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Pattern of Injuries in Fatal Head Trauma Due to Road Traffic Accidents

M. N. Rajamani Bheem Rao[1], A. Nirmala[2], R. Raguram[3]

[1]Associate Professor, Department of Forensic Medicine, Stanley Medical College, Chennai, [2]Assistant Professor, Department of Forensic Medicine, Madras Medical College, Chennai, [3]Assistant Professor, Department of Forensic Medicine, Stanley Medical College, Chennai.

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Abstract

Background: Head trauma is considered to be the major cause of death in road traffic accidents. According to world health organisation, about 1.24 million deaths occur due to road traffic crashes. Particularly, the treatments for head injury in the older aged people seems to be more complicated when compared to younger and middle age groups. The aim of this study is to analyse and identify the significance and outcome of head trauma due to road traffic accidents of various age groups.

Methods: This study was conducted on Madras Medical College, in the Department of Forensic Medicine, Chennai . a total of 200 fatal head injury case autopsies were performed. After obtaining the necessary and relevant information about the deceased, a thorough autopsy was performed and the findings were recorded.

Result: Out of 200 cases, 83% were men and 44.5% were recorded to be between 31-50 age group. Fissure fracture of skull was found to be most prevalent (40.5%) and subdural haemorrhage was the common findings in head injury (95%).

Conclusion: The resultsof our study showed that most of the people who had accidents were pedestrian and two wheeler driving persons.

Keywords: Head injuries; intracranial hemorrhages; road traffic accident; skull fracture.

Introduction

According to WHO estimates, about 1.24 million deaths occur each year as a result of road traffic crashes. Around 20 to 50 million more people suffer non-fatal injuries, with many incurring a disability as a result of their injury. In India, according to Ministry Of Road Transport and Highways (MORTH), during the year 2020, there were around 5 lakh road accidents, which resulted in deaths of 134,513 people and injured more than 5 lakh persons in India. It is the leading cause of mortality for young adults of age less than 45 years. Among all the regional injuries, the injury to the head is the most important in forensic practice. The present study aims to analyze the significance of nature of injuries, part of the brain injured, duration of survival and intracranial hemorrhages noted in fatal road traffic accidents.

Corresponding Author: A. Nirmala, Assistant Professor, Department of Forensic Medicine, Madras Medical College, Chennai.

E-mail: nirmalmanju643@gmail.com

Materials and Methods

The study was conducted on 200 fatal head injury cases brought for autopsy and conducted at the Mortuary, Department of Forensic Medicine, RAJIV GANDHI GENERAL HOSPITAL Medical College, Chennai. A complete autopsy was done and all the findings were recorded in detail. The dissection technique of scalp, skull and dura was in accordance with the procedures suggested by Gresham GA and Turner AF and the brain dissection as suggested by Ludwig J. All the statistical analysis was done using EpiInfo 3.4.3 (2007) software. Descriptive statistics of categorical data were presented as proportions for comparison.

Results

General distribution of fatal RTA Cases. The most vulnerable age group was those in 31-50 years followed by the age group of 21–30 years. The reason being that they form the most active group of the society and hence are prone to road traffic accidents.

(83%) Were males and (17%) were females, males were more prone to head injuries in road traffic accidents since they are more into outdoor activities like driving vehicles, working outdoor posing them risk due to accidents.

Females succumbed to road traffic accidents were mainly due to them being pillion riders without helmet and pedestrians.of the 200 cases studied scalp contusion was present in 190 cases. Diffuse scalp deep contusion of the scalp was commonest in 79 cases(39.5%) followed by scalp contusion of right-fronto- temporo-parietal regions of scalp. laceration of the scalp was present in 20 cases i.e., 10% of cases. Two wheeler drivers accounted for 80 cases 40%, pedestrians accounted for 80 cases 40% followed by two wheeler pillion riders 19 Cases (9.5%).

Table 1: Percentage of different types of fracture of the skull.

Fracture_group	Frequency	Percent
Bony and Dural Defect	12	6.0%
Comminuted Fracture	8	4.0%
Diastatic Fracture	1	0.5%
Depressed Fracture	6	3.0%
Fissure Fracture	81	40.5%
Intact	87	43.5%
Others	5	2.5%
Total	200	100.0%

As in table-1, fissure fractures were the commonest type (81 Cases) 40.5% followed by Comminuted fracture (8 cases) 4.0% and depressed fracture (6 cases) i.e. 3.0%. Skull vault was intact in 43.5% of the case, i.e. 87 cases.

