

# Fatal road traffic accidents and their relationship with head injuries: An epidemiological survey of five years

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**Abstract:** In depth studies of fatal vehicular accidents provide valuable data for implementing effective emergency services to reduce the trauma related mortality and strengthening legal measures in peak hours of fatal accidents. We aimed to study, pattern of injuries especially fatal traumatic brain injuries occurring in vehicular accidents. Postmortem reports and clinical records of victims of road traffic accident autopsied during the period of 2001-2005 at Department of Forensic Medicine and Toxicology, All India Institute of Medical Sciences, New Delhi, were analyzed retrospectively. Out of total 7008 medico legal autopsies conducted during the study period, 2472 (35.27 %) were of vehicular accidents. The male/female ratio was 7.49:1. Commonest age group affected was between 21-40 years involving 1341 (54.24%) cases. Pre-hospital mortality was in 985 (39.84 %) cases. Fatal traumatic brain injuries were seen in 1699 (68.73%) cases. Skull fractures were found in 1183 (69.63%) cases of head injury; most common bone fractured was temporal bone (n=559, 47.25%). The commonest variety of intracranial hemorrhage was subdural hemorrhage (n=1514, 89.11%). The craniotomy was done in 297 (17.48%) cases; maximum mortality (41.07%) was seen within 4-14 days. Most commonly injured abdominal organ was liver (n=532, 21.52%). No significant difference was evident in incidence of fatal vehicular accident on weekends and weekdays. However November month took maximum toll of deaths (n=273, 11.04%) of total vehicular accident fatalities in five year duration. 53.20% of fatal accident occurred between 6 PM and 6 AM. The results of study emphasize the need to improve the pre hospital care with provision of trauma services at site and to establish neurosurgical facilities with trauma registry.

**Keywords:** fatal vehicular accidents, fracture, head injury

## INTRODUCTION

Road traffic injuries account for 2.1% of global mortality. The developing countries bear a large share of burden and account for about 85% of the deaths as a result of road traffic crashes<sup>1</sup>.

India accounts for about 10% of road accident fatalities worldwide<sup>2</sup>. Road accident contributed 30.2 percent to all kind of natural and unnatural accidental deaths during 2005<sup>3</sup>. According to the Institute of Road Traffic Education (2006) Institute of road education, New Delhi, out of the estimated 1.4 million serious road accidents/collisions occurring annually in India, hardly 0.4 million are recorded<sup>4</sup>. This indicates that the surveillance system for vehicular accidents is not well established in India.

Epidemiological data on road traffic accidents in India have been reported but there is no proper correlation with head injury. The earlier study correlating head injury

with road traffic accidents in Delhi was done in 1979<sup>5</sup>, since then there have been significant social and demographic changes including changes in life style, population and number of vehicles. Continuous growth in number of motor vehicles, increase in population and poor access to health care are some of the important factors in fatalities due to vehicular accidents. As per census 2001, the total population of Delhi was 1.34% (13.78 Million) of all India population with average annual population growth rate of 3.81%<sup>6</sup>. The ratio of road area to total area of Delhi city is 21% as compared to 23% in London and 25% in Paris. There has been significant growth in number of motor vehicles from 241 (1996-1997) to 317 (2006-2007) per 1000 population. Majority of vehicles were two wheelers. The road length has been reduced from 2.06 (2000-2001 to 1.88 (2006-2007) km per 1000 population and 8.45 (2000-2001) to 5.90 (2006-2007) km per 1000 vehicles<sup>7</sup>.

The present study was therefore conducted to ascertain the incidence of fatal vehicular accidents and patterns of injuries with emphasis on traumatic brain injuries amongst RTA victims brought to a tertiary care hospital in Delhi.

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**MATERIAL AND METHODS**

All the deaths due to road traffic accidents occurred at AIIMS, during the period 2001-2005 (5 Years) were retrospectively analyzed. The detailed analysis of these cases was based on the inquest report, medical records and evaluation of autopsy reports.

