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Study of various types of road traffic accidents and associated skull injuries

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Abstract
Background: In the Road Traffic Accidents, the injury to the head and neck is the most important of all regional injuries. The nature of the internal damage may or may not be reflected in the superficial injury to the head and face.
Objectives: To study various types of road traffic accidents and associated skull injuries
Methods: The sequence, frequency and distribution of the injuries is investigated in detail for all patients admitted to the hospital. Factors such as age, gender, injury and intoxication have been investigated. Both fatal and non-fatal accidents have been recorded. The data has been collected from PME reports and inquest reports, relatives and friends of the deceased.
Results: Incidence of skull fractures is 397(84.3%) in males and 74 (15.7%) in females. M: F ratio is 5.36:1. Highest number of fractures are seen in temporal 100 (21%), then in occipital 56 (11.9%), frontal 19 (4%), least single bone fracture is seen in 9 (1.9%) cases. Temporal bone is the bone that is fractured the most, individually in 100 cases, around 246 (52.2%) cases survived for a duration in hospital and died in hospital, 185 (39.2%) cases died on the spot, 40(8.5%) cases died on the way to hospital.
Conclusion: Effective interventions include designing safer infrastructure and incorporating road safety features into land-use and transport planning, improving the safety features of vehicles, improving post-crash care for victims of road crashes, setting and enforcing laws relating to key risks, and raising public awareness.

Keywords: Road traffic accidents, injuries, trauma, temporal bone fracture

Introduction

India is going through a massive economic and demographic change, which is being accompanied by increased urbanization and motorization. Before two decades, road traffic accidents (RTAs) were the tenth leading cause of death in the country; however, with rising urbanization and lifestyle changes, road traffic accidents are expected to rise to the fifth leading cause of death and the second leading cause of disease burden [1, 2].

The National Advisory on Neurological Diseases and Stroke Council defines head injury as a morbid condition caused by mechanical forces that cause gross or subtle anatomical alterations in the scalp, skull, and/or the contents of the skull [3]. It is also known as 'any injury to cranium, meninges and the brain that causes injury or functional damage.' The most common cause of death of trauma-related deaths is head injuries [4].

In forensic practice, the injury to the head and neck is the most important of all regional injuries. The nature of the internal damage may or may not be reflected in the superficial injury to the head and face. Forensic pathologists need a strong practical knowledge of neuropathological trauma and brain injuries are the leading cause of death in assaults, falls, and road accidents [5].

The medical profession faces a significant challenge in understanding the mechanism, diagnosis, and management of head injury [6]. Improvements in people's economic status also led to an increase in drug and alcohol misuse, which has only added to the complexity of the situation, not only for doctors but also for law enforcement authorities. The elevated rates of morbidity and mortality associated with head injuries necessitate an understanding of the underlying causes, anatomical improvements, management justification, and long-term consequences of such injuries.

It is important not only from the standpoint of the surgeon, but also in terms of medico-legal implications such as survival time, acts of volition, event reconstruction, responsibility, and compensation settlements [6].
Despite the significant progress achieved, it is nevertheless impossible to determine all of the lesions encountered. On the autopsy table, a minor injury with a seemingly normal appearance will reveal itself to be a serious injury. This research is a genuine effort to dissect and deduce the potential causes and processes of head trauma in a step-by-step manner [7].

Materials and Methods
In the Department of Forensic Medicine at Osmania General Hospital 4,213 post-mortem Examinations were carried out during the period (August 2019 to January 2021. In 784 cases, death was attributed to Road Traffic Accidents. Head injury was present in 634 cases. In 471 cases out of 784, skull fractures were found.
The sequence, frequency and distribution of the injuries is investigated in detail for all patients admitted to the hospital. Factors such as age, gender, injury and intoxication have been investigated. Both fatal and non-fatal accidents have been recorded.
The data has been collected from PME reports and inquest reports, relatives and friends of the deceased.

Type of Study: Analytical Study.

Inclusion criteria: All cases of road traffic accidents with a finding of skull fracture.

Exclusion criteria: All cases of road traffic accidents without skull fracture.

Place of study: Department of Forensic Medicine and Toxicology, Mortuary, Osmania General Hospital, Afzalgunj, Hyderabad.

Duration of study: 1.5 year (August 2019 to January 2021) (Since lockdown affected and extended the duration of our study)

Statistical Analysis: SPSS software version 22 has been used for statistical analysis. Data were presented as statistical tables.

