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A clinical study of patients with head injury among vehicular accidents

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Abstract

Introduction: Road traffic accidents (RTAs) are the curse of contemporary civilization. [1] Traumatic brain injury is one of the most frequent causes of death and disability in road traffic accidents. [2] The pattern of injury between two wheeler and four wheeler vehicular accidents is entirely different and needs to be evaluated accordingly. [1] The present study was carried out to analyse the pattern and mechanism of injury among vehicular accidents, evaluate the aetiology and mechanical causes of vehicular accidents and compare and analyse injuries among two-wheeler, four-wheeler and pedestrian injury.

Materials and Methods: This prospective observational study was carried out in the Department of General Surgery, Hamidia Hospital, GMC, Bhopal, M.P. between June 2021 and September 2022 among 200 consented patients of road traffic accidents with head injury; more than 14 years of age; admitted in the department using a pre-designed proforma, basic investigations, CT head/ MRI brain and GCS scoring. Based on the clinical assessment and CT/MRI findings, surgical/ conservative management was planned. Data was analyzed using SPSS-PC-21 version. P-value < 0.05 was considered statistically significant.

Result: Two-wheeler vs. two-wheeler accidents were the most commonly occurring (48.50%) followed by two-wheeler vs. four-wheeler (21%). Most injured persons comprised those riding two-wheeler (87%); 6.50% were pedestrians and 6% were traveling by a four-wheeler. Drivers were most commonly injured (58.50%); most were those driving a two-wheeler (65.10%). This was because 79.31% of the two-wheeler drivers were not wearing helmets and 83.33% of the four-wheeler drivers had not fastened their seatbelts/ did not have functional airbags in car. The passengers who were injured comprised 35% of the population, of which majority were riding on a two-wheeler (34.90%). Head on

collision was the most common type (49.50%), followed by head to side (27.50%). Most pedestrians (46.20%), four-wheeler (66.70%) and three-wheeler riders (100%) were injured by head to side collision (p-value=0.000). Patients in the second, third and fourth decade of life were more involved in RTAs. Males were more commonly involved as compared to females. GCS score was calculated and majority patients riding a two-wheeler suffered mild injury, while most of those in a four-wheeler suffered severe injury. The average duration of stay in patients with mild and moderate injury was 1 day and 17 days respectively. CT head/ MRI brain findings suggested that larger number of patients sustained haemorrhagic and non-haemorrhagic contusions. 82.50% were managed conservatively. Of the total deaths among two-wheeler riders, 11 were drivers and 2 were pillions. Of these, only 1 had used helmet. Among the total deaths, 10 were under the influence of alcohol and 9 were using mobile phones while driving.

Conclusion: Head injury due to RTAs is a serious health issue that contributes significantly to morbidity and mortality particularly in younger age groups. Prevention is the major step to decrease the morbidity and mortality caused due to RTA.

Keywords: Road traffic accident, head injury, driver

Introduction

Road traffic accidents (RTAs) are the curse of contemporary civilization. The prevalence of RTAs has significantly increased as a result of general lack of concern for safety precautions, subpar law enforcement and unrestrained motorization. [1] RTAs have been ranked as the sixth most common cause of death in India by the World Health Organization (WHO), with a higher proportion of hospitalizations, fatalities, disability, and socioeconomic losses among young and middle-aged populations. [1] The absence of trustworthy and excellent national or regional data has thwarted its actual magnitude. [1]

Traumatic brain injury is one of the most frequent causes of death and disability in road traffic accidents. Approximately 20% of this was classed as moderate to severe harm, with majority being mild injury. [2] A brain injury accounts for around half of the 1,50,000 trauma deaths each year. [2]

Many injuries have variable degree of brain swelling but about 1% develop a significant intracranial clot, extradural, subdural or intracerebral, the early removal of which reduces morbidity and may prevent mortality. [3] As there is a limit to the capacity of the intracranial space, secondary brain swelling those results from the initial injury, whether focal or generalized, will soon cause an increase in intracranial pressure, which will result in cellular hypoxia, intracranial volume, and insufficient or irregular respirations as a result of brain stem injury or brain stem compression. [4]

The pattern of injury between two-wheeler and four-wheeler vehicular accidents is entirely different and needs to be evaluated accordingly. [1] The present study was carried out to analyses the pattern and mechanism of injury among vehicular accidents, evaluate the aetiology and mechanical causes of vehicular accidents and compare and analyses injuries among two-wheeler, four-wheeler and pedestrian injury.

