

# Pattern of skull fractures in cases of two wheelers without wearing helmet in fatal road traffic accidents in Mangalore

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## Abstract

**Background:** Head is a major site of trauma in road accidents, even with improvements in safety measures, the mortality rate in head injuries has not declined. Unfortunately, both mortality and morbidity rate shows increasing trend even though compulsory helmet rule is there. Injuries to the head is not always isolated but often associated with neck, spine, chest and abdomen and pelvic cavity. **Amis and objectives:** To study the pattern of skull fractures in cases of two wheelers without wearing helmet in fatal road traffic accidents in Mangalore. **Materials and method:** All cases of road traffic accidents involving fatal head injuries among two wheelers which underwent autopsy at the Wenlock District Hospital and Justice K.S Hegde charitable Hospital, Mangalore from January 2009 to December 2013 were included in the study. 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. The details about the pattern of skull fractures and also about intracranial haemorrhages were obtained and entered in the proforma. **Results:** Out of total 101 cases of RTA with two wheelers 91.09% had not used helmet while only 8.91% were wearing helmet. Majority of the cases (36.96%) not using helmet were 20-29 years of age. Among helmet non users 94.57% cases were male. The most common associated injury was head injury (45.65%) and rib fracture (44.57%). Abrasions (71.75%) and Lacerations (70.66%) were the most common injuries to face and head. Diffuse Extravasation of Blood from Scalp (41.3%) was observed most commonly followed by combined Extravasation from Frontal, Parietal and Temporal region (14.13%) among the non helmet users. Among the helmet non users ACF with MCF and PCF was seen as most common (21.74%) base of skull fracture. The most common type of fracture in vault was linear fracture (34.78%) followed by Comminuted fracture (18.48%). In 27(29.35%) cases not using helmet no fracture was observed. Parietal bones (27.18%), Frontal bones (25.01%) and temporal bone (20.65%) were the most commonly fractured bone. **Conclusion:** Thus we conclude that Linear and Comminuted fracture of skull were common in cases of two wheelers without wearing helmet in fatal road traffic accidents in Mangalore. Parietal bones (27.18%), Frontal bones (25.01%) and temporal bone (20.65%) were the most commonly fractured bone. Abrasion and lacerations were the most common injuries observed on head and face region.

**Key words:** fatal road traffic accidents, skull fractures, two wheelers without wearing helmet

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## INTRODUCTION

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.<sup>1</sup> 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 accidents. Injuries and fatalities occur in all forms of transportation, but road traffic accidents accounts highest throughout the world, in both developed and developing countries, 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 <sup>2</sup>. Head is a major site of trauma in road accidents, even with improvements in safety measures, the mortality rate in head injuries has not declined. Unfortunately, both mortality and morbidity rate shows increasing trend even though compulsory helmet rule is there. Injuries to the head is not always isolated but often associated with neck, spine, chest and abdomen and pelvic cavity. 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<sup>3</sup>. 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.

### AIMS AND OBJECTIVES

To study the pattern of skull fractures in cases of two wheelers without wearing helmet in fatal road traffic accidents in Mangalore.

### MATERIALS AND METHOD

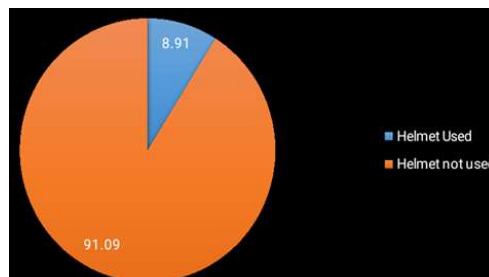
The present record based retrospective study was conducted at the Wenlock District Hospital and Justice K.S Hegde charitable Hospital, Mangalore. All cases of road traffic accidents involving fatal head injuries which underwent autopsy at the Wenlock District Hospital and Justice K.S Hegde charitable Hospital, Mangalore from January 2009 to December 2013 were included in the study. Out of these cases patients involved in two wheeler accidents were further evaluated. Both of the hospitals being major tertiary care hospitals, situated in Mangalore. While all other fatal head injury other than road traffic accidents was excluded. 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. 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	No. of cases	Percentage
Helmet Used	09	8.91
Helmet not used	92	91.09
<b>Total</b>	<b>101</b>	<b>100.00</b>

It was observed that out of total 101 cases of RTA with two wheelers 91.09% had not used helmet while only 8.91% were wearing helmet.