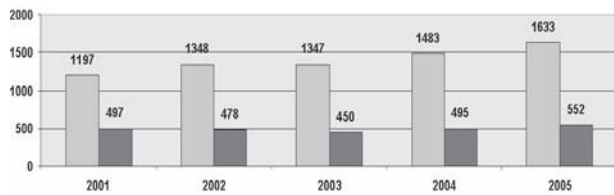


Fig 1: Yearly distribution of total medico legal cases autopsied (Blue Bar) and fatal vehicular accidents (Red Bar)

**OBSERVATIONS**

Out of 7008 medico legal autopsies conducted during the study period, 2472 (35.27%) were of vehicular accident fatalities (Figure-1). Males comprised 88.22% of the total fatalities, while females accounted for 11.77% (Figure-2). Unclaimed or unidentified cases comprised 108 cases (4.40%). The age group between 21-30 years was the most vulnerable (n=842, 34.06%) of the total cases followed by the age group 31-40 years (n=499, 20.18%) and 41-50 years (n=358, 14.48%). Accordingly, the highest number of fatalities (54.24%) was in the 21-40 year age group. Children below 10 years comprised 5.09 % of the total fatalities (Figure- 3). A large proportion of the victims (n=985, 39.84%) died on the spot while 28.51% (n=705) died within 24 hrs of the accident. On adding up these figures, 1690 cases (68.35%) of the victims either died on the spot or within 24 hrs of the accident. Two hundred and nine cases (8.47 %) survived for 4-7 days & 218 cases (8.82%) survived for 8-14 days (Figure-4).

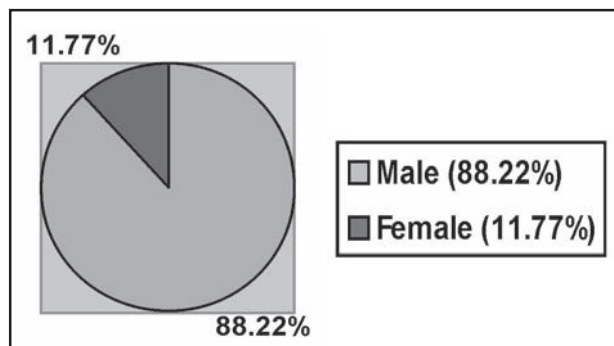


Fig 2: Showing Sex distribution of cases of Fatal Vehicular Accidents (2001-2005)

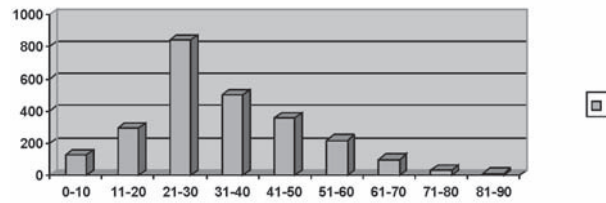


Fig 3: Age distribution of fatal vehicular accident victims (2001-2005)

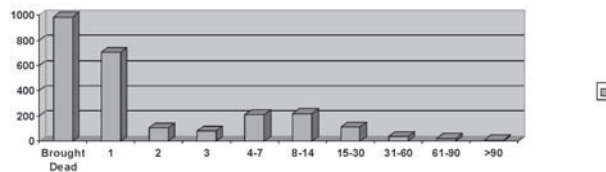


Fig 4: Survival time of Fatal Vehicular Accidents (2001-2005)

**Head Injuries**

Out of total number of 1699 cases (68.73 %) who sustained head injury, 779 cases (31.51 %) sustained head injury without any significant injury to other parts of the body [Table-1]. Skull fractures were found in 1183 (69.63 %) cases of head injury. The most common bone involved was the temporal bone 559 (47.25 %), followed by parietal bone (45.47 %), occipital bone (41.01%) and frontal bone (33.64%). Fracture of sphenoid bone was present in 237 (20.03 %) cases. In 72.53 % cases with intracranial hemorrhage there was associated skull fracture [Table-2]. The commonest variety of intracranial

Table 1: Death due to injury in fatal vehicular accidents (2001-2005)

Injury	No.	%
Head alone	779	31.51
Head + other	920	37.21
Other	773	31.27

Table 2: Incidence of skull fracture in total head injury cases (n=1699) due to fatal vehicular accidents (2001-2005)

Fracture	No.	%
<b>Total cases of skull fractures</b>	<b>1183</b>	<b>69.63</b>
<i>Bone involved</i>		
Temporal	559	47.25
Occipital	497	42.01
Parietal	538	45.47
Frontal	398	33.64
Sphenoid	237	20.03
Base of skull	787	66.52

haemorrhage was subdural haemorrhage (n=1514, 89.11%) followed by Subarachnoid haemorrhage (n=1240, 72.98 %). Extradural haemorrhage was present in 344 cases (20.25 %) [Table-3].