Materials and methods

This prospective observational study was carried out in the Department of General Surgery, Hamidia Hospital, GMC, Bhopal, M.P. after approval by the Institutional Ethics Committee, over a period ranging from June 2021 to September 2022. 200 consented patients of road traffic accidents with head injury; more than 14 years of age; admitted in the department were included in the study. As soon as the patient was admitted, detailed history was

taken, complete physical examination was done, vital parameters were recorded, basic investigations sent and initial treatment was started. All details regarding the socio-demographic characteristics and investigations were noted in a prescribed proforma. The assessment of severity of head injury was also done using Glasgow Coma Scale at the time of admission. The severity was classified according to the score as mild (14-15), moderate (9-13) and severe (<3-8). All patients with head injury were scanned by non-contrast CT head as well, for any finding such as extradural hematoma (EDH), subdural hematoma (SDH), subarachnoid haemorrhage (SAH), hemorrhagic contusion/ traumatic intraparenchymal haemorrhage, skull fracture, spinal injuries etc. Diffuse axonal injury was identified by MRI Brain. Based on the clinical assessment and CT/MRI findings, risk assessment was done and surgical/ conservative management planned accordingly.

Statistical analysis

Data was collected, transformed into variables, coded and entered in Microsoft Excel. It was analysed and statistically evaluated using SPSS-PC-21 version. Quantitative data was expressed as mean and standard deviations. Qualitative data was expressed as numbers and percentage. Statistical differences between the proportions were tested by Chi-square test or Fischer's exact test. The level of significance was fixed at 95%. P-value < 0.05 was considered statistically significant.

Results

Table 1: Incidence of individuals involved in RTA during the study periods

Total incidence of Road Traffic Accidents (RTA)		200
Total number of persons involved in the above RTAs		541
Persons not injured in the above RTAs		122
Patients admitted due to RTA (n=384 out of 541)	Admitted with head injury	200
	Admitted without head injury	184
Died before reaching hospital		35
Died in the hospital		24
Total number of deaths		59

Table 2: Distribution of study participants on the basis of various mechanisms and characteristics of the RTA

Characteristics	Number	Percentage
Mechanism of Injury		
2-wheeler vs. 2-wheeler	97	48.50%
2-wheeler vs. 4-wheeler	42	21.00%
2-wheeler vs. stationary object	34	17.00%
2-wheeler vs. 3-wheeler	2	1.00%
4-wheeler vs. 4-wheeler	7	3.50%
4-wheeler vs. stationary object	5	2.50%
Hit by 2/4-wheeler	13	6.50%
Total	*200*	*100%*
Type of vehicle/ Pedestrian having injured person in RTA		
2-wheeler	174	87.00%
3-wheeler	1	0.50%
4-wheeler	12	6.00%
Pedestrian	13	6.50%
Total	*200*	*100%*
Position of the injured person in vehicle		
Driver	117	58.50%
Pillion	70	35.00%
Pedestrian	13	6.50%
Total	*200*	*100%*
Types of collision occurred in RTA		
Head on Collision	99	49.50%
Head to Side	55	27.50%
Head to rear	40	20.00%
Collision with divider	6	3.00%
Total	*200*	*100%*
Cause of head injury in RTA		
Helmet not used (n=174)	138	79.31%
No air bags (n=12)	10	83.33%
Using mobile while driving among drivers (n=117)	60	51.28%
Alcohol intoxication while driving among drivers (n=117)	59	50.42%

Table 3: Comparative analysis of various parameters and the type of vehicle/pedestrian involved in the RTA