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

**Table 2: demographic details of study subjects**

		Helmet Used	Helmet not used	Grand Total
<b>Age in Years</b>	1-9 years	0 (0.00%)	0 (0.00%)	0 (0.00%)
	10-19 years	2 (22.22%)	5 (5.43%)	7 (6.93%)
	20-29 years	2 (22.22%)	34 (36.96%)	36 (35.64%)
	30-39 years	3 (33.33%)	20 (21.74%)	23 (22.77%)
	40-49 years	1 (11.11%)	14 (15.22%)	15 (14.85%)
	50-59 years	1 (11.11%)	13 (14.13%)	14 (13.86%)
	60-69 years	0 (0.00%)	2 (2.17%)	2 (1.98%)
	≥70 years	0 (0.00%)	4 (4.35%)	4 (3.96%)
<b>Sex</b>	Male	9 (100.00%)	87 (94.57%)	96 (95.05%)
	Female	0 (0.00%)	5 (5.43%)	5 (4.95%)
<b>Total</b>		<b>9 (100.00%)</b>	<b>92 (100.00%)</b>	<b>101 (100.00%)</b>

It was observed that majority of the cases (36.96%) not using helmet were 20-29 years of age. Among helmet non users 94.57% cases were male.

**Table 3: Distribution of cases according to details of injuries**

	Row Labels	Helmet Used	Helmet not used	Grand Total	
Associated Injuries	<b>Rib fractures</b>	1(11.11%)	<b>17(18.48%)</b>	<b>18(17.82%)</b>	
	Rib fractures+ Long bone fractures	0(0.00%)	5(5.43%)	5(4.95%)	
	Rib fractures+ Long bone fractures+Pelvis fractures+ Visceral Lacerations	0(0.00%)	2(2.17%)	2(1.98%)	
	Rib fractures+ Long bone fractures+ Vertebral fractures	1(11.11%)	2(2.17%)	3(2.97%)	
	Rib fractures+ Long bone fractures+ Visceral Lacerations	0(0.00%)	8(8.70%)	8(7.92%)	
	Rib fractures+ Visceral Lacerations	0(0.00%)	7(7.61%)	7(6.93%)	
	Long bone fractures	0(0.00%)	5(5.43%)	5(4.95%)	
	Vertebral fractures	0(0.00%)	1(1.09%)	1(0.99%)	
	Visceral Lacerations	1(11.11%)	2(2.17%)	3(2.97%)	
	Only head injury	6(66.67%)	42(45.65%)	48(47.52%)	
	Injuries to face and head	Absent	1(11.11%)	3(3.26%)	4(3.96%)
		Abrasion	0(0.00%)	8(8.70%)	8(7.92%)
		Abrasion+Laceration	3(33.33%)	23(25.00%)	26(25.74%)
Abrasion+Laceration+ Contusion		2(22.22%)	21(22.83%)	23(22.77%)	
Abrasion+Laceration+Contusion		0(0.00%)	2(2.17%)	2(1.98%)	
Abrasion+Contusion		0(0.00%)	4(4.35%)	4(3.96%)	
Abrasion+Surgical Scar		0(0.00%)	8(8.70%)	8(7.92%)	
Laceration		0(0.00%)	7(7.61%)	7(6.93%)	
Contusion		0(0.00%)	1(1.09%)	1(0.99%)	
Crush		0(0.00%)	3(3.26%)	3(2.97%)	
Surgical Scar		3(33.33%)	12(13.04%)	15(14.85%)	
Absent		1(11.11%)	10(10.87%)	11(10.89%)	
Diffuse		3(33.33%)	38(41.30%)	41(40.59%)	
Scalp Extravasation of blood	Frontal	0(0.00%)	6(6.52%)	6(5.94%)	
	Frontal+Parietal +Temporal	3(33.33%)	13(14.13%)	16(15.84%)	
	Frontal+Temporal+Occipital	0(0.00%)	2(2.17%)	2(1.98%)	
	Parietal	0(0.00%)	3(3.26%)	3(2.97%)	
	Parietal+Temporal+Occipital	2(22.22%)	6(6.52%)	8(7.92%)	
	Temporal	0(0.00%)	5(5.43%)	5(4.95%)	
	Occipital	0(0.00%)	9(9.78%)	9(8.91%)	
<b>Grand Total</b>		<b>9(100.00%)</b>	<b>92(100.00%)</b>	<b>101(100.00%)</b>	

