation of appropriate preventive programs for the management of patients with brain injuries is essential, which requires initial epidemiological assessments. The aim of the present study is to investigate the epidemiology of head injuries in patients presenting to the emergency department of Ganjavian Hospital in Dezful.

Methods: The present cross-sectional study was conducted on all patients with head injuries presenting to the emergency department of Ganjavian Hospital in Dezful from 2019 to 2021. Demographic information and data pertaining to the time, cause, and outcome of the injury in terms of the duration of hospitalization were collected and examined using a checklist.

Findings: In the present study, a total of 996 patients with head injuries were evaluated. The main causes of injury included traffic accidents with a share of 66.46%, falls from height with 97%, and the smallest share was related to physical altercations with 4.61%. Of the 83 patients with head injuries, 69 were male and 14 were female. Males sustained head injuries approximately 4 times more frequently than females. In terms of the season of occurrence, most head injuries occurred in the spring and during the late hours of the night, and some secondary injuries and prolonged hospitalization were associated with the method of patient transfer from the scene of the accident to the emergency department. On average, patients were hospitalized for 8.5 days.

Conclusion: The results of the study demonstrated that the most common cause of head injury is traffic accidents. Therefore, health policymakers should reconsider the management of human resources and available facilities.

Keywords: *Head Injury, Emergency Department, Epidemiology.*

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Introduction

Trauma is the third leading cause of disability and death across all age groups, causing 16,000 deaths per day worldwide and resulting in more than five million deaths annually across the globe (1–3). The statistics for road accidents in Iran have been reported at an average of 24,000 people annually, which is a high rate (4, 5). In developing countries, the majority of deaths resulting from road accidents occur in the pre-hospital stage (6). Head injury accounts for the majority of injuries resulting from trauma (Traumatic Brain Injury=TBI) (7). Given that 85% of the world's population resides in low- and middle-income countries, TBI is considered one of the challenges of the healthcare system, as well as a socioeconomic burden (8-15). TBI is one of the common causes of mortality among youth and adults and, due to its associated complications, is considered one of the leading causes of disability among survivors (16, 17). Head injury includes damage to various layers of the head, including the scalp, skull, and brain, encompassing a wide range of injuries from mild to severe (18). In the United States, more than 7.1 million people present to hospital emergency departments each year following traumatic brain injuries (19). However, the reported statistics are likely lower than the actual rate, because in many cases, individuals do not seek medical attention following a head injury (20).

The mortality rate of severe brain injury is approximately 40%, and 60% of the remaining cases develop disorders such as cognitive deficits and behavioral problems that affect their functional status and quality of life. Most of these individuals experience prolonged periods of disability or die due to complications that could potentially be reduced or eliminated through early detection and appropriate treatment (21). Brain injuries are divided into two groups: primary and secondary (22). Scalp laceration, skull fracture, concussion, cerebral contusion, hematomas, subarachnoid hemorrhage, and diffuse axonal injury are categorized as primary injuries (23). In contrast, secondary brain injuries are a cellular and chemical response to the primary trauma that causes the destruction of brain tissue, resulting in ischemia, hypotension, increased blood carbon dioxide, cerebral edema, or even resistant hypertension (22).

In terms of the level of consciousness, patients who survive after trauma are divided, based on clinical examination, into four groups: normal, GCS>12, GCS=9-12, and GCS≤8 (24, 25). According to previous studies, 95% of patients have a normal level of consciousness or mild reduction (GCS>12) (26, 27). Classification of patients based on the level of consciousness can predict long-term outcomes in patients with head injury (28). One of the major factors affecting mortality in low- and middle-income countries is traumatic brain injury (TBI). Conducting epidemiological studies in different communities and at different times is essential for identifying the causes and factors underlying head injuries, in order to carry out precise and correct planning. Therefore, the aim of this study is to investigate the epidemiology of head injuries in patients presenting to the emergency department of Ganjavian Hospital in Dezful.

