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Pattern and Outcome of Traumatic Head Injury in A Tribal Region of Northern Telangana

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Abstract

Background: In India, more than 10,000 lives are lost every year, with more than 1 million suffering from serious head injuries. Due to the debilitating effects of head injuries on human resources, there is a rising need for the evaluation of cases in these areas, identifying the causes and implementing strategies to reduce their occurrences. To study the epidemiological factors, mechanism, type of head injury, along with the evaluation of the pattern and outcome of TBI in the tribal region of Northern Telangana.

Methods: This cross-sectional study was conducted among traumatic brain injury patients at a tertiary care hospital under the Neurosurgery Department.

Results: Males constituted a significantly high number of TBI cases compared to females. The most common location of impact was multiple skull sites in 47% of the patients, followed by the frontal site (21%) and the temporal site (15%). The overall frequency of SDH, SAH, ICH and EDH is 10%, 21%, 5%, and 16%, respectively. Most of the patients who recovered successfully had mild GCS scores. (p value<0.05).

Conclusion: Traumatic brain injury can be prevented mainly by the prevention of road traffic accidents, since they constitute about 50% of the cases. Intracranial Pressure Monitoring using GCS charting and timely surgical intervention plays a pivotal role as patients overtly suffer from multiple brain injuries.

Keywords: Traumatic brain injury (TBI); Road traffic accident (RTA); Glasgow coma scale (GCS); Subdural haemorrhage (SDH); Extradural haemorrhage (EDH).

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Introduction

In a developing country like India, injuries are the seventh leading cause of death. Of all the injuries, head injuries, more commonly called Traumatic Brain Injuries (TBI), play a major role due to high mortality, morbidity, disability, and socioeconomic impact.[1] In India, more than 10,000 lives are lost every year, with more than 1 million suffering from serious head injuries.[2]

The severity of the head injury can range from a mild contusion to severe fractures, hemorrhages, coma, and death. This problem continues to rise in tribal areas due to a lack of knowledge, infrastructure, poorly planned and congested roads, reckless driving, violation of traffic rules, absence of awareness of using protective equipment like helmets, and absence of trauma care in these areas.[3]

The Sustainable Development Goals (SDGs), launched in 2015, called on countries around the world to begin efforts to achieve the 17 SDGs by 2030, aiming for a better and sustainable future for all. SDG Goal 3, target 3.6, emphasizes the global reduction of deaths and injuries from road traffic accidents by 2030, thereby indirectly calling for the reduction of traumatic brain injuries and their consequences.[4]

Due to the debilitating effects of head injuries on human resources, there is a rising need for the evaluation of cases in these areas, identifying the causes, and implementing strategies to reduce their occurrences. The incidence of head injury can be reduced by improving socio-economic conditions, enhancing healthcare facilities, and educating people about the importance of safety measures.[5] Indeed, despite a rapidly increasing number of scientific publications related to this topic, none have focused on and compared the various diverse patterns and outcomes of traumatic brain injuries in tribal areas. Therefore, this study was undertaken to study the causes and consequences of TBIs and provide meticulous thinking for the development of trauma care in these areas.

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OBJECTIVES

1. To study the epidemiological factors and mechanisms of head injuries in the tribal region.
2. To assess the types and severity of head injuries in the tribal region.
3. To evaluate the outcome of traumatic head injury patients in the tribal region.

Materials and Methods

Study Design

This hospital-based cross-sectional study was conducted at a tertiary care hospital under the Neurosurgery Department in a tribal region located in Northern Telangana. This study was conducted in a 500-bed tertiary care hospital where approximately 80 patients suffering from TBI seek medical attention every month. This is the only hospital in this region providing tertiary health care facilities and catering to approximately 15 lakhs population, with more than 60% being tribal. (Scheduled Tribe Population: 224622) It not only provides health care facilities to this area but also to the surrounding districts. The present study was conducted during the period from July to December 2022.

