



## STUDY OF PATTERN OF HEAD INJURY IN GOVERNMENT MEDICAL COLLEGE, NAGPUR.

### Forensic Medicine

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### ABSTRACT

Head injury is the leading cause of death and disability following road traffic accidents and fall from height due to its anatomical location in our body. In present study medico legal autopsy was carried out on 1339 cases of head injury brought to post-mortem centre in Department of Forensic Medicine, Government Medical College and hospital, Nagpur. Aim of our study was to analyze the socio-demographic profile and pattern of head injury in cases to provide epidemiological data, which can be used to refine treatment protocols and help the policy makers to take preventive measures. In our study head injury was prevalent in urban areas (n=941, 70.3%). Males (n=1083, 81.9%) outnumbered females (n=256, 18.1%) with an approximate male to female ratio of 4.2:1. Most affected age group was 21-30yrs. Road traffic accident (n=1180, 88.1%) was most common etiological factor, followed by fall (n=131, 9.7%) and assault (n=22, 1.6%). Maximum cases (n=426, 31.8%) were reported in Evening 18.01 hrs-23.59 hrs. Majority of Road Traffic Accident cases were of two wheeler drivers (n=551, 46.7%) followed by Pedestrians (n=395, 33.5%). 65.2% victims were not wearing helmet. Maximum cases (n=851, 63.6%) belong to Middle socio-economic class and majority (n=757, 56.5%) were graduates. Skull fracture was found in 1050 (78.4%) cases; commonest type of skull fracture was linear (n=522, 39%). Commonest bone fractured was temporal (n=653, 62.2%). The commonest variety of intracranial haemorrhage was subdural (n=1215, 90.7%). Most cases (n=468, 35%) survived less than an hour or died on their way to hospital.

### KEYWORDS

Head injury, Skull fracture, Intra cranial haemorrhage.

### INTRODUCTION

It has been truly said that no injury of the head is too trivial to be ignored or so serious as to be despaired of<sup>1</sup>. Patients with head injury are the major cause of death and morbidity not only in India but also worldwide. Global status report on road safety 2015, World Health Organization, Geneva reported that road traffic injuries claim more than 1.2 million lives each year and have a huge impact on health and development. Severe head injury, with or without peripheral trauma, is the commonest cause of death and/or disability up to the age of 45 years in developed countries<sup>2</sup>. Head injury has been defined by the National Advisory of Neurological Disease and Stroke Council as "A morbid state resulting from gross or subtle changes in scalp, skull and/or contents of the skull produced by mechanical forces restricted to those forces applied externally to head<sup>3</sup>. Neurotrauma may result from blunt forces, which may be due to impact (contact) or movement (inertia). The most common result is a closed head injury with no exposure of the brain to the external environment. Impact (contact) injuries occur in one of three circumstances: a moving object strikes the resting head, a moving head strikes a stationary object; or a collision between a moving head and a moving object. The resulting injuries are due to local deformity and are focal. The acceleration/deceleration causes widespread internal movements of the brain that result in stretching, compression and shearing of the nerve fibers and intracranial blood vessels. Inertial injuries are diffuse. Combined injuries are common, such as when an impact to a movable head causes localized contusions due to impact and diffuse injury due to the resulting acceleration/ deceleration. Many brain injuries are complex, such as seen in a motor vehicle accident, a fall down stairs or a beating, so it is common to see both focal and diffuse brain injuries in the same patient. Intracranial haemorrhages resulting from blunt force head injury are the most common cause of clinical deterioration and death after a lucid interval and often are associated with skull fracture<sup>4</sup>.

### MATERIALS AND METHODS

Current study was carried out in the department of Forensic Medicine, Government Medical College and Hospital, Nagpur from 01 January 2016 to 31 September 2017. A total of 1339 cases of head injury which were brought for post-mortem examination at autopsy centre were included in this study. Cases of head injuries associated with ante mortem burns and ante mortem drowning were not included in the study. History was gathered from police inquest papers, hospital records and relatives. Meticulous medico legal autopsy was carried out on each of these cases to find out pattern of head injury in Road traffic

accidents, falls, railway accidents and assaults after which data was formulated.