Results and Discussion
The study sample included 471 autopsy cases in one-year duration. After analyzing inquest, PME reports of all the 471 cases with skull fractures in deaths due to road traffic accidents the results and discussion are described and depicted below.

Gender-Wise Distribution

Table 1: Gender wise distribution of victims

Frequency	
Males	397
Females	74

Incidence of skull fractures is 397(84.3%) in males and 74 (15.7%) in females. M: F ratio is 5.36:1. Males are predominant as they are head of a family and go out for earning livelihood, where as females takes care of house hold chores.

Age Group Distribution

Table 2: Age Group Distribution

Age Group	Frequency
0 to 10	14
11 to 20	39
21 to 30	119
31 to 40	103
41 to 50	90
51 to 60	55
61 to 70	42
71 to 80	8
81 to 90	1

Frequency of cases in different age groups is 14(2.97%) in 0 to 10 yrs of age group, 39(8.28%) in 11 to 20 yrs of age group, 119(25.2%) in 21 to 30 yrs of age group, 103(21%) in 31 to 40 yrs of age group, 90(19%) in 41 to 50 yrs of age group, 55(11.6%) in 51 to 60 yrs of age group, 42(8.9%) in 61 to 70 yrs of age group, 8(1.69%) in 71 to 80 yrs of age group, 1(0.2%) in 81 to 90 yrs of age group. Highest number of victims are seen in age group of 21 to 30 yrs, then 31 to 40 yrs of age.

Table 3: Age-Group Gender Wise Distribution

Age Group	Males	Females
0 to 10	7	7
11 to 20	33	6
21 to 30	110	9
31 to 40	91	12
41 to 50	75	15
51 to 60	44	11
61 to 70	30	12
71 to 80	6	2
81 to 90	1	0

Frequency of victims of different sexes in different age groups is males, females in 0 to 10 years of age group is 7, 7 (1.48% 1.48%), 11 to 20 years of age group is 33,6 (7%, 1.2%), 21 to 30 years of age group is 110, 9 (23.3% ,1.9%), 31 to 40 years of age group is 91, 12 (19.3%,2.5%), 41 to 50 years of age group is 75, 15 (15.9%, 3.8%), 51 to 60 years of age group is 44, 11 (9.3%,2.3%), 61 to 70 years of age group is 30, 12(6.36% , 2.5%), 71 to 80 years of age group is 6, 2 (1.27%, 0.42%) 81 to 90 years of age group is 1, 0(0.2%, 0%). Maximum number of male victims are seen in age group of 21 to 30 yrs, females in 41 to 50 yrs. Most productive, active age group is 21 to 40 yrs, it includes the students, working group. Maximum sex differentiation was in the age group of 21 to 30 years with male and female ratio of 12.2: 1, while overall male and female ratio was 5.36:1.

Table 4: Distribution of Victims

VICTIMS	
Vehicle Victims	Pedestrians
306	165

Victims using vehicles are 306 (64.9%), pedestrians 165 (35)% of all cases. Absence of pavements and zebra crossings, impatient or unaware individuals crossing the roads and over speeding of vehicles increases the chances of pedestrian deaths.

Table 5: Distribution of Different Types of Victims

Victims	
Pedestrian	165
Riders	207
Pillion Rider	56
Driver	19
Occupant	24

Single Bone Fracture

Riders are maximum in number with 207 (43.9%) of all victims, then pedestrians 35%, then pillion riders 11.8%, drivers 4%, Occupants 5%. Highest number of victims observed in riders of two wheelers, lowest in drivers of four wheelers.

Table 6: Distribution of single bone fractures

Frequency	
Frontal	19
Temporal	100
Parietal	9
Occipital	56
Orbit	3
Nasal	1

Injuries in RTA's are almost always due to blunt force on cranial vault. Highest number of fractures are seen in temporal 100 (21%), then in occipital 56 (11.9%), frontal 19 (4%), least single bone fracture is seen in 9 (1.9%) cases. Temporal bone is the bone that is fractured the most, individually in 100 cases, with extension to surrounding in only 16 cases, while parietal is fractured separately in only 9 cases, as an extension from surrounding bones (temporal or frontal or occipital) in 72 cases mostly from temporal (48 of 72), the reason being for it may be due to anatomical location of these bones, thickness of bones[52-55]. Temporal bone (squamous portion) is present at sides of the skull (lateral cranial vault), parietal on top of skull, this anatomical presence makes the temporal bone most vulnerable, parietal the least. In RTA'S the victim may get hit by a vehicle or fall on the ground as a primary impact, but this scenario is most likely when the victim is either a pedestrian or two wheeler rider/pillion rider wherein he would fall on ground and vulnerable anatomical areas of skull come in contact with ground, and the likely regions i.e, the frontal, temporal or occipital rather than parietal get affected and then lead to casualty.

