

■ ORIGINAL ARTICLE

Injury Patterns and Factors Responsible in Fatal Motorcyclist's Road Traffic Accidents: A Forensic Perspective

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ABSTRACT

Road traffic accidents are the major cause of premature death and disability all over the world and motorized two-wheelers accidents account for the majority of such cases particularly in developing countries like India. The aim of the present study is to analyze the pattern of injuries with a focus on head injuries and the environmental factors leading to events.

Methodology: A cross-sectional analytic study was conducted in the Department of Forensic Medicine at Osmania General Hospital, Afzalgunj Hyderabad during the period January 1st, 2018 to December 31st, 2018.

Results: A big majority of victims constitute a working and economically productive age group of 20-40 yrs with male predominance (72.46%). Most accidents (22.6%) occurred during 6-9 pm. Hit by other vehicles (44%) followed by self-skid (32%), and hitting the barriers, or stoppers, sudden interruption by animals and pedestrians, the influence of alcohol all constitute the remaining. About nearly 87% of injuries are multiple and head injuries. Skull fractures were seen in the majority with Subdural Haemorrhage (47.1%) and Sub arachnoid Haemorrhage (43.6%) which lead to death.

Conclusions: The involvement of economically productive males was a major concern. Major responsible factors are nighttime driving, road conditions, barriers, sudden interruption by animals, pedestrians, and the influence of alcohol. Injuries were highly frequent in Head and neck region followed by extremities. There is a need to emphasize on use of helmets and improvement in road conditions and safety measures.

Keywords: Injury Patterns; Fatal Motorcyclist; Forensic Perspective; Analytic study.

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INTRODUCTION

The history of the occurrence of road traffic accidents goes before the invention of the motorized vehicle; with the invention of automobiles, the number of road traffic accidents grew exponentially.¹ The first recorded case of road traffic injury was on 30 May 1896 by a cyclist in New York City USA. Road traffic accidents are a major cause of premature death and disability all over the world and motorized two-wheelers account for a majority of such cases particularly in developing countries like India where they are one of the most important means of transportation.² Head injuries are a leading cause of death from motorcycle crashes.³

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Official Indian government statistics report a total of 4,37,396 road accidents in 2019. During 2019, two-wheelers have accounted for maximum fatal road accidents (58,747 deaths), contributing 38.0% of total road accidental deaths.^{4,5} Road accident severity measured by the number of persons killed per 100 accidents has seen an increase of 0.6 percentage points in 2018 over the previous year. Road accidents in India kill almost 1.5 lakh people annually. Accordingly, India accounts for almost 11% of the accident-related deaths in the World.⁶ Motorcyclist constitute a large segment of the population with head injury associated with other multiple organ injuries. The present study is conducted to analyze the pattern of injuries and causes of death and detailed study of head injuries from a forensic perspective and also the environmental factors of Motorcyclists accused in the event.

MATERIALS AND METHODS

Across-sectional analytic study was conducted in the Department of Forensic Medicine at Osmania General Hospital, Afzalgunj Hyderabad. The study was carried out from January 1st, 2018 to December 31st, 2018. Data was collected from post mortem examination reports, inquests, hospital records for studying various variables involved in the Motorcyclist's fatalities. Total post mortem examinations carried out during the study period are 3762. Among them death was attributed to Road traffic accidents in 1153, total motorcycle deaths were 314 of which 276 were motorcyclists and 38 were pillion riders.

Inclusion Criteria: All RTA cases where a Motorcyclist's death occurred and referred for autopsy at our Medico-legal centre.

Exclusion Criteria: Motorcyclist's injuries out of the jurisdiction, four-wheelers, and Pedestrians.

Statistical analysis: Data thus collected was entered in an excel sheet and further descriptive analysis was done using Microsoft Excel spreadsheet 2016. Results were expressed in frequencies, percentages and further tabulated and charted.

RESULTS

A total of 314 autopsy cases in one-year duration due to Motorcycle accidents were analyzed which includes 276 Motorcyclists and 38 Pillion riders.

The majority of victims belong to the age group of 11 to 50 years. Working and economically productive age group of 20-40yrs constitute 72.46%. In all age groups, 80-90% was male population. Percentage of age less than 20yrs accounted for 8.69% who are having inadequate experience in riding two-wheelers. Pillion riders also followed similar distribution except for the age group 51 to 60 years as more cases were involved in RTA (Table 1).

