



Original Research

Pattern of Traumatic Brain Injuries and Their Frequencies in Motorcyclists

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ABSTRACT

Objective: To identify different patterns of Traumatic Brain Injury (TBI) and their frequencies among motorcyclists presenting to our Neurotrauma unit.

Material and Methods: This cross-sectional study was conducted at the Department of Neurosurgery, Lady Reading Hospital, Peshawar. A total of 156 patients were enrolled. An elaborate history was taken from all patients after initial stabilization. Baseline investigations and radiological work-ups, including CT scans of the brain, were performed to identify the pattern of injuries. Patients were followed up until discharge to monitor improvement in TBI.

Results: Out of 156 patients, 90.4% (n=141) were males with an average age of 33.3±9.39 years and 9.6% (n=15) were females with an average age of 34.0±10.4 years. The severity of TBI was categorized as mild in 53.2%, moderate in 32.1%, and severe in 14.7% of cases. The most common patterns of TBI observed were contusions (42.3%), extradural hematomas (23.1%), cranial fractures (10.3%), intracerebral bleeds (7.7%), subdural hematomas (7.1%), traumatic subarachnoid hemorrhages (6.4%), and other TBI patterns (3.2%).

Conclusion: The study concluded that different patterns of TBI exist among motorcyclists. It is recommended that preventative measures such as helmet use be enforced to reduce the occurrence of such injuries.

Keywords: Traumatic Brain Injuries, Motorcyclists, Pattern of TBI, RAT: Road Traffic Accidents.

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INTRODUCTION

Trauma is the third most significant cause of overall deaths worldwide below 40 years of age and about 25% of traumatic injuries are due to Road traffic accidents (RTAs).^{1,2} An estimated 5 million people worldwide are thought to be killed in RTAs each year, and there may be as many as 50

million wounded. All of these deaths and injuries are avoidable, and new studies have placed RTA injuries in third position, up from ninth on the burden of disease list.² Traumatic brain injury (TBI) accounts for about half of all RTA injury-related deaths (around 50%), followed by cardiac and aortic injuries (17%), hemorrhagic causes (12%), sepsis (10%), lungs (6%), burns 3%, and liver (2%).³ Almost 90% of RTA deaths occur in low and middle-income countries and have double the mortality rate, 20/100,000 as compared to high-income countries.⁴ More than 10 million people worldwide suffer from traumatic brain injury (TBI), which is a serious public health issue that is expected to overtake many other diseases as the primary cause of death and morbidity by 2020. Motorcycles are very popular for transportation in low-income countries and their use increased especially among youths, with an increase in cars and fuel prices, they are very cheap and have good fuel economy so widely used in third countries like Pakistan.⁵ Due to the rapid increase in the number of motorbikes, the number of accidents increased due to less protection as locally manufactured having no safety options, and less visibility on roads, over speeding as it thrills the youth and without any corresponding improvement in road infrastructures.⁶ TBI is the main cause of death in motorcycle accidents under the age of 25 years.⁷ The Glasgow Coma Scale, a rapid tool for determining the prognosis and severity of head injury, divides traumatic brain injury (TBI) into three major classes. TBI is defined as insult and disruption in brain functions caused by external physical force.³ As the brain cannot heal or repair via surgery any injury to the brain can lead to ischemia of that region, which leads to severe disabilities and coma that cost high and causes even death. Family members are also affected financially, spiritually, and psychologically by their beloved ones.⁶ TBI secondary to a bike accident is a serious threat to our neurosurgery unit, ranging from small abrasions over the scalp to coma and death. The main purpose of this study is to

determine different patterns of TBI, their severity according to GCS, and their frequency in motorcyclist accidents with which they present to our neurotrauma. Very limited work done in both national and regional literature, so this will generate local statistics that will help in spreading awareness among bikers for adaptation of safety measures and will also help in maintaining and implementing laws and orders, regarding traffic rules. It will also subsequently decrease the injuries in motorcyclists and will prevent many morbidities and mortalities among vulnerable group members (below 45 years of age). Furthermore, we think that by recognizing injury patterns, we may better anticipate when more resources and services will be required, as well as lay the groundwork for preventative measures and direct health policy.

MATERIALS & METHODS

Study Design and Study Setting

This descriptive cross-sectional study was conducted at the Department of Neurosurgery, Lady Reading Hospital, MTI, Peshawar (Approval Reference# Irh/03) over six months from December 7, 2020, to June 7, 2021.

Inclusion Criteria

Patients of both genders, aged below 45 years, who had experienced motorcycle accidents resulting in traumatic brain injuries (TBI), were included in the study.

Exclusion Criteria

Patients with polytrauma involving severe injuries other than TBI, as well as those with comorbid conditions such as diabetes, hypertension, or bleeding disorders, were excluded.