### OBSERVATIONS AND RESULTS

TABLE NO.1 AGE AND SEX WISE DISTRIBUTION OF CASES

Age	Males	Males (%)	Females	Females (%)	Total	Total (%)	Sex Ratio
0-10	32	2.95	4	1.56	36	2.7	8:1
11-20	84	7.76	16	6.25	100	7.5	5.3:1
21-30	304	28.07	76	29.69	343	25.6	4:1
31-40	236	21.79	44	17.19	280	20.9	5.4:1
41-50	231	21.33	39	15.23	307	22.9	5.9:1
51-60	72	6.65	40	15.63	112	8.4	1.8:1
61-70	80	7.39	28	10.94	108	8.1	2.8:1
>70	44	4.06	9	3.52	53	4	4.8:1
	1083(81.9%)	100.00	256(18.1%)	100.00	1339	100.00	4.2:1

Table no.1 depicts Age and sex wise distribution of cases of head injury. Out of 1339 cases of head injury studied, there was preponderance of victims in the age group of 21-30yrs with male victims (n=1083, 81.9%) outnumbering the female victims (n=256, 18.1%). Male to female ratio was found to be 4.2:1. Victims in the age group 0-10 yrs (n=36, 2.7%) and >70 yrs (n=53, 4%) were very less as compared to other age groups.

TABLE NO. 2. RURAL V/S URBAN DISTRIBUTION OF CASES

Area	Number of cases	Percentage
Urban	941	70.3
Rural	398	29.7
Total	1339	100.0

Table no.2 depicts distribution of cases of head injury as per urban and rural areas. In present study majority of head injury cases (n=941, 70.3%) were found in urban areas.

TABLE NO. 3. EDUCATION QUALIFICATION

Education qualification	Number of cases	Percentage
ILLITERATE	188	14.0
PRIMARY	13	1.0
SECONDARY	66	4.9

SENIOR SECONDARY	167	12.5
GRADUATE	757	56.5
POST GRADUATE	148	11.1

Table no.3 depicts distribution of cases according to educational qualification of victims. Majority of victims (n=757, 56.5%) were Graduates, followed by Illiterate (n=188, 14%), senior secondary (n=167, 12.5%), Postgraduates (n=148, 11.1%), Least affected were those with Primary education status (n=13, 1%).

Socio-economic status	Number of cases	Percentage
LOWER	93	6.9
LOWER MIDDLE	131	9.8
MIDDLE	851	63.6
UPPER MIDDLE	236	17.6
UPPER	28	2.1

Table no.4 depicts distribution of cases according to socio-economic status. Majority of victims (n=851, 63.6%) belonged to Middle class followed by upper middle class (n=236, 17.6%), lower middle class (n=131, 9.8%) and lower class (n=93, 6.9%). Number of cases reported in Upper class (n=28, 2.1%) were less as compared to other socio-economic class.

Month	Number of cases	Percentage
Jan	107	8.0
Feb	110	8.2
Mar	118	8.8
Apr	116	8.7
May	144	10.7
Jun	112	8.4
Jul	106	7.9
Aug	104	7.8
Sep	96	7.2
Oct	106	7.9
Nov	100	7.5
Dec	120	9.0

Table no.5 depicts month wise distribution of cases of head injury. Maximum number of head injury cases were observed in the month of May (n=144, 10.8%) followed by December (n=120, 9%).

Mechanism of head injury	Number of cases	Male	Female
RTA	1180(88.1%)	1153	27
Fall	131(9.7%)	103	28
Assault	22(1.6%)	18	4
Railway	6(0.5%)	4	2
Total	1339	1278	61

Table no.6 depicts distribution of head injury cases as per mechanism of head injury. Road traffic accident was the most common cause of head injury in our study and was seen in 1180(88.1%) cases followed by fall (n=131, 9.7%), assault (n=22, 1.6%) and railway accident (n=6, 0.5%).