Table 7: Frequency of different hit by vehicles

Hit By (Factor)	
2 Wheeler	54
4 Wheeler (Light Motor)	104
Heavy Vehicle	84
Non-Vehicle Collision	229
Total	471

Highest frequency is noted in non-vehicle collisions in 229 (48%) cases, then due to four wheelers (mainly trucks, rtc bus, bus, lorry, van, car, tempo trolley etc) in 104(22%) cases. RTC bus alone was the hitting vehicle in 23 cases, school bus in 3 cases, other buses in 10 cases. Tipper was the hitting vehicle in 6 cases. Lorry, truck, tankers in 33 cases. Cars were a hitting factor in 96 (20%) cases, two wheelers were hitting vehicles in 54 (11%) cases. Cars constitute highest frequency of hitting vehicles individually in this study, then motorbikes, then RTC bus.

Table 8: Frequency of usage of helmet

Usage of Helmet					
	Total	Helmet used	Helmet not used	Not Known
Riders	207	30	160	17
Pillion Riders	56	1	53	2

Table 9: Frequency of usage of seatbelt

	Used	Not used	Unknown
Drivers	0	11	8
Occupants	0	8	16
Total		19	24

Helmet was used in 14.5% of riders, 1.7% of pillion riders. Information was not available in 19 cases.

Survival Interval

Table 10: Frequency in different survival intervals

Brought Dead	40
Hospital Death	246
Spot Dead	185

246 (52.2%) cases survived for a duration in hospital and died in hospital, 185(39.2%) cases died on the spot, 40(8.5%) cases died on the way to hospital.

Discussion

Road traffic injuries are a major public safety issue. These not only result in death, but also in injuries among survivors, who can become a burden to the society. India, as a developing nation, is undergoing a demographic, epidemiological, and economic transition that has had a significant impact on health outcomes. This change led to the rise of non-communicable disorders, such as road traffic accidents resulting in serious injuries, as a major health-care problem [8, 9]. Since road traffic accidents are a leading cause of morbidity and mortality, this research was undertaken to determine the epidemiological factors that influence accidents [10].

The rest of the casualties are men who are the family's key breadwinners. Frank *et al*. discovered a higher male-to-female ratio [11]. The majority of the accidents occurred in the city limits in the evenings, nights, and early mornings, and were caused by people returning from jobs, bars, or outings with friends and family while speeding and disregarding traffic laws. The majority of the accidents were caused by exhaustion, work place pressures, or drunk driving, resulting in collisions with cyclists, dividers, barricades, or other vehicles. Our results are consistent with those of other studies [12].

Face, head, and neck fractures accounted for the majority of the injuries. Many studies showed similar results [13, 14, 15, 16]. Many of the cases had abrasions, fractures, and lacerations, with abrasion being the most frequent. The lower end fractions are due to the interaction of gravity and the speed of the vehicle during collisions, which leads to the creation of kinetic energy, which in turn contributes to fractures. Head injuries is a leading cause of morbidity in survivors;

disability may occur regardless of the severity of the initial head injury, and recovering patients with head trauma are more impacted than those with injuries to other body parts.

Limitations

1. Role of helmet in prevention of accidents couldn't be ascertained (in detail) due to lack of information in majority of the study sample.
2. Role of alcohol in causation of accidents couldn't be understood (in detail) in hospital admitted cases because of lack of initial sampling.

Conclusion

Road traffic injuries can be prevented. Governments need to take action to address road safety in a holistic manner. This requires involvement from multiple sectors such as transport, police, health, education, and actions that address the safety of roads, vehicles, and road users.

Effective interventions include designing safer infrastructure and incorporating road safety features into land-use and transport planning, improving the safety features of vehicles, improving post-crash care for victims of road crashes, setting and enforcing laws relating to key risks, and raising public awareness.

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