

## Original Research Paper

# Pattern of Craniocerebral Injuries in Fatal Vehicular Accidents in Patna (Bihar)

<sup>1</sup>Sanjay Kumar, <sup>2</sup>R K P Singh

### Abstract

Among all type of accidents, those caused by motor vehicle claims the largest toll of life and tend to be the most serious. The present prospective study was conducted in the Department of Forensic Medicine and Toxicology, Patna Medical College and Hospital Patna from September, 2007 to April, 2009 on 100 cases. The primary aim of this study was to find out nature and types of cranio-cerebral injuries (CCI) sustained in fatal road traffic accidents (RTA) and make an attempt to establish various causative factors, patterns and distribution of CCI and thereby to plan successful measures against it. Our study shows that 30% victims were of middle age group, male: female ratio was 4.5:1. Maximum number of cases was during the summer season. 66% victims were pedestrians; in 47% cases heavy vehicles were involved. In 86% cases the death was due to fatal cranio-cerebral injuries alone. In 30% cases the death was instantaneous, 65% cases died within 48 hours after the injury and were able to obtain only minor surgical aid and only 9% cases died after 48 hours of the injury receiving definitive surgical treatment.

**Key Words:** Cranio-cerebral injuries, Fatal vehicular accidents, Pedestrians, RTA

### Introduction:

The term 'ACCIDENT' has been defined as an occurrence in the sequence of events which usually produces unintended injury, death or property damage. [1] It is also defined as "an unexpected, unplanned occurrence which may involve injury". [2]

Among all types of accidents, those caused by motor vehicles claims the largest toll of life and tend to be the most serious.

Over 1.2 million people die each year on the world's roads and between 20 and 50 million suffer non-fatal injuries. Over 90% of the world's fatalities on the roads occur in low-income and middle-income countries, which have only 48% of the world's registered vehicle (WHO, 2004).

The most of such deaths are among "vulnerable road users" such as pedestrians, pedal cyclists and motorcyclists. [3] Developing countries bear the brunt of the fatalities and disabilities from road traffic crashes, accounting for more than 85% of the world's road fatalities.

### Corresponding Author:

<sup>1</sup>Senior Resident,  
Department of Forensic Medicine,  
All India Institute of Medical Sciences, New Delhi  
E-mail: drsanjayh2022@gmail.com

<sup>2</sup>Prof. & HOD, Dept. of Forensic Medicine,  
Patna Medical College & Hospital, Patna  
DOR: 27.11.2013 DOA: 23.05.2014

About 90% of the total disability adjusted life years (DALYs) lost due to road traffic injuries. The problem is increasing in these countries at a fast rate, while it is declining in all industrialized nations.

During 1990s road traffic injuries ranked ninth among the leading cause of deaths in the world and predicted to become third most major cause by the year 2020. [4]

Accidents have their own natural history and follow the same epidemiological pattern as any other disease- i.e. the agent, the host and the environment interacting together to produce injury or damage. The important human factor could be lack of adequate traffic planning and consumption of alcohol. Accidents occur more frequently in certain age-groups, at certain times of day and week and at certain localities.

Some people are more prone to accidents than others and susceptibility is increased by the effect of alcohol and other drugs as well as physiological state such as fatigue. Besides these many of the psychological circumstances in which accidents occur are still poorly known. [1]

The steep rise in vehicular accidents in present era is the result of urbanization and tremendous growth in road transport sector. Population explosion is a catalyzing factor for a number of accidents. Since accidents are multifactorial, they call for an intersectoral approach to both prevention and care of the

injured. The fatalistic attitude in the form of widespread belief that accidents are inevitable must be curbed as majority of accidents are preventable.

### **Materials and Methods:**

The present prospective study was conducted in Department of Forensic Medicine, Patna Medical College and Hospital, Patna from 01-09-2007 to 31-04-2009. During that period out of 3929 autopsies, 100 cases of road traffic accidents were selected for the present study.

The relatives of the victims of the accidents and accompanying police were interviewed to obtain the information about the circumstances leading to death.

A performa specially designed for this purpose was used at the time of autopsy. The details about the victim regarding the name, age, sex, address, date, time and place of death, type of vehicle involved and the cause of sustaining the injury were noted from the police records. Position of the victim during accident (driver/pedestrian/occupant) was noted.

