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Original Research Article

An Observational Study Evaluating the Pattern of Skull Fractures in Cases of Two Wheelers without Wearing Helmet in Fatal Road Traffic Accidents

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Abstract:

Aim: The aim of the present study was to assess the pattern of skull fractures in cases of two wheelers without wearing helmet in fatal road traffic accidents.

Material & methods: The present record based retrospective study was conducted in the Department of FMT**.** 100 cases of road traffic accidents involving fatal head injuries which underwent autopsy over the period of 2 years were included in the study. Out of these cases patients involved in two wheeler accidents were further evaluated. Informed consent was obtained from the parent or legal guardian of each enrolled patient.

Results: It was observed that out of total 100 cases of RTA with two wheelers 91% had not used helmet while only 9% were wearing helmet. It was observed that majority of the cases (36%) not using helmet were 20-29 years of age. Among helmet non users 93.40% cases were male. The most common associated injury was head injury and rib fracture. Abrasions and Lacerations were the most common injuries to face and head. Diffuse Extravasation of Blood from Scalp was observed most commonly followed by combined Extravasation from Frontal, Parietal and Temporal region among the non-helmet users. Among the helmet non users ACF with MCF and PCF was seen as most common base of skull fracture. The most common type of fracture in vault was linear fracture followed by Comminuted fracture. Parital bones, Frontal bones and temporal bone were the most commonly fractured bone.

Conclusion: Head injury due to road traffic accidents often leads to fatal outcomes. Wearing helmets by two wheeler riders, strict implementation of traffic rules and prompt emergency services especially neurosurgery facilities can help in reducing the incidence of road traffic accident fatalities.

Keywords: Fatal Road Traffic Accidents, Skull Fractures, Two Wheelers Without Wearing Helmet.

Introduction

Road traffic accident (RTA) is a collision between vehicles; between vehicles and pedestrians; between vehicles and animals; or between vehicles and geographical or architectural obstacles. Road traffic accidents are human tragedy. They involve high human suffering and socioeconomic costs in terms of premature deaths, injuries, loss of productivity, and so on. [1] According to WHO estimates, about 1.24 million deaths occur each year as a result of road traffic crashes. Around 20 to 50 million more people suffer non-fatal injuries, with many incurring a disability as a result of their injury.

In India, according to Ministry Of Road Transport and Highways (MORTH), during the year 2020, there were around 5 lakh road accidents, which resulted in deaths of 134,513 people and injured more than 5 lakh persons in India. [2] According to World Health Organization (WHO), road traffic injuries are the sixth leading cause of deaths, disabilities and socio-economic losses in the young and middle-aged population. [3] It is the leading cause of mortality for young adults of age less than 45 years. As motorized two wheeler vehicles constitute a large portion of the vehicle fleet in India, the exponentially increasing number of automobile vehicles, poor adherence to traffic rules and regulations such as maintaining lane discipline, driving in zigzag patterns by public, poorly maintained and congested roads, abuse of alcohol, and lack of awareness about helmets and new generation of high speed vehicles are altogether responsible for accident**s.**

Among all the regional injuries, the injury to the head is the most important in forensic practice. Traumatic brain injury (TBI) is a significant public health problem leading to mortality, morbidity, and socioeconomic losses in India. The majority (60%) of TBI cases are a result of road traffic accidents (RTA).[4] "Head injury" as defined by the National

Advisory Neurological Diseases and stroke council, is a morbid state, resulting from gross and subtle structural changes in the scalp, skull and/ or the contents of the skull produced by mechanical forces. Mechanical forces is restricted to the forces applied externally to the head, thus excluding surgical ablations and internally acting forces such as increased intracranial pressure resulting from edema, hydrocephalus, or mass occupying lesion without antecedent head trauma. [3] Road traffic injuries also place a huge burden on the health sector in terms of pre-hospital care and acute rehabilitation. [4]

History head trauma did not take long to be realized by human, the head has always been seen by both assailant and defender as a region of particular vulnerability, where an incapacitating blow might most effectively be landed. [5] This is well attested by the creation of protective helmet (iron hat) worn by the warriors far back in the antiquity and now as well, at war and at peace, while at work and in variety of sport- connected activities. [6] Accidents are common cause of death in various age group but trend is more common among younger generation, may be lack of traffic laws, drunken drive, rash and negligent act, poor condition of the road and lack of infrastructure. Road traffic accidents involving two wheelers contribute 70% of the total vehicle population. Mortalities and morbidity are more due to head injuries in riders and pillion riders of the two wheelers. [7] Early recognition of the injury and immediate treatment are mandatory in saving the lives of many patients, repeated clinical, radiological examinations and observations for the appearance of clinical signs and symptoms in the persons with head injury are more important than any other investigation. [8] Majority of the deaths of trauma victims have medico-legal complications. It is therefore necessary to establish the cause of the death to get compensations from the state or from insurance companies. Hence the aim was to study the pattern of skull fractures in cases of two wheelers without wearing helmet in fatal road traffic accidents.

