ORIGINAL RESEARCH PAPER

Forensic Medicine

ANALYTICAL POST MORTEM STUDY OF FRACTURE IN VAULT IN HEAD INJURY IN ROAD TRAFFIC ACCIDENT IN LUCKNOW CITY.

KEY WORDS: Head injury, Post Mortem, Road traffic accidents, Subdural hemorrhage

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ABSTRACT

Background: Traffic accidents are the world's most serious health problem causing premature death and disability with increasing prevalence. Head is the most common site to be injured in road traffic accident. Head injuries may result in injury to the contents of the skull, either alone or with a fracture of the skull. The objective of the study was analytical post mortem study of fracture in vault in head injury in road traffic accident in city Lucknow **Material and Methods:** This study was conducted on XYZ Medical College, in the Department of Forensic Medicine, Lucknow. A total of 200 fatal head injury case autopsies were performed. The criteria for exclusion were decomposed bodies, unknown, natural diseases, admitted cases and fatality due to other body parts. **Results:** Out of 200 cases 88.0% were male and 12.0% were female. The highest incidence of RTA was observed in the age group of 21-30 years. The highest number of victims were of two-wheelers. (46.0%). Regarding injury pattern, all the victims had multiple abrasions and bruise, 83.0% had laceration, 85.0% had injury in skull bone, 100.0% injury to brain, 11.0% victims had injury to abdominal viscera, In the skull linear/fissure fracture was the commonest type of fracture (61.0%), followed by comminuted fracture (26.0%), depressed fracture (17.0%). Temporal bone was most prone to be fractured (32.0%) followed by Parietal bone (29.0%). Most victims had subdural haemorrhage (85.0%). **Conclusion:** The results of our study showed that most of the people who had accidents were pedestrian and two-wheeler driving persons. Subdural haemorrhage was the commonest intracranial haemorrhage associated with head injuries.

INTRODUCTION:

Road Traffic Injuries (RTIs) are one of the leading causes of deaths, hospitalizations, disabilities and socioeconomic losses in India. Large number of poor and middle-income family is compelled to use two wheelers, as they are not highly expensive. In the case of two-wheeler occupants, the rider or the pillion can hit the colliding object, (which can be an incoming vehicle, a roadside stationary object or the ground) (at different speeds and velocities). The resulting energy release and its impact on the brain is determined by the amount of energy generated, presence or absence of protective equipment, viz., helmet, physiological characteristics of the injured person and energy threshold levels. Skull and brain injuries are produced by either static or dynamic forces. Skull fractures with or without brain damage is possible.

India reports highest number of accident fatalities (1,37,423 in year 2013) in the world. More alarming than the sheer number of accidents is their severity (persons killed per 100 accidents). It steadily rose from 21.2 to 28.3 from 2003 to 2013. National figures report 377 deaths per day and 1287 injuries per day due to Road Accidents. 66 Deaths per day are by Truck/Lorry and 94 deaths by Two-wheeler. Uttar Pradesh shared 11.3% in 2010, 15.1% in 2011, 11.7 % in 2012 and 11.6 % in 2013 of total national road traffic deaths. Accidental deaths in Varanasi are 40.3 %, higher than its parent State's average of 15.8 %. Other cities from Uttar Pradesh in the list above are: Kanpur, Agra, Meerut, Allahabad and Lucknow which have higher accident rate than the State's average.[2]

Head Injury has been defi ned as, "A morbid state, resulting in gross or subtle structural changes in scalp, skull and/or the contents of skull, produced by mechanical forces". It has also been defi ned as physical damage to scalp, skull or brain produced by an external force.

Unintentional head injury varies with extremes of outcome from good recovery to death. The lethality of injury depends on amount of strike force, skull properties at the point of the contact, thickness of scalp, amount of hair and thickness and elasticity of individual skull, etc. It is observed that the victim is more vulnerable in frontal collision, side collision and if hit by heavy motor vehicle. Head injury is also caused by the assault as a common reason and pattern of injuries depends upon type of weapon. Clinical features of head injury are: Loss of consciousness or headache, nausea and vomiting, ear bleed, vertigo and papilloedema.

Likelihood of skull fracture is directly associated with severity of injury and vault is involved three times more often than the base. Subdural hematoma (SDH) was the most common intracranial lesion resulting from head injury. Contusions and lacerations of the brain often seen in vehicular accidents and fall from height cases. These may occur with or without external injury to the scalp and fracture of the skull.

