

## Original Research Article

# Pattern of head injury in central India population

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**Received:** 19 May 2017

**Accepted:** 17 June 2017

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### ABSTRACT

**Background:** In India, the developing economy and growing population simultaneously made a strong impact on increase in motor vehicle population. This increase in motorization has some adverse effects such as increase in road accidents with economic and functional loss. Head injury is the most common cause of mortality in road traffic accidents. The aim of this study was to know the incidence, pattern, mechanism, mode of head injury along with its distribution in relation to site of vault fracture and intracranial hemorrhage.

**Methods:** Total 391 post-mortem cases of head injury were enrolled during study period. The information regarding age, sex, residence, marital status, date and time of time of accident and of death was gathered from police inquest report, relatives, dead body challan and clinical details from hospital records. During autopsy, detailed examination was carried out and data regarding both external and internal injuries were carefully recorded and analyzed.

**Results:** The peak incidence of head injury was observed in the age group of 21-30 years. Most of deceased were from early age group and the male deceased were more than females. Majority victims of head injury were from road Traffic Accidents followed by fall from height, railway accidents and assault. Fissured fracture of vault was found in almost half cases. Subdural and subarachnoid hemorrhage were the most common one we encountered.

**Conclusions:** Head injury due to RTA is well known public health problem causing death and disability. It is required from concerned government authority to take appropriate and immediate measures for reducing the incidence of head injury.

**Keywords:** Head injury, Intracranial haemorrhages, Road traffic accidents, Skull fractures

### INTRODUCTION

In India, the developing economy and growing population simultaneously made a strong impact on increase in motor vehicle population. This increase in motorization along with expansion of the road network has brought not only rural economic development in India but also some adverse effects such as the increase in

road accidents.<sup>1</sup> Road traffic injuries (RTI) ranked fourth among the leading causes of death in the world.<sup>2</sup> Almost 1.3 million people die in road traffic accidents (RTA) every year and 20 to 50 million people suffer non-fatal injuries, with many sustaining a disability because of their injury. According to the fourth UN global road safety week held on 8-14 May 2017, with the theme "speed management" 328,000 people dying on the roads

every year, making it leading cause of death for those aged 15-49 years and cost countries 1-3% of their gross domestic product (GDP).<sup>3,4</sup> The most prominent and vulnerable part of human body is head which made it more vulnerable for injury in road traffic accidents.<sup>5</sup> Head injury has been defined as a morbid state resulting from gross or subtle structural changes in the scalp, skull, and/or the contents of the skull, produced by mechanical forces.<sup>6</sup> Most common vehicular accidents happen with two wheelers as they constitute main vehicle fleet in India.

Depending upon whether the dura matter was torn or not, the head injury may be termed as open or closed type.<sup>7</sup> The extent and degree of injury to the skull and its content is not necessarily proportional to the quantum of force applied to the head. According to Munro, any type of cranio-cerebral injury is possible with any kind of blow to head.<sup>8</sup>

The objective of this study were to determine the pattern of head injury and to study the mechanism of head injury. To demonstrate the mode or causation of head injury. To study the incidence of head injury in relation to age, sex and etiology and to know diverse types of intracranial lesions, their frequency and relation with the mode of injury.

**METHODS**

The present study was carried out in the department of forensic medicine and toxicology, tertiary care hospital, central India population, Maharashtra, India during the period from 1 January 2012 to 31 December 2012. All cases brought for post-mortem examination at mortuary with history of road traffic accident, railway accident, and accidental fall or homicides with head injury are included in the study. The information regarding age, sex, residence, marital status, date and time of accident and of death were gathered from police inquest report, relatives,

dead body challan and clinical details from hospital records. During autopsy, detailed examination was carried out and data regarding both, external and internal injuries were carefully recorded analyzed.

**RESULTS**

It was a cross sectional, observational study with a duration of one year. Total 391 cases were enrolled fulfilling the inclusion criteria. Table 1 shows age and sex distribution in head injury cases. The peak incidence was observed in the age group 21-30 years comprising 36.57% of the cases. It was also observed that 22.25% cases belong to the age group 31-40 years. Thus, 58.82% cases comprised of age group 21-40 years. Individuals in the age group 0-10 years were the least affected i.e. 4.35% of total cases. Out of 391 cases, 263 (67.26%) were males while 128 (32.74%) were females. Thus, overall gender ratio for male to female was 2.05:1. So, most of deceased were from early age group and the male deceased were more than females.