Table 3: Pattern of cranial trauma

Injury	No.	%
Head injury	1699	68.79
Skull fracture	1183	69.63
Intracranial haemorrhage		
Subdural	1514	89.11
Subarachnoid	1240	72.98
Intracerebral	282	16.60
Extradural	344	20.25
Brain laceration	272	16.01

In 297 (17.48 percent) patients of head injury, craniotomy was performed. 34.67 % of these patients died within 48 hrs. Maximum mortality (41.07 %) occurred within 4-14 days which again is a pointer to the severity of the head injury [Figure-5].

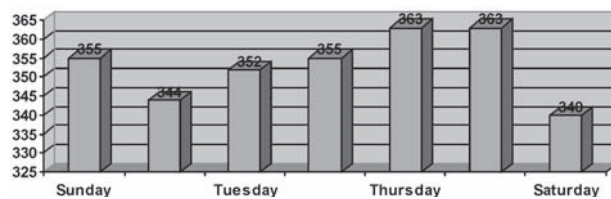


Fig 5: Bar Chart showing incidence of fatal vehicular accidents by day

Among other injuries, contusion and laceration of lungs were present in 558 cases (22.57%). Heart was contused & lacerated in 4.33 % cases (n=107). Most commonly injured abdominal organ was liver (n=532, 21.52 %) followed by kidney (n=262, 10.59%). Ribs were the commonest bone to fracture (n=831, 33.62%) followed by long bones of lower limbs (n=515, 20.83%), pelvic bone (n=378 16.29%) and upper limbs (n=270, 10.92 %) [Table-4].

An effort was also made in the present study to find out any correlation between numbers of vehicular accident occurring on a particular day [Figure-6] of a week. No significant difference was evident in incidence of vehicular accident on weekends and weekdays. Maximum number of deaths was observed in the month of November (n=273, 11.04%) [Figure-7].

Table 4: Incidence of regional injuries in fatal vehicular accident victims (2001-2005)

Injury	No.	%
<i>Soft tissue injuries</i>		
Lungs	558	22.57
Heart	107	4.33
Liver laceration	532	21.52
Spleen	233	9.42
Kidney	262	10.59
Intestine	143	5.78
<i>Bony injuries (fractures)</i>		
Ribs	831	33.62
Clavicle	198	8.00
Sternum	95	3.84
Spine	157	6.35
Facial bones	237	9.59
Pelvis	378	15.29
Upper limbs	270	10.92
Lower limbs	515	20.83

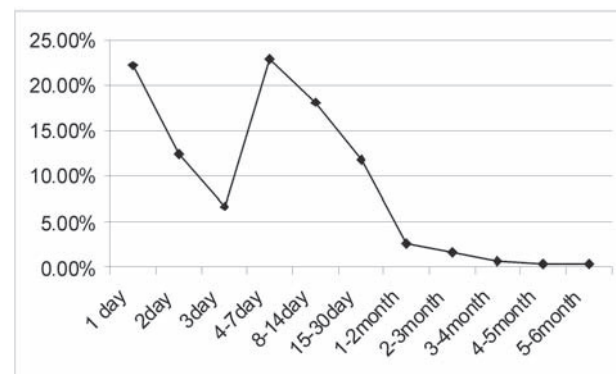


Fig 6: Duration of Survival in patients undergoing craniotomy (post-mortem data 2001-2005)

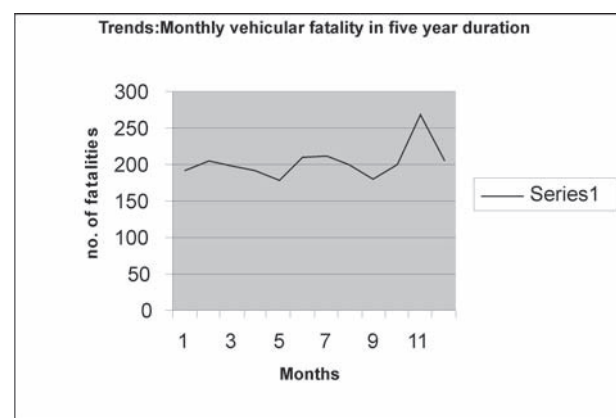


Fig 7: Monthly vehicular fatality in five year duration (2001-2005)

In the present study, 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.