Sample size and sampling technique

The sample size was calculated using the standard formula $N = 4pq/l^2$, where 'p' was the prevalence of TBI (60%) in the study conducted by G. Gururaj[1] and 'l' was the allowable error. Sample size $N = 4pq/l^2 = 4 \times 60 \times 40/ 10^2 = 96$. A 5% extra sample was taken to increase the power of the study, composite factors and refusal to incorporate in the study. So, the final sample size was kept at 100. Non-probability purposive sampling was done to select 100 patients suffering from TBIs and collect the required data using a semi-structured questionnaire.

Data collection and processing

Patients > 12 years of age with a traumatic head injury and associated minor injuries were included, while Patients with head injury having severe associated injuries involving any other part of the body were excluded. On reporting, the patient was admitted, and the data was collected after proper clinical examination and other conservative treatment by taking written informed consent of the patient or the family members. The medical record of the patient was taken into account, including age, gender, mechanism of injury, type and pattern of injury, the severity of the injury, Glasgow coma score (GCS), and associated other body part injuries. Length of hospital stay, CT scan findings, types of management, surgical intervention (if any), and Glasgow outcome score were also recorded.

In cases of RTAs, data like the date, place and time of the accident, vehicle type, and cause of the accident were collected. Associated factors, like safety measures taken and alcohol consumption, were also considered. The data was collected while maintaining the anonymity and privacy of respondents.

Data analysis

All the data collected were analysed using Epi Info TM 7 version 7.1.5.0 developed by the Centres for Disease Control and Prevention (CDC), Atlanta. Descriptive analysis was performed using frequencies, percentages and a p-value of <0.05 was considered statistically significant.

Results

Among the study subjects, 89% were males and 11% were females. Out of 100 study subjects reporting in the hospital, 24% were educated till graduation level, whereas 26% were illiterate. There was no significant association between gender and the educational status of the participants. The majority of the subjects, i.e. 27% were unemployed, followed by 26% Unskilled workers, 19% Semi-professional, 15% semi-skilled and 13% Skilled workers. Unemployed subjects had significantly more TBI compared to employed subjects (p<0.05) (Table 1). Most of

Table 1. Distribution of study subjects according to characteristic (N=100).

Characteristic	Male, N (%)	Female, N (%)
Age		
12-19	7 (7.8)	0 (0)
20-29	26 (29.2)	0 (0)
30-39	18 (20.2)	4 (36.4)
40-49	21 (23.6)	2 (18.2)
50-59	13 (14.6)	3 (27.3)
≥60	4 (4.5)	2 (18.2)
Education		
Illiterate	20 (22.5)	6 (54.5)
Primary	9 (10.1)	3 (27.3)
Middle	9 (10.1)	1 (9.1)
Higher Secondary	18 (20.2)	0 (0)
Intermediate	10 (11.2)	0 (0)
Graduate	23 (25.8)	1 (9.1)
Occupation		
Unemployed	20 (22.5)	7 (63.6)
Unskilled	24 (26.9)	2 (18.2)
Semiskilled	13 (14.6)	2 (18.2)
Skilled	13 (14.6)	0 (0)
Semi professional	19 (21.3)	0 (0)
Total	89 (89)	11 (11)

Table 2. Association between the mechanism of injury and age (N=100).

Age in years	Mechanism of Injury				Total, N (%)	P value
	Road traffic accident, N (%)	Violence, N (%)	Fall, N (%)	Animal attack, N (%)		
12-19	3 (5.4)	1 (4.3)	2 (16.7)	1 (11.1)	**7 (7)**	**0.59**
20-29	19 (34)	4 (17.4)	0 (0)	3 (33.4)	**26 (26)**	
30-39	11(19.6)	6 (26.1)	3 (25)	2 (22.2)	**22 (22)**	
40-49	12 (21.4)	7 (30.4)	3 (25)	1 (11.1)	**23 (23)**	
50-59	9 (16.1)	3 (13.1)	2 (16.7)	2 (22.2)	**16 (16)**	
≥60	2 (3.5)	2 (8.7)	2 (16.6)	0 (0)	**6 (6)**	
Total	**56 (56)**	**23 (23)**	**12 (12)**	**9 (9)**	**100 (100)**	

Table 3. Relationship between the mechanism of injury and mode of accident among TBI patients (N=100).