Severe head injury, with or without peripheral trauma, is the most common cause of death or prolonged disability in the victims of road traffic accidents and in the people of up to the age of 45 years in developed countries. Several studies had been conducted previously denoting head injury as a principal killer in road traffic accidents. According to one study in Chandigarh head injury accounted for 73.0% of all fatal road traffic accidents. This necessitated an in-depth analysis of the pattern of fatal head injury in road traffic accidents. Therefore, we assess analytical post mortem study of fracture in vault in head injury in road traffic accident in city Lucknow

MATERIAL AND METHODS:

Present study was done on the cases selected from the dead bodies brought into the mortuary of the Department of Forensic Medicine, XYZ college, Lucknow, for medico-legal postmortem examination from the various police stations of Lucknow region. The data of the materials were sourced from 200 fatal Road Traffic Injury cases over a period of 2 years. Condition of the scalp, cranial bones, meninges, intra-cranial haemorrhages and brain parenchymal involvement were noted at the time of autopsy.

Study population: 200 fatal Road Traffic Injury cases in Department of Forensic Medicine during the study period.

Study Design: Prospective study.

Study location: Department of Forensic Medicine, XYZ College and Hospital, Lucknow, UP

Sample Size: 200 patients

Inclusion Criteria- Those cases, where the cause of death was directly or indirectly related to road traffic accidents were included in the study

Exclusion criteria– Other deaths following injuries sustained in any other manner were excluded

Procedure and preliminary data:
The profile and general particulars of the patient, clinical and laboratory investigations, procedures done if any, survival period of the patient, time and cause of death were ascertained from the Post-mortem report, hospital records, panchnammma and requisition for post mortem. The information regarding to the time and manner of road traffic accident was taken from the police investigating officer. All these information then correlated with the

Ethical clearance
The research procedure followed was in accordance with the approved ethical standards of Department of Forensic Medicine, XYZ College and Hospital, Lucknow, UP, India Ethics Committee (Human).

OBSERVATION AND RESULTS

Table 1: Demographic details

Parameters		No. of patients (n=200)	Percentage
Gender	Males	176	88.0
	Females	24	12.0
Age in years	≤20	22	11.0
	21-30	102	51.0
	31-40	49	24.5
	41-50	17	8.5
	>50	10	5.0
Mean Age	36.7±10.2 years		
Type of Vehicle	Pedestrian	66	33.0
	Two-wheeler	84	42.0
	Car	30	15.0
	Bus/Truck	20	10.0

Table 2: Type of injury

Type of Injury	No. of patients (n=200)	Percentage
Multiple Abrasions and Bruise	200	100.0
Laceration	166	83.0
Injury in Skull Bone	170	85.0
Injury to Brain	200	100.0

Table 3: Skull Fracture

Skull Fracture	No. of patients (n=200)	Percentage
Linear/fissure fracture	132	61.0
Comminuted fracture	52	26.0
Depressed fracture	26	13.0

Table 4: Incidence and pattern of cranial vault fractures

Pattern		No. of patients (n=200)	percentage
pattern of cranial vault fractures (Bones involved)	Frontal	40	20.0
	Perietal	58	29.0
	Temporal	62	32.0
	Occipital	24	12.0
	Sphenoid	14	7.0
Pattern of hemorrhage	Subdural hemorrhage	170	85.0
	Subarachnoid hemorrhage	22	11.0
	Extradural hemorrhage	8	4.0

DISCUSSION:

India is a south Asian developing country. Here poverty and unemployment push the people towards urban areas. This rapid and unplanned urbanization associated with incompetent traffic system, unplanned roads and highways, violation of traffic laws by the drivers and pedestrians, over-crowding, unlicensed rickshaws, reckless driving etc are responsible for this highest figure of road traffic accidents. The essential factors involved in RTA's include the person, the machine and the road.

In this study males were predominantly affected with RTA than females and the mean age of the studied samples was 36.7±10.2 years with majority of accidents taking place in the age group ranging from 21 to 40 years. Two-wheeler accidents in 42.0% followed by pedestrians (33.0%). Our findings were in accordance with **Ahmad M et al** who reported male and female ratio observed among the victims was 64:36. This ratio is in conformity with previous studies in other countries., In this country, males are predominantly the earning member of the family. Moreover, they are at higher risk of injuries than women because of their greater exposure to traffic and more risky behavior like hanging on the side of bus or rush to get in a running bus. Road conditions are important actiologic factors in RTA world-wide. Rural roads tend to pose special and additional hazards. Many roads have become death traps with potholes are dotted along the length and breadth of the roads. Most accidents in this country take place in the highways and caused by buses. Aggressive driving, impatience, lack of attention and drinking alcohol (in case of drivers) prior to driving are responsible for this. **Awasthi A et al** also reported the comparable result and reported that of 121 cases 88.42% were male and 11.57% were female. The highest incidence of RTA was observed in the age group of 21-30 years. The highest number of victims were of two wheelers. (46.34%). **Rao RB et al** reported that 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. (83.0%) Were males and (17.0%) were females.

