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Outcomes of Patients with Traumatic Brain Injury between Two-Wheeler and Non-Two-Wheeler Vehicles: A Cohort Study

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ABSTRACT

Introduction

Traumatic brain injury (TBI) is growing public health concern and one of the most devastating types of injury. Incidence of road traffic accidents is growing in low middle income countries. Pattern of injuries and outcome in two wheeler and non two-wheeler vehicular accidents should be evaluated and addressed separately. This study aims to determine the outcome between two wheeler and Non two-wheeler vehicular Traumatic brain injury (TBI) patients.

Methods

This is retrospective cohort study which include the data from October 2020 to December 2022, of patients with vehicular traumatic brain injuries, admitted in Department of Neurosurgery, Institute of Medicine, Tribhuvan University Teaching Hospital, Nepal. Primary data was collected from emergency records, in patient files, operative notes and post operative discharge. Patients were followed up via phone call and at follow up visits.

Results

A total of 75 patients with mean age of 39.39 ± 18.3 years and male to female ratio of 3.6:1 were enrolled in the study. 63 patients and 12 patients were included in two wheeler and non two wheeler TBI patients. Among two wheeler patients, 39.68% used helmet whereas 16.6% of non two-wheeler patients used seatbelts. Alcohol consumption was high in 2 wheelers (52.38%) than in non two-wheelers (25%). Majority of the patients had mild head injury,73% among two wheelers and 83.3% in non 2-wheelers. Favourable Extended Glasgow Coma score(4-8) was seen in 98.4% of two wheeler TBI patients and among all of non two-wheeler TBI patients.

Conclusion

There are differences in outcomes between Traumatic Brain Injury of two wheelers and Non two-wheelers. Favourable outcomes in terms of Extended Glasgow coma score was seen in non-two-wheelers as compared to two-wheelers in our study.

Keywords

Extended Glasgow coma score; Glasgow coma scale; Traumatic brain injury.

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INTRODUCTION

Traumatic brain injury (TBI) contributes to death and disability among all trauma-related injuries and referred as "silent epidemic".[1] Brain Injury Association of America (BIAA) 2011 defined TBI as "an alteration in brain function or other evidence of brain pathology caused by an external force." Recent studies stated that there are 500 to 800 new cases of TBI per 100,000 people[2]. WHO estimates that 90% of the deaths due to TBI occur in Low to middle income countries[3]. Rapid urbanization without safeguarding measures are other risk factors[4]. Inadequate safety protocols and mode of injury affect the outcome[5]. Use of two-wheeler is growing rapidly, leading to an increase in road traffic accidents[5]. Case fatality rates range between < 1 % in mild TBI up to 40% in severe TBI[6].

Primary brain injury occurs at the time of impact. Numerous secondary brain insults (SBIs) complicate the initial damage and lead to secondary brain injury. In the ICU, the mainstay of treatment of TBI is the prevention of systemic SBI such as hypoxemia, hypotension, hypercapnia etc[7].

The risk of death following TBI is 7 times greater than that of the general population in the first year after injury and 5.3 times greater over 7 years of injury[8]. Vehicular traumatic brain injury can be divided into two-wheeler for eg. motorcycle, scooters etc. and non two-wheeler eg. car, auto rickshaw etc. This study aims to identify severity of TBI between these 2 groups and outcome in terms of Extended Glasgow coma outcome score (GOSE).

METHODS

This is retrospective cohort study conducted at Department of Neurosurgery, Tribhuvan University Teaching Hospital (TUTH), kathmandu, Nepal from October 2020 to December 2022. Ethical approval was taken from Institutional Review of Institute of Medicine with approval no. IRC ref 260 081/082.

Rider or pillion rider amongst two wheeler and driver and copassenger of non two-wheeler vehicles, those who are more than or equal to 16 years of age, presenting with TBI in TUTH are included in the study. Those who had leave against medical advice, previous cranial surgeries and those patients who had cardiopulmonary resuscitation before the admission are excluded from this study. Consecutive sampling was used and all cases meeting the inclusion criteria were included. Glasgow Coma scale was assessed after resuscitation and they were classified based on severity of head injury defined as severe (GCS 3–8), moderate (GCS 9–12) and mild (GCS 13-15). Patients were managed with the standard head injury protocol and then discharged once they met the discharge criteria.

The Outcome of patients was assessed at the time of discharge and at 3 months follow-up using Extended Glasgow outcome scale (GOSE). GOSE was dichotomized into favourable(score 4-8) and unfavourable (score 1-3). Statistical analyses were performed using SPSS 25.0 software. Categorical variables are expressed as frequency (percentage). Continuous variables are expressed as Mean ± SD. Fisher exact test used for statistical significance. P value <0.05 was considered significant.

RESULTS

This study consists of 75 patients, 63 two wheelers and 12 non-two wheelers and analysis was done.

Age Distribution

Mean age of the patient in the study was $39.39_{\pm}18.3$ years. Most common age group affected in two wheeler TBI patient was 25-50 years with median age of 32. In Non two-wheelers, most affected age group was 22-51 years with median age of 45 years.