Postmortem (both external and internal) findings were recorded in the same performa and analyzed.

### **Observations:**

In our study maximum percentages of cases (72%) were from urban area i.e. fatal RTAs were more common in urban area than rural area. (Fig. 1) Highest fatality (30%) was found in the 20-29 years age group and lowest in the old age group (61-80 years). Fatal RTAs were common in males (82%) compared to females (18%) with male to female ratio 4.5:1. (Table 1) Present study showed that maximum victims were pedestrians (66%) followed by occupants of heavy vehicles (22%) and cyclists (12%). (Fig. 2) In 30% cases death was instantaneous, out of which only 8 cases had other major injuries in association with the cranio-cerebral injury. (Table 2)

In this study 65% cases died within 48 hours after the injury and were able to obtain only minor surgical aid or hospital observation and only 9% died after 48 hours of the injury receiving definitive surgical treatment.

In 86% of cases death was due to cranio-cerebral injuries alone and in 14% cases it was associated with injuries sustained in other parts of the body. (Table 3)

The postmortem examination was done within 24 hours after death in 92% cases and in 4% cases it was delayed beyond 36 hours. (Table 4) In our study 71% cases had fracture of the skull bones. Fracture vault of skull was found in 61.97% cases and in 29.58% cases both the

vault and base were involved. Fissured fracture was found in 63.64% cases and comminuted type in 16.89% of cases. Temporal region had highest number (50) of fractures. The right side slightly more involved than the left. (Fig. 3)

Intracranial bleeding was observed in 98 cases, mostly having subdural and extra-dural hemorrhage together (53 cases). Subdural hemorrhage was seen in 33% cases. (Table 5) In associated injuries, chest (ribs, lungs, sternum, Heart) was found to be involved most. (Table 6) Maximum number of cases were during the summer season (March to June) and minimum during the rainy season (July to October). (Fig. 4)

### **Discussion:**

Present study shows that the sex wise distribution of incidence of fatal cranio-cerebral injuries is of male preponderance. Out of 100 cases of fatal Cranio-cerebral injuries observed in the present series there were 82 males and 18 females. The preponderance of males over the females has also been recorded by various authors. [5-7]

This male preponderance can be explained by the fact that in a common Bihari family females are much less exposed to vehicular as they mostly remain indoors as compared to the males who on the contrary usually remain outdoors in numerous everyday pursuits. The highest fatality has occurred in the age group of 20 to 29 years and lowest in the old age group. No case was recorded above 80 years of age. This young age predominance is consistent with other studies. [5, 8, 16]

In our part of India people of young age (20 to 29 years) are the ones who are mostly exposed to vehicular accidents in the form of pedestrians or cyclists or drivers of light motor vehicle. They usually have a craze for speed while driving and a disregard for the general traffic rules. Now-a-days the younger generation is the one which indulges most in alcohol or other forms of intoxication.

Season seems to have some influence over the incidence of fatal cranio-cerebral injuries in vehicular accidents. In the present series, the highest number (38%) has been found to have occurred in the summer season followed by the winter. This may be explained from the fact that during the summer months (March to June) people in this part of the country spend their time mostly outdoors.

Due to the intense heat in this part of the country, the physical and mental state of the drivers of vehicles are not at its best, resulting in error of judgment which frequently cause fatal

accidents. Compulsory air-conditioning of vehicles may contribute a lot in minimizing the number of fatalities. Higher incidence in summer is similar to the study of Biswas G et al. [9] However, study of Ravikiran et al [10] shows monsoon predominance.

Vulnerability of pedestrian as RTA victim is a common phenomenon in all study across the country. [5, 6, 8, 10-12, 15] In analytical study done by Salgado MS et al [16] also showed the highest fatalities in pedestrian. In this study also highest fatality was seen in pedestrians (66 cases) followed by vehicle occupant (22 cases) and cyclists (12 cases).

This pattern indicates that much more attention is needed for safety of pedestrian. One must bear in mind that in a developing country like ours most of the road users are pedestrians, majority of whom are illiterate or are totally unaware of traffic rules. There is no effort on the part of the government to educate the people of all ages about traffic rules and road safety.