In our study regarding injury pattern in different parts of the body, all the victims had multiple abrasions and bruise, 83.0% had laceration, 85.0% had injury in skull bone, 100% injury to brain. Our findings were consistent with the findings of **Awasthi A et al**[18] who reported that all samples had multiple abrasions and bruise and injury to brain, followed by laceration, injury in skull bone, 10.74% victims had injury to abdominal viscera, 16.52% had injury to rib cage bones, 14.87% to heart and lungs, 17.35% to liver and spleen and 7.43% to kidney. **Ahmad M et al**[11] depicted that various types of injury pattern in different parts of body are seen in RTA victims. All the victims in this study had multiple abrasion and bruises all over the body Laceration were present in (90.0%) cases. 78.0% victims had injury to brain, 82.0% had fracture of different skull bones, 77.0% had injury to liver and spleen. Thirty six percent cases had fracture of pelvic bones, 49.0% had fracture femur, 41.0% had rupture of kidneys. This pattern of injuries coincides with other studies done before.

In present study on analyzing skull fractures the majority of the samples had Linear/fissure fracture (61.0.%), followed by Comminuted fracture (26.0%) and depressed fracture (13.0%). Our findings were comparable to the findings of **Ahmad M et al**[11] who reported that in case of head injury,

various patterns of skull fracture were found. Linear/fissured fracture was the commonest type (36.0%), followed by comminuted fracture (18.0%), depressed fracture (11.0%). Linear fracture is the commonest one because during RTA head strikes by forcible contact with broad resisting surface like the roads. **Pany TP et al** reported that linear fractures were more common than comminuted fractures. **Kumar D et al** also reported the similar results. Rao RB et al found that 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 C et al** in Copenhagen, where linear fracture was the commonest type followed by comminuted, depressed, ring and spider -web fractures. In the Jaipur study by **Goyal MK et al**, linear fractures were the commonest followed by depressed and then the comminuted fractures. This correlates with data as given in **Aggrawal A** who concluded linear fracture as the commonest type of fracture.

In our study regarding pattern of cranial vault fractures (Bones involved) we found that the majority of the studied sample had affected temporal bone followed by Perietal and frontal bone whereas pattern of hemorrhage shows that Subdural hemorrhage was the commonest (85.0%). Similar to the present study performed by **Ahmad M et al**[11] reported about intra cranial lesions and found that most of the victims had subdural haemorrhage (43.0%), followed by sub arachnoid haemorrhage (36.0%). Extradural haemorrhages are more common in 20-40 years of age and occurred mostly due to RTA or hit by other objects. Subdural haemorrhages mostly occur in old ages and children due to fall on ground by accidents, whereas subarachnoid haemorhages are most common pattern of intra cranial haemorrhage in RTA. Regarding fracture of individual bones, temporal bone was most prone to fracture (23.0%) followed by parietal bone (17.0%). This coincides with other studies done before. The thinnest area in outer skull is temporal bone (4 mm), followed by frontal bone (6 mm), parietal bone (10 mm) and occipital bone (15 mm). **Rao RB et al**[16] reported that 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 and subdural haemorrhage was the common findings in head injury (95.0%). **Kumar D et al**[21] temporal region was the commonest (35.9%) region involved in fracture followed by parietal (29.5%) and frontal (34.6%) region. Subdural (43.1%), subarachnoid (31.9%) and extradural (19.4%) haemorrhage was associated with skull fracture. **Ravikumar R et al**[1] reported the commonest variety of Intra Cranial Haemorrhage found was subdural haemorrhage 90.8%, followed by sub arachnoid haemorrhage 70.5%, Intra cerebral haemorrhage 20.6% and least is extradural haemorrhage found in 4.7% of cases.

CONCLUSION:

Head injury due to RTA is a recognized major public health problem causing death and disability among the populations of this country. In skeletal fractures overall fractures of whole temporal skeleton were the commonest, followed by parietal fractures. Subdural hemorrhage was the most common affliction of meninges. It is the high time for concerned authority to take appropriate and immediate measures for reducing the incidences of head injury associated with RTA and thereby protecting this vulnerable group of people.

