

## Analysis of Fatal Blunt Force Head Injuries in Cases of Road Traffic Accidents: A study from Civil Hospital, Ahmedabad

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**How to cite this article:** Prabhakaran Selvam, Dominic Infant Raj, Joshiyara Rajeshkumar Vithtalbhair et. al. Analysis of Fatal Blunt Force Head Injuries in Cases of Road Traffic Accidents: A study from Civil Hospital, Ahmedabad. Indian Journal of Forensic Medicine and Toxicology/Volume 19 No. 1, January - March 2025.

### Abstract

Road traffic accidents are a leading cause of death and disability worldwide, with significant implications in India due to its vast and diverse population. Post-mortem studies provide crucial insights into the epidemiology, causes and characteristics of fatal head injuries, informing prevention and management strategies in case of road traffic accidents. This study aims to analyse the epidemiological profile of head injury cases subjected to post mortem, identifying patterns in demographic factors, causes of injury and anatomical characteristics of blunt force head trauma. In this study, analysis was done for blunt force head injury in road traffic accident cases brought to the mortuary of Civil Hospital, B.J Medical College, Ahmedabad, over a one year period from January to December (2019). Among 1138 cases of road traffic accidents, 847 cases with head injury were selected. Data on age, gender, cause of injury, type and location of blunt force head trauma and associated injuries were collected, analysed and compared with other similar studies. Of 847 head injury cases, majority were males and age group of 21 – 40 Years. 43 % of study population died within 1 hour. Predominantly two wheeler's were involved in RTA and without safety measures. 43.5% of cases showed laceration as external injury and 53.4% of study population showed linear fracture of skull. This study on blunt head injury cases reveals critical epidemiological trends, emphasizing the need for enhanced road safety measures and public awareness. The findings underscore the importance of targeted prevention strategies and improved trauma care to reduce fatalities from head injuries in India.

**Key Words:** Road traffic accident, Fatal head injury, Survival period, Head on collision, blunt force injury, Skull fracture

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**Submission date:** August 22, 2024

**Revision date:** Sept 25, 2024

**Published date:** December 3, 2024

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## Introduction

Road traffic accidents continue to show an alarming rise in India. According to Ministry of Road Transport and Highways, more than 1.5 lakh people lose their lives every year, with reports showing an all-time high in road traffic accidents<sup>1</sup>. India universally has the highest number of road fatalities. Out of which head injury is the major contributor to deaths. The incidence of head injury is increasing with the rise in high velocity transport, traffic violations and failure to follow safety measures while driving. Accurate interpretation of head injuries in postmortem is very important for proper reconstruction.

Head injury is a morbid condition characterized by gross or subtle structural changes in scalp vault and /or the content of the skull. The application of blunt force may result in injury to the skull and its contents.<sup>2</sup>

The patterns of head injury observed during autopsy were analysed and evaluated meticulously because the factors responsible for it were multiple and variable. The nature and severity of head injury and circumstances surrounding it, not only speaks about the different manners of head injury but also underscore the need to reduce the high mortality rate in this group.

The present study aims to analyse the common place of occurrence, types of vehicles involved and whether safety measures like wearing helmet in two wheelers help in preventing fatal injuries in road traffic accidents. Cases with definite head injuries irrespective of predisposing factors were selected for the purpose of scrutiny. From the head injury cases so scrutinized, fatal cases were isolated where the cranio-cerebral injury was the cause of death.

## Material and Method

The present prospective study was conducted at the Department of Forensic Medicine and Toxicology at Civil Hospital, B. J. Medical College, Ahmedabad during the period from January 2019 to December 2019. The material for the present study consists of data collected from the autopsy reports and from police information forms 146 (i) and (ii) of all blunt force fatal head injuries cases of road traffic accident brought to mortuary of Civil Hospital, B.J Medical College, Ahmedabad.

A proforma was prepared to collect the data based on the deceased's particulars, including a complete external and internal examination of those involved in fatal head injury cases of road traffic accident.

The particulars of deceased selected for proforma were as follows.