Parameters	Type of Vehicle/ Pedestrian								p-value
	Two-Wheeler		Three-Wheeler		Four-Wheeler		Pedestrian		
	N	N%	N	N%	N	N%	N	N%	
Type of Collision									
Head on Collision	85	48.86%	0	0.00%	0	0.00%	0	0.00%	*0.000 significant*
Head to Side	47	27.01%	1	100%	8	66.70%	6	46.20%	
Head to rear	39	22.41%	0	0.00%	4	33.30%	3	23.10%	
Collision with divider	3	1.72%	0	0.00%	0	0.00%	4	30.70%	
Total	***174***	***100%***	***1***	***100%***	***12***	***100%***	***13***	***100%***	
Position of injured person									
Driver	112	65.10%	1	100%	4	33.33%	-	-	*<0.0001 significant*
Pillion	62	34.90%	0	0.00%	8	66.67%	-	-	
Total	***174***	***100%***	***1***	***100%***	***12***	***100%***	-	-	
Age group									
10-20 years	16	9.20%	0	0.00%	0	0.00%	0	0.00%	*0.414*
21-30 years	45	25.86%	1	100%	7	58.30%	4	30.77%	
31-40 years	60	34.48%	0	0.00%	2	16.70%	5	38.46%	
41-50 years	30	17.24%	0	0.00%	2	16.70%	4	30.77%	
51-60 years	17	9.77%	0	0.00%	0	0.00%	0	0.00%	
61-70 years	6	3.45%	0	0.00%	1	8.30%	0	0.00%	
Total	***174***	***100%***	***1***	***100%***	***12***	***100%***	***13***	***100%***	
Gender									
Female	28	16.60%	0	0.00%	0	0.00%	0	0.00%	*0.089*
Male	146	83.40%	1	100%	12	100%	13	100%	
Total	***174***	***100%***	***1***	***100%***	***12***	***100%***	***13***	***100%***	
Severity (GCS)									
Mild (13-15)	74	42.53%	0	0.00%	2	16.70%	4	30.77%	*0.063*
Moderate (9-12)	62	35.63%	1	100%	3	25.00%	5	38.46%	
Severe (>8)	38	21.84%	0	0.00%	7	58.30%	4	30.77%	
Total	***174***	***100%***	***1***	***100%***	***12***	***100%***	***13***	***100%***	
CT Head/MRI Brain									
Haemorrhagic and Non-haemorrhagic Contusion	102	58.62%	1	100%	8	66.66%	7	53.85%	*0.831*
SAH	12	6.90%	0	0.00%	0	0.00%	0	0.00%	
SDH	20	11.49%	0	0.00%	2	16.70%	4	30.77%	
EDH	27	15.52%	0	0.00%	2	16.70%	2	15.38%	
DAI	13	7.47%	0	0.00%	0	0.00%	0	0.00%	
Total	***174***	***100%***	***1***	***100%***	***12***	***100%***	***13***	***100%***	
Outcome									
Died	16	9.20%	0	0.00%	4	33.33%	4	30.77%	*0.032 significant*
Discharged with full recovery	95	54.60%	0	0.00%	4	33.33%	6	46.15%	
Discharged with morbidity	63	36.20%	1	100%	4	33.34%	3	23.08%	
Total	***174***	***100%***	***1***	***100%***	***12***	***100%***	***13***	***100%***	