Table 2: Region Wise Distribution of Extradural Hemorrhage in Fatal RTA Cases.

EDH	Frequency	Percent
Parietal	19	9.5%
Frontal	1	0.5%
Temporal	6	3.0%
Occipital	1	0.5%
No	173	86.5%
Total	200	100%

As in table 2, extradural hemorrhage was more commonest in parietal region 19 cases 9.5% followed by temporal region and least common in frontal and occipital regions 0.5%.

Table 3: Distribution of Subdural Hemorrhage in Fatal Head Injury Cases in RTA

SDH	Frequency	Percent
RTFTP	37	18.5
LTFTP	34	17.0
Diffuse	119	59.5
No	10	5.0
Total	200	100.0

As in table 3, the most common extra axial hemorrhage was subdural hemorrhage. Subdural hemorrhage was more common in both the cerebral and cerebellar hemispheres of brain 59.5% followed by the surface of fronto- temporo-parietal region of right cerebral hemisphere of brain, 37 cases (18.5%).

Table 4: Distribution of Subarachnoid Hemorrhage in Fatal Head Injury Cases.

SAH	Frequency	Percent
RTFTP	33	16.5
8LTFTP	25	12.5
Diffuse	111	55.5
No	31	15.5
Total	200	100.0

As in Table 4, Subarachnoid haemorrhages were present in 169 cases. The most common site for

subarachnoid haemorrhage was on the surfaces of both the cerebral and cerebellar hemispheres of brain (55.5%) followed by the surface of fronto temporo-parietal region of the right cerebral hemisphere of brain (16.5%).

Overall Incidence of Intracerebral Hemorrhages

Subdural hemorrhage was present in 190 cases 95%, followed by subarachnoid hemorrhage 84.5%, extradural hemorrhage 13.5%, intraventricular hemorrhage 13.5%, intracerebral hemorrhage 9.5% and brain stem hemorrhage 6.5%.

If the type of hemorrhage is considered in isolation,then cases having subdural haemorrhages were the highest in number 190 cases (95%) followed by subarachnoid haemorrhages in 169 cases (84.5%), extradural haemorrhages in 14 cases and intracerebral haemorrhages.9.5%. brain stem haemorrhage was present in 17 cases.(8.5%).

Table 5: Base of Skull Fractures

Base skull	Frequency	Percent
ACF	5	2.5
Comminuted Fracture	9	3.0
IGH	1	.5
Intact	112	56.0
MCF	47	23.5
MCF –PCF	1	.5
MCF ACF	2	1.0
NIL	1	.5
PCF	17	8.5
Right Middle and Posterior Cranial Fossa	1	.5
Right Temporal Bone to Left Temporal Bone	1	.5
Surgical Defect	1	.5
The Right Bone and Temporal to Occipital Bone	1	.5
The Right Temporal Bone	1	.5
Total	200	100.0

As in table 5, Fracture of the base of the skull was noted in 78 cases. middle cranial fossa is the commonest with 47 cases (23.5%), Fracture of the posterior cranial fossa is observed in 17 cases (8.5%) and fracture of the anterior cranial fossa noted in 5 cases (2.5%).

Discussion

According to Ministry of Road Transport and Highways (MORTH)[2], India pedestrians, bicyclists and two-wheeler riders comprise the most unprotected road users, accounting for around 40% of all fatalities. In our study also, we found that pedestrians [80 cases (40%)], pillion riders [19 cases (9.5%)] and drivers of two-wheelers [80 cases (40%)]. pedestrians were the most vulnerable group followed by drivers and pillion riders of two-wheelers.

In a study done by Menon et al.[1] 682 victims of road traffic accidents who died due to injuries sustained to the head were autopsied at District Wenlock Hospital, Mangalore, India over a period of 5 years between January 1999 and December 2003. Skull fractures were present in 88.88% of the cases. Fractures of the vault were found in 88%, base of the skull in 35.97% and a combination of both in 35% of cases. In most of the cases, fissured fractures were found (23%). Among intra-cranial haemorrhages, subdural haemorrhage was found in 52.63% and subarachnoid haemorrhage in 27.27% of cases. Contusions and lacerations of brain were found equally in 35% of cases.