Sex Distribution

Males accounted for 78.7% (59) and females for 21.3%(16).

Distribution of riders/ drivers and pillion riders/ copassengers

Among 63 two wheeler TBI patients, riders slightly outnumbered the pillion rider (1.1:1). Of 12 non two-wheeler TBI patients, copassenger were high as compared to driver (3:1) .

Table 1. Demographic profiles between two-wheelers and non-two-wheelers

Characteristics	two-wheelers	Non-two-wheelers
Sex		
Male	51	8
Female	12	4
Vehicle user		
Driver/Rider	33	3
Copassenger	30	9
Diagnosis		
SDH	15	3
EDH	12	0
Contusion	25	6
Traumatic SAH/DAI	4	3
Fracture	7	0
Alcohol		
Consumed	33	3
Not consumed	30	9

Diagnosis Distribution

Most common diagnosis among two wheeler TBI was contusion followed by Subdural hematoma(SDH), which was also similar for non two-wheeler TBI patients. P value was 0.106.

Alcohol Consumption

Amongst 63 two wheeler TBI patients, 33 consumed alcohol (52.38%) whereas 30 did not consume alcohol (47.62%). In non two-wheeler TBI patients, out of 12 patients, 3 consumed alcohol(25%) and 9(75%) did not consume alcohol (p=0.117).

Grade of head injury

Among two wheeler TBI patients, 46 (23 rider and 23 pillion rider) had mild head injury. 14 (9 rider and 5 pillion rider) had moderate head injury, 3 (1 rider and 2 pillion rider) had severe head injury. Among non two-wheeler, 10 (2 drivers and 8 copassenger) had mild head injury. 1 copassenger had moderate head injury and 1 driver had severe head injury.

Table 2. *GCS severity score among 2 wheeler and non 2 wheelers*

GCS severity	2 wheeler		Non 2 wheeler	
	Rider	Pillion rider	Driver	Co passenger
Mild (13-15)	23	23	2	8
Moderate (9-12)	9	5	0	1
Severe (<8)	1	2	1	0

Helmet or seatbelt used

25 patients used helmet and 38 did not use the helmet among 63, two wheeler TBI patients. Two patients used and 10 did not use the seatbelts amongst the non two-wheeler patients.

Hospital and ICU stay

Mean duration of hospital stay was 10.56 days and mean duration of ICU stay was 1.96 days. Range of Hospital stay was 2-70 daysand that of ICU stay was 0-24 days. Median duration/Interquartile range(IQR) of hospital and ICU stays are shown in table below:

Table 3. *Duration of Hospital and ICU stays*

Stay	Duration	
	Two Wheeler	Non two-wheeler
ICU stay	2.06	1.42
Hospital stay	11.08	7.83

Intervention

Most operative intervention was done in two wheeler TBI patients(20,31.74%) and most common indication for operation was SDH. Operative intervention was done in Non two-wheeler patients in 3(25%), p value was 0.745.

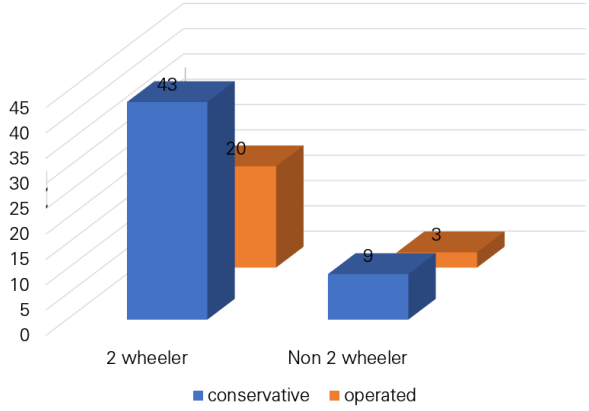

Figure 2. *Interventions among 2 wheelers and non2 wheelers*

Outcome

Outcome was measured in terms of GOSE score at 3 months of discharge. GOSE score was further