Provision of foot-paths for the pedestrians should be made along the roads in order to minimize the high fatality in the pedestrians. Out of 100 cases of fatal vehicular accidents in this series, 86% cases died due to cranio-cerebral injuries alone and in only 14% of the cases it was associated with major injuries elsewhere in the body. (Table 3)

This high incidence of fatality in cases of cranio-cerebral injuries has also been reported by other workers. [5, 13, 16] Hence the role of helmet in two wheeler riders can be enforced for all practical purposes.

In our study the postmortem examinations of 92% of the fatal vehicular accident cases with cranio-cerebral injuries were done within 24 hours after the death of the victim. In only 4% of the cases it was delayed beyond 36 hours. Cases in which postmortem examination was delayed, it was either because the photographs of unknown cases were not taken or due to the delay in the transportation of the dead body from a distant site of accident.

Present study showed that 30% cases died instantaneously out of which 22 died due to cranio-cerebral injuries alone and eight had other major injuries in addition to it. The number of instantaneous death was found to be more than that of other study. [5, 6]

This finding reveals the poor state of cranio-cerebral injury management in hospitals of this part of the country. Patna Medical College is the only hospital with a full-fledged Neuro-surgical unit. By the time the unfortunate victims arrive here from the place of occurrence it is already too late.

Out of different types of fractures of the skull, encountered in cases of cranio-cerebral injuries due to vehicular accidents, Fissured fractures have been most frequently seen (63.64%) in the present series. Next were the comminuted fractures (16.89%). These findings were almost similar to that of Gupta S. et al. [5]

The remarkable point of our study was that 98% of the victims had intracranial hemorrhage and only 2% had none. The subdural variety has been found in 33% cases and subdural and extradural hemorrhage together has been found in 53% of the cases. This agrees with the observations of Singh H et al and Menon A et al. [8, 14]

Chest injury with fracture of ribs, clavicle and sternum and rupture of the lungs and heart are associated with the cranio-cerebral injuries in the highest number of cases. They were followed by the fatal abdominal injuries with rupture of the liver, spleen, kidney and the G.I.T.

### Conclusion:

The first recorded pedestrian accident was in Britain in 1896, where a man was killed by a car traveling at 4 miles/hour. Today hundred times the number of vehicles that were playing in 1896, travel at speed of nearly 100 miles/hours. This comparison is enough to throw light on rate of increase in road traffic accidents.

In our study, the triad of middle aged-male pedestrians being most accident prone is very significant which other authors have also revealed. This is good indicator for a faulty traffic management system where pedestrian safety is always overlooked.

The finding that majority of the fatal victims of cranio-cerebral injury of road traffic accidents died on the spot of within twenty four hours of accident highlights the prevalent poor traumatic management infrastructure.

Hence, improvement of road surface infrastructure, strict compliance with road safety rules by drivers & pedestrians, rapid emergency services & establishment of trauma care centers are major factors to reduce this hazard.

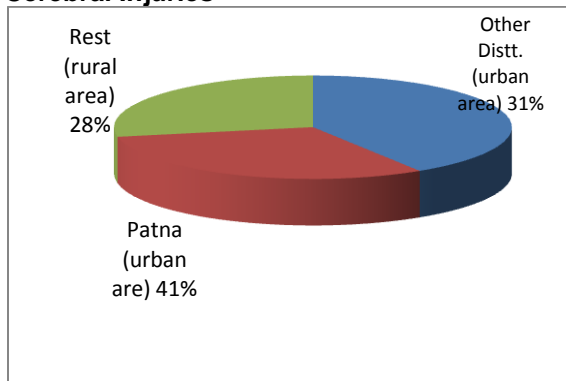
There needs to be a proper national reporting system of road traffic accidents so that an overall picture can be drawn for proper traffic management planning.

