Article

Patterns, Types, and Outcomes of Head Injury in Aseer Region, Kingdom of Saudi Arabia

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**Abstract:** Head injuries contribute to approximately 50% of all injuries and remain a leading cause of loss of life and function among young adults. Currently, more than 57 million people worldwide live with traumatic brain injury-related neurological issues, of whom 10 million require hospital-based care.This retrospective cross-sectional study aimed to determine the epidemiological characteristics and outcomes of patients with head injury treated at Aseer Central Hospital (ACH).Data were collected from patient files and the registrar’s database of ACH between January 2015 and December 2017. We included patients with head injury admitted to ACH during the study period. We calculated descriptive statistics and used the t-test and chi-squared test to examine significant differences between variables. Of 353 patients with head injury (age [mean ± standard deviation], 27.01 ± 13.9 years), 87.3% were male and 12.7% were female. We observed that motor vehicle accidents comprised the leading cause of brain/head injuries (89.3% of all such injuries) in the Kingdom of Saudi Arabia, despite the implementations of new speeding rules. However, new regulations forbidding cellphone use while driving and requiring seat belts to be worn are expected to markedly affect these numbers. Thus, a future study is recommended to assess these expectations.

**Keywords:** keyword 1; keyword 2; keyword 3

1. Introduction

Head injuries contribute to approximately 50% of all injuries and are a major cause of loss of life and function among young adults [1–4]. Head injury has been reported as an issue of great concern, with more than 57 million people worldwide living with traumatic brain injury (TBI)-related neurological issues; of these, 10 million require hospital-based care [5].

Head injuries comprise an important cause of death and disability irrespective of age. In light of the epidemiological findings from the last 10 years, some effective preventive measures have been implemented, such as ensuring the most appropriate healthcare provision for both the acute care and rehabilitation of survivors of injury with disabilities [6]. Head injury accounted for two-thirds of in-hospital trauma deaths. Estimated epidemiological data showed that the frequency of TBI is high in North America and Europe. On average, 2.8 million people sustained a TBI annually [6]. Head injury also has economic consequences, results in financial losses, and reduces productivity. Almost 60 billion USD was utilized to overcome head injury-related damages in 2000 [7, 8]. The estimated population incidence of TBI in the United States was 73.5/100,000 individuals. A US-based study reported that head injuries were most common among young children [9, 10]. In 1998, in Malaysia, 4.75% of patients admitted to the emergency department had head injuries [11]. One epidemiological study reported that 69 million individuals worldwide were estimated to have TBI [12].

According to an Ethiopian study, head injuries are more common in male than in female individuals. Death is positively associated with severe head injuries in all age groups. Based on the Glasgow Coma Scale (GCS) score, head injury was mild in most cases; this degree was followed by severe and moderate degrees of injury [13]. According to a Nigerian study, head injury was observed to be the most common type of injury [14].

The Saudi population size was reported to be 33,920,622, according to the February 2019 United Nations estimates. Among 1,870 individuals implicated in motor vehicle accidents (MVAs) in the Kingdom of Saudi Arabia (KSA), 30% died as a result of the accident; a further alarming finding was that most patients (56.7%) had head injuries [15]. According to another study from the KSA, 32.1% of 1,219 patients had head injuries, and MVAs were the leading cause of such injuries (34.2%) [16].

The objective of this study was to determine the epidemiological characteristics of patients with head injury who were treated at Aseer Central Hospital (ACH), Aseer region, a region that has one of the highest numbers of car accidents based on the census of the Ministry of Interior of the KSA.

2. Materials and Methods

This was a retrospective cross-sectional study. Data were retrieved from patient files and the registrar’s database of ACH. The study was conducted between January 2015 and December 2017. All patients with head injury admitted to ACH during the study period were included in the study.

We collected data on demographics, the GCS score, Glasgow Outcome Score, type of head injury, mechanism of injury, type of surgery, and outcomes of patients. Data were analyzed with SPSS ver. 20 (IBM Corp., Armonk, NY). Descriptive statistics were calculated [means, standard deviations (SDs), frequencies, and percentages]. We used the t-test and chi-squared test to examine significant differences between variables. A P-value lower than 0.05 was considered significant.

3. Results

The mean (± SD) age of 353 patients with head injury was 27.01 ± 13.9 years. Figure 1 shows that MVAs (89.3%) were the leading cause of head injury. Of all patients, 87.3% were male, while 12.7% were female; 94% were Saudi nationals, while 6% were foreign nationals; 55.3% resided in high altitudes (mountain areas), 38.3 in low altitudes (plains), and 8.4% in other regions; and 42.5% were employed, 15.9% were unemployed, 34.6% were students, and 4% were workers (Table 1). Figure 2 shows that 34% of patients were placed in rehabilitation centers, 63.2% were discharged, and 2.8% were referred to other centers during the acute phase either based on the family’s or patient’s request or when the patient was from another province.

**Figure 1.** Causes of head injury (n=353).

**Figure 2.** Outcomes of patients with head injury.

**Table 1.** Demographic variables (n=353).

Of all patients, 46.7% had severe GCS scores (GCS ≤ ≤8), 42.2% had moderate scores, and 11.1% had mild scores (Table 2). As described in Table 3, 2.5% of the patients died, while 64.3% fully recovered. Table 4 shows that there was no significant difference between the Glasgow Outcome Score and head injury type, although patients with subdural and intraventricular hemorrhages tended to have low Glasgow Outcome Scores. Table 5 shows that there was a significant difference between the type of head injury and the GCS score (P<0.05), as lower GCS scores upon presentation were observed in patients with subdural hematomas and those with brain contusions than in those with other types of head injury. Table 6 clearly shows that there was a significant difference between the type of head injury and outcome in terms of placement at the end of acute management (P=0.0001), as a greater proportion of patients with intraventricular hemorrhage and subdural hemorrhage than of patients with other types of head injury were placed in rehabilitation centers. Table 7 shows that patients with subdural hematoma either underwent craniectomy or were treated medically. Almost 30% of patients with traumatic subarachnoid hemorrhage underwent craniectomy because of major underlying brain edema. Patients with brain contusions or epidural hematomas were less likely to undergo craniectomy (P<0.05).