1. Age
2. Sex
3. Time of sustaining injury
4. Hospitalization and survival
5. Details of Road Traffic Accidents
  - Type of Vehicle
  - Place of Incident
  - Type of Crash
  - Usage of safety measures (Seat belt, helmet)
6. Type of external Injury on Head along with skull fractures

The criteria used for selection of cases for this study were as follows:

### Inclusion Criteria

- All autopsies of blunt force fatal head injury cases of road traffic accident at B.J Medical College, Civil Hospital, Ahmedabad during the period from January 2019 to December 2019.

### Exclusion Criteria

- Decomposed cases with fatal head injuries, where the interpretation of injuries is not possible due to extensive decomposition.
- Unknown cases where the history and details are not available.
- Injuries as a result of causes other than road traffic accident.
- Extensive burns involving head, where there is difficulty in interpretation of injuries.

The data from all the proformas were compiled into a master chart and analysed by calculating sum, range, distribution and percentage. The data was also tabulated and appropriate inferences were drawn. These inferences were then compared with those from other similar studies. Merits and demerits with possible causes, reasons and solutions were deduced.

### Results

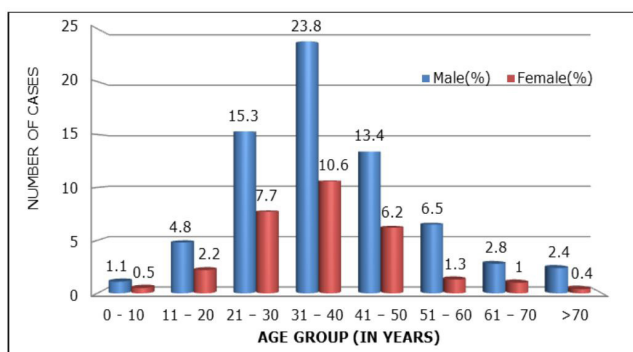
A total of 3803 autopsies were conducted at the mortuary of Civil Hospital, Ahmedabad, from January 2019 to December 2019. Out of which, 1138 cases were Road traffic accident cases. Among the 1138 road traffic accident cases, 847 cases of blunt force head injury were selected for this study after applying exclusion criteria.

The relevant observations made during the study are as follows.

In the study, 593 were Male (70.1%) and 254 were Female (29.9%), showing a male dominance (Table 1). The maximum numbers of head injury fatalities was recorded in the age group of 21 - 40 years (57.4%), while the least number of deceased were below 10 years (1.6%) (Figure 1). The maximum number of victims, 369 (43.6%) died within 1 hour, which includes death occurred on the spot at the time of accident and could be the reason for the highest number within period (Table 2). Among the different vehicle user and pedestrian, maximum numbers of vehicles observed in case of RTAs were Two-Wheelers (554 cases, 65.4%) followed by Four-Wheelers 183 (21.7%) and least numbers observed among pedestrians(110 cases, 12.9%) (Figure 2).

**Table 1: Sex Wise Distribution of Cases**

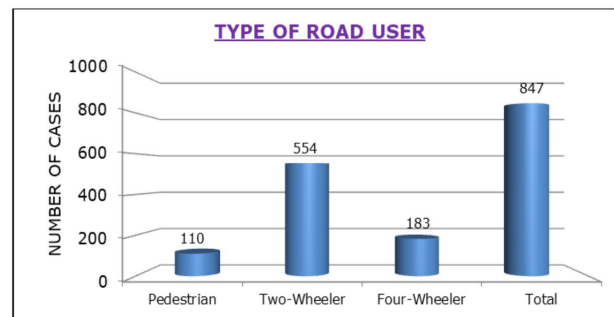
Gender	Number of cases	Percentage (%)
Male	593	70.1
Female	254	29.9



**Figure 1: Age Wise Distribution of Cases**

**Table 2: Distribution of Case According to Survival Period**

Survival Period	Number of cases	Percentage (%)
< 1 hour	369	43.6
1 to 12 hours	331	39
12 to 24 hours	58	6.8
>24 hours	89	10.5