Mechanism of Injury	Mode of Accident	Total, N (%)
RTA	Two-wheeler	48 (85.7)
	Pedestrian	6 (10.7)
	Light / Heavy motor vehicle	2 (3.6)
Fall	-	12 (100)
Violence	Blunt weapon	19 (82.6)
	Sharp weapon	4 (17.4)
Animal attack	Boar	4 (44.5)
	Bull	3 (33.3)
	Dog	2 (22.2)
Total	-	100 (100)

Table 5. Results of CT Brain Scan findings in TBI patients (N=100).

Types of head Injury	Total No of cases. (%)	Radiological finding	Total No.
Scalp injury	40 (40)	Scalp hematoma	40
Fracture	5 (5)	Linear	4
		Communited	1
Haemorrhage	3 (3)	ICH	1
		EDH	2
		SAH	0
		SDH	0
Mixed	52 (52)	Fracture + Hemorrhage + Scalp injury	52

the subjects belonged to socioeconomic classes IV (43%) and III (39%).

There were a remarkably high number of injuries caused by Road traffic accidents (56%), followed by cases of violence (23%). Most patients of TBI due to RTAs belong to the middle-aged group, i.e. 30-59 years. It was observed that the age group was not significantly associated with the mechanism of injury (p>0.05) (Table 2).

The frequency of RTA and Violence is slightly more at night-time, but the association of the mechanism of injury with the time of the accident was not a statistically significant one (p>0.05) (Table 3).

Among the total TBI patients, 37 were reported to have consumed alcohol before the injury. More than half of the people who consumed alcohol met with a road traffic accident (78.4%) (Figure 1).

The frontal site is most susceptible to trauma, followed by the temporal and parietal sites, respectively, in RTA and Animal attacks (Table 4). Most of the patients presented with multiple symptoms, among which headache (53%) was the most common presenting symptom, followed by loss of consciousness (44%) and vomiting (39%). Seizures were present in the least number of patients with TBI.

Most of the patients who recovered successfully had a mild GCS score (65.3%). The association between GCS and the outcome of the admitted patient was highly significant. (Table 7). The length of hospital stays of the maximum patients (73.7%) with severe GCS was less than 1 day.

The length of hospital stays in 52.7% of the patients with mild GCS was 1-3 days. Very few patients were admitted to the hospital for more than 6 days (5%). The association between the GCS scores and length of hospital stay is highly significant in this study. (p<0.05) (Table 8).

Table 4. Association between the mechanism of injury and location of impact among TBI patients (N=100).

Location of Impact	Mechanism of Injury				Total, N (%)	P value
	Road traffic accident, N (%)	Violence, N (%)	Fall, N (%)	Animal attack, N (%)		
Frontal	12 (21.4)	3 (13.1)	2 (16.6)	4 (44.5)	**21 (21)**	
Temporal	9 (16.1)	2 (8.7)	2 (16.7)	2 (22.2)	**15 (15)**	
Parietal	2 (3.6)	7 (30.4)	2 (16.7)	0 (0)	**11 (11)**	
Occipital	3 (5.5)	1 (4.3)	0 (0)	1 (11.1)	**5 (5)**	**0.17**
Skull base	1 (1.7)	0 (0)	0 (0)	0 (0)	**1 (1)**	
Multiple	29 (51.7)	10 (43.5)	6 (50)	2 (22.2)	**47 (47)**	
Total	**56 (56)**	**23 (23)**	**12 (12)**	**9 (9)**	**100 (100)**	--

Discussion

The highest frequency of subjects was found in the middle age group, i.e., from 21-50 years of age and the least was found in extreme age groups like<20 years and >60 years of age. A similar age group were studied by Sivakumar et al (2018)[6] in their study, which revealed that 67% of the patients belonged to the age group 21-50 years. According to the study of Menon et al (2005)[7] 21-30 years of age group was the most commonly affected by head injury, and the elderly age group was the least affected. A high incidence of TBIs in the above age groups may be explained by the fact that they are the prime breadwinners of the family and are more often required to move outdoors in the pursuit of their work and studies. The incidence was lowest in people below 19 years and above 60 years for the obvious reason that they are least required to move out on the roads either for their work or studies, and hence tend to stay most of the time indoors.