Table 1: Gender and Age distribution Motorcyclists and Pillion riders.

	Motorcyclists		Pillion riders	
	Number	Percentage	Number	Percentage
Gender				
Male	262	95	20	52.6
Female	14	5	18	47.4
Total	276	100	38	100
Age Group				
0 to 10 yrs	0	8.70	6	15.79
11 to 20 yrs	24	41.30	3	7.89
21 to 30 yrs	114	16.67	9	23.68
31 to 40 yrs	46	14.49	4	10.53
41 to 50 yrs	40	11.23	5	13.16
51 to 60 yrs	31	5.07	8	21.05
61 to 70 yrs	14	1.45	1	2.63
71 to 80 yrs	4	1.09	1	2.63
81 to 90 yrs	3	8.70	1	2.63
Total	276	100	38	100.00

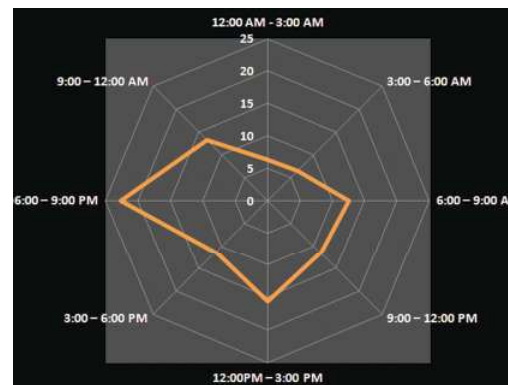


Fig. 1: Time of accident.

The maximum proportion of accidents occur at peak hours of travel i.e. between 6-9 pm where the presence of maximum density of vehicles

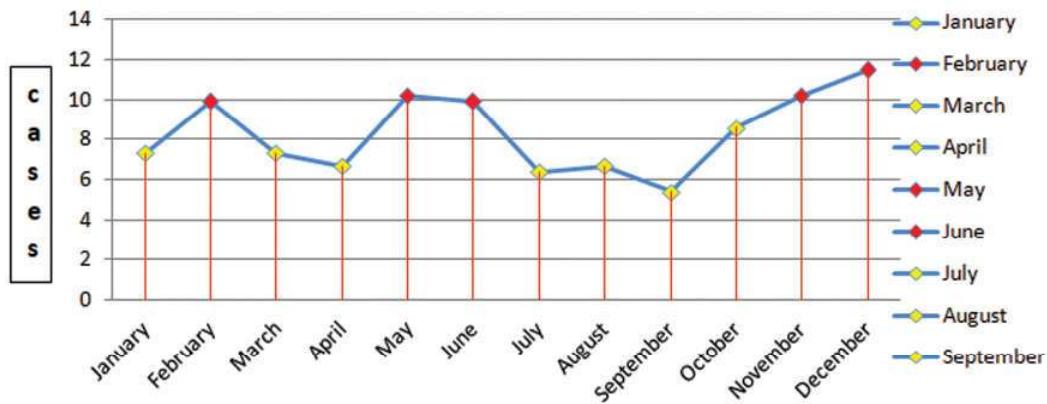


Fig. 2: Month-wise distribution.

in connection with evening fatigue and stress might aggravate the events (Figure 1). Motorcycle accidents are reported more or less uniformly with a dip in July, August and September followed by a gradual rise till December (Figure 2).

Table 2: Circumstances leading to the accident.

Circumstances	No. of Cases	Percentage
Hit by other Vehicles	141	44.90
Self-Skid	99	31.53
Hit the Barriers, Stoppers, etc	28	8.92
Hit other Vehicles	13	4.14
Sudden Interruption [Animal/Pedestrian]	12	3.82
Dim/Absence of light	8	2.55
Triple Riding	5	1.59
Wrong Direction [U-Turn]	4	1.27
On a Mobile Call	1	0.32
Trauma consequent to Natural disease	3	0.96

Hit by other vehicles is the most common type which proves fatal followed by self-skid and fall. Self-Skid due to the poor environment and road conditions is the next common cause of falls from the motorcycle which resulted in deaths. Few others like Hit the Barriers, Stoppers, Sudden interruption by animals and pedestrians are few other circumstances that led to road traffic accident. 36.9% of drivers and 22.5% were under the influence of alcohol (Table 2). Head injury is one of the most important causes of death among motorcyclists who are involved in the accident. Multiple injuries, blunt, crush, and

spinal injuries all types of injuries were noted as the whole body is affected in motorcyclist accidents (Figure 3). 56.5% of drivers, 86.8% of pillion riders didn't wear helmets.