The most common associated injury was head injury (45.65%) and rib fracture (44.57%). Abrasions (71.75%) and Lacerations (70.66%) were the most common injuries to face and head. Diffuse Extravasation of Blood from Scalp (41.3%) was observed most commonly followed by combined Extravasation from Frontal, Parietal and Temporal region (14.13%) 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(22.22%)	27(29.35%)	29(28.71%)
	Linear	5(55.56%)	32(34.78%)	37(36.63%)
	Linear+Comminuted	0(0.00%)	6(6.52%)	6(5.94%)
	Comminuted	2(22.22%)	17(18.48%)	19(18.81%)
	Comminuted+ Depressed	0(0.00%)	4(4.35%)	4(3.96%)
	Depressed	0(0.00%)	4(4.35%)	4(3.96%)
Site of Fracture in vault	Diastatic	0(0.00%)	2(2.17%)	2(1.98%)
	Absent	2(22.22%)	27(29.35%)	29(28.71%)
	Frontal	1(11.11%)	8(8.70%)	9(8.91%)
	Frontal+ Parietal	1(11.11%)	7(7.61%)	8(7.92%)
	Frontal+ Parietal+ Temporal	0(0.00%)	8(8.70%)	8(7.92%)
	Parietal	0(0.00%)	6(6.52%)	6(5.94%)
	Parietal+ Temporal	1(11.11%)	3(3.26%)	4(3.96%)
	Parietal+ Temporal+ Occipital	1(11.11%)	1(1.09%)	2(1.98%)
	Temporal	1(11.11%)	7(7.61%)	8(7.92%)
	Occipital	0(0.00%)	8(8.70%)	8(7.92%)
	All	2(22.22%)	14(15.22%)	16(15.84%)
	All+ Facial Bones	0(0.00%)	3(3.26%)	3(2.97%)
Base of skull fractures	Absent	3(33.33%)	30(32.61%)	33(32.67%)
	ACF+MCF+PCF	1(11.11%)	20(21.74%)	21(20.79%)
	ACF	1(11.11%)	7(7.61%)	8(7.92%)
	ACF+MCF	1(11.11%)	7(7.61%)	8(7.92%)
	ACF+PCF	0(0.00%)	3(3.26%)	3(2.97%)
	MCF	2(22.22%)	7(7.61%)	9(8.91%)
	MCF+PCF	0(0.00%)	12(13.04%)	12(11.88%)
	PCF	1(11.11%)	6(6.52%)	7(6.93%)
	<b>Grand Total</b>	<b>9(100.00%)</b>	<b>92(100.00%)</b>	<b>101(100.00%)</b>

Among the helmet non users ACF with MCF and PCF was seen as most common (21.74%) base of skull fracture. The most common type of fracture in vault was linear fracture (34.78%) followed by Comminuted fracture (18.48%). In 27(29.35%) cases not using helmet no fracture was observed. Parietal bones (27.18%), Frontal bones (25.01%) and temporal bone (20.65%) were the most commonly fractured bone.