This study shows a male-to-female ratio of 8.1:1 among the study subjects. Out of 100 subjects, 89 were male, and 11 were female. Akhade et al (2014)[8] in their study observed that the male preponderance of head injury was 90.6%, which is similar to that in our study. The preponderance of

males over females may be explained on the basis that most males tend to work outdoors, whereas women, apart from children, are generally habituated to remaining indoors and hence are not so much exposed to the risk of road traffic accidents, assaults and other occupational injuries.

Table 6. Association between the mechanism of injury and Glasgow Coma Scale Score (N=100).

Glasgow Coma Scale Score (GCS)	Mechanism of Injury				Total, N (%)	P value
	Road traffic accident, N (%)	Violence, N (%)	Fall, N (%)	Animal, N (%)		
Mild (13-15)	37 (66.1)	18 (78.3)	9 (75)	8 (88.9)	**72 (72)**	**0.10**
Moderate (9-12)	6 (10.7)	0 (0)	3 (25)	1 (11.1)	**10 (10)**	
Severe (3-8)	13 (23.2)	5 (21.7)	0 (0)	0 (0)	**18 (18)**	

Table 7. Association between Outcome of Admitted Patients and Glasgow Coma Scale Score (N=100).

Glasgow Coma Scale Score (GCS)	Outcome of admitted patients			Total, N (%)	P value
	Recovered, N (%)	Referred, N (%)	DAMA*, N (%)		
Mild (13-15)	47 (65.3)	10 (13.9)	15 (20.8)	72 (72)	<0.05
Moderate (9-12)	4 (40)	5 (50)	1 (10)	10 (10)	
Severe (3-8)	0 (0)	14 (77.8)	4 (22.2)	18 (18)	
Total	**51**	**29**	**20**	**100 (100)**	**--**

Table 8. Association of GCS and Length of hospital stay (N=100).

Glasgow Coma Scale Score (GCS)	Length of hospital stay (days)				Total No. (%)	P value
	< 1, N (%)	1- 3, N (%)	4 – 6, N (%)	> 6, N (%)		
Mild (13-15)	10 (13.9)	38 (52.8)	20 (27.8)	4 (5.5)	72 (72)	<0.05
Moderate (9-12)	4 (44.5)	3 (33.3)	1 (11.1)	1 (11.1)	9 (9)	
Severe (3-8)	14 (73.7)	4 (21.1)	1 (5.2)	0 (0)	19 (19)	
Total	28 (28)	45 (45)	22 (22)	5 (5)	100 (100)	

There were a remarkably high number of injuries caused by Road traffic accidents (56%), followed by cases of domestic violence (23%). A significant association was also seen between age, gender and the mechanism of accident. Most of the male patients of TBI were injured due to RTA (61.8%), whereas most of the female patients were injured due to falls and violence, respectively. Most patients of TBI due to RTAs belong to the middle-aged group, i.e., 30-59 years. The same is the case with falls and violence. The distribution of animal attacks is almost similar in all age groups. It was observed that the age group was not significantly associated with the cause of trauma ($p>0.05$). In all the related studies, Sivakumar et al (2008),[6] Akhade et al (2014),[8] Jha S et al (2011)[9] and Farooqui et al (2013)[10], it was found that RTA was the major cause of TBI, followed by falls and violence.

The high occurrence rate of TBI due to RTAs is because of the poorly planned and congested roads, the increasing number of unrestricted purchases of automobiles, heavily populated areas, reckless driving, ignoring traffic laws, and unawareness of the importance of safety measures like helmets. Apart from this, a state highway runs through the location of our study area, which is then further connected to national highways and other state highways, which makes this area more prone to RTAs. Animal attacks were also significantly high in our study because of the high distribution of forest areas in these tribal areas. This is not found in any other studies, so this needs to be addressed.

The maximum number of patients were driving 2-wheelers at the time of the accident (85.7%), and the frequency of pedestrians suffering from RTA was 10%. And the patients suffering due to violence were mostly injured by blunt weapons (82.6%). The overall frequency of falls was 12%. Similarly, Pal et al (2016)[11] in their study observed that two-wheeler vehicular injuries were the most common mode (60.83%), followed by falls (13.95%) and pedestrian injuries (13.65%). This might be because two-wheelers are the most commonly used mode of transport by a majority of the population. The high incidence of injuries in underdeveloped areas can be explained by the fact that these areas lack good roads, and infrastructure and an ample amount of government transport facilities is not available. The high frequency of involvement of blunt weapons may be because blunt weapons are cheap and easily available.