## DISCUSSION

In our present study total vehicular accident fatalities comprised 2472 (35.27 %) out of total 7008 medico legal cases autopsied during five years (2001 to 2005). For last four years the percentage of vehicular accident fatalities has remained almost constant.

Not surprisingly our study shows the overwhelming majority of the deceased (88.2%) were males. It is due to greater male exposure on urban streets and similar higher incidence of traffic accidents among males has been found by many other researchers<sup>8-13</sup>.

The most common age group affected in the study was between 21-40 years (n=1341, 54.24%) and is consistent with the studies available from India and other countries<sup>5,8-10,12-13,15</sup>. The age group 20-40 years is the most active phase of life, physically and socially, and hence outnumbers the other road users. They, therefore account for the maximum number of accidental deaths. Considering the maximum involvement of individuals in the economically productive years, vehicular collision fatalities may have an important economic impact. Preventive measures targeting at these high-risk groups are important to reduce the incidence of severe TBI.

The most commonly injury was to the head (69.63 %) followed by chest (33.62%). Similar observations were reported in studies from Iran and USA<sup>16,17</sup>. Out of total 1699 cases (68.73 %) who sustained head injury, 1183 cases (69.63%) had a fatal skull fracture. Similar findings were seen in few other studies<sup>18,19</sup>.

Most commonly found intracranial haemorrhage was subdural haemorrhage (89.11 %) which is consistent with the findings by other researchers<sup>19,20,21</sup>.

Pre-hospital mortality was found to be in 985 cases (39.84%). The rest (64.16 %) were taken to hospital where later they succumbed to their injuries. This is consistent with the study conducted in Iran<sup>16</sup>.

No significant variation was evident in the incidence of fatal vehicular accidents by days of a week in our study. This pattern differs from earlier study conducted in Delhi<sup>22</sup> according to which highest numbers of accidents were on Saturdays. In the study conducted in

Nepal<sup>13</sup> highest numbers of vehicular accidents were observed on Sundays and lowest on Mondays. National Injury Mortality Surveillance System (2004) reported that most of the transport related deaths occurred on Saturday (20.8 percent) followed by Sunday (17.1 percent)<sup>23</sup>.

Maximum number of fatal accident took place in November months (11.04%) in present study. In Nepal, maximum numbers of cases were reported in July followed by January<sup>13</sup>. In the earlier studies conducted in Delhi<sup>22-24</sup> reported maximum numbers of victims were seen in January month. National Crime Record Bureau (2005)<sup>3</sup> has reported higher incidence of road accidents during May (10.3%) and March (9.3 %) in India with the peak time between 3 PM to 6 PM.

In the studies conducted in Mangalore and Kathmandu (Nepal)<sup>19,25</sup> most of the accidents had taken place during the afternoon and evening hours. In our study maximum incidence of vehicular accidents are reported in evening hours. This difference in the peak is quite suggestive that fatal vehicular accidents had different temporal correlation with time, day and month as compared to nonfatal vehicular accidents.

## CONCLUSIONS

This study shows that most of the deaths in road traffic accidents, brought to a tertiary care hospital of South Delhi, take place either on the spot or within 24 hours of injury which is very alarming and highlights the need for taking urgent steps for establishing good pre-hospital care and provision of trauma services at site in India. Our study also shows that head injuries remain the most common and serious type of trauma seen in emergency department of our hospital and availability of good neurosurgical care is essential for these patients. A nationwide computerized trauma registry is urgent required to bring out the risk factors, circumstances, chain of events leading to the accidents and will be extremely helpful in policy making and health management at the national level in India.

## REFERENCES

1. M Peden, L Sminkey. World Health Organization dedicates World Health Day to road safety. *Inj Prev* 2004; 10:67.
2. Institute of Road Traffic Education, a nongovernmental organization based in New Delhi. <http://www.newsindia-times.com/2002/09/13/med30-poor.html> as accessed on 21<sup>st</sup> May 2008.