### References:

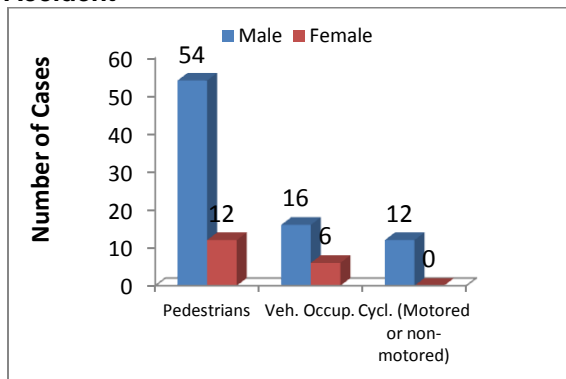
1. Park's Textbook of Preventive & Social Medicine. 19<sup>th</sup> edition 2007: p 340-345.
2. Hogarth, J. Glossary of Health Care Terminology, WHO, Copenhagen (1978).
3. WHO (2004), The World Health Report 2004, Changing history: ROAD Safety is no Accident: <http://www.thinkroadsafety.gov.uk> , accessed on 02-08-2007.

4. Murray C J L and Lopez A D. The global burden of disease. World Health Organization and World Bank. Harvard University Press, 1996 USA.
5. Gupta S, Deb P K, Moitra R, Chhetri D. Demographic study of fatal cranio-cerebral road traffic injuries in North Bengal region. JIAFM 2007; 29(1); 25-27.
6. Chavali K H, Sharma B. R, Dasari H, Sharma A. Head Injury: The principal killer in RTA. JIAFM 2006; 28 (4); 121-124.
7. Kaul A, Shina S, Pathak YK, Singh A, Kapur AK, Sharma S, Singh S. Fatal RTA, Study of distribution ,nature & type of injury. JIAFM 2005;27(2); 71-76.
8. Singh H, Dhatarwal S.K, Mittal S, Aggarwal A, Sharma G, Chawla R. A review of pedestrian traffic fatalities. JIAFM 2007; 29(4); 55-57.
9. Biswas G, Verma S K, Sharma J.J., Agrawal N.K. Pattern of road traffic accidents in North - East Delhi. J. Acad. Forensic Med. Toxicology. 2003;20(1); 27-32.
10. Ravi Kiran E, Saralaya K M, Vijaya K. Prospective study on RTA. J. Punjab Acad. Forensic Med. Toxicology. 2004; 4(1); 12-16.
11. Pathak A, Desania N L, Verma R. Profile of road traffic accidents and head injury in Jaipur (Rajasthan). JIAFM 2007; 30 (1); 6-9.
12. Kochar A, Sharma G K, Murari A, Rehan H S. Road traffic accidents and alcohol: A prospective study. Int. J Med Toxicology. Leg Med.2002; 5(1); 22-24.
13. Dillon. S, Kapila. P, Shekhon H.S. Pattern of injuries in road traffic accidents in Shimla hills. J Punjab Acad. Forensic Med. Toxicol.2007;7(2); 50-53.
14. Menon A, Pai VK, Rajeev A. Pattern of fatal head injuries due to vehicular accidents in Mangalore. J. For. Leg Med 2008;15; 75-77.
15. Sharma et al. Fatal road traffic injuries in Northern India: Can they be prevented? Trends in Medical Research.2007; 2(3); 142-148.
16. Salgado M.S., Colombage S.M. Analysis of fatalities in road accidents. Forensic Sci. Int. 1988, Jan: 36(1-2); 91-96.

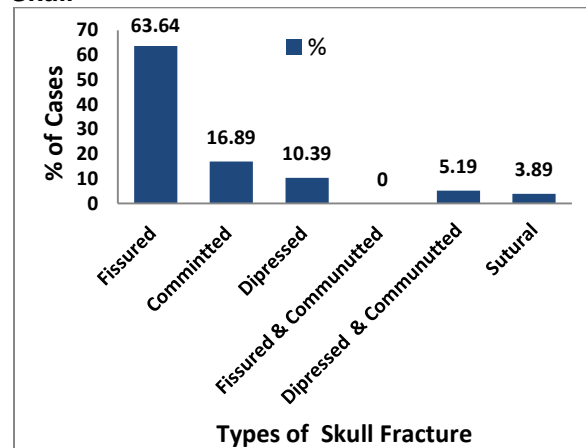
**Fig. 1: Regional Incidence of Fatal Cranio-Cerebral Injuries**