Type of vehicle	Number of cases	Percentage
4 wheeler	199	16.9
2 wheeler	551	46.7
Bicycle	35	3.0
Pedestrian	395	33.5
Total	1180	100.00

Table no.7 depicts distribution of RTA cases according to type of vehicle. Majority of victims were 2- wheeler drivers (n=551, 46.7%) followed by pedestrians (n=395, 33.5%). 35(3%) victims of RTA were bicycle users.

Use of helmet	Number of cases	Percentage
Yes	113	9.6
No	769	65.2
4 wheeler/ Data not available	298	25.3
Total	1180	100.0

Table no.8 depicts distribution of death due head injury in RTA cases as

per use of helmet. Majority of RTA cases (n=769, 65.2%) with head injury were not using helmet. However head injury was found in 113 cases (9.6%) of RTA despite of use of helmet.

Type of head injury	Number of cases	Percentage
Scalp injury	1037	77.4
Intra Cranial Haemorrhage	1339	100.0
Skull fracture	1050	78.4
Brain injury	569	42.4

Table no. 9 depicts distribution of cases according to type of head injury sustained. Intracranial haemorrhage was found in all cases of head injury (n=1339, 100%). Skull fracture was found in 78.4% cases (n=1050). Scalp injury was found in 77.4% cases (n=1037) and brain injury was seen in 42.4% cases (n=569).

Type of Skull fracture	Number of cases	Percentage
Linear or fissured fracture	522	39.0
Depressed fracture	163	12.2
Comminuted fracture	284	21.2
Sutural or diastatic fracture	39	2.9
Ring or foramen fracture	42	3.1
No fracture	289	21.6

Table no. 10 depicts distribution of cases according to type of skull fracture sustained. Linear fracture was the most common type of fracture associated with head injury (n=522, 39%) followed by comminuted fracture (n=284, 21.2%). 289 cases (21.6%) of head injury were not associated with head injury.

Bones involved	Number of cases	Percentage
Frontal	462	44.0
Parietal	517	49.2
Temporal	653	62.2
Occipital	460	43.8
Sphenoid	138	13.1
Base of skull fracture	437	41.6

Table no.11 depicts distribution of cases according to involvement of bones of skull. Most common skull bone fractured was temporal bone (n=653, 62.2%) followed by parietal bone (n=517, 49.2%). Base of skull was fractured in 437 cases (41.6%) of head injury.

Site of fracture	Number of cases	Percentage
Anterior cranial fossa	185	42.3
Middle cranial fossa	207	47.4
Posterior cranial fossa	95	21.7

Table no.12 depicts the distribution of cases according to site of fracture in the base of skull. Most common site of fracture was Middle cranial fossa (n=207, 47.4%) followed by Anterior cranial fossa fracture (n=185, 42.3%). Least common site of fracture was posterior cranial fossa (n=95, 21.7%).

Type of Intra cranial haemorrhage	Number of cases	Percentage
Extra Dural Haemorrhage	298	22.26
Subdural Haemorrhage	1215	90.74
Subarachnoid Haemorrhage	987	73.71
Intra cerebral Haemorrhage	231	17.25
Total	1339	

Table no.13 depicts distribution of cases according to type of intracranial haemorrhage. Most common type of intracranial haemorrhage was Subdural haematoma (n=1215, 90.74%) followed by subarachnoid haemorrhage (n=987, 73.71%) and extradural haematoma (n=298, 22.26%). Least common type of intracranial haemorrhage was intra cerebral haemorrhage (n=231, 17.25%).

Time(Hours)	Number of cases	Percentage
00:00 to 06:00(Night)	297	22.2
06:01 to 12:00(Morning)	216	16.1
12:01 to 18:00(Afternoon)	340	25.4
18:01 to 23:59(Evening)	426	31.8
Not known	60	4.5

Total	1339	100.00
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Table no.14 depicts distribution of head injury cases in relation to time of incidence. Maximum incidence (n=426, 31.8%) was found in evening between 18.01 hrs-23.59hrs followed by afternoon (n=340, 25.4%); 12.01hrs-18.00 hrs and night (n=297, 22.2%); 00.00hrs-06.00hrs. Least number of Head injury cases were found to occur in the morning 06.01hrs- 12.00hrs (n=216, 16.1%).