Data Collection

After receiving approval from the hospital's research and ethical committee, patients were

admitted through the emergency department and underwent comprehensive physical and neurological examinations, baseline investigations, and radiological assessments including CT scans to ascertain the patterns of injury. Continuous follow-up until discharge was conducted to monitor the progress of TBI.

Data Analysis

Data were analyzed using SPSS version 23. The analysis included calculating means ± SD for quantitative variables like age, and percentages/frequencies for categorical variables such as gender and TBI patterns. Stratification of TBI by age and gender was performed, followed by post-stratification chi-square tests to assess statistical significance at a 5% level.

RESULTS

Age & Gender Distribution

In this study, 156 individuals with a mean age of 33.4±9.46 years were included. Out of the total enrolled patients, 141 patients were male while 15 patients were female as shown in Tables 1 and 2.

Table 1: Age and gender distribution of the Study Population.

Gender	Frequency	Percentage	Mean Age ± SD (Years)
Males	141	90.4	33.3±9.39
Females	15	9.6	34.0±10.4
Total	156	100	33.4± 9.46

Patterns of TBI

Table 2 shows the distribution of patients based on the pattern of traumatic brain injury (TBI). The most common pattern was contusion, affecting 66 patients (42.3%). Extradural injuries were next, with 36 patients (23.1%), followed by cranium fractures in 16 patients (10.3%). Other patterns included intra-cerebral bleeds (12 patients, 7.7%), subdural

hematomas (11 patients, 7.1%), traumatic subarachnoid hemorrhages (10 patients, 6.4%), and other types of injuries in 5 patients (3.2%).

Table 2: Distribution of patients based on pattern of TBI.

Pattern of TBI	Frequency	Percentage
Contusion	66	42.3
Extradural	36	23.1
cranium fracture	16	10.3
traumatic subarachnoid	10	6.4
subdural hematoma	11	7.1
intra cerebral bleed	12	7.7
Others	5	3.2
Total	156	100

Distribution of Patients Based on The Severity

Table 3 shows the distribution of patients based on the severity of traumatic brain injury (TBI). Mild TBI was the most common, affecting 83 patients (53.2%). Moderate TBI was reported in 50 patients (32.1%), while severe TBI affected 23 patients (14.7%).

Table 3: Distribution of patients based on TBI.

TBI	Frequency	Percentage
Mild	83	53.2
Moderate	50	32.1
Severe	23	14.7
Total	156	100.0

Stratification of Traumatic Brain Injury (TBI) Based on Gender

Table 4 shows the stratification of traumatic brain injury (TBI) based on gender. Among males, 80 (56.7%) had mild TBI, 42 (29.8%) had moderate TBI, and 19 (13.5%) had severe TBI. Among females, 3 (20.0%) had mild TBI, 8 (53.3%) had moderate TBI, and 4 (26.7%) had severe TBI. The p-value was 0.025, indicating a significant difference.

Stratification of TBI Based on Age Group

Table 5 shows the stratification of traumatic brain injury (TBI) based on age group.

- In the < 20 years age group, 7 patients (46.7%) had mild TBI, 6 (40.0%) had moderate TBI, and 2 (13.3%) had severe TBI, totaling 15 patients (100.0%).
- In the 20-40 years age group, 42 patients (51.2%) had mild TBI, 26 (31.7%) had moderate TBI, and 14 (17.1%) had severe TBI, totaling 82 patients (100.0%).
- In the > 40 years age group, 34 patients (57.6%) had mild TBI, 18 (30.5%) had moderate TBI, and 7 (11.9%) had severe TBI, totaling 59 patients (100.0%). The p-value was 0.84, indicating no significant difference.

DISCUSSION

Traumatic brain injury (TBI) is a major public health concern that has increased in frequency over the past 25 years, with an estimated 69 million new cases occurring worldwide each year.⁸ About 2.8 million TBI diagnoses, 282,000 TBI-related hospital admissions, and 56,000 TBI-related deaths occurred in the United States alone in 2013.⁹ Imaging methods, especially CT and MRI are very important for the treatment and outcome of traumatic brain injuries.¹⁰ Moreover, 1.25 million people died internationally in traffic accidents in 2013, with the largest death rates occurring in Africa. Road traffic accidents are the leading cause of traumatic brain injury (TBI) among young individuals from low- and middle-income nations, whereas falls are the primary cause in older adults.¹¹

Table 4: Stratification of TBI based on gender.

Gender	TBI			Total	P-value
	Mild	Moderate	Severe		
Male	80 (56.7%)	42 (29.8%)	19 (13.5%)	141 (100.0%)	0.025 Significant
Female	3 (20.0%)	8 (53.3%)	4 (26.7%)	15 (100.0%)	
Total	83 (53.2%)	50 (32.1%)	23 (14.7%)	156 (100.0%)	

Table 5: Stratification of TBI based on age group.