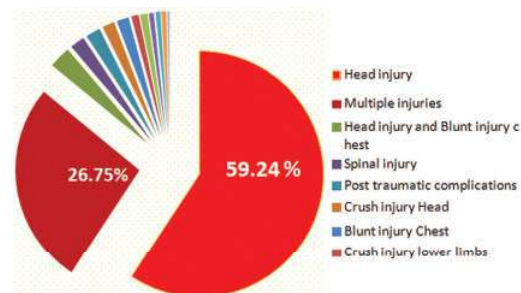


Fig. 3: Cause of Death.

Different types of mechanical injuries are seen. Abrasions and Contusions followed by soft tissue injuries were among the most observed pattern of injuries (Table 3).

Table 3: Pattern of injuries.

Pattern of Injuries*	No. of Cases
Abrasions	314
Contusions	314
Soft tissue injuries	189
Head Injury	186
Lacerations	147
Chest Injuries	92
Hemothorax	34
Hemoperitoneum	32

*Multiple responses

Fractures of ribs were identified as the most common chest wall injuries followed by fractures of the clavicle. Coming to the soft tissue injuries liver and spleen followed by lungs and hearts were observed during the study (Table 4).

Table 4: Chest wall injuries and Soft tissue injuries.

Chest wall injuries*	n	Percentage
Fracture Ribs	61	66.3
Fractured Clavicle	15	16.3
Fractured Sternum	7	7.6
Fracture Thoracic vertebrae	7	7.6
Fracture Acromioclavicular joint	1	1.1
Fracture Sternoclavicular joint	1	1.1
Soft tissue injuries*		
Liver	46	24.3
Spleen	44	23.2
Lungs	41	21.6
Heart	20	10.5
Kidneys	13	6.8
Bowel loops	10	5.2
Bladder	8	4.2
Genitalia	3	1.5
Stomach	2	1
Uterus	2	1

*Multiple responses

Head injury was one of the commonest causes of death. While exploring further, skull fractures were seen in the majority with Sub Dural Hemorrhage and Subarachnoid Hemorrhage. Among skull fractures, temporal bone fractures were seen in the majority followed by frontal and Parietal bones (Table 5).

Table 5: Head Injury.

Injury*	No. of Cases
Skull Fractures	186
Extradural Haemorrhage	21
Subdural Haemorrhage	148
Subarachnoid Haemorrhage	137
Intraventricular Haemorrhage	8
Skull bone fractures*	Total no. of Cases
Temporal	81
Frontal	61
Parietal	58
Occipital	44

* Multiple responses

In the present study, primary impact injuries are most commonly seen in the lower extremities & pelvis followed by upper extremities & shoulder. Secondary impact injuries are mostly seen in the Head & neck and followed by upper and lower extremities. Crush injuries are responsible for more incidences of secondary injuries. Contusions are more common on the scalp.

DISCUSSION

RTA continues to be one of the major causes of morbidity and mortality all over the world. In the present study working and economically productive age group (20-40yrs) constitute 55%. In all the age groups 80-90% was male population as they constitute the largest fraction of those who use the motorized vehicles and earning members of the family. The percentage of study subjects' age less than 20yrs was 8.69% who are having inadequate experience in riding two-wheelers. The factors which explain why this age people are involved include inexperience, risk exposure, risk-taking behavior.

