

## Epidemiology and impact of traumatic brain injuries from motorbike accidents

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### Abstract

**Background:** Head injuries are a major cause of trauma-related deaths worldwide, significantly impacting both healthcare systems and socioeconomic structures. Despite the availability of safety measures, their inconsistent enforcement has led to persistently high injury rates. Motorbike accidents, in particular, have emerged as a leading cause of traumatic brain injuries (TBI), especially in regions with high motorbike usage.

In Kerbala, the rise in motorbike accidents has placed a substantial burden on emergency and neurosurgical services. Many of these injuries result in severe head trauma, leading to increased mortality, long-term disability, and significant healthcare costs. Understanding the epidemiological trends and clinical outcomes associated with these accidents is crucial for implementing effective prevention and management strategies. This study aims to provide a comprehensive analysis of motorbike-related TBIs and their impact compared to other mechanisms of head trauma.

**Conclusion:** Motorbike-related traumatic brain injuries are a critical public health issue in Kerbala, leading to significant morbidity and mortality.

**Objective:** This study examines the frequency, severity, and consequences of motorbike-related traumatic brain injuries in Kerbala and compares them with other causes of head trauma.

**Keywords:** Traumatic brain injuries; Head trauma; Morbidity; Mortality

### 1 Introduction

Traumatic brain injuries (TBI) are a major cause of morbidity and mortality worldwide, with road traffic accidents being one of the leading contributors. <sup>(1,2)</sup> Among these, motorbike accidents account for a significant proportion of head injuries, especially in regions where motorbikes are a common mode of transportation. <sup>(3)</sup> The lack of protective measures, such as helmet use, and non-compliance with traffic regulations contribute to the increased incidence and severity of injuries in motorbike-related crashes. <sup>(4)</sup>

Motorbike accidents often result in high-energy trauma, leading to severe head injuries, long-term disability, and an increased need for surgical intervention. <sup>(3,5)</sup> Understanding the epidemiology and impact of these injuries is crucial for implementing effective preventive and management strategies <sup>(6)</sup>. In Kerbala, the rising number of motorbike accidents has placed a considerable burden on healthcare systems, highlighting the need for research to assess injury patterns, treatment approaches, and patient outcomes <sup>(7,8)</sup>.

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This study aims to analyze the incidence, severity, and outcomes of traumatic brain injuries caused by motorbike accidents in comparison to other causes of head trauma. By evaluating the need for surgical interventions and disability outcomes, this research seeks to provide evidence for improving trauma care and prevention policies.

## 2 Methods

This study analyzed 130 patients admitted with traumatic brain injuries to the neurosurgical ward and intensive care unit at AlHussein Medical City Hospital between February and December 2023. Patients were categorized based on injury causes, including motorbike accidents, car accidents, falls from height, and other incidents.

A standardized data collection form was used to gather demographic details such as age, gender, and injury mechanism. Injury severity was assessed using the Glasgow Coma Scale (GCS), while associated injuries were documented based on clinical examination and radiological findings.

Treatment methods were classified into conservative and surgical interventions, with the latter including craniotomies, decompressive surgeries, and other neurosurgical procedures. Patient outcomes were evaluated based on recovery status, residual disability, and mortality. Statistical analysis, including chi-square tests, was performed to assess the significance of differences between trauma groups in terms of severity, surgical intervention, and disability outcomes. A p-value of <0.05 was considered statistically significant.

## 3 Results

Motorbike accidents were the most frequent cause of traumatic brain injuries (n = 76, 58.5%). Young males were the most affected, and these accidents resulted in the highest rates of severe injury and mortality.

**Table 1** Incidence of Traumatic Brain Injuries by Cause (Motorbike injuries statistically significant, p<0.01)

Cause of Injury	Number of Cases	Percentage (%)
Motorbike Accidents	76	58.5%
Car Accidents	31	23.8%
Falls from Height	10	7.7%
Other Causes	13	10%

**Table 2** Gender Distribution (Male percentage statistically significant, p<0.01)

Gender	Number of Cases	Percentage (%)
Male	90	69.2%
Female	21	16%

**Table 3** Age Distribution (Patients below 20 years statistically significant, p<0.01)

Age Group	Number of Cases	Percentage (%)
<20 years	84	64.6%
21-40 years	30	23%
41-60 years	12	9.2%
>60 years	4	3.2%