Material & Methods

The present record based retrospective study was conducted in the Department of FMT, Netaji Subhas Medical College and Hospital, Bihta, Patna, Bihar, India**.** 100 cases of road traffic accidents involving fatal head injuries which underwent autopsy over the period of 2 years were included in the study. Out of these cases patients involved in two wheeler accidents were further evaluated. Informed consent was obtained from the parent or legal guardian of each enrolled patient.

Exclusion Criteria: All other fatal head injury other than road traffic accidents was excluded.

Methodxology

A proforma was prepared accordingly to collect the data based on the deceased's particulars, with complete external and internal examination in retrospective studies of those involved in fatal head injury cases due to road traffic accidents. Recorded details include name, age, sex, address, information furnished by the police in the inquest papers, postmortem reports, investigation reports if any and cause of death. All the data obtained was kept anonymous to protect the identity of the deceased and also for confidential medico legal information.

Statistical Analysis: The details about the pattern of skull fractures and also about intracranial haemorrhages were obtained and entered in the proforma. The data from all the proformas were compiled in a master chart, analyzed by calculating sum, range, distribution and percentage. The data was also tabulated and appropriate inferences were drawn. These inferences were compared with other similar studies.

Results

Table 1: Distribution of cases according to use of helmet at the time of accident

Safety measure	N	%
Helmet used	9	9
Helmet not used	91	91
Total	100	100

It was observed that out of total 100 cases of RTA with two wheelers 91% had not used helmet while only 9% were wearing helmet.

Table 2: Demographic details of study subjects

		Helmet Used	Helmet not used	Grand Total
Age in Years	1-9 years	0 (0.00%)	0 (0.00%)	0
	10-19 years	2 (22.22%)	6 (6.60%)	8 (8%)
	20-29 years	2 (22.22%)	34 (37.36%)	36 (36%)
	30-39 years	3 (33.33%)	21 (23.07%)	24 (24%)
	40-49 years	1 (11.11%)	11 (12.08%)	12 (12%)
	50-59 years	1 (11.11%)	14 (15.38%)	15 (15%)
	60-69 years	0 (0.00%)	1 (1.10%)	1 (1%)

	≥70 years	0 (0.00%)	4 (4.40%)	4 (4%)
Sex	Male	10 (100.00%)	85 (93.40%)	95 (95%)
	Female	0 (0.00%)	6 (6.60%)	5 (5%)
Total		9 (100%)	91 (100%)	100 (100%)

It was observed that majority of the cases (36%) not using helmet were 20-29 years of age. Among helmet non users 93.40% cases were male.

Table 3: Distribution of cases according to details of injuries

	Row Labels	Helmet Used	Helmet not used	Grand Total
Associated Injuries	**Rib fractures**	1	17	18 (18%)
	Rib fractures+ Long bone fractures	0	5	5 (5%)
	Rib fractures+ Long bone fractures+Pelvis fractures+ Visceral Lacerations	0	1	1 (1%)
	Rib fractures+ Long bone fractures+ Vertebral fractures	1	2	3 (3%)
	Rib fractures+ Long bone fractures+ Visceral Lacerations	0	7	7 (7%)
	Rib fractures+ Visceral Lacerations	0	7	7 (7%)
	Long bone fractures	0	5	5(5%)
	Vertebral fractures	0	1	1(1%)
	Visceral Lacerations	1	2	3(3%)
	Only head injury	6	43	49(49%)
Injuries to face and head	Absent	1	4	5(5%)
	Abrasion	0	7	7(7%)
	Abrasion+Laceration	3	22	26(26%)
	Abrasion+Laceration+ Contusion	2	22	24(24%)
	Abrasion+Laceration+Contusion	0	2	2(2%)
	Abrasion+Contusion	0	3	3(3%)
	Abrasion+Surgical Scar	0	8	8(8%)
	Laceration	0	7	7(7%)
	Contusion	0	1	1(1%)
	Crush	0	3	3(3%)
	Surgical Scar	3	11	14(14%)
	Absent	1	9	10(10%)
	Diffuse	3	39	42(42%)
	Frontal	0	6	6(6%)
Scalp Extrava Sation of blood	Frontal+Parietal +Temporal	3	12	15(15%)
	Frontal+Temporal+Occipital	0	2	2(2%)
	Parietal	0	3	3(3%)
	Parietal+Temporal+Occipital	2	6	8(8%)
	Temporal	0	6	5(5%)
	Occipital	0	9	9(9%)
	Grand Total	9(100%)	91(100%)	100(100%)

The most common associated injury was head injury and rib fracture. Abrasions and Lacerations were the most common injuries to face and head. Diffuse Extravasation of Blood from Scalp was observed most commonly followed by combined Extravasation from Frontal, Parietal and Temporal region among the non helmet users.

