

## Pattern of Injuries among Two or Four Wheeler Occupants in Fatal Road Traffic Injuries

Yadukul S<sup>1\*</sup>, Devadass PK<sup>2</sup>, Gururaj G<sup>3</sup>

<sup>1</sup> Department of Forensic Medicine and Toxicology, Chamarajanagar Institute of Medical Sciences, Chamarajanagar, India

<sup>2</sup> Bangalore Medical College and Research Institute, Bengaluru, India

<sup>3</sup> Department of Epidemiology, WHO Collaborating Centre for Injury Prevention and Safety Promotion, NIMHANS (National Institute of Mental Health and Neurological Sciences), Bengaluru, India

---

### ARTICLE INFO

*Article Type:*  
Original Article

---

*Article History:*  
Received: 17 Feb 2016  
Revised: 12 Mar 2016  
Accepted: 2 Apr 2016

---

*Keywords:*  
Road Traffic Injury  
Injuries  
Two Wheeler  
Four Wheeler

---

### ABSTRACT

**Background:** Every day, we read, listen, or witness, injuries in our day to day lives. Over time, it has moved from 5<sup>th</sup> to 3<sup>rd</sup> to 1<sup>st</sup> page of our newspapers. Some days, it is not uncommon to see the entire page of our newspaper filled with news about injury and violence. On television channels, even on prime time, injury and violence has occupied the center stage. Many times, the 'breaking news' is only deaths due to road crashes, suicides, mass burns and blood loaded violence. The present study is aimed at analyzing the various types of injuries that occur in road traffic injuries and to take necessary actions by the concerned authority to prevent such incidents in the future.

**Methods:** In this study, we studied the various patterns of injuries sustained by the occupants of two/four wheeler during fatal road traffic injuries. A total number of 238 cases (those who died in road traffic injuries) were included in the study for a period of 2 years from October 2010 to September 2012 in Department of Forensic Medicine and Toxicology, Bangalore Medical College and Research Institute, Bengaluru.

**Results:** Among the cases studied in our study (n=238), majority of the victims were males constituting 94% of the cases and in age-wise distribution of cases, age group of 21-30 years (46.2%) followed by 31-40 years (21.4%) constitutes to about 2/3rd of the cases. Time of injury among the cases studied showed that highest incidence being during the night times (18:01-00:00) which constitutes 44.11%. Among the road user category, two wheeler riders (78.15%) formed the major contributors for road traffic injury.

**Conclusion:** In the present study, it is very clear that the middle aged, male bike riders are more prone for fatal road traffic injuries. Hence, Government should take proper initiatives in the future to focus on these high risk individuals to prevent such fatalities.

Copyright©2016 Forensic Medicine and Toxicology Department. All rights reserved.

---

► *Implication for health policy/practice/research/medical education:* Injuries among Two or Four Wheeler Occupants in Fatal Road Traffic Injuries

---

► *Please cite this paper as:* Yadukul S, Devadass PK, Gururaj G. *Pattern of Injuries among two or Four Wheeler Occupants in Fatal Road traffic injuries. International Journal of Medical Toxicology and Forensic Medicine.* 2016; 6(3): 142-7.

---



## 1. Introduction:

The 'Incredible India' is on the move and changing at a fast pace. This change has seen a decline of some communicable diseases, while non-communicable diseases and injuries are on the increase. In this changing scenario, injury and violence is a leading cause of death and disability. This change is palpable across the country and Bengaluru is no exception to this change (1).

**The Problem, Profile and Pattern.** The United Nations General Assembly adopted a resolution on road safety on October 26 2005 which invites Member States to implement the recommendations of the World Report on Road Traffic Injury Prevention; to participate in the first United Nations Global Road Safety Week; and to recognize the third Sunday in November of every year as the World Day of Remembrance for Road Traffic Victims (2). This resolution follows the publication of The World Report on Road Traffic Injury Prevention by the World Health Organization in 2004 (3). This report highlights the fact that all over the world working age people are more likely to suffer hospitalization, permanent disability and death due to road traffic injuries than most other diseases. The situation in India is not very different.

About 82,000 persons were killed on Indian roads in 2002 (4). Official statistics regarding serious injuries are not reliable as they underestimate the actual number (5), but it is estimated that the number of people hospitalized may be 15-20 times the number killed (6).