**Table 4** Severity of Traumatic Brain Injuries

Severity Level	Number of Cases	Percentage (%)
Mild (GCS 13-15)	71	54.2%
Moderate (GCS 9-12)	21	15.8%
Severe (GCS $\leq 8$ )	38	30%

**Table 5** Severe Injuries by Cause (Motorbike injuries statistically significant,  $p < 0.01$ )

Cause of Injury	Severe Cases (GCS $\leq 8$ )	Percentage of Severe Cases (%)
Motorbike Accidents	24	63.2%
Car Accidents	8	21.1%
Falls from Height	3	7.9%
Other Causes	3	7.9%

**Table 6** Treatment Approach

Treatment Type	Number of Cases	Percentage (%)
Conservative	98	75%
Surgical	32	25%

**Table 7** Surgical Intervention by Cause (Motorbike injuries statistically significant compared to other groups,  $p < 0.01$ )

Cause of Injury	Surgical Cases	Percentage of Surgical Cases (%)
Motorbike Accidents	18	56.3%
Car Accidents	7	21.9%
Falls from Height	4	12.5%
Other Causes	3	9.3%

**Table 8** Patient Outcomes

Outcome	Number of Cases	Percentage (%)
Full Recovery	82	62.9%
Disability	25	19.2%
Death	23	17.9%

**Table 9** Disability and Mortality by Cause

Cause of Injury	Disability Cases	Percentage of Disability Cases (%)	Mortality Cases	Percentage of Mortality Cases (%)
Motorbike Accidents	18	72% (p<0.01, statistically significant)	13	56.5% (not significant)
Car Accidents	5	20%	7	30.4%
Falls from Height	1	4%	2	8.7%
Other Causes	1	4%	1	4.3%

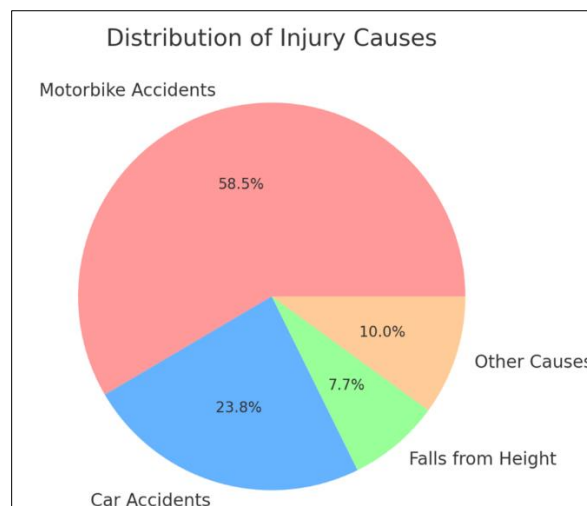
#### 4 Discussion

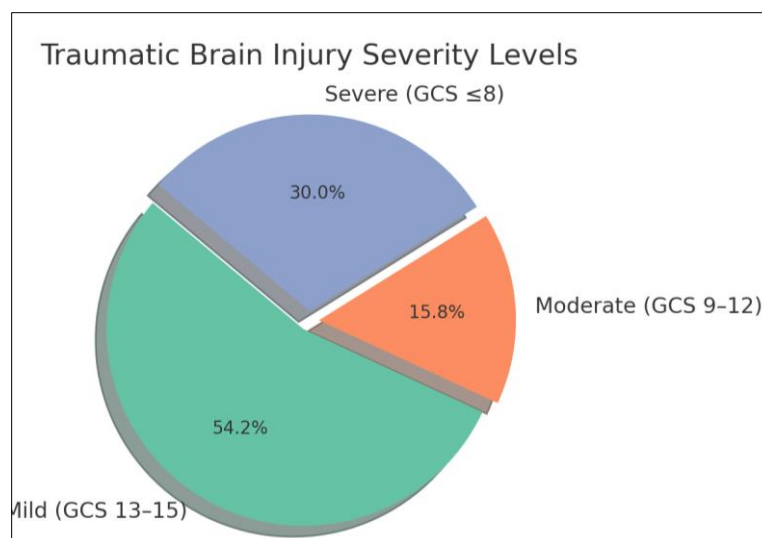
Motorbike accidents remain the leading cause of traumatic brain injuries in Kerbala, particularly among young males. (3,7) These accidents result in the highest rates of severe injuries and mortality, leading to long-term disability and substantial healthcare burdens. Many patients sustained associated systemic injuries, including fractures, maxillofacial, chest trauma, and abdominal injuries, which further complicated their management and recovery. (7,9,10)

Comparing this study to previous research by Al-Anbari in 2011 on head injuries due to motorcycle accidents, similar trends were observed in terms of young males being the most affected group (3). Both studies emphasize the significant burden of motorbike-related TBIs on healthcare facilities, with high rates of severe injuries requiring surgical intervention. The prior study also highlighted the role of non-compliance with helmet laws and reckless driving as contributing factors, aligning with the findings of this study. However, the current research further establishes statistical significance in surgical intervention and disability outcomes, providing a more detailed epidemiological insight into the long-term consequences of these injuries.