**DISCUSSION**

The present record based retrospective study was conducted at the Wenlock District Hospital which caters to about 90% of all medico-legal autopsies and Justice K S Hegde charitable hospital, both of the hospitals being major tertiary care hospitals, situated in Mangalore. The study aimed to assess the pattern of skull fractures in cases of two wheelers without wearing helmet in fatal road traffic accidents in Mangalore. It was observed that out of total 101 cases of RTA with two wheelers 91.09% had not used helmet while only 8.91% were wearing helmet. Similarly Manjul Tripathi *et al.*,<sup>6</sup> 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.*<sup>5</sup> 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. Failure to wear a helmet resulted in a significantly higher incidence of head injury and death

among both riders and pillion rider motorcycle crashes as found in Nupur pruthi *et al.*<sup>6</sup> and Sharma BR *et al.*<sup>7</sup>. Study in Mumtaz B *et al.*<sup>8</sup> where frequency of helmet use is 56.6% and that of non users in 43.3%. It was observed that majority of the cases (36.96%) not using helmet were 20-29 years of age followed by 30-39 years of age (21.74%). R. Ravikumar<sup>5</sup> study showed that the two wheeler RTAs were more in the third and fourth decades constituting 47.75% and 22.44% of total 245 victims. Findings found in the studies by Kumar A *et al.*<sup>9</sup> results show that the younger economical active groups 21-30years followed by 31-40 years, highest number of fatalities (54.24%) was in the 21-40years were predominantly involved as these age groups are found using the roads frequently and are generally rash drivers. In Kakeri SR *et al.*<sup>10</sup> 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.*,<sup>4</sup> also observed male predominance. R. Ravikumar<sup>5</sup> observed the cases are seen more in the male victims (87.75% as compared to females (12.25%). Similar to the findings of studies of Kumar *et al.*<sup>9</sup> were males belonging to 88.22% and females 11.77% and in the study of Singh YN *et al.*<sup>11</sup> males belong to 86.96% and females belong to 13.04%. In the study by Kakeri SR *et al.*<sup>10</sup> male comprised a majority and constituted 83.3% of 150 cases compared to females 16.7%(30) cases. The male preponderance may be due to the effect that males are more exposed to outdoor activities travelling between the home and place of work to earn bread for the family. While woman remains mainly indoor involved in house hold work. The most common associated injury was head injury (45.65%) and rib fracture (44.57%). Abrasions (71.75%) and Lacerations (70.66%) were the most common injuries to face and head. Diffuse Extravasation of Blood from Scalp (41.3%) was observed most commonly followed by combined Extravasation from Frontal, Parietal and Temporal region (14.13%) among the non helmet users. In Kakeri SR *et al.*<sup>10</sup> study 62% of victims showed facial injuries like abrasion, contusion and laceration, in 55.3% victims no injuries were seen at all. Commonest injury was abrasion (28.6%) seen along face region as seen in (16.3) was alone of 97 cases of facial injuries (40.6%) cases had facial bone fracture. Skull fractures are not a dictum to be present in all fatal head injury cases. Among the helmet non users ACF with MCF and PCF was seen as most common (21.74%) base of skull fracture. The most common type of fracture in vault was linear fracture (34.78%) followed by Comminuted fracture (18.48%). In 27(29.35%) cases not using helmet no fracture was observed. Frontal (25.01%) and parital bones (27.18%) were the most commonly fractured bone. In the study by R. Ravikumar<sup>5</sup> Basal plus Linear fracture of Vertex constituted 23.53% cases, out of 187 riders and 18.97% cases out of 58 of pillion riders. Linear fracture of vertex only comprised 13.90% cases in riders, 18.97% cases in pillion riders followed by fractures of the base only in 11.23% in riders and 13.79% in pillion riders, Depressed fractures of vertex was found 5.60% in riders and 4.87% in Pillion riders. Commuted fractures were the least common in both riders and pillion riders. No fracture of skull was found in 62 cases, out of 187 riders and 17 cases out of 58 Pillion riders. Thus skull fractures were present in 166 (67.75%) cases. Compared to 69.63% of cases in the study by Kumar A *et al.*<sup>9</sup> and Singh B *et al.*<sup>12</sup> The dominant type of skull fractures found was the linear (fissured) fracture in 55.43% cases followed by basilar fracture in 17.47%, Crushes fracture in 18.07%,

Comminuted fracture in 5.42% and depressed fracture in 3.62%. Fissured fracture was the most commonly observed fracture (57%) in study of Menon A *et al.*<sup>13</sup> and Shivakumar BC *et al.*<sup>14</sup> In Kakeri SR *et al.*<sup>10</sup> study, skull fracture is seen in 90% victims, of which 28 have crush injury of the skull. The combination of vault and base of skull fracture is the commonest observed in 39(26%) victims, Fissured fracture of Vault and Base 2(81%). 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<sup>12,15</sup>. Solheim, Sevitt and Chandra *et al.* who reported that vault of skull was more commonly fractured<sup>16</sup>.