Distributions of diverse types of modes involved in head injury are shown in Figure 1. Majority of victims were of road traffic accidents (205 cases, 52.43%) followed by fall from height (FFH) 74 cases, 18.93%), railway accidents (60 cases, 15.35%) and assault (20 cases, 8.44%). So, in both; males and females, most common reason of head injury is similar i.e. road traffic accident. Majority of victims who died from head injury had association with injuries to thoraco-abdominal area and extremities which comprise 50.64% of total cases. Only 15.86% deceased showed head injury without any other detectable body injury. Pedestrians, two-wheeler and three-wheeler users sustained maximum injuries on extremities in association with head injury followed by injuries over head, neck and face (Table 2). Closed head injury was observed in 281 cases (71.87%) while open head injury with torn dura matter was observed in 110 cases (28.13%).

**Table 1: Age and sex-wise distribution of head injury.**

Age	Male	%	Female	%	Total	%
0-10	12	3.07	5	1.28	17	4.35
11-20	36	9.21	16	4.09	52	13.30
21-30	97	24.81	46	11.76	143	36.57
31-40	58	14.83	29	7.42	87	22.25
41-50	23	5.88	11	2.81	34	8.70
>51	37	9.46	21	5.37	58	14.83
Total	263	67.26	128	32.74	391	100.00

Scalp was involved in almost all cases of head injury in the form of contusion, laceration, abrasion, under scalp hematoma or crush injury or combination of these

injuries. A fracture of skull vault was observed in 89 cases (99%).

**Table 2: Distribution of head injury cases.**

Type of injury	No. of cases	%
Head injury	62	15.86
Head, neck, face injuries	131	33.50
HI + other body injuries	198	50.64
Total	391	100.00

**Table 3: Distribution according to fracture of vault in head injury cases.**

Fracture of vault	Frequency	%
None	43	11.00
Fissured # of vault	105	26.85
Fissure # of base	19	4.86
Depressed	20	5.12
Comminuted	24	6.14
Fissured+depressed	29	7.42
Fissured # of vault and base	64	16.37
Fissured+depressed+comminuted	18	4.60
Depressed+comminuted	9	2.30
Crush	38	9.72
Craniotomy/ burr holes/ drain/ other surgical procedures	22	5.63
Total	391	100.00

# - fracture.

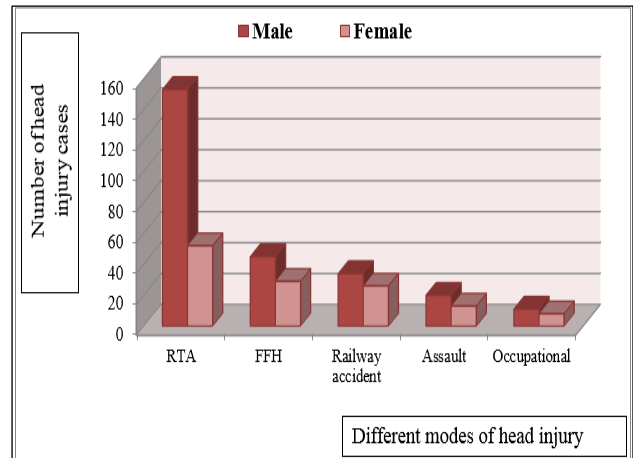
Distribution of types of vault fracture is summarized in the Table 3. In 11% cases, death occurred due to internal damage to brain without fracture of skull. Fissured fracture alone was observed in 48.08% cases, whereas skull vault was crushed in 9.72% cases. 22 cases were admitted and operated in the form of burr hole, craniotomy or any other surgical procedure but despite all effort died due to gravity of impact. Traumatic lesions to the brain were observed in 93.09% cases. Intracranial hemorrhages were observed in 9.79% victims.

**Table 4: Distribution of types of intracranial hemorrhages in head injury cases.**

Intracranial hemorrhages	Frequency	%
SAH	59	15.09
EDH	0	0.00
SDH	47	12.02
EDH+SDH	18	4.60
SDH+SAH	168	42.97
EDH+SDH+SAH	9	2.30
ICH	4	1.02
Other combination	52	13.30
SDH+SAH+ICH	7	1.79
Absent	27	6.91
Total	391	100.00

SAH- subarachnoid hemorrhage, EDH- extradural hemorrhage, SDH- subdural hemorrhage, ICH- intracerebral hemorrhage.