Survival time	Number of cases	Percentage
Brought dead	468	35.0
1-6 hours	226	16.9
6-24 hours	215	16.1
1-3 days	236	17.6
3 days-1 week	95	7.1
> 1 week	67	5.0
>6 months	32	2.4

Table no.15 depicts distribution of cases according to survival time after head injury. Majority of victims(n=468, 35%) succumbed to death on the spot or died on their way to the hospital. 236 victims (17.6%) survived for 1-3days after head injury, followed by 226 victims (16.9%) who survived for 1-6 hrs after head injury. Only 32 victims (2.4%) survived for >6months after head injury.

## DISCUSSION

On studying 1339 cases of head injury of all age groups and both the sexes, it was inferred that males (81.9%) outnumbered the female victims (18.1%) with age group 21-30yrs being the most vulnerable age group in both the sexes. Approximate Male to female ratio being 4.2:1. These findings are in accordance with the study carried out by **Chaturvedi et al<sup>5</sup>, Shivakumar et al<sup>6</sup>, Thube et al<sup>7</sup>, Kumar A et al<sup>14</sup>**. This could be due to the fact that the age group 21-30yrs is the youth and highly active as well as social age group. This age group is usually the earning age group in most of the family who remain outside for work purpose. Male preponderance can be related to the fact that the males usually remain outside the house till late night as compared to females and males are usually involved in rash driving.

70.3% cases were reported from urban areas as compared to 29.7% cases from rural areas. This could be due to urbanization due to which there has been increased in the number of motor vehicles on road. Similar observations were made by **Ravikumar<sup>11</sup>**.

In our study maximum victims (63.6%) belong to Middle class of socio-economic status and least were from upper class (2.1%). Among 1339 cases of head injury, highest incidence (56.5%) of head injury was noted in cases with educational qualification of Graduate, followed by Illiterates in 14% and senior secondary in 12.5%. Similar observations were made by **Akhade et al<sup>12</sup>, Kumar D et al<sup>18</sup>**.

Maximum cases were reported in the month of May (10.8%) followed by December (9%). This can be due to the fact that in summers usually people stay outdoors till late as well as this is month of summer vacation and hence there is more transportation on road. More number of head injuries in the month of December may be attributed to the fact that there is decreased visibility on roads due to fog in winter season. These findings are in accordance with the study of **Akhade et al<sup>12</sup>**.

Most common cause of head injury was road traffic accident (88.1%) cases followed by 9.7% cases of fall from height and 1.6% of cases due to assault. These findings were in accordance with study of **Thube et al<sup>7</sup>, Ravikumar<sup>11</sup>, Akhade et al<sup>12</sup>, Gambhir et al<sup>17</sup>**. This can be attributed to the fact that there has been increase in the number of vehicles on road which has led to reporting of more number of road traffic accident cases. Also, rash driving and non-compliance to traffic rules are well known reasons behind road traffic accidents.

46.7% head injury cases associated with RTA were of 2 wheeler vehicles. Head injury was found in pedestrians in 33.5% cases. These findings are in accordance with the study of **Chaturvedi et al<sup>5</sup>**. However **Srivastav et al<sup>3</sup>, Singh et al<sup>4</sup>** and **Akhilesh et al<sup>13</sup>** reported incidence of head injury in pedestrians more commonly than motorcyclists. Motorcyclists are at an increased risk because they often share the traffic space with fast-moving cars, buses and trucks, and because they are less visible. In addition, their lack of physical protection makes them vulnerable to injury. Injuries to the head and neck are the main cause of death, severe injury and disability among

motorcyclists.<sup>19</sup>

Majority of victims i.e. 65.2% were not wearing helmet at the time of accident which suggest importance of wearing helmet while driving. Similar observations were found by **Shivakumar et al<sup>6</sup>, Thube et al<sup>7</sup>, Pathak et al<sup>10</sup>, Akhade et al<sup>12</sup>**.