In our study, only 2% of the injured patients were wearing helmets at the time of the accident. Jha S et al (2011)[9] similarly, in their study observed that more than 9/10th of victims (71 or 92%) were not wearing the helmet at the time of the accident. Taking safety measures while driving vehicles and following proper traffic rules play a major role in reducing the incidence of RTAs and also lowering the severity of the injury caused by the accidents. Alcohol consumption is a major risk factor in the occurrence of TBIs, and it also affects the severity and the outcome. G.Gururaj et al (2004)[12], also in their study, observed that 16% of injured patients were intoxicated at the time of hospital registration. Due to illiteracy, unemployment and the ease

in the availability of alcohol, the consumption of adulterated alcohol is on the rise in this area.

It was observed that almost half of the patients (47%) have multiple sites of injury, irrespective of the cause. The frontal site is most susceptible to trauma, followed by the temporal and parietal sites, respectively, in RTA and animal attacks. The parietal site is highly associated with violence. Scalp injury-like lacerations and hematomas were found in a total of 77% of subjects. Isolated fractures were found in 5% of the study subjects, of which linear fractures were more common than comminuted fractures. Intracranial haemorrhage was seen in 52% of the subjects. The overall frequency of SDH, SAH, ICH and EDH is 10%, 21%, 5%, and 16%, respectively. Most patients of TBI are suffering from multiple brain injuries (52%), which include lacerations, fractures and intracranial haemorrhages. Sivakumar et al (2008)[6] in their study, observed that the frequency of skull fracture was 40% and intracranial haemorrhage was 51%, which is similar to that of our study. In contrast to our study, they observed that the frequency of SDH (28%) is greater than EDH (23%). Akhade et al (2014)[8] also in their study observed that among all the intracranial haemorrhages, the most common was SDH (45%), followed by EDH (20%) and SAH (12.5%). The variations in the frequency of different forms of injuries in various studies may be explained by the fact that different mechanisms of trauma cause different forms of injuries depending on the severity of the trauma.

The maximum number of patients (72%) had mild GCS, followed by severe (18%) and moderate GCS (10%). Most of the patients with mild GCS scores recovered. Maximum patients with moderate GCS scores were either referred or recovered, respectively. The association between the outcome and GCS score was highly significant. ($p<0.05$) In contrast to our finding, Pal R et al.[11] in their study, concluded that nearly half (45.40%) had moderate to severe brain injury as assessed by GCS. The above phenomenon could be because the Neurosurgery Centre has recently been developed in this area, and the maximum number of people tend to transfer patients directly to higher centres located in cities where advanced facilities and experienced staff are available. Therefore, at this centre, mild cases were reported that recovered very well.

Limitations of this study

As this was a time-bound study, the proper incidence and pattern of the TBI and the seasonal variations could not be studied.

Moreover, the sequelae of head injury have a chronic pattern, so further follow-up of the patients was not possible through this study.

Conclusion

This study provides insight into the association between RTAs and TBIs, particularly among the tribal population. With the increasing ongoing development and projects in the tribal region of the country, exploding population, and increasing ownership of vehicles, the incidence of road traffic accidents is on the rise.

The CT findings in this population suggest polytrauma to cranial structure is more prevalent than isolated lesions, emphasising the importance of prompt imaging for accurate diagnosis, early triaging and effective management of patients. As the Glasgow Coma Scale decreases, the likelihood of unfavourable outcome increases, reinforcing the prognostic value of GCS and highlighting the importance of competency-based training for emergency staff involved in patient care.

The proportion of patients getting discharged against medical advice is on the rise, so it becomes inevitable to provide education to the patient attendant to not set unrealistic expectations.

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Ethical consideration

This study was conducted after obtaining Institutional Ethical Committee approval. IEC approval number- IEC/RIMS/38/2022.

Competing Interests

The authors declare no conflict of interest.

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