**Injury.** Commonly injuries are considered as accidents. 'Accident' simply means that it just happens and nothing can be done about it. The term injury by definition means that there is a body lesion due to an external cause, either intentional or unintentional, resulting from a sudden exposure to energy

(mechanical, electrical, thermal, chemical or radiant) generated by agent–host interaction (7).

**Types of Injury.** Injuries are classified in number of ways. A commonly used method is to classify injuries as intentional, unintentional and undetermined injuries, based on intent of injury occurrence. A second common method of classifying injuries is according to the mechanism which caused the injury, like road traffic crashes, poisoning, falls, fires/burns, drowning, fall of external objects and others. A third method of classifying injuries is according to the place of occurrence like road injuries, home injuries, sports injuries and work related injuries based on place of occurrence of injury. The fourth method is based on anatomical types and location of injuries depending on body organs injured like head injury, facial injuries, injury to long bones etc., International classification of diseases<sup>8</sup> and international classification of external causes of injuries<sup>9</sup> are commonly used for systemic and scientific classification of injuries all over the world. A particular classification chosen is primarily determined by the purpose of a programmed and availability of resources. Commonly, the first three methods (viz., intent, mechanism, and place) are preferred, as changes can be made in products and environment, to prevent injuries occurring in future (7-9).

**Injury spectrum.** Use of injury spectrum is another useful method to understand injuries. This method maps an injury over time, starting with its exposure, followed by the event, through the occurrence of injury time finally resulting in disability or death. Understanding this time spectrum can help in developing interventions that can either prevent injury or lessen the impact of injury (10).

## 2. Materials and Methods:

The present study has been carried out in the Department of Forensic Medicine and Toxicology, Victoria Hospital, attached to Bangalore Medical College and Research Institute, Bengaluru during the period October 2010 to September 2012. All the cases of Death due to road traffic injury were

---

*Corresponding author:* Yadukul. S, MD. Department of Forensic Medicine and Toxicology, Chamarajanagar Institute of Medical Sciences, Chamarajanagar, Karnataka, India  
E-mail: dr.kooooool@gmail.com

selected for the study. The study did not involve any removal of organs or mutilation of bodies, which is prohibited by the ICMR guidelines. The clearance for the study was obtained from the college ethical committee. Demographic information regarding the deceased was collected from the police as well as the eye witness at the injury site. All the data were statistically analyzed using latest SPSS software.

**Inclusion criteria.** Fatal road traffic injuries resulting in deaths of two wheeler riders/pillions and four wheeler occupants due to motor vehicle crashes reported to Department of Forensic medicine, Victoria hospital, Bengaluru from Oct 2010 to Sept 2012 and deceased in age groups of 16 – 60 years of either sex.

**Exclusion criteria.** Road traffic injuries which have been treated for more than 30 days, fatal pedestrian injury, and decomposed cases.

### 3. Results:

A total number of 7347 autopsies were performed in the Department of Forensic Medicine and Toxicology, Victoria Hospital, Bangalore Medical College and Research Institute, Bengaluru, over a period of 24 months from October 2010 to September 2012. There were 998 cases (13.58%) of deaths due to road traffic injuries and only 238 cases were included in our study based on the inclusion and exclusion criteria. This constitutes 3.23% of all the autopsies performed at our Institute.

Among the cases studied in our study (n=238), in sex-wise distribution of cases (Table 1), 94% were males and 6% were females. Age group of 21-30 years (46.2%) followed by 31-40 years (21.4%) constitutes to about 2/3rd of the cases studied in our study (Table 1). Time of injury among the cases (Table 2) showed that highest incidence being during the night times i.e. 18:01 hrs - 00:00 hrs which constitutes 44.11%. Place of injury (Table 3) which are more prone for road traffic injuries indicates that city/municipal roads (56.03%) and highway roads (30.25%) accounts for more than 2/3rd of the cases. Two wheeler riders (78.15%) contribute to the majority of the