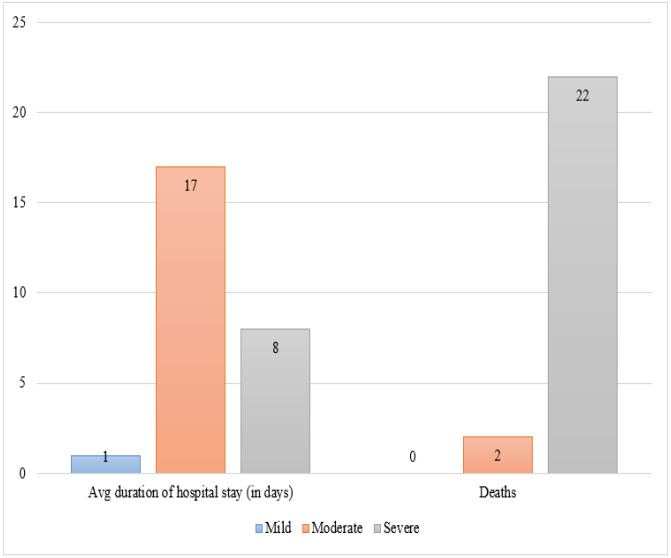

Figure 1: Comparative analysis of severity of head injury on admission and average duration of hospital stay and number of deaths. (The overall mortality was found to be 12%).

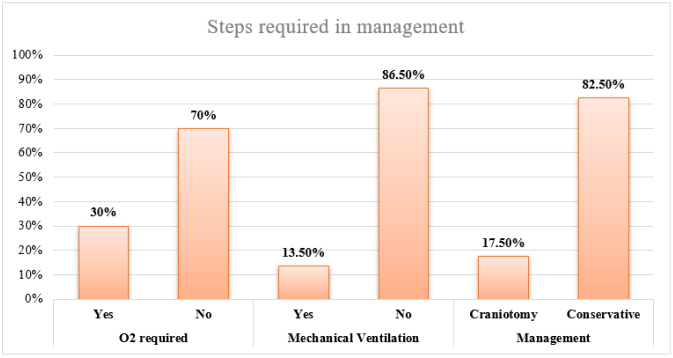

Figure 2: Management required in patients of head injury

Table 4: Comparative analysis of safety measures adopted in different types of vehicles and number of deaths.

Type of vehicle	Status of safety measures	Deaths	
		N	N%
Two-Wheeler	Using helmet	1	6.25%
	Not using helmet	15 (10 drivers)	93.75%
Four-Wheeler	Using seat belt/ air bag in vehicle	0	0.00%
	Seat belt not used/ no air bags in vehicle	4	100%

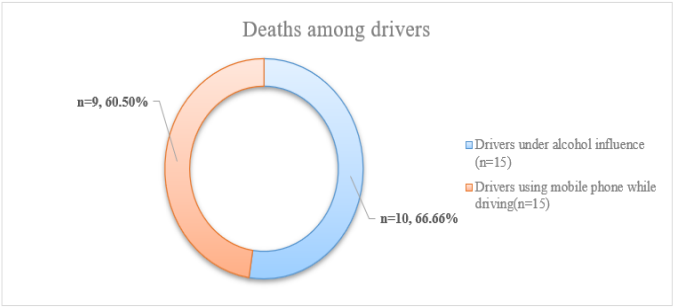

Figure 3: Death among drivers under alcohol influence and using mobile phones.

As depicted in Table 1, the total incidence of Road Traffic Accidents (RTAs) that presented to our hospital during the study period was 200. A total of 541 individuals were involved in these RTAs, of which 122 remained uninjured. Of the remaining 384 that got

