ORIGINAL RESEARCH

Analysis of Pattern of Cranio Cerebral Injuries at a Tertiary Care Centre

[1]Dr. Nabajit Barman, [2]Dr. NetraMoniKakati, [3]Dr. MeentooMohanLahon

[1]Assistant Professor, Department of Forensic Medicine, Fakhruddin Ali Ahmed Medical College, Barpeta, Assam, India.
[2]Associate Professor, Department of Forensic Medicine, Jorhat Medical College and Hospital, Jorhat, Assam, India.
[3]Assistant Professor, Department of Forensic Medicine, Nalbari Medical College, Nalbari, Assam, India.

Corresponding author
Dr. Meentoo Mohan Lahon,
Assistant Professor, Department of Forensic Medicine, Nalbari Medical College, Nalbari, Assam, India.

Received: 20 April, 2023 Acceptance: 17 May, 2023

ABSTRACT

Background: To analyse the pattern of cranio cerebral injuries at a tertiary care centre.

Materials & Methods: A total of 100 subjects were included in the study, all of whom were taken directly to the mortuary for postmortem examination, regardless of the cause of their injuries. A comprehensive review of legal inquests and legal records was also conducted. The results were subsequently analyzed using SPSS software.

Results: Skull fractures are observed more frequently in motorcycle riders, accounting for 34 cases (34%), followed by assault with 29 cases (29%), and they are least commonly seen in cases involving falls from height, which amounted to 3 cases (3%).

Conclusion: Skull fractures are most commonly seen in motorcycle accidents, followed by assault.

Keywords: Skull Fractures, Cranio Cerebral Injuries, Hemorrhage.

INTRODUCTION

Trauma is a serious global public health problem.[1] Traumatic injuries (TIs) are estimated to account for 10% of all deaths and about 5.8 million deaths annually and at least 6% of Years Lived with Disability (YLD).[2,3] Low and medium-income countries (LMICs) account for about 90% of this global trauma disease burden.[4] Globally, traumatic brain injury (TBI) is the leading form of TI burden.[1] Currently, about 69 million people suffer from TBI annually, mainly from road traffic injuries (RTIs), violence and falls.[5,6] The estimated economic cost of RTIs in Europe is substantially high with an approximate range of 7500-1,200,00 US dollars.[7] Young persons aged less than 40 years are the most affected.[8] In the EU, over 1.5 million people are admitted to hospital for TBI annually, with Austria and Germany reporting about eight times more admissions compared to Portugal and Spain. One study found EU hospital admissions, adjusted for population, to be three times higher compared to the USA.[5] This indicates significant inter-continental TBI burden and trauma system development variations.Head injury is a major public health and socioeconomic problem causing death and disability particularly among young population throughout the world. Nowadays, the term "head injury" has been replaced by the new term "traumatic brain injury (TBI)." TBI is defined as "cerebral insult not degenerative or congenital nature, due to external mechanical force that possibly leads to permanent or temporary disabilities of cognitive, physical, and psychosocial functions with or without altered level of consciousness."[9] The incidence of TBI is rising worldwide because of increased mechanization, inadequate traffic education, and poor implementation of traffic safety rules, especially in developing countries like India. Head injury is recognized as a major public health problem that is frequent cause of death and disability in young people and makes considerable demand on health services.[10]The quality of survival after severe and moderate head injury is highly dependent on the adequacy of cognitive recovery. Outcome assessments are usually based on the integrity of neurological function and give little information regarding cognitive abilities.[11] The mortality of children's caused by trauma and head injury is second only to congenital disease in developed countries.[12] Since 1970's Glasgow coma scale (GSC) and computed tomography (CT) scanning has been used in evaluating head injury patients.[13] Trauma presents with variety of injuries and problems that demand rapid evaluation, discussion, improvisation and intervention to save life and prevent permanent disability.[14] The types of TBI can be divided into two major categories which are primary and secondary injuries based on the timing of the insult. Primary injuries include those sustained at the time of the traumatic event. For example, vascular disruption, contusions, and diffuse axonal injury. Secondary injuries result from metabolic and physiologic changes that begin at the time of the initial injury and can last for hours and days. Secondary brain injuries include cerebral edema, alterations in cerebral blood flow, and intracranial hypertension.[15]Another way of categorizing TBI is by the level of severity using the Glasgow Coma Scale (GCS) score. The GCS score has been the most widely used clinical measure of the severity of injury in patients with TBI since 1974, and it is one of the parameters that will be assessed in this research.[16] Hence, this study was conducted to analyse the pattern of cranio cerebral injuries at tertiary care centre.

MATERIALS & METHODS

Present study was conducted in Fakhruddin Ali Ahmed Medical College, Barpeta, Assam, India. A total of 100 subjects were included in the study, all of whom were taken directly to the mortuary for postmortem examination, regardless of the cause of their injuries. Individuals who were hospitalized and had undergone surgery were excluded from the current research. Ethical clearance and consent were obtained from the deceased individuals' relatives to gather the necessary information. A thorough postmortem examination was conducted, with a specific focus on examining the skull and brain for the presence of fractures, hematomas, hemorrhages, and brain tissue injuries. Magnifying lenses and measuring tape were employed to examine fractures and other injuries in detail. A comprehensive review of legal inquests and legal records was also conducted. The results were subsequently analyzed using SPSS software.Univariate analysis was used for evaluation of level of significance.