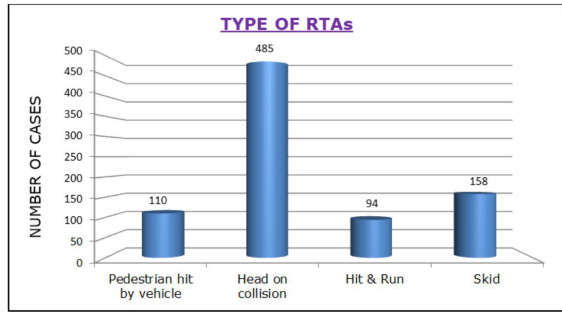


**Figure 2: Distribution of Cases According to Type of User in Case of RTAs**

Majority of RTAs occurred on district main roads(554 cases, 65.4%), followed by State and National High Ways (156 cases, 18.4%) (Table 3). Maximum number of deceased died due to head on collision (485 cases, 51.3%), while the minimum numbers died due to hit and run (94 cases, 11.1%) (Figure 3). The most common type of external injury noticed was laceration in (369 cases, 43.5%), followed by Contusion were seen in (160 cases, 18.9%), combination of multiple injuries in 145 (17.2%), Crush injuries were seen in 86 (10.2%) (Table 4). Extravasation of blood in the scalp region was found in temporal region 29.4%, whereas in frontal region 19%, in parietal region 18.7%, occipital region 16.6% and seen diffusely in 7.1%. Linear or Fissure fracture was the most common type of fracture of skull vault seen in (453 cases, 53.4%), while as (214 cases, 25.3%) showed no fractures. When considering the most common site of fractures in the skull vault, multiple bones were fractured in (66 cases, 26.9%). Temporal bone fractures was next common, seen in (60 cases, 17.5%), followed by frontal bone fractures in 54 cases (13.4%)(Figure4)

**Table 3: Distribution of Cases According to Place of Rtas**

Place of RTA	Number of cases	Percentage (%)
District main roads	554	65.4
National & State highways	156	18.4
Inner city/Village road	114	13.4
Others	23	2.8



**Figure 3: Distribution of Cases According to Type of Rtas**

**Table 4: Distribution of Cases According to Type of External Injury**

Type of external Injury	Number of cases	Percentage (%)
Abrasion	87	10.3
Contusion	160	18.9
Laceration	369	43.6
Crush Injury	86	10.1
Multiple Injuries	145	17.1

Image 1: Abrasion  
B. J Medical College, Ahmedabad (2019)



Image 2: Laceration  
B. J Medical College, Ahmedabad (2019)



Image 3: Contusion  
B. J Medical College, Ahmedabad (2019)



Image 4: Crush Injury  
B. J Medical College, Ahmedabad (2019)



**Figure 4: Distribution of Cases According to the Skull Fractures**

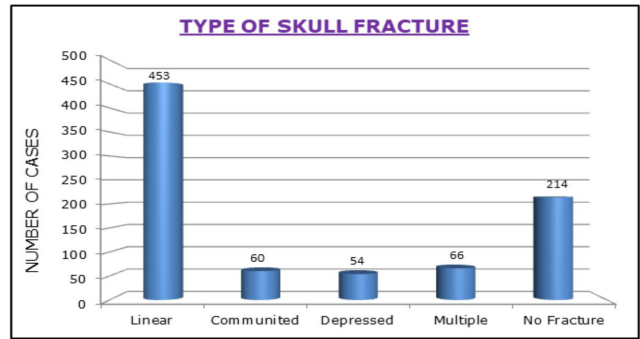


Image 5: Linear Fracture  
B. J Medical College, Ahmedabad (2019)



Image 6: Communitated Fracture  
B. J Medical College, Ahmedabad (2019)



Image 7: Depressed Fracture  
B. J Medical College, Ahmedabad (2019)

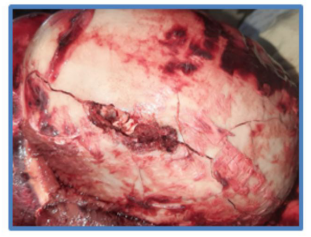


Image 8: Multiple  
B. J Medical College, Ahmedabad (2019)