When analyzing the contributing factors for the occurrence of road traffic accidents in our study, out of the 99 victims who were drivers or pillion riders of two-wheelers, 80 had not used helmet and hence succumbed to head injuries.

According to WHO, wearing helmet can reduce the risk of deaths by almost 40% and the risk of severe injury by over 70%. Hence strict laws should be enforced to make helmet use mandatory for the drivers of two-wheelers and pillion riders.

In the present study of 200 cases, maximum number of persons sustained fatal head injuries in the day time.Preponderance of occurrence of fatal head injuries in road traffic accidents during day time can be explained by the fact that active work is done at day time.

Another common risk factor for RTAs is drunken driving. In a systematic review done by Das A et al.[2], 2-33% of the injured and 6-48% of killed RTA victims had consumed alcohol or drugs. In our study however only five victims were reported to have consumed alcohol. This should be because of under reporting and lack of data regarding alcohol use.

Recently there has been a marked increase around the world in the use of mobile phones by drivers that is becoming a growing concern for road safety. But in our study, no data was available regarding the use of mobile phones by the accident victims. Other risk factors like bad illumination, rain, pet or domestic animals and natural diseases contributed very less to the occurrence of RTAs in our study.

Majority of the patients were managed conservatively and only 23 cases (11.6%) had undergone surgery. The period of survival was less than a week in the majority of cases. In approximately 22% of the cases, the period of survival was > 7 days.

The maximum number of deaths occurred during the first 24 hours can be explained by the fact that intracranial haemorrhages, contusions of the brain ,laceration of the brain and edema of the brain which are not compatible with life can occur immediately.

In 16 cases (8%) of the fatal head injury cases death occurred on the spot. Among the type of road users, two wheeler drivers accounted for 80 Cases (40%), pedestrians accounted for 80 cases 40% followed by two wheeler pillion riders 19 Cases (9.5%). In a study by Bayan et al.[3] in Pune also, they had found that pedestrians were the most vulnerable group followed by drivers and pillion riders of two-wheelers.

In a study done by Ogleznev et al.[4] on craniocerebral trauma in road traffic accidents, the most severe form of brain compression was multifactorial compression (27.6%) and its most common form was compression with subdural hematoma (35.3%). In over half the cases (62.6%), BI due to RTA was associated with extracranial lesions, leading to diagnostic problems. The pattern and site of lesions were related to the type of a transport vehicle and to the role of a victim as a traffic participant. Multiple extracranial lesions were mostly frequently encountered in victim pedestrians (30.3%), BI concurrent with chest damage was common in drivers (12.8%), BI concurrent with "whip" injury of the cervical spine was found in drivers and passengers though such combinations were also seen in pedestrians (1.5%-5 cases).

In the present study, among scalp injuries contusion of the scalp was the commonest scalp injury, followed by lacerations and abrasions. Frontal, parietal and temporal regions of the scalp were the commonest regions to be involved.

When the fractures of the skull vault are analyzed, linear fractures were the commonest type (81) followed by comminuted (8) and depressed (6) fractures. This correlates with the study done by Jacobsen et al.[7] in Copenhagen, where linear fracture was the commonest type followed by comminuted, depressed, ring and spider -web fractures. In the Jaipur study by Goyal et al.[8], linear fractures were the commonest followed by depressed and then the comminuted fractures. This correlates with data as given in Anil Aggrawal[9] who concluded linear fracture as the commonest type of fracture. Considering the predominant site of the skull fractures, frontal and temporal fractures were much more common than parietal and occipital fractures. This is because of the mechanism of most road traffic accidents exposing the fronto-temporal region to risk of trauma than the parieto-occipital region.

The incidence of the fractures of the base of skull in the present study was 78 cases which was much higher when compared with the previous studied [Goyal et al.[5] (< 1.1%).

In the majority of the cases of fatal head injury, there was a combination of fracture of the vault of the skull, intracranial haemorrhages and fracture of the base of the skull. This can be explained by the fact that, fracture commences at the region of maximum impact and then radiates downwards to the base of the skull.