Methods

After approval by the Ethics Committee of Dezful University of Medical Sciences under code IR.DUMS.REC.1400.044, the present cross-sectional study was conducted on patients with head injuries presenting to the emergency department of Dr. Ganjavian Hospital (a total of 1,107 individuals) from 2019 to 2021. Sampling was performed using the census method, and patients who had not undergone CT scanning or whose other information was unavailable were excluded from the study. Ultimately, 996 patients were included in the study.

Data collection was carried out by a trained team using a checklist that included patients' demographic information (age, sex, weight, height, and BMI, marital status, drug and alcohol addiction, medical history), the mechanism of head trauma, the time of head injury, the level of consciousness upon arrival at the emergency department, the severity of head injury based on the Glasgow Coma Scale (mild, moderate, severe) (29, 30), the location and type of head injury, imaging findings, and laboratory findings (Na, K, Ca, Phosphorus, BUN, Cr, INR, WBC, RBC, PLT). Patient information (laboratory and imaging findings) was obtained through access to the comprehensive electronic information system of Dr. Ganjavian Hospital, and supplementary information (hour and season of injury, type of accident, etc.) was completed through review of patients' physical records available in the hospital's document archive department.

Following data extraction and categorization, SPSS software version 22 was used for data analysis, and descriptive statistics were calculated for each of the variables. To examine possible relationships among the variables, T-test, one-way analysis of variance (ANOVA), and chi-square tests were employed, and $p < 0.05$ was considered statistically significant.

Results

During the study, 996 patients were enrolled, with a sex distribution of 83% (828 patients) male and 17% (168 patients) female, and a mean age of 33.63 ± 2.03 years (range: 1 to 84 years). 72.5% of the participants were in the age range of 1 to 42 years, and 27.5% were in the age range of 42 to 84 years. 565 patients (56.72%) were married and 431 patients (43.27%) were single. The mean weight of patients was 65.96 ± 1.93 kg, the mean height was 162.61 ± 25.84 cm, and the mean body mass index (BMI) was calculated as 24.19 ± 3.67 kg/m² (Table 1).

Table 1. Demographic information and medical history of the study participants

Variable	Number(%)
Sex	
Male	828(83)
Female	168(17)
Total	996(100)
Age (years)	
1-42	722(72.5)
42-84	274(46.37)
1-84	996(100)
Marital status	
Married	565(56.72)
Single	421(43.27)
Medical history	
Hypertension	203(20.3)
Diabetes mellitus	179(17.91)
Cardiovascular disease	47(4.71)
Hypercholesterolemia	83(8.31)
Pulmonary disease	61(6.13)
Thyroid disease	59(5.91)
Cancer	49(4.81)
Family history of cancer	35(3.51)
Chemotherapy	46(4.61)
Immunosuppressive drugs	26(2.61)

662 patients (66.46%) of the study population sustained head injuries in traffic accidents, 199 patients (19.97%) from falls from height, and 46 patients (4.61%) following altercations. 65.7% of men sustained head injuries due to traffic accidents, 19.92% of men from falls from height, and 4.95% of men following altercations and conflicts. Additionally, 70.23% of women sustained head injuries in traffic accidents, 20.23% of women from falls from height, and 2.97% of women following altercations (Figure 1).