In our study intracranial haemorrhage was found in all cases of head injury, Skull fracture was found in 78.4% cases, scalp injury in 77.4% cases and brain injury in 42.4% cases. In a study carried out by **Pathak et al<sup>10</sup>**, Skull fracture was found in 91.67% cases, intracranial haemorrhage in 92.5% cases, and brain injury in 92.5% cases. **Kumar A et al<sup>14</sup>** found Skull fracture in 69.63% cases and Brain laceration in 16.01% cases.

Most common type of skull fracture was linear fracture and was found in 39% of head injury cases. This finding is in accordance with the study carried out by **Chaturvedi et al<sup>5</sup>, Pathak et al<sup>10</sup>, Ravikumar et al<sup>11</sup>, Akhilesh Pet al<sup>13</sup>, Ahmad et al<sup>15</sup>**.

Most common bone fractured in head injury was temporal bone (62.2%). Similar findings were found in the study carried out by **Pathak et al<sup>10</sup>, Kumar A et al<sup>14</sup>, Gambhir et al<sup>17</sup>**.

Middle cranial fossa was found fractured in majority i.e. 47.4% cases followed by anterior cranial fossa in 42.3% cases and posterior cranial fossa in 21.7% cases of head injury. However **Pathak et al<sup>10</sup>** reported anterior cranial fossa fracture in majority i.e. 40% cases.

Most common intracranial haemorrhage associated with head injury was Subdural haemorrhage (90.74%) followed by Subarachnoid haemorrhage (73.71%) and extradural haemorrhage (22.26%). These findings are in accordance with the study carried out by **Chaturvedi et al<sup>5</sup>, Shivakumar et al<sup>6</sup>, Ravikumar<sup>11</sup>, Kumar A et al<sup>14</sup>, Ahmad et al<sup>15</sup>**. Incidence of head injury was found to be highest in evening between 18.01hrs-23.59hrs followed by afternoon 12.01hrs-18.00hrs. Similar observations were made by researchers **Ravikumar<sup>11</sup>, Akhade et al<sup>12</sup>**. In an annual report published by Government of India, Ministry of road transport and highways (Road accidents in India 2015), majority of road traffic accidents were found to occur between 18.00 hrs -24.00 hrs<sup>16</sup>.

Majority of victims i.e. 35% succumbed to death on the spot or while on their way to the hospital. Similar findings were found in the study by **Chaturvedi et al<sup>5</sup>, Shivakumar et al<sup>6</sup>, Thube et al<sup>7</sup>**.

## SUMMARY AND CONCLUSION

This study shows that maximum number of victims of head injury succumbed to death within 1 hour of injury or on their way to hospital. This tells us that how crucial is the initial hour after head injury and the importance of early management which otherwise can lead to unavoidable consequences. The causes, distribution and pattern of head injury remain more or less same as in other studies. Road traffic accidents remain the most common cause of head injury. Most commonly affected age group was 21-30 yrs in both the sexes. Most accidents occurred in the evening 18.01 hrs- 24.00 hrs. Cases of head injury were prevalent more in the month of May followed by December. Most affected class was of Middle Socio-economic status. 2 wheeler drivers were more affected followed by pedestrians. Linear fracture was most common type of fracture encountered and subdural haematoma was most common type of intracranial haemorrhage in head injury cases.

## RECOMMENDATIONS

1. As majority of head injury cases are associated with road traffic accidents, special awareness about traffic rules as well as consequences of its violation must be taught to children from an early age.
2. Strict implementation of use of helmets and seat belts should be made and hefty fine must be charged for non-compliance. Helmet laws should cover all riders and specify a helmet quality standard.
3. Government must keep a check on the quality control of roads as not all the accidents are a result of human error. Installation of functioning street lights and proper layout of roads and speed breakers can avoid accidents to some extent. Separating road users according to pedestrians, cyclists, motorcyclists, cars or heavy vehicles can ensure reduction in the incidences of accidents.
4. As initial hours of head injury are very crucial and timely

management if not done adverse outcomes may result. Increasing the number of well equipped "Mobile Trauma Service Van" will not only decrease the time in reaching the site of incident but also increase the chances of survival of patient.

5. Policy makers must give more attention to making vehicles and roads safer.

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