Young riders overestimate their driving capacity to deal in co-coordinating various tasks involved in the art of driving and experience more peer pressure to engage in risky driving. The middle age group is more exposed to road traffics for the following reasons like office visits, dropping kids in homes, attending any functions, etc. Motorized two-wheelers contribute to the major burden of road traffic accidents in the present study which is well established finding in developing countries because of their least stability; thrill-seeking behavior and over the speed of the riders "restless driving". Similar observations were seen in studies conducted by Vishal koulapu et al, Anuj Gupta et al, Dileepkumar R et al, Anuj Gupta et al, Khare N et al.⁷⁻¹¹ Pillion riders constitute 12.11%, as riders are the most frequent travelers of two-wheelers; they were affected in almost every Road traffic accident. These findings are matching with studies conducted by Badri Narayan Mishra et al, Menon A et al and Jain A et al.¹²⁻¹⁴

The maximum proportion of accidents occur at peak hours of travel i.e. between 6-9 pm; stress, fatigue, and sleeplessness while returning from office contribute more which is supported by many other studies.^{15,16} Consuming alcohol in the evening hours, the invisibility of oncoming vehicles, poor quality of roads, etc. are other factors contributing. The accidents are less likely to occur between 3-6 AM due to less traffic movement. Hit by other vehicles is the most common type which proves fatal followed by self-skid and fall.

Deaths due to self-skid and fall are due to various factors like over speed, stress, hurry to the office or home, fatigue, dim light, etc. Studies conducted by Lakshmi Prasad et al and Tiwari et al showed that most of the injuries occurred between 4 pm to 8 pm followed by 8 pm-12 noon and risk factors like high speeding, driving under the influence of alcohol, non-usage of helmets and seat belts were other factors lead to road traffic injury.^{17,18}

Multiple body parts were involved in each case. Multiple injuries like Abrasions, Contusions, Lacerations, and Fractures were seen. The majority of fatal two-wheeler accident victims have received multiple external injuries. Head and extremities were the most common areas to suffer. Crush injuries are predominantly seen in lower limbs. Head injuries and multiple injuries are the major causes of death.¹⁹ In the present study abrasions are the most common type of injuries and were common on extremities. In the present study, abrasions are seen more in the extremities i.e. over the upper limbs and lower limbs followed by head & neck region and thoracoabdominal regions.

This correlates with the parachute reflex i.e. when a conscious individual falls there will be a reflex extension of all four limbs to protect the head & torso which contains vital organs. Primary impact injuries are most commonly seen in the lower extremities & pelvis followed by the upper extremities & shoulder. Secondary impact injuries are mostly seen in the Head & neck and followed by upper and lower extremities. Crush injuries are responsible for more incidences of secondary injuries. Contusions are more common on the scalp. Skull fractures and the temporal bone was found to be the most common vault bone to get fractured as it is the thinnest vault bone. Similar findings are observed in studies conducted by Nilambar Jha and Oberoi.^{20,21}

The abrasions seen over the body surface are often caused due to friction over the road surface on falling over the ground. Grazed abrasions occur when the victim's body is dragged against a rough surface like roads etc or due to the fall of the motorcycle over

them. Elbows & forearms are injured in this study caused either by a handle bar or fall on the ground. Legs often injured when the motorcycle dash with other vehicle or any fixed structures or legs may be trapped in.^{22,23}

In the study, Cranio-cerebral injuries are the commonest cause of death. Head injury remains to be the most common killer major cause of death among the non-helmet users which is a similar finding in other studies by Hui Zhao et al, Jain A et al, Cherpitel C J et al.^{14,16,24} Meningeal hemorrhages and cranial fractures are most frequent fatal injuries than the actual injury which damage the underlying Brain tissue and causes death.

CONCLUSION

The majority of the victims were males belong to the age group of 20-30yrs. Most of the accidents occurred around 6-8 pm, the majority being hit by another vehicle. Self-skid, and fall account for a significant proportion of the total burden of two-wheeler accidents. Elbow and forearm suffer most among abrasions on the upper limb. In lower limbs, the knee was abraded most. All types of injuries were highly frequent in the Head and neck region followed by extremities. Meningeal hemorrhages rank first followed by scalp contusions and skull fractures in head injuries. Head injury followed by underlying Brain tissue damage is the cause of death in the majority.

RECOMMENDATIONS

Usage of helmets is a safety measure to protect the head, crash Bars to protect the legs. Transportation law in controlling the speed of vehicles and the amount of alcohol under which an individual is lawfully deemed to be capable of controlling or being in charge of a means. Design road signs and other furnishings so that they are preventive, crash protective, yielding to impacts or cushioning them.

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