**Table 1:** Sex-wise and Age-wise distribution of cases

Age group	Males	Females	Total	Percentage
16-20 yrs	28	0	28	11.7
21-30 yrs	102	8	110	46.2
31-40 yrs	50	1	51	21.4
41-50 yrs	27	3	30	12.6
51-60 yrs	17	2	19	7.9
Grand total	224 (94%)	14 (6%)	238	100

**Table 2:** Time of injury of cases

Time	Number of cases	Percentage
00:01-06:00 hrs	18	7.56
06:01-12:00 hrs	53	22.26
12:01-18:00 hrs	62	26.05
18:01-00:00 hrs	105	44.11

cases in the road user category (Table 3). Among the type of crash, 'hit from back' (44.95%) and 'head on collision' (30.67%) accounts for majority of the type of crash (Table 4). Among the parts of the body involved (Table 4) in road traffic injuries, involvement of upper limbs (95.79%) and lower limbs (95.79%) were the highest followed by involvement of Head in 82.35% of cases.

### 4. Discussion:

In the present study, majority of the victims were males constituting 94% of the cases and in age-wise distribution of cases, age group of 21-30 years (46.2%) followed by 31-40 years (21.4%) constitutes to about 2/3rd of the cases. Similar findings were noted in Gururaj G *et al* (11) (84% males, 76% injuries were in 15-44 years age group), Arvind K *et al* (12) (88.22% males, 54.24% in the age group of 21-40 years), Singh B *et al* (13) (85% males, 58% in the age group of 11-40 years) and Mohammad KH *et al* (14) (76% males, 47% in the age group of 16-25 years). This implies that the middle age

**Table 3:** Place of injury and Road user category among the cases studied

Place of injury	Road user category				Number of cases	Percentage
	Two wheeler rider	Two wheeler pillion rider	Motorcar driver	Motorcar passenger		
City/municipal roads	106	23	1	4	134	56.30
Highway	52	8	7	5	72	30.25
Inner roads	1	0	0	0	1	00.42
Rural roads	27	3	0	1	31	13.02
Grand total	186 (78.15%)	34 (14.28%)	8 (3.36%)	10 (4.20%)	238	100

males are more prone to injuries in fatal road traffic injuries.

Time of injury among the cases studied showed that highest incidence being during the night times i.e. 18:01 hrs - 00:00 hrs which constitutes 44.11%. These findings are similar to studies done by Gururaj G *et al*, [30% of fatal and 23% non-fatal crashes occurred between 7 pm and 12 midnight], Mohammad HK *et al*, [66% of the road traffic injuries occur during the day times] and Arvind K *et al*, [peak time for fatal accidents (7.26 %) was between 10 pm and 11 pm followed by 9 pm to 10 pm (6.01%) with 53.20% of fatal accident occurring between 6 pm and 6 am] (11-14).

Place of injury accounting into which roads are more prone for road traffic injuries, shows city/municipal roads (56.03%) and highway roads (30.25%) accounting for more than 2/3rd of the cases. Gururaj G *et al* (11) reports that nearly two thirds of crashes occurred in the city/municipal roads as against 1/4 on highways traversing from the city. Proper precautionary measures should be taken in these roads to prevent such incidence in the future. Among the road user category of the person at the time of crash, with two wheeler riders (78.15%) being the major contributors for road traffic injury. Similar findings were noted in study done by Mohammad *et al* (14) which reports 37% were motorcyclist, 23% bicyclist, 22% motorized two-wheelers and 18% bus users. Among the type of crash, 'hit from back' (44.95%) and 'head on collision' (30.67%) accounts for majority of the type of crash, which is supported by study done by Bela S *et al* (15) [majority of injuries that occurred

among two-wheeler riders/pillion riders and pedal cyclists was due to skidding (46%) and falling (40%)]. In the parts of the body injured during the road traffic injuries, it showed that involvement of upper limbs (95.79%) and lower limbs (95.79%) followed by involvement of head in 82.35% of cases. Arvind K *et al* (12) reported that the most common injury was to the head (69.63%) followed by chest (33.62%). Bela S (15) observed in their study that among the road traffic victims 42.1% of the injuries affected the lower limbs. Upper limb injuries were reported by 33.7% victims while head injuries occurred in 40.0% cases. Face injuries occurred among 27% cases. The limitation of the study is that, it is confined only to a particular part of the city and not the entire city.