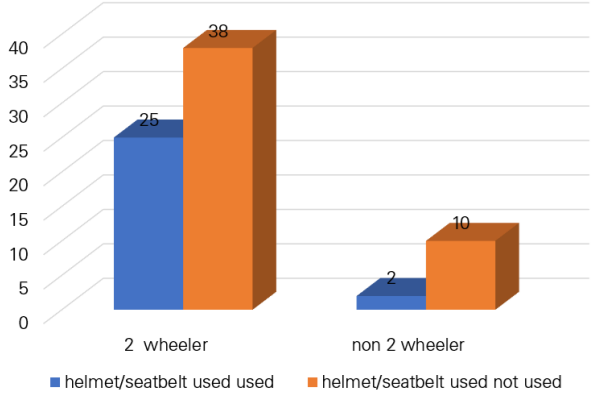

Figure 1. *Helmet or seatbelt usage*

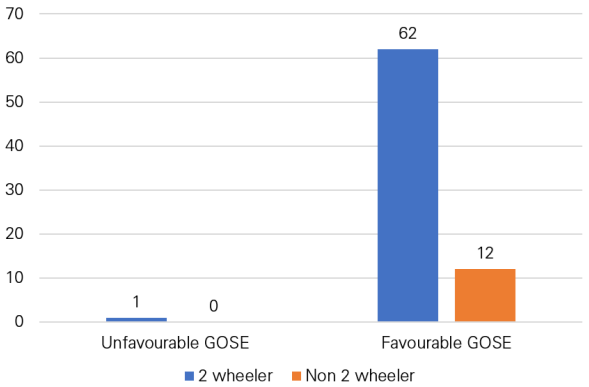

Figure 3. *GOSE score at 3 months*

dichotomised into favourable group(GOSE 4-8) and unfavourable group(GOSE 1-3). Favourable outcome in two wheeler was 98.4% and, in non two-wheeler was 100%. Unfavourable outcome among two wheeler was slightly higher (1.6%)as compared to Non two-wheeler(0%). P=1.00

DISCUSSION

Increasing population, increasing registration of automobiles, encroachment of roads, traffic rules violation and peer pressure of drinking alcohol and drug abuse in early age had resulted in most of the road traffic accidents (RTAs)[9]. Most common age group affected is young to middle age group, between 22-50 years of age. 84% of patients were two wheeler patients and 16% were non two-wheeler patients. Incidence of two wheeler RTAs are higher than non two-wheeler due to huge number of two wheeler population, lack of safety measures in two wheelers and no compulsory use of helmet use to the pillion riders. Mean age of patients in our study was 39.39 $\pm$ 18.3 which is comparable with the study done by Panczykowski et al. and Olivecrona et al. where they had mean ages of 37.8 and 35.5 years respectively[10,11].

In our study there was male preponderance. Males accounted for 78.7% (59) and females for 21.3% (16), male : female ratio of 3.7:1. This study was consistent with study done by Maya et.al and Nicola newall et.al[12,13]. These studies denote that men have a heavy risk taking behaviour that lead to serious injuries.

In our study, majority of the diagnosis was contusion followed by subdural hematoma in both two wheeler and non two-wheeler patients. Results were consistent with study done by Maharjan S. et.al.[14]

In two wheeler TBI patients, helmet use was seen in 39.68% and seatbelt was used in 16.6% of non two-wheeler patients, which is slightly higher as compared to study by Tripathi M.et al[9].

Alcohol consumption and driving is often fatal, as it would lead to impaired sense, impaired judgement and thoughts. In our study 52.38% consumed alcohol in two wheeler patients whereas 25% of the patients consumed alcohol in non 2 wheeler patients. In a study by Joshi P. et.al., 12.19% patients were driving under the influence of alcohol, out of which 99.35% were 2 wheeler[15].

In two wheeler patients, 73% had mild head injury at the time of presentation, 22% had moderate and 5% had severe head injuries. In non two-wheeler patients, 83.3% had mild head injury followed by 8.3% of moderate and severe head injury. Majority of the patients had mild head injuries which was comparable with other studies[16].

Mean duration of hospital stay was 10.56 days. Mean duration of ICU stay was 1.96 days.

Operative intervention was more in two wheeler(31.74%) and most common indication was acute subdural hematoma. In 25% of non two-wheelers, operative intervention was done.

Study stated that the outcome of TBI depends on the GCS at the time of presentation[17,18]. In our study, only one of the case with severe TBI (GCS<8), had unfavourable outcome. In a study by G. Gururaj, recovery rate was higher among mild traumatic brain injuries (65%) compared with moderate and severe Traumatic brain injuries(55% and 38% respectively)[19]. In this study, GOSE score was divided into favourable (4-8) and unfavourable (1-3). Favourable outcome was seen in 98.4% of 2 wheelers whereas it was 100% in non 2 wheelers. Mortality was 2.6%, both in 2 wheeler patients who were presented with moderate and severe head injury.

This study is single centered and focused only on road traffic accidents with head injuries, it does not include those head injuries due to fall or other mechanisms. Assessment and follow up of only 3 months would be inappropriate to comment on overall outcome after injury. Injuries to the pedestrians and bystanders were also not included in this study.

CONCLUSION

Majority of head injuries were seen in young to middle aged group, mostly in males. Majority of the road traffic accidents were seen in two wheelers. Alcohol intake and inappropriate safety measures like no use of helmet, were mostly seen in two wheelers. It was seen that more favourable outcome is seen in non two-wheeler patients than two wheelers. Mean hospital and ICU stay was increased in two wheelers ultimately leading to economic burden. Legislation of laws regarding helmet use both in rider and pillion rider and use of seatbelt by co-passengers would have significant impact in reducing the Traumatic brain injuries incidence.

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CONFLICT OF INTEREST

The author(s) declare that they do not have any conflicts of interest with respect to the research, authorship, and/or publication of this article.

AUTHOR CONTRIBUTIONS

Bishwash Shrestha carried out data collection and manuscript preparation; Prabhat Jha performed

statistical analysis; Mohan Raj Sharma helped in the research concept; Sushil Krishna Shilpakar helped in literature review; Gopal Sedain and Amit Pradhananga performed research design.

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