injured, 200 were admitted in our hospital with head injury while the rest did not have any kind of head injury. The total number of individuals who succumbed to their injuries was 59, of which 35 died before reaching the hospital, and 24 died in the hospital while under treatment. Table 2 shows that two wheeler vs. two wheeler accidents were the most commonly occurring (48.50%) followed by two wheeler vs. four wheeler (21%). The least commonly occurring was two wheeler vs. three wheeler (1%). Most of the injured persons were among those riding a two wheeler (87%); while 6.50% were pedestrians and 6% were traveling by a four-wheeler (Table 2). Drivers of these vehicles were most commonly injured (58.50%) (Table 2); most were those driving a two wheeler (65.10%) (Table 3). This was because 79.31% of the two wheeler drivers were not wearing helmets and 83.33% of the four wheeler drivers had not fastened their seatbelts or did not have functional airbags in their car. 51.28% of the drivers were distracted due to the usage of mobile phones while driving and 50.42% were under the influence of alcohol (Table 2). The passengers who were injured comprised 35% of the population (Table 2), of which majority were riding on a two wheeler (34.90%) (Table 3). Head on collision was the most common type (49.50%), followed by head to side (27.50%), head to rear (20%) and collision with divider (3%) (Table 2). Most pedestrians (46.20%), four wheeler (66.70%) and three wheeler riders (100%) were injured by head to side collision, while majority two wheeler riders (48.86%) were injured by head on collision (p-value=0.000). Patients in the second, third and fourth decade of life were more involved in RTAs. These were those individuals who were more involved in outdoor work requiring more travelling on a daily basis. Young population was more involved in rash driving, and some were also found to drink and drive. There was no significant difference among the age group of patients who were injured when compared between two, three and four wheelers. Males were more commonly involved as they do more outdoor work and travel a lot compared to females. The male: female ratio was found to be 5.6:1. However, no significant difference between the gender of the study participants and the type of vehicle. The GCS score was calculated for the admitted patients. Majority patients riding a two-wheeler suffered mild injury, while most of those in a four wheeler suffered severe injury. (Table 3). Most of the mild head injury patients were not admitted and discharged from the casualty after initial management. The average duration of stay in patients with mild and moderate injury was 1 day and 17 days respectively as seen in Figure 1. Patients with moderate head injury needed more hospital stay. The mortality was highest in patients with severe head injury (Figure 1). The average duration of stay in patients with severe head injury was less because many of them died during the treatment. CT head/ MRI brain findings suggested that larger number of patients sustained haemorrhagic and non-haemorrhagic contusions during the RTA (Table 3). SAH and DAI were lesser common injuries sustained among the study participants. As seen in Figure 2, a major proportion of the patients (82.50%) were managed conservatively. Only 30% patients required oxygen and only 13.50% required mechanical ventilation. A significantly larger number of deaths occurred among patients who were on a two-wheeler (Table 3). Other deaths included those travelling on a four wheeler, as well as, pedestrians. Of the total deaths among two wheeler riders, 11 were drivers and 2 were pillions. Of these, only 1 had used helmet. Among those in a four wheeler, all patients who suffered mortality were drivers and had not used seatbelts or did not have airbags in their vehicle.

Among the total mortality cases, 10 (66.66%) were under the influence of alcohol and 9 (60.50%) were distracted due to the use of mobile phones while driving.

Discussion

Head injury is one of the major health problems worldwide. It results in significant morbidity and mortality especially among the younger age group of individuals. Exploding population, increasing registration of automobiles every month, rampant encroachment of roads, habitual tendency of violating rules and chaotic traffic systems have greatly contributed to rapid strides in RTAs. [1]

It was observed in the present study that two-wheeler vs. two-wheeler accidents were the most common (48.50%) followed by two wheeler vs. four wheeler (21%). 19.50% vehicles collided with a stationary object. The least common was two-wheeler vs. three-wheeler (1%). When compared to the **national statistics** of 2020, [5] the incidence of two-wheeler vs. two wheeler and two wheeler vs. four wheeler accidents was 33.8% and 20.4% respectively and those that collided with stationary objects constituted 16.40%. Our data is similar to the national statistics of 2022. This could be because of greater usage of two wheelers in our country. In the present study, most of the injured persons were among those riding a two-wheeler (87%); while 6.50% were pedestrians and 6% were traveling by a four-wheeler. According to the **national statistics** [5], most involved were two wheelers (56.10%), followed by four wheelers (16.3%) and pedestrians (15.60%). In a study by **Gururaj et al (2008)** [6] the percentage of two wheelers was maximum (71%), followed by four wheelers (12%), three wheelers (11.50%) and pedestrians (5.5%). These findings were similar to our study.The total percentage of drivers, pillions and pedestrians injured was 58.50%, 35% and 6.5% respectively, in the present study. As per the **national statistics** [5], the percentage was 43.50%, 31.20% and 12% respectively. In a study by **Tripathi et al (2014)** [1], drivers, pillions and pedestrians constituted 65.95%, 28.05% and 6% of the injured respectively. These findings match our study and state that most of the injured persons were drivers either of two or four wheelers. As observed in the present study, head on collision was the most common type (49.50%), followed by head to side (27.50%), head to rear (20%) and collision with divider (3%). Most pedestrians (46.20%), four-wheeler (66.70%) and three-wheeler riders (100%) were injured by head to side collision, while majority two wheeler riders (48.86%) were injured by head on collision (p-value=0.000). According to the **national statistics** 2020 [5], head on, head to side, head to rear collisions and collision with divider/ stationary objects constituted 41%, 24.30% 37.80% and 7.2% respectively. The data is in concordance with our data. In the present study, it was noted that 79.31% of the two-wheeler drivers had not worn helmets and 83.33% of the four wheeler drivers had not fastened their seatbelts/ did not have functional airbags in their car. 51.28% drivers were distracted by mobile phones while driving and 50.42% were under the influence of alcohol. The **national statistics** 2020 [5] state that 56.10% did not use helmets, 22.70% did not wear seatbelts, 26% used mobile phones and 33.3% drove under alcohol influence. **Tripathi et al (2014)** [1] found that 87.2% did not wear helmets, 27.3% did not fasten their seatbelts and 22.5% drove after drinking alcohol. These findings are similar to ours.