Table 4 shows intracranial hemorrhages seen either in combination or in isolation. Subdural and subarachnoid hemorrhages were the most common one we encountered.



**Figure 1: RTA-road traffic accidents, FFH-fall from height.**

**DISCUSSION**

India is a developing country where poverty and unemployment pushes people towards urbanized cities. This rapid and unplanned urbanization associated with incompetent traffic system, unplanned roads and highways, violation of traffic rules by drivers and pedestrians, overcrowding of people and vehicles, unlicensed rickshaws, reckless driving, etc. are responsible for highest rate of road traffic accidents.<sup>9</sup>

In this study, Males clearly outnumbered females with male to female ratio of 2.05:1. Similar findings were observed in other studies such as Thube et al, Patil et al, Shivkumar et al.<sup>10-12</sup> This gender bias could be because males work outdoor and hence are more commonly exposed to road traffic accidents, assaults and occupational injuries.<sup>13</sup> In the age group analysis of victims, maximum incidence was in age group of 21-30 years followed by 31-40 years and least in group 0 to 10 years. Similar findings were observed by other researchers<sup>13-18</sup> except Akang et and Lai et al who observed that the peak age of such victims was in fourth decade.<sup>19,20</sup> This could be because young adults are the prime bread earners of the family and remain outdoors during most of the day. Furthermore, young people are by nature indulge in more violent activities. People in extremes of the ages usually remain indoors whereas children are confined within residential premises only.<sup>13</sup>

Among head injury, the most common cause was road traffic accidents followed by fall from height. Similar findings are seen in studies done by Chen CL et al which showed 70% road traffic accidents, 15.3 % fall from height and assault in 8.7% cases.<sup>21</sup> Results of Kumar L et al and Kremer C et al do agree on the same.<sup>13,22</sup>

Homologous results were found regarding other accompanying injuries.<sup>10,23</sup> In majority of cases, (198; 50.64%) deceased head injury was associated with some other body surface injury followed by face and neck region involvement. Only 15.86% cases of head injury were present without any detectable body surface injury.

Scalp injury with skull fracture along with intracranial hemorrhage was the most common presentation of head injury. The predominance of contusion and laceration in scalp can be explained by the heavy blunt force, loose areolar space available for blood accumulation beneath scalp, minimal musculature of the scalp and the velocity of victim to fall on the ground.<sup>24</sup> Linear fracture of skull was the commonest type of skull fracture. Other researchers found the similar findings.<sup>10,12</sup> Commonest intracranial hemorrhage is subarachnoid hemorrhage followed by subdural hemorrhage as seen with study of Chandra et al because negligible impact is sufficient to cause subarachnoid hemorrhage.<sup>25</sup> Most of other researchers found subdural hemorrhage as a commonest type.<sup>9,14,24</sup>

The study showed that most head injury victims brought to a tertiary care hospital, were due to road traffic accidents and males are more prone to get injured. So, it warrants the urgency to establish good pre-hospital care and provision of efficient and prompt trauma services at road side to prevent mortality from RTA. RTA remains the most common cause for head injury and demands good neurosurgical care for such patients. Many deceased of fatal head injury happen in road traffic accident were not using helmets. These fatalities could be avoidable. By compiling the records of these injuries at national level or international level; one can underline risk factors involved in these accidents. This will be extremely helpful in the policy building and making the decisions for health promotion at national or international level.

This study has shown that traumatic brain injury (TBI) is one of the major causes of mortality and morbidity in our society. The result showed that road traffic accidents, mostly those involving motorcyclists are the most common cause of TBI during festival periods in our society. Traders are more affected than other occupations and most affected age group is the 20-30 years. This highlights the need for sensitization of our youth on the traffic rules and the need for safety measures, building and maintenance of roads by the government, implementation and enforcement of the road traffic rules by the federal road safety commission (FRSC) especially during the festival periods when the number of motorists and their recklessness are expected to be on the rise.

## CONCLUSION

Road traffic accidents are an unfortunate economic burden on developing countries like India. Head injury due to RTA is a recognized public health problem causing death and disability. It is required from

concerned government authority to take appropriate and immediate measures for reducing the incidence of head injury. At the same time, people should be educated for taking good preventive actions to avoid head injury.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the Institutional Ethics Committee*

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**Cite this article as:** Pate RS, Hire RC, Rojekar MV. Pattern of head injury in central India population. *Int J Res Med Sci* 2017;5:3515-9.