Age Group	TBI			Total	P-value
	Mild	Moderate	Severe		
< 20 years	7 (46.7%)	6 (40.0%)	2 (13.3%)	15 (100%)	0.84 Insignificant result
20-40 years	42 (51.2%)	26 (31.7%)	14 (17.1%)	82 (100%)	
>40 years	34 (57.6%)	18 (30.5%)	7 (11.9%)	59 (100%)	
Total	83 (53.2%)	50 (32.1%)	23 (14.7%)	156 (100%)	

This study was conducted to recognize various TBI patterns and their frequencies among motorcyclists. According to our results, a different pattern of TBI was identified in patients presenting to our neurosurgery unit. Motorcyclists having different patterns of traumatic brain injury may present with brain edema, epidural hematoma, subdural hematoma, subarachnoid hemorrhage, linear and depressed skull fractures, intraventricular hemorrhages, contusions and herniations, and hydrocephalus diagnosed with computed tomography (CT) scan of the brain.

In our study, most of the patients fall in the Mild TBI category. While mild traumatic brain injury (TBI) is prevalent, it can be difficult to diagnose, define, and treat. This can have negative clinical outcomes.

Motorcycle riders are responsible for around 23% of road user mortality worldwide, while motorcycle crashes (MCCs) account for 60% of RTIs.¹ Because motorbikes are designed to be exposed, riders can sustain a range of injuries; nonetheless, head injuries are a significant source of morbidity and death among victims of motorcycling crashes. These head injuries range in severity from moderate to severe, and they can include traumatic brain injuries (TBIs), in which the brain tissues are harmed by the abrupt force of

trauma. With a population of over 220 million, Pakistan is a model LMIC. The 21st century has witnessed an enormous increase in motorization and urbanization in the nation. The number of vehicles is growing quickly, with many of them being outdated and unfit for use on the roads. At the same time, road networks are being built at a low standard.¹² Similar to several South Asian nations, the majority of the population, who are primarily from low-income backgrounds, now primarily travel by motorcycles, which are among the riskiest automobiles. Pakistan has one of the highest global rates of traumatic brain injury. In the 2004 National Injury Survey, the incidence of TBI related to RTAs was found to be 1500 per 100,000 people annually. The Pakistani neurosurgical community and society are aware that youngsters may operate motorcycles for fun, home duties, or jobs.¹²

Motorcycle rights groups in the West are fighting to prioritize individual freedom over safety since, in their view, that is a personal decision. The kind of car driven and involved in the collision is greatly influenced by cultural, social, and economic variables. Motorcycles are primarily used for leisure in Western countries, despite being one of the most convenient modes of transportation. The need for quick access made motorbike usage necessary in underdeveloped nations. Motorbike use is highest in Southeast Asian nations, where low- and low-middle-income nations account for roughly 85% of all traffic fatalities worldwide.¹³ With 220 million people, Pakistan is the prototypical developing nation where motorcycle use has skyrocketed along with the severity of related issues. Across the globe, motorcycles are the primary mode of transportation for men.¹⁴ According to the motorcycle industry council in the United States, nearly one in five motorcycle owners is now female, compared with one in ten a decade ago.¹⁵

In our study most of the patients were men. This the part of our culture that male uses motorcycles as a source of easy transport. Over the

years 2002 to 2016, men were more likely than women to utilize motorbikes on average. During the years 2002–2016, the average number of motorcycle journeys taken by men was 412.¹⁶ Due in large part to the widespread usage of motorcycles in our nation, TBI rates are likewise high, with men being the most common victims. As per the latest data issued by the Federal Bureau of Statistics (FBS), the percentage of households in Pakistan that possess motorcycles has increased from 41% in 2015 to 53% now. Pakistan has 32.2 million households, according to the 2017 Census.¹⁷

CONCLUSION

It was concluded that patients presented to our department had different patterns of TBI, so it was recommended that precautions such as the use of helmets should be taken to avoid such type of TBI patterns.

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Additional Information

Ethical Board Approval: The study conformed with the ethics review committee requirements.

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AUTHORS CONTRIBUTIONS

Sr.#	Author's Full Name	Intellectual Contribution to Paper in Terms of:
1.	Hameed Ullah	1. Study design and methodology.
2.	Hameed Ullah, Amer Zaman	2. Paper writing.
3.	Ibrahim, Hameed Ullah	3. Data collection and calculations.
4.	Junaid Alam	4. Analysis of data and interpretation of results.
5.	Waseef Ullah	5. Literature review and referencing.
6.	Amer Zaman	6. Editing and quality insurer.