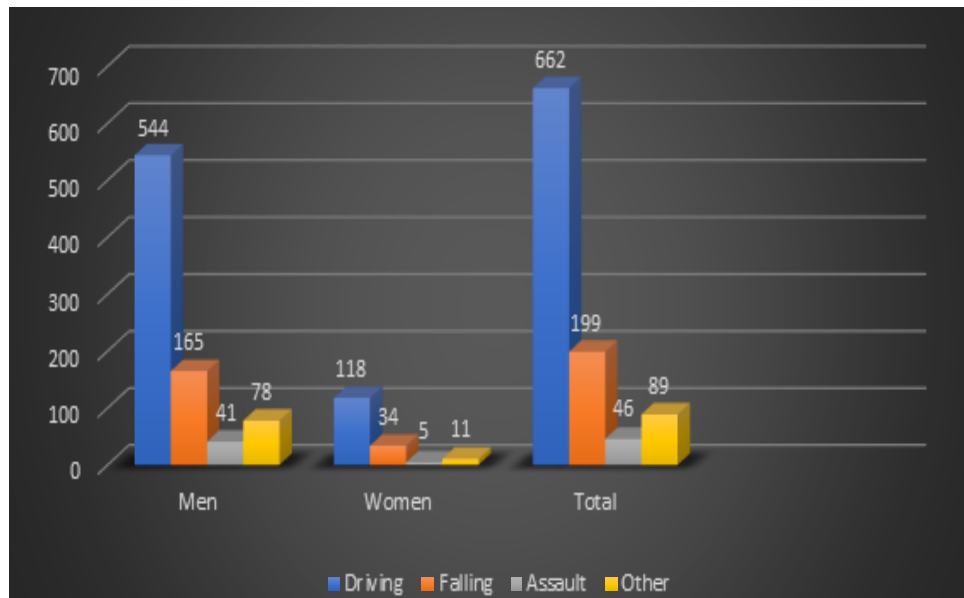


Figure 1. Frequency of each traumatic factor by sex

The mean number of days of hospitalization was 8.5 days, with a range of 1–92 days. Regarding the season of injury occurrence, the highest number of cases occurred in the spring, with 575 cases (57.73%), followed by autumn with 119 cases (11.94%). With respect to the hour of injury, approximately half of the injuries occurred in the morning and half in the afternoon until 8 p.m. 454 patients (45.58%) with head injuries were transferred to the center by pre-hospital emergency services, and 542 patients (54.41%) were transferred by private vehicle. Almost all patients had clinical symptoms of head injury at the onset of injury, the most common of which were, in order, decreased level of consciousness, headache, nausea and vomiting, and dizziness. 45.98% (458 cases) had mild injury ($GCS > 13$), 22.99% (229 cases) had moderate injury ($GCS = 8-13$), and 31.02% (309 cases) had severe injury ($GCS < 8$). The mean GCS score upon arrival at the emergency department was 11.54 ± 3.76 , with a range of 4 to 15, and the mean GCS score three days after admission was 11.96 ± 3.92 , with a range of 3 to 15. 278 patients (27.91%) had $GCS \leq 8$ upon arrival, and 718 patients (72.08%) had $GCS \geq 9$. Three hours after admission, 291 patients (29.21%) had $GCS \leq 8$, and 704 patients (70.68%) had $GCS \geq 9$.

Regarding disease status, 52.91% (527 cases) of patients achieved complete recovery, 28.81% (287 cases) partial recovery, 16.86% (168 cases) died, and 1.4% (14 cases) were transferred to other centers. Investigations showed that the majority of deceased patients (118 cases, with a frequency percentage of 11.84%) died due to cardiopulmonary arrest. Based on the results of the independent t-test, the mean GCS score upon arrival was 9.1 in deceased patients and 11.4 in recovered patients, and this difference was considered statistically significant ($p < 0.001$). 279 patients (28%) had skull fractures. Subarachnoid hemorrhage was found in 229 cases (23%), subdural hematoma in 207 cases (21%), epidural hematoma in

206 cases (21%), cerebral edema in 205 cases (21%), cerebral contusion in 97 cases (10%), intraparenchymal hemorrhage in 85 cases (8%), intraventricular hemorrhage in 39 cases (4%), and pneumocephalus in 38 cases (4%), respectively (Figure 2).