**Discussion**

The present study was compared with more than 10 significant studies related to Head Injury cases that were done in India. On comparison of present study with similar studies by Kamdar BA et al<sup>3</sup>, Tripude BH et al<sup>4</sup>, Khubchandani HT et al<sup>5</sup>, Vaidehi Singh et al<sup>6</sup>, Chavali KH et al<sup>7</sup>, it is evident that all studies found a predominance of males among total cases of RTA similar with present study. Age group comparisons with studies by Vaidehi Singh et al<sup>6</sup>, Gupta et al<sup>8</sup>, Vaghela AC et al<sup>9</sup>, Tandem RM et al<sup>10</sup> & Behra C et al<sup>11</sup>, it is evident that age group of 21 to 30 years is the most common, followed by age group of 31 to 40 years, corresponding with present study. In comparison of survival period with studies by Kamdar BA et al<sup>3</sup>, Khubchandani HT et al<sup>5</sup>, Shivkumar

BC et al<sup>12</sup> and Vaghela AC et al<sup>9</sup>, it is evident that in all studies, the majority of victims had a survival period of less than 1 hour, followed by survival period of 1-12 hours in most of the studies similar with the present study. Comparison of types of user in RTAs with studies done by Tandem RM et al<sup>10</sup>, Pathak A et al<sup>13</sup>, Vaghela AC et al<sup>9</sup>, it was clear that studies done in last ten years show that maximum number of RTA cases were of two wheeler users. Whereas studies of Chandra J et al<sup>14</sup>, Salgado MSL et al<sup>15</sup>, Menon A et al<sup>16</sup> & Pruthi N et al<sup>17</sup>, done before 15 years are showing maximum number of RTA cases in pedestrians.

Regarding the place of RTAs, studies by Vaghela AC et al<sup>9</sup> & Behra C et al<sup>11</sup> found that majority of RTAs occurred on district main roads, corresponding with the present study while study of Khubchandani et al<sup>5</sup> found maximum cases of RTAs occurred in inner city/village road. Comparison of type of RTAs with similar studies done by Pathak A et al<sup>13</sup>, Vaghela AC et al<sup>9</sup> & Behra C et al<sup>11</sup>, it was evident that maximum type of RTAs are head on collision similar with current study. It was evident that studies of Menon A et al<sup>16</sup>, Oberoi SS et al<sup>18</sup> & Vaghela AC et al<sup>9</sup> showed laceration as the most common external injury in head injury cases of Road traffic accident which is similar with the current study. It was evident that in all the similar studies, maximum type of skull fractures were found to be linear. Comparison of use of safety measures with similar studies done by Pathak A et al<sup>13</sup>, Shivkumar BC et al<sup>12</sup> & Surendra J et al<sup>19</sup>, it was evident that maximum two wheeler user of RTA were found to be without helmet except studies of Ravikumar R et al<sup>20</sup> and Behera C et al<sup>11</sup> where it was found that maximum two wheeler user of RTA were with helmet.

### Summary and Conclusion

The present study helped in drawing the following conclusions.

- The incidence was common among the age group of 20 to 40 years with 485 cases (57.4%).
- Male predominance was seen with 593 cases (70.1%) and Female incidence in remaining 254 cases (29.9%).
- A significant 82.7% deaths occurred within 12 hour following the incident of head injuries, while 17.3% had survived for more than 24 hours.

- Regarding the history of RTAs, 65.4% involved two wheeler motor vehicle occupants, 12.9% were those of pedestrians and 21.7% were those of four wheelers occupants.
- The most common place of occurrence of RTAs is Main Road which comprise 65.4% of cases of RTAs.
- Among RTA cases, 57.3% cases involved head on Collision, 13% cases involved Pedestrians being hit by the vehicles, 18.22% cases involved skidding incidents, and 11.1% cases were Hit and Run over.

### Recommendation:

India tops the world in road crash deaths. It has 1% of the world's vehicles but accounts for 11% of all road crash deaths, witnessing 53 road crash every hour; killing 1 person every 4 minutes<sup>21</sup>. Therefore, the single most important thing a person can do to stay healthy and alive is to pay close attention to how they drive. Traffic safety education should be given in schools for production of skilled and responsible drivers in future. There are many causative factors involved in road traffic accidents, so a multidimensional approach involving road users, vehicles and the road environment is required.

**Conflict of Interest:** Nil

**Financial support & sponsorship:** Nil

**Ethical Clearance:** Ref No- 15/2020, IEC, B. J Medical College, Ahmedabad

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