Patients in the second, third and fourth decade of life were more involved in RTAs, in the present study. There was no significant difference among the age group of patients who were injured when compared between two, three and four wheelers. In a study by **Goel A et al (2022)** [7], the maximum number of accidents occurred

among the 3rd and 4th decade, similar to our study. Similar findings were also demonstrated by **Waghmare et al (2021) [8].** In the present study, males were more commonly involved as they do more outdoor work and travel a lot compared to females. However, no significant difference between the gender of the study participants and the type of vehicle. The male: female ratio was found to be 5.6:1. Similarly Waghmare et al (2021) [8] and Goel A et al (2022) [7] reported a male: female ratio of 4.5:1 and 2.9:1 respectively. The GCS score was calculated for the admitted patients, in the present study. 40%, 35.50% and 24.50% had mild, moderate and severe injury respectively. Majority patients riding a two-wheeler suffered mild injury, while most of those in a four-wheeler suffered severe injury. As per the study by Waghmare et al (2021) [8], the involvement was 42%, 22% and 31% and 59.60%, 22.30% and 18.10% as per Goel A et al (2022) [7] for mild, moderate and severe injury respectively. CT head/ MRI brain findings in the present study suggested that larger number of patients sustained haemorrhagic and non-haemorrhagic contusions during the RTA (59%), followed by EDH (14.50%) and SDH (13%). SAH (6%) and DAI (7.5%) were lesser common injuries sustained among the study participants. Palekar et al (2021) [9] reported similar findings with 47.82% haemorrhagic and non-haemorrhagic contusions, followed by SDH (13.10%) and EDH (9.90%). Goel A et al (2022) [7] observed 46.20% contusions, 21.50% EDH and 14.60% SDH. In the present study, a major proportion of the patients (82.50%) were managed conservatively. Only 30% patients required oxygen and only 13.50% required mechanical ventilation. Our findings are concordant with Waghmare et al (2021) [8] who found that 32% cases required oxygen, 80% were managed conservatively and 20% required surgery. 49.50% patients in the present study recovered completely while 39.50% were discharged with morbidity. 12% mortality was reported. Waghmare et al (2021) [8] reported complete recovery in 56%, morbidity in 24% and mortality in 20%. Goel A et al (2022) [7] reported full recovery in 63.10%, morbidity in 19.60% and death in 17.30%.

Conclusion

Head injury due to RTAs is a serious health issue that contributes significantly to morbidity and mortality particularly in younger age groups. Morbidity due to moderate and severe head injuries leads to loss of healthy and productive years of life, mainly in younger population and increases the disease burden on the society. Mortality causes heavy loss to the family as well. Prevention is the major step to decrease the morbidity and mortality caused due to RTA.

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