The most common extra axial hemorrhage in our study was subdural 190 cases, followed by subarachnoid169 cases, whereas in most of the previous studies [Jacobsen et al.[6], Bhat VJ et al.[7]], subarachnoid hemorrhage was the commonest. Subdural haemorrhage was observed in 190 Cases. Subdural haemorrhage was the most common intracranial haemorrhage (95%) followed by subarachnoid haemorrhage (84.5%), extradural haemorrhage (14%) and intracerebral haemorrhage (9.5%). Our observations are in correlation with the above findings.

In the present study, it is evident that subdural haemorrhages is one of the commonest intracranial haemorrhages followed by subarachnoid haemorrhage, extradural haemorrhage, intraventricular haemorrhage and intracerebral haemorrhage.

In the present study of 200 cases of fatal head injuries in road traffic accidents, in addition to other parts of the body were also involved in addition to cranio-cerebral injury. Chest injury was noted in in 11cases, rib fractures in 6 cases and fracture of the extremities in 8 cases.

Conclusion

1. The most vulnerable age group was 31-50 years followed by 21-30 years, 83% of the victims were men.
2. 80% of the victims were pedestrians or two-wheeler riders. Majority of the two-wheeler victims were not wearing helmets at the time of the accident and hence sustained significant head injuries.
3. In majority of the cases (78%), the period of survival was less than a week.
4. The maximum number of accidents causing fatal head injuries were observed during day time 134 cases as compared to night time 66 cases.
5. The motor cyclist and pedestrian were the commonest group of victims in vehicular accidents 160 cases (80%) followed by two wheeler pillion riders.
6. Twowheeler was the commonest offending vehicle followed by four wheeler.

7. Scalp injury with fracture of the skull, fracture of the base of the skull and intracranial hemorrhage was the commonest presentation in fatal head injury cases of road traffic accidents.
8. Totally 96 cases fractures of the vault of the skull were detected in the autopsy. Linear or fissure fractures were the most common type seen in 81 cases, 8 cases were comminuted fractures and 6 cases were depressed fractures.
9. On considering the most common site of fractures in the skull vault, temporal bone was the commonest bone to be fractured followed by frontal bones.
10. Fracture of the base of the skull was observed in 78 cases.The floor of middle cranial fossa was most commonly fractured 47 cases (23.5%) followed by floor of posterior cranial fossa 17 cases (8.5%)
11. Subdural haemorrhage was the most commonest intracranial hemorrhage observed in 190 cases (95.0%) followed by subarachnoid haemorrhage 169 cases (84.5%). Brain stem hemorrhage was found in 13 cases(6.5%)
12. Contusion of the scalp was the commonest scalp injury 190 cases followed.
13. Laceration of the brain parenchyma was found in 20 cases.(10%)
14. In addition to head injury, chest, upper limbs and lower limbs are commonly involved in road traffic accidents.
15. Two wheeler drivers and pedestrians were more commonly involved in Fatal head injuries in road traffic accidents followed by two wheeler pillion rider.
16. As regard to the type of vehicle, two wheeler was the common offending vehicle.

Recommendations

1. A national level registry must be established for registering all road traffic accidents all over the country. It will give insight about the epidemiological correlates and risk factors of RTAs, which will help in taking appropriate preventive measures.
2. Modifiable risk factors contributing to the occurrence of RTAs should be brought under control. Use of helmets for two-wheeler riders should be strictly enforced by law. Drunken driving and use of mobile phones while driving should be strictly prohibited. Use of seat belts should be made compulsory. Traffic rules including the lane discipline should be enforced strictly. Bad roads should be repaired and adequate lighting should be provided in all the roads.
3. Emergency contact numbers should be provided in all the roads. Health care facilities should be improved to provide timely interventions to RTA victims. Adequate ambulance facilities should be made available.
4. Standardised national level guidelines should be developed for the management of RTA victims in order to improve their survival.
5. Strict actions should be enforced against the negligent drivrers for rash driving.
6. Drivers to be carefully scrutinised before issuing driving license.
7. Traffic rules to be enforced strictly.
8. Use of seat belts and wearing of helmets to be made compulsory for the occupants of vehicle.

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