## CONCLUSION

Thus we conclude that Linear and Comminuted fracture of skull were common in cases of two wheelers without wearing helmet in fatal road traffic accidents in Mangalore. Parital bones (27.18%), Frontal bones (25.01%) and temporal bone (20.65%) were the most commonly fractured bone. Abrasion and lacerations were the most common injuries observed on head and face region.

## REFERENCES

1. Reddy KSN. The essentials of Forensic Medicine and Toxicology, 29th edition, published by K. Sugana Devi, 2010; p218.
2. Sharma BR *et al.*. Road Traffic Accidents-A Demographic and Topographic Analysis. *Medicine, Science and Law*, 2001; 41(3):266-274.
3. Udelleziro *et al.*. Motor Vehicle Pedestrians Accidents. *American Journal of Forensic Science and Pathology*, 1993; 14(3):185-186.
4. Tripathi M, Tewari MK, Mukherjee KK, Mathuriya SN. Profile of patients with head injury among vehicular accidents: An experience from a tertiary care centre of India. *Neurol India* 2014;62:610-7.
5. R. Ravikumar. Patterns of Head Injuries in Road Traffic Accidents Involving Two wheelers: An Autopsy Study. *J Indian Acad Forensic Med.* 2013; 35(4): 349-52
6. Nupur Pruthi, Chandramouli, Sampath S, BI Devi. Patterns of head injury among drivers and pillion riders of motorized two-wheeled vehicles in Bangalore, *Indian Journal of Neurotrauma* 2010, 7(2): p123-128.
7. Sharma BR, Gupta Neha, Sharma AK, Sharma Swati. Pattern of fatal motorized Two-Wheeler Crash Injuries in Northern India: is safety Helmet adequate prevention. *Trends in Medical Research*, 2007, 2:27-36.
8. Mumtaz B, Hussain Khan M, Wasif Khan M, Ahmed M, Mahmood A. Frequency of helmet used among motorcycle riders in Rawalpindi, *Professional Med Journal*, 2007 Dec; 14(4): p663-668.
9. Kumar A, Lalwani S, Agarwal D, Rauti R, Dogra TD. Fatal Road Traffic Accidents and their relationship with head injuries, An Epidemical survey of 5 years; *Indian Journal of*

Neurotrauma 2008, 5(2): p63-67.

10. Shamsuddin R. Kakeri, M.A. Bagali, E.S. Goudar and Sayed Yunus Qadri. Pattern of injuries and death sustained by the occupants of the two-wheeler during road traffic accidents. *Al Ameen J Med Sci.* 2014; 7(2) :118-124.
11. Singh YN, Bairagi KK, Das KC. An epidemiological study of road traffic accident victims in medico-legal autopsies, *JIAFM*, 2005, 27(3); 166-169.
12. Singh B, Palimar V, A run M, Mohanty MK. Profile of trauma related mortality at Manipal, Kathmandu University Medical Journal, 2008, 6(3); 393-398.
13. Menon A, Nagesh KR. Pattern of fatal head injuries due to vehicular accidents in Manipal, *Journal of Indian Academy of Forensic Medicine*, 2005, 27(1); 19- 22.
14. Shivakumar BC, Srivastava Prem Chandra, Shantakumar HP. Patterns of head injuries in mortality due to road traffic accidents involving Two-Wheelers. *JIAFM*, 2007; 32(3), p239-242
15. Pathak A, Desania NL, Verma R. Profile of Road Traffic Accidents and head injuries in Jaipur (Rajasthan),*JIAFM* 2008, 30(1); 6-10.
16. Kraus JF, Rice TM, Peek Asa C, Mc Arthur DL. Facial Trauma and the risk of intracranial injury in motor cycle riders, *Ann Emerg Med*, 2003 Jan, 41(1); 18- 26.

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