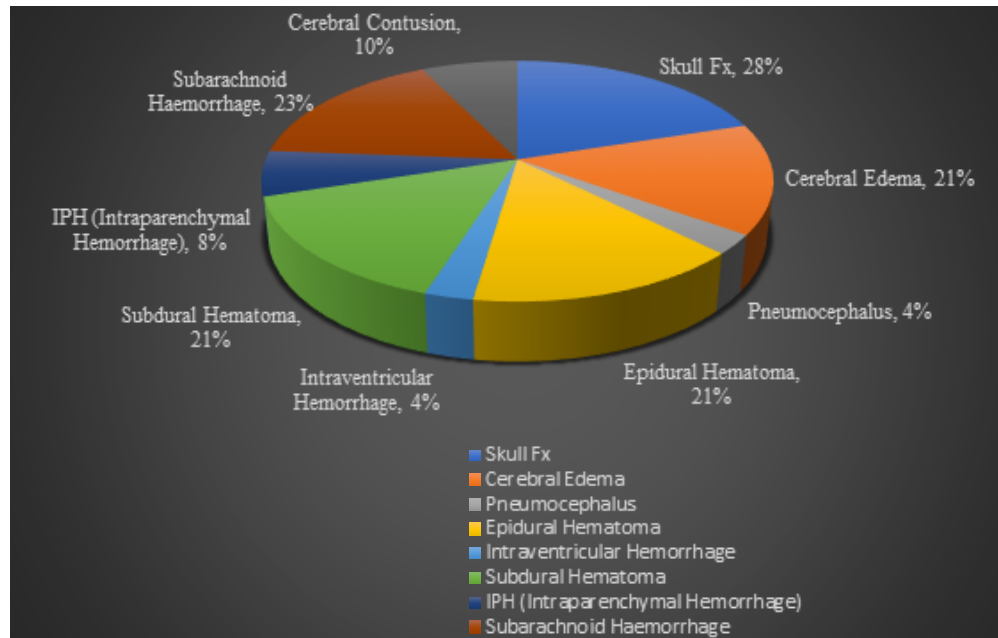


Figure 2. Frequency of types of head injury

Discussion

According to the present study, males sustain head injuries 4 times more frequently than females; this ratio in similar studies conducted in Iran has been 3 to 5 times (31-33), whereas this difference has been less pronounced in other countries than in Iran, and in some cases, head injuries have been reported more frequently in women than in men (34).

In the study by Yousefzadeh et al., aimed at investigating the epidemiology of head trauma in patients presenting to Poursina Hospital in Rasht, their mean age was 31.35 years and the male-to-female ratio was 3:1. The most common age group sustaining head injury was 25-44 years. In approximately 77% of cases, the cause of trauma was traffic accidents, and motorcyclists constituted approximately 48% of these. Most accidents occurred between the hours of 20:00 and 24:00, and summer was the most accident-prone season (38.75%). In 12% of patients, brain injury was severe. Approximately 13% of patients died, and motorcycles were the cause of injury in 55% of deceased patients (31).

The World Health Organization has identified motor vehicle accidents as the most common cause of head injury (35). In the present study, 8.7% (684 patients) of patients sustained head injuries due to accidents, and 20.5% (204 patients) following falls. The results of other studies conducted in Iran and other countries have also identified road accidents and falls as the most common causes of head trauma (31, 32, 36-38).

In the study by Aghakhani et al., aimed at investigating the epidemiology of head injury caused by falls, the results showed that falls are the second leading mechanism of head injury in Iran, and falls are more common in young children and the elderly. The prevalence of falls in men with head injuries was higher than in women. In other countries as well, falls constitute the first and second mechanisms of head injury

(39). Only one study in Iran has reported falls from a low height as the most common cause of head injury (40). In the present study, the frequency of falls did not differ significantly between women and men. The highest rate of head injury occurs in the spring and the lowest in the winter, which, given the volume of road travel in spring and summer, is consistent with similar previous studies (31). However, regarding the hour of accident occurrence in this study, the highest rate of head injuries was recorded in the afternoon before 8 p.m., which is contrary to the results of the study by Yousefzadeh et al. (31). However, it is consistent with the study by Esmailnejad Ganji et al. (41). Given the ratio of head injury rates between men and women, it can be concluded that, due to the greater social activity of men compared to women in Iran, accident-related injuries are also more frequent among them, leading to a significant increase in the ratio of head injuries in men compared to women.

The results of the study showed that the most common cause of head injury is traffic accidents. Therefore, health policymakers should reconsider the management of human resources and available facilities. Due to the high statistics of road accidents, large-scale measures are needed to reduce the incidence of accidents; furthermore, given pre-hospital injuries, the necessary facilities for referring patients from the scene of the accident to the hospital must be provided.

Among the limitations of the present study, the failure of some patients with head injuries to present to Dr. Ganjavian Hospital in Dezful can be mentioned, which, of course, includes a very small number of patients and can be referred to as unofficial statistics.

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