3. NCRB (2005). National crime records bureau, Ministry of Home Affairs, Govt. of India.
4. <http://www.irte.com/crashlabs.htm> as accessed on 21st May 2008.
5. Chandra J, Dogra TD and Dikshit PC. Pattern of cranio-intracranial injuries in fatal vehicular accidents in Delhi, 1966-76. *Med Sci Law* 1979;19 : 188-94.
6. Economic Survey of Delhi 2001-02. Planning Department, Government of National Capital Territory of Delhi, Demographic Profile, Chapter-3, 14-25.
7. Economic Survey of Delhi 2007-08. Planning Department, Government of National Capital Territory of Delhi, Transport, Chapter-12.
8. Salgado MSL, Colombage SM . Analysis of fatalities in road accidents. *Forensic Sci Int* 1998; 36; 91-6.
9. Sahdev P, Lacqua MJ, Singh B, Dogra TD. Road Traffic fatalities in Delhi: causes, injury patterns and incidence of preventable deaths. *Accid Ann Prev* 1994;26: 377-84.
10. Friedman Z, Kungel C, Hiss J, Margovit K, Stein M, Shapira S . The Abbreviated injury scale – a valuable tool for forensic documentation of trauma. *Am J Forensic Med Pathol* 1996;17: 233-8.
11. Henriksson EM, Ostrom M, Eriksson A. . Preventability of vehicle-related fatalities. *Accid Ann Prev* 2001;33: 467-75.
12. Sharma BR, Harish D, Sharma V, Vij K. Road Traffic accidents – a demographic and topographic analysis. *Med Sci Law* 2001 ;41: 266-74.
13. Jha N, Agrawal CS, Epidemiological Study of Road Traffic Accident Cases: A Study from Eastern Nepal. Regional Health Forum WHO South-East Asia Region, 2004;8(1): 15-22.
14. Malhotra C, Singh MM, Garg S, Malhotra R, Dhaon BK, Mehra M. Pattern And Severity Of Injuries In Victims Of Road Traffic Crashes Attending A Tertiary Care Hospital Of Delhi *Anil Aggrawal's Internet Journal of Forensic Medicine and Toxicology*, 2005; Vol. 6, No. 2 (July - December 2005)
15. BL Meel. Trends in fatal motor vehicle accidents in Transkei region of South Africa. *Med Sci Law* 2007; 47: 64-8.
16. Montazeri A. Road-traffic-related mortality in Iran: a descriptive study. *Public Health* 2004 ; 118:110-3.
17. Friedman R, Harris JP, Sitzer M, Schaff HB, Marshall L, Shackford S. Injuries related to all-terrain vehicular accidents: a closer look at head and neck trauma. *Laryngoscope* 1988;98:1251-4.
18. Elesha SO, and Daramola AO. Fatal head injuries: the Lagos University Teaching Hospital experience (1993-1997). *Niger Postgrad Med J* 2002; 9:38-42.
19. Menon A, Pai VK, Rajeev A. Pattern of fatal head injuries due to vehicular accidents in Mangalore. *J Forensic Leg Med* 2008 ;15:75-7.
20. Akang EE, Kuti MA, Osunkoya AO, Komolafe EO, Malomo AO, Shokunbi MT, Amutta SB. Pattern of fatal head injuries in Ibadan—a 10 year review. *Med Sci Law* 2002 ;42:160-6.
21. Freytag E. Autopsy findings in head injuries from blunt forces: statistical evaluation of 1367 cases. *Arch Pathol* 1963;75: 402-13
22. Mehta SP. An epidemiological study of road traffic accident cases admitted in Safdarjang Hospital, New Delhi. *Ind J Med Res* 1968; 56:456-66.
23. A profile of fatal injuries in South Africa, 6th Annual Report of the, National Injury Mortality surveillance System, Published by the Medical Research Council/UNISA-Crime, Violence and Injury Lead Programme, 30 November 2005
24. Ghosh PK. Epidemiological study of the victims of vehicular accidents in Delhi. *J Ind Med Assoc* 1992; 90: 309-12.
25. Bantia P, Koirala B, Rauniyar A, Chaudhary D, Kharel T, Khadka SB. An epidemiological study of road traffic accident cases attending emergency department of teaching hospital. *J Nepal Med Assoc* 2006 ;45:238-43)