REFERENCES:

1. Ravikumar R. An autopsy Study of Patterns of Skull fractures in Road Traffic Accidents Involving Two Wheelers. JKAMLS 2014;23(1)
2. Accidental Deaths and Suicides in India (2013), National Crime Records Bureau (Ministry of Home Aff airs).
3. Gurudatta KS, Kumar SA, Gouda HS. Analysis of fatal cases of mechanical asphyxia at Belgaum, Karnataka 2011;28 (2):51-53.
4. Dimaio VJ, Dmaio D. Forensic Pathology, 2nd ed. Washington, DC: CRC Press; 2001:
5. Dhillon S, Kapila P, Sekhon HS. Pattern of injuries present in road traffic accident in shimla hills. Journal of Punjab Academy of Forensic Medicine & Toxicology 2007;7:7-10.
6. Yavuz MS, Asirdizer M, Cetin G, Gunay Balci Y, Altinkok M. The correlation between skull fractures and intracranial lesions due to traffic accidents. Am J Forensic Med Pathol 2003;24:339-345.
7. Stables G, Quigley G, Basu S, Pillay R. An unusual case of a compound depressed skull fracture after an assault with a stiletto heel. Emerg Med J 2005;22:303-304.
8. Baethmann A, Lehr D, Wirth A. A Prospective Analysis of patient management in severe head injury. Acta Neurochirargica 1998;715:107-110.
9. Sharma BR, Harish D, Sharma V, et al. Dynamics of Road Traffi c Fatalities in Chandigarh – a surprise. JFMT 2002;19(1):25-30
10. Stutts JC, Hunter WW. Motor vehicle and roadway factors in pedestrian and bicyclist injuries: an examination based on emergencydepartment data. Accid Anal Prev 1999;31:505-514
11. Ahmad M, Rahman FN, Chowdhary MH, Islam AKMS and Hakim MA. Postmortem study of head injury in fatal road traffic accidents. JAFMC. 2009;5(2):24-28
12. Majumdar B, Karmakar R, Bose T, Dasgupta S, Basu R. Some hostfactors and seasonal variations in the fatal road traffic accidents occurring in eastern suburban Calcutta. Ind J Pub Health 1996;40(2):46-49.
13. Sharma BR, Harish D, Sharma V, Vij K. Road-Traffic accidents-a demographic and topographic analysis. Med Sci Law 2001;41(3):266-274.
14. Al-Balbissi AH. Role of gender in road accidents. Traffic Inj Prev 2003;4(1):64-73.
15. Awasthi A, Khan I, Prasad BD, Anoop V. Analytical Post Mortem Study of Head Injury in Road Traffic Accident in City Lucknow. Indian Journal of Forensic Medicine and Toxicology 2018;12(1):1
16. M. N. Rajamani Bheem Rao, A. Nirmala, R. Raguram. Pattern of Injuries in Fatal Head Trauma Due to Road Traffic Accidents. Indian Journal of Forensic Medicine and Toxicology 2022;16(3):26-30.
17. Banerjee KK, Agarwal BB, Kohli A, Aggarwal NK. Study of head injury victims in road traffic accidents in Delhi, Ind J Med Sci. 1998;32(9):395
18. Adesunkanmi AR, Oginni LM, Oyelami OA, Badru OS. Road traffic accidents to African children: assessment using the injury severity score (ISS). Injury 2000;31(4):225-228.
19. Pathak A. Desania N L, Verma R. Profile of Road Traffic accidents and head injury in Jaipur. J Indian Acad Forensic Med 2008;30(1):6-10
20. Pany TP, Dashottar S, Nema D. NCCT findings of pattern of head injuries in road traffic accidents. IJCR. 2018;10(09):73324-73329
21. Kumar D, Bains V, Sharma BR, Harish D (2012) Descriptive Study of Head Injury and its Associated Factors at Tertiary Hospital, Northern India. J Community Med Health Educ 2:141.
22. Jacobsen C, Lynnerup N: Craniocerebral Trauma - Congruence between Post-mortem Computed Tomography Diagnoses and Autopsy Results - A 2-year retrospective study
23. Mukesh K Goyal, Rajesh Verma, Shiv R Kocher, Shrikant S Asawa. Correlation of CT scan with post mortem findings of Acute Head Trauma cases at SMS Hospital, Jaipur. JIAFM 2010;32(3);208-211.
24. Anil Aggrawal: Textbook of Forensic Medicine and Toxicology, 1st edition, 2017
25. Reddy KSN. The Essentials of Forensic Medicine and Toxicology. 25th ed. India: Medical Book Coy;2006:207-219.