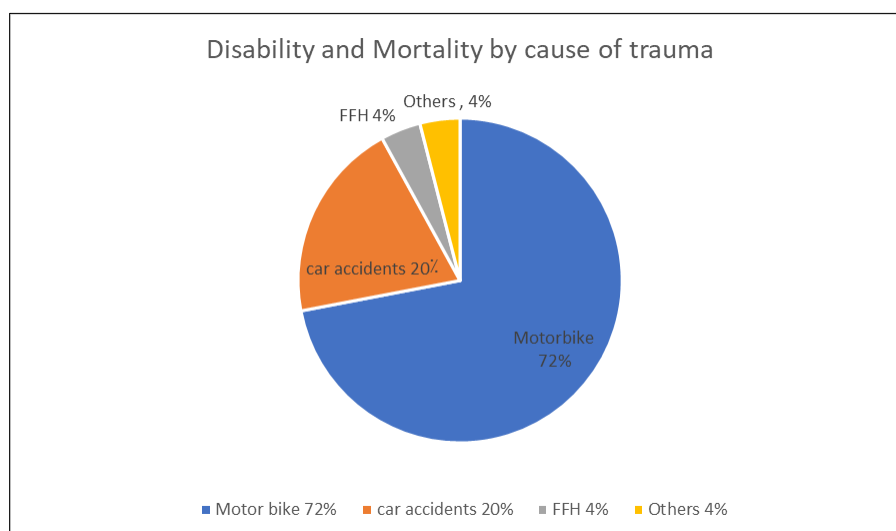
Additionally, motorbike accident victims demonstrated a statistically significant need for surgical intervention compared to other trauma groups, indicating the severe nature of their injuries (11,12). The high rate of disability in this group underscores the long-term economic and social impact of such accidents, with many survivors requiring prolonged rehabilitation and facing challenges in returning to their pre-injury quality of life (13,14,15).

Despite these alarming trends, conservative management remained the most common approach, possibly due to limited healthcare resources or late presentation of patients (16). Future studies should investigate the barriers to timely and optimal surgical intervention and explore strategies to enhance post-trauma rehabilitation programs to improve patient outcomes. These accidents result in the highest rates of severe injuries and mortality, leading to long-term disability and substantial healthcare burdens (17).

**Figure 1** Distribution of patients according to the injury causes.



**Figure 2** Severity of TBI



**Figure 3** Disability and mortality with different causes of injuries

## 5 Conclusion

Motorbike accidents continue to be a major public health concern in Kerbala. There is an urgent need for stricter enforcement of road safety measures, enhanced public awareness campaigns, and improvements in emergency trauma care.

### Recommendations

- **Public Education:** Increase awareness about helmet use, speed control, and road safety as illustrated by other studies <sup>(14,18)</sup>.
- **Strict Traffic Regulations:** Enforce laws to reduce reckless driving and mandate protective gear. <sup>(19)</sup>
- **Improved Emergency Response:** Enhance trauma care systems, including pre-hospital management and hospital emergency services <sup>(20,21)</sup>.
- **Policy Initiatives:** Collaborate with local authorities to implement road safety campaigns and stricter enforcement measures. <sup>(22)</sup>

By addressing these concerns, we can reduce the incidence and severity of motorbike-related traumatic brain injuries in Kerbala and improve public health outcomes.

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## Compliance with ethical standards

### *Acknowledgments*

Acknowledgments must be inserted here.

### *Disclosure of conflict of interest*

If two or more authors have contributed in the manuscript, the conflict of interest statement must be inserted here.

### *Statement of ethical approval*

If studies involve use of animal/human subject, authors must give appropriate statement of ethical approval. If not applicable then mention 'The present research work does not contain any studies performed on animals/humans subjects by any of the authors'.

### *Statement of informed consent*

If studies involve information about any individual e.g. case studies, survey, interview etc., author must write statement of informed consent as "Informed consent was obtained from all individual participants included in the study."

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