Table 4: Distribution of cases according to details of Skull injuries

		Helmet Used	Helmet not used	Grand Total
Type of fracture in vault	Absent	2	27	29 (29%)
	Linear	5	31	36(36%)
	Linear+Comminuted	0	6	6(6%)
	Comminuted	2	16	18(18%)
	Comminuted+ Depressed	0	4	4(4%)
	Depressed	0	4	4(4%)
	Diastatic	0	3	3(3%)

Site of Fracture in vault	Absent	2	27	29(29%)
	Frontal	1	8	9(9%)
	Frontal+ Parietal	1	7	8(8%)
	Frontal+ Parietal+	0(0.00%)	8(8.70%)	8(8%)
	Temporal			
	Parietal	0	6	6(6%)
	Parietal+ Temporal	1	3	4(4%)
	Parietal+ Temporal+	1	1	2(2%)
	Occipital			
	Temporal	1	7	8(8%)
	Occipital	0	8	8(8%)
	All	2	13	15(15%)
	All+ Facial Bones	0	3	3(3%)
Base of skull fractures	Absent	3	29	32(32%)
	ACF+MCF+PCF	1	19	20(20%)
	ACF	1	7	8(8%)
	ACF+MCF	1	7	8(8%)
	ACF+PCF	0	3	3(3%)
	MCF	2	7	9(9%)
	MCF+PCF	0	12	12(12%)
	PCF	1	7	7(7%)
	Grand Total	**9**	**91**	**100**

Among the helmet non users ACF with MCF and PCF was seen as most common base of skull fracture. The most common type of fracture in vault was linear fracture followed by Comminuted fracture. Parital bones, Frontal bones and temporal bone were the most commonly fractured bone.

Discussion

Road Traffic accident is an unplanned event occurring suddenly, unexpectedly and inadvertently in an unforeseen circumstance. Incidences are more common among the two wheeler vehicles. Head was the most common site to be injured in RTAs. [9] Head injury as defined by the National Advisory Neurological Diseases and stroke council, is a morbid state, resulting from gross and subtle structural changes in the scalp, skull and/ or the contents of the skull produced by mechanical forces. Mechanical forces is restricted to the forces applied externally to the head, thus excluding surgical ablations and internally acting forces such as increased intracranial pressure resulting from edema, hydrocephalus, or mass occupying lesion without antecedent head trauma. [10]

It was observed that out of total 100 cases of RTA with two wheelers 91% had not used helmet while only 9% were wearing helmet. Similarly Manjul Tripathi et al [11] observed only 13.4% of all two wheeler passengers were wearing helmet at the time of accident. Thus despite legislation and many public awareness programs, the use of helmet is very less. R. Ravikumar et al [12] in their study observed that 35.82% riders, among 187 riders have not been wearing a helmet at the time of accident while none of the pillion riders have been wearing Helmet. It was observed that majority of the cases (36%) not using helmet were 20-29 years of age. Among helmet non users 93.40% cases were male. In Kakeri SR et al [13] study maximum victims (29.5%) were seen in the age group of 21-30 years, followed by 25.5% in the age group of 31-40 years. Individuals in the age group of 71-80 years is the least affected 4 cases (2.2%), maximum number of males 45 is seen in the age group of 21-30 years and 2 cases of male 54 cases of females is seen. Among helmet non users 94.57% cases were male while among helmet users all were male. Similarly Manjul Tripathi et al [14] also observed male predominance. The dominance of males is explained by the fact that males are more exposed to the hazards of road, industry, violence as they constitute working and earning member in majority of the families, while females usually stay at the home and look after the house hold work in this region.

The most common associated injury was head injury and rib fracture. Abrasions and Lacerations were the most common injuries to face and head. Diffuse Extravasation of Blood from Scalp was observed most commonly followed by combined Extravasation from Frontal, Parietal and Temporal region among the non helmet users. On considering the anatomical location of the skull fracture present study had showed involvement of all bones in majority of cases followed by involvement of facial bones which is then followed by frontal involvement, in contrast to Chandigarh based study which had showed parietotemporal area being common followed by parietal area. [15] In Kakeri SR et al [16] study 62% of victims showed facial injuries like abrasion, contusion and laceration, in 55.3% victims no injuries were seen at all. Among

the helmet non users ACF with MCF and PCF was seen as most common base of skull fracture. The most common type of fracture in vault was linear fracture followed by Comminuted fracture. Parital bones, Frontal bones and temporal bone were the most commonly fractured bone. The high incidence of comminuted fracture may be due to heavy motor vehicles causing the accidents with greater force and compact. These figures were consistent with the finding. [17,18] Solheim, Sevitt and Chandra et al. who reported that vault of skull was more commonly fractured. [19]

Conclusion

Head injury due to road traffic accidents often leads to fatal outcomes. Wearing helmets by two wheeler riders, strict implementation of traffic rules and prompt emergency services especially neurosurgery facilities can help in reducing the incidence of road traffic accident fatalities.

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