**Table 2.** Patient categorization based on the Glasgow Coma Scale score.

**Table 3.** Patient categorization based on the Glasgow Outcome Score.

**Table 4.** Crosstabulation of Glasgow Outcome Scores and the type of head injury.

**Table 5.** Crosstabulation of the type of head injury and Glasgow Coma Scale scores.

**Table 6.** Crosstabulation of the type of head injury and outcomes of patients.

**Table 7.** Crosstabulation of the type of head injury and type of surgery.

4. Discussion

In this study, we examined the epidemiological characteristics and outcomes of patients with head injury treated at ACH and found MVAs to be the leading cause of injury; while most patients recovered, 2.5% died, 22.3% underwent surgery, and 34% were placed in rehabilitation centers.

The occurrence of head injuries refers to the number of new cases recognized in a certain period. For almost every year under study, approximately 1.7 million head/brain injury cases were recorded in the United States (in all age groups), contributing to approximately 30.5% of injury-related deaths. A previous study showed that babies and toddlers (0 to 4 years), adolescents from 15 to 19 years, and adults ≥ 65 years were more likely to sustain a brain injury [17].

According to a Malaysian study, MVAs comprise the most common cause of head injury worldwide, together with accidents at home, at the workplace, and during sports events. In this study, 10% of patients were referred to higher centers, 29% underwent rehabilitation, and 68% were discharged. Based on the findings of the Malaysian study, head injury was the fifth (7.86%) most common cause of hospitalization in Malaysian public hospitals in 2014 [18].

In one review of 26 studies, TBI was found to be the most common cause of trauma-related death in European countries [19], accounting for 235/100,000 patients with a mean mortality of 15/100,000 patients per year. In our study, MVAs comprised the leading cause of head injuries, comparable with the findings of other studies. For example, one study found that, in five European countries, traffic accidents were the most common (47%) cause of head injury [20].

In the present study, 87.3% of participants were male and 12.7% were female; another study from the KSA reported that men were more likely than women to sustain a head injury (78.4% vs. 21.6%) [21]. The results indicated that men are 2.4 times more likely than women to sustain a TBI in their lifetime. These results were also comparable to those reported by Kisser et al. [22].

The GCS score has been frequently used as a major outcome predictor after head injury since its introduction in 1974 [23]. In our study, based on GCS scores, TBIs were severe in 42.2%, moderate in 28.5%, and mild in 11.1% of patients. In another study [23], 57% of participants with severe TBI had GCS scores of 13–15, 19% had scores of 10–12, 9% had scores of 7–9, and 15% had scores of 3–6 upon admission; the authors reported that a low GCS score is more likely to lead to unfavorable outcomes.

Our finding that patients with intraventricular hemorrhage had a worse prognosis and were more frequently placed in rehabilitation centers is in line with the fact that traumatic intraventricular hemorrhage is associated with poor outcomes; however, the difference is that intraventricular hemorrhage was more frequently observed in our study population [24].

Additionally, acute subdural hematomas remain challenging for neurosurgeons and continue to be associated with less favorable outcomes, despite advances in medical and surgical treatment. Although the mortality rates have decreased, patients with subdural hematomas tend to have low Glasgow Outcome Scores, and they represent a major portion of patients who need rehabilitation services after acute treatment [25].

The fact that almost 12.5% of our patients underwent craniectomy reflects that our institution favors decompressive craniectomy, and this may explain the reasonably low mortality rate; however, 34% of our patients were placed in rehabilitation hospitals or long-term care facilities [26]. These findings reflect the need for rehabilitation centers in almost every province in the KSA given that MVAs remain a major national problem.

Since 2010, strict speeding rules and regulations have been implemented in the KSA, and cameras are now installed within cities and on highways; however, countrywide implementation of these measures took several years. In 2018, new rules forbidding texting while driving and issuing traffic tickets for such behavior were brought into effect and are expected to lower the occurrence of devastating car accidents. In addition, the KSA is greatly concerned with safety features of its imported vehicles, including airbags and anti-lock braking systems. For the last 30 years, all cars have to undergo periodic vehicle inspections, which are electronically connected to the car licensing authorities of the Ministry of Interior (http://www.mvpi.com.sa). Furthermore, Saudi authorities have stopped importing cars older than 5 years since 2010. The impact of such measures is worth reviewing in the next few years.

The principal limitations of this study are its retrospective nature and the lack of long-term follow-up data and examination of long-term consequences such as seizure and psychiatric disorders; the fact that there were some missing data is another limitation.

5. Conclusions

We found that MVAs were the leading cause of brain/head injuries in the KSA, despite the implementation of new speeding rules. To the best of our knowledge, our study was the first in Aseer region to shed light on the head-injury burden, to examine the short-term outcomes, and to address the fact that the new traffic regulations may not suffice, and thus, the Aseer region should introduce more measures to decrease the numbers of accidents leading to head injuries. However, the new regulations of forbidding cellphone use while driving and requiring seat belts to be worn are expected to markedly affect these numbers going forward. Thus, a future study is recommended to assess these expectations.

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