### 5. Conclusion:

In the present study, it is very clear that the middle aged, male bike riders are more prone for fatal road traffic injuries. Hence, government should take proper initiatives in the future to focus on these high risk individuals to prevent such fatalities. Since majority of the accidents occur during the evening hours on city/municipal roads and highways, many preventable risk factors like avoiding high beam light in city roads, use of protective gears, sign boards along the roads and other useful directions for the drivers should be done to prevent such incidences in the future.

### 6. Acknowledgement:

We sincerely thank all the teaching and non-teaching faculty of Bangalore Medical

**Table 4:** Manner of the crashes and body parts involved among the cases

Type	Parts of the body involved among the cases							No. of cases	Percent
	Head	Neck	Upper limb	Abdomen	Lower limb	Chest	Spine and vertebral column		
Head on collision	59	6	69	22	70	28	8	73	30.67
Hit vehicle in front	2	0	3	1	2	0	0	3	01.26
Hit from back	86	12	102	38	106	63	14	107	44.95
Skid and fall	21	0	23	3	23	12	0	23	09.66
Run off road	9	1	10	0	11	5	1	11	04.62
Hit a fixed object	16	5	18	6	18	9	6	18	07.56
Others	3	0	3	0	2	0	0	3	01.26
Grand total	196 (82.35%)	24 (10.08%)	228 (95.79%)	69 (28.99%)	228 (95.79%)	117 (49.15%)	29 (12.18%)	238	100

College and Research Institute, Bengaluru and NIMHANS, Bengaluru for extending their support in collecting data.

### 7. Conflicts of Interest:

Nil

### 8. References:

- Gururaj G. Injuries in India: A National Perspective. In: Burden of disease in India. National Commission on macroeconomics and Health. Ministry of health and Family Welfare. Government of India, 2005;325-47.
- Road traffic [online] 2012 [accessed on September 10th, 2012] available from URL: [http://www.who.int/violence\\_injury\\_prevention/publications/road\\_traffic/en](http://www.who.int/violence_injury_prevention/publications/road_traffic/en)
- Peden M, Scurfield R, Sleet D, Mohan D, Hyder AA, Jarawan E, *et al*. World report on road traffic injury prevention. Geneva: World Health Organization; 2004.
- Accidental deaths and suicides in India 2002. New Delhi, National Crime Records Bureau, Ministry of Home Affairs. 2004;1-288.
- Gururaj G, Thomas AA, Reddi MN. Under reporting of road traffic injuries in Bangalore: Implications for road safety policies and programmes. In: Proceedings of the 5th World conference on injury prevention and control. Delhi: Macmillan India Ltd. 2000;54-5.

6. Mohan D. The road ahead: Traffic injuries and fatalities in India. New Delhi: Transportation Research and Injury Prevention Programme, Indian Institute of Technology. 2004;1-30.

7. Krug E(ed). Injury: A leading cause of the global burden of disease. Geneva: World Health Organisation. 1999.

8. World Health Organisation. International Classification of diseases. 10<sup>th</sup> Edition. 2004.

9. World Health Organisation. ICECI – Guidelines for counting and classifying external causes of injuries for prevention and control. 1998.

10. World Health Organization. Injury surveillance guidelines. Holder Y, Peden M, Gururaj G, Geneva. 2002.

11. Gururaj G. Road traffic Injury Prevention in Bangalore, India. National Institute of Mental Health and Neuro Sciences, Bangalore. 2006;26.

12. Aravind K, Sanjeev L, Deepak AM, Rajiv R, Dogra TD. Fatal road traffic accidents and their relationship with head injuries: An epidemiological survey of five years. Ind JNT. 2008;5:63-7.

13. Singh B, Palimar V, Arun M, Mohanthy MK. profile of trauma related mortality at manipal. Katmandu University Medical Journal. 2008;6(3):393-98.

14. Mohammad HK, Babar M, Mohammad WK, Ayesha M. Frequency of Helmet use among motorcycle riders in Rawalpind.: Professional Med J Dec. 2007;14(4):663-8.

15. Bela S, Geetha RM, Gururaj G, Murlidhar T.  
Development of a Feasibility Module for Road

traffic injuries Surveillance. ICMR Report.  
2009;43-7.