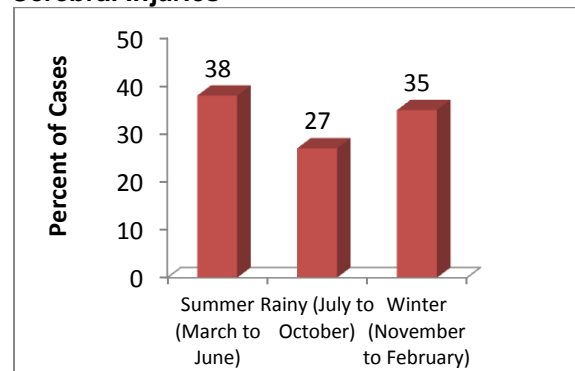
**Fig. 2: Types of Road Users Involved in the Accident**



**Fig. 3: Various Types of Fractures of the Skull**



**Fig. 4: Seasonal Incidence of Fatal Cranio-Cerebral Injuries**



**Table 1: Age and Sex Wise Distribution**

Age (yrs)	Cases	Male	Female
0 – 9	10	9	1
10 – 19	12	10	2
20 – 29	30	27	3
30 – 39	17	13	4
40 – 49	14	9	5
50 – 59	12	11	1
60 – 69	4	2	2
70 – 79	1	1	0
>80	0	0	0
Total	100	82	18

**Table 2: Instantaneous death due to Vehicular Accidents**

Cause of deaths	Cases
Instantaneous deaths due to cranio-cerebral injuries alone	22
Instantaneous deaths due to cranio-cerebral injuries in association with other major injuries	8
Total	30

**Table 4: Time Elapsed Since Death during Postmortem Examination**

Time (hours)	Cases	Percentage
Immediate	-	-
Approximately 6 hrs	4	4.0
Approximately 12 hrs	6	6.0
Approximately 18 hrs	5	5.0
Approximately 24hrs	77	77.0
Approximately 36 hrs.	4	4.0
More than 36 hrs	3	3.0
More than 48 hrs	1	1.0
Total	100	100.0

**Table 5: Various Types of Intracranial Hemorrhage**

Hemorrhage	Cases	Percentage
Extradural alone	2	2.0
Subdural alone	33	33.0
Subarachnoid alone	0	0.0
Intracerebral alone	2	2.0
Extradural and subdural	53	53.0
Subdural and Intracerebral	1	1.0
Subdural and subarachnoid	1	1.0
EDH, subdural and subarachnoid	1	1.0
Crush	5	5.0
No intracranial hemorrhage	2	2.0
Total	100	100.0

**Table 6: Major Injuries of Different Organs in Association with Cranio-Cerebral Injuries**

Organ involved	Cases
Rupture of the lungs	20
Rupture of liver	8
Rupture of spleen	4
Rupture of kidney	3
Rupture of G.I.T.	3
Rupture of the heart	5
Fracture of pelvis	3
Fracture of lower limbs	16
Fracture ribs	20
Fracture sternum	8
Fracture facial bones	13
Fracture of the vertebra	2
Fracture of upper limbs	2
Fracture clavicle	3

**Table 3**

**Incidence of Cranio-Cerebral Injuries in relation to other Regional Injuries in Both Sexes**

Total cases	Death due to cranio-cerebral injuries alone			Death due to cranio-cerebral injuries in association with major injuries elsewhere		
	Male	Female	Total (%)	Male	Female	Total (%)
100	70	16	86(86)	12	2	14(14)

**Dear Delegates you are cordially invited to attend**

**XIII<sup>th</sup> National Conference of Indian Congress of Forensic Medicine & Toxicology (ICFMT-2014)**

***Theme: Heinous Crimes & Human Rights Violation against Women and Children: Need for a Proactive Forensic Approach***

**Date: 12<sup>th</sup> & 13<sup>th</sup> September, 2014**

**&**

**National Pre- Conference CME on 11<sup>th</sup> September 2014**

**Organized by: Department of Forensic Medicine & Toxicology,  
School of Medical Sciences & Research, Sharda University,  
Greater Noida, G.B. Nagar, U.P. PIN: 201310**

**Organizing Secretary**  
Prof. (Dr.) Mukesh Yadav  
**Mob: 91-8527063514**

**Co-Organizing Secretary**  
Prof. (Dr.) Pooja Rastogi  
**Mob: 91-9560234171**