RESULTS

In the present study, a total of 100 subjects were included. Mean age was found to be 43.5 years while majority of the subjects were males. Skull fractures are observed more frequently in motorcycle riders, accounting for 34 cases (34%), followed by assault with 29 cases (29%), and they are least commonly seen in cases involving falls from height, which amounted to 3 cases (3%). Among the types of fractures identified, linear fractures were the most prevalent, found in 50 cases (38.5%), followed by depressed fractures in 40 cases (30.7%). The least common type of fracture observed was the ring fracture, with only 2 cases (1.5%). No sutural fractures were detected in any of the cases.The most prevalent type of intracranial hemorrhage is extradural hemorrhage, accounting for 68 cases (42.5%), followed by subdural hemorrhage with 54 cases (33.7%). Intra-cerebral hemorrhage is the least common type of intracranial hemorrhage, occurring in only 7 cases (4.4%), and it is consistently observed alongside one of the other types of intracranial hemorrhage.

Table 1: Pattern of skull fractures according to the type of case

Case	Number	Percentage %
Bike rider	34	34%
Assault	29	29%
Pillion rider	25	25%
Four-wheeler	5	5%
Fall from height	4	4%
Railway accident	3	3%
Total	100	100

Table 2: pattern of type of skull fracture

Type	Number	Percentage %
Linear	50	38.5
Depressed	40	30.7
Comminuted	38	29.3
Ring	2	1.5
Sutural	0	0
Total	130	100

Table 3: Pattern of intracranial hemorrhage associated with skull fracture.

Types	Number	Percentage %
Extradural	68	42.5
Subdural	54	33.7
Subarachnoid	31	19.4
Intracerebellar	7	4.4
Total	160	100

DISCUSSION

TBI patterns comprise a complementary component of a responsive trauma/injury assessment and response at the pre-hospital care level. For instance, effective EMS response may require responses matched to the specific trauma source, injury type and its severity level.[17] In this study, trauma pattern is defined in three different ways; based on source (RTIs and non-RTI), type of injury (blunt and penetrating) and day of injury (weekday and weekend). Reviews indicate the main cause of TBIs is RTIs, followed by violence and falls.[18,19] Blunt trauma has been closely linked to motor vehicle collisions and falls.[20] TBI burden from RTIs has continued to exert pressure on already weak health systems globally due to increasing motorization and lack of effective EMS response systems.[21,22] In Kenya, more than 75% of health facilities' emergency department visits are also due to RTIs.[23] Hence, this study was conducted to analyse the pattern of cranio cerebral injuries at tertiary care centre.In the present study, skull fractures are observed more frequently in motorcycle riders, accounting for 34 cases (34%), followed by assault with 29 cases (29%), and they are least commonly seen in cases involving falls from height, which amounted to 3 cases (3%). A study by Alexis RJ et al, the 303 fatal head injury patients, a majority were males and age group between 21 and 40 years. Eighty-eight percent (267/303) of fatal head injuries were due to road traffic accidents. Twenty-five of the 303 patients reached our center within 1 h (golden hour) of trauma. Of the 303 fatal head injuries, 153 (50.5%) died within 24 h of reaching our center. The most common autopsy finding in this study was subarachnoid hemorrhage (SAH) (247/303, 81.3%). Diagnostic accuracy of Epidural hemorrhage (EDH) antemortem had the highest value (98.35%). SAH had least diagnostic accuracy value (45.72). subdural hemorrhage (SDH) had highest sensitivity (57.02%). EDH had higher specificity (100%). Significant SDH, SAH, and brain contusions were not detected during antemortem evaluation. Among fatal head injury patients, half of them died within first 24 h after reaching to tertiary care center. Diagnostic accuracy to detect extradural hemorrhage antemortem had the highest value and SAH had least diagnostic accuracy value. Significant subdural hemorrhage, subarachnoid hemorrhage, and brain contusion were not detected during antemortem evaluation. Expertise in interpretation of imaging, adequate clinical examination, proper documentation, and early resuscitation may reduce the chances of missed injuries in head injury patients.[24]In the present study, among the types of fractures identified, linear fractures were the most prevalent, found in 50 cases (38.5%), followed by depressed fractures in 40 cases (30.7%). The least common type of fracture observed was the ring fracture, with only 2 cases (1.5%). No sutural fractures were detected in any of the cases. A study by Fernandes TB et al, records of 4350 facial trauma patients over a five-year period were reviewed. A total of 3564 (81.9%) patients were victims of motor vehicle accidents (MVA). Male patients predominated, comprising 3711 (85.3%), and 36.6% were in the third decade of life. Facial fractures were seen in 2120 (48.7%), the most common being zygomatic fractures (60%). At the time of trauma, 2383 (57.3%) patients were under the influence of alcohol, and 2821 (87.8%) victims of two-wheeler MVAs were not using their helmet. Of all patients, 29.75% sustained a traumatic brain injury (TBI). Midface fractures were strongly associated with TBI. Maxillofacial injury may be considered a risk factor for TBI, and as such should immediately be suspected and investigated in all patients. Prompt recognition and management can improve outcomes in these patients.[25]Koome G et al, a case-control study with a sample of 316 TBI patients. The majority of patients were aged below 40 years (73%) and were male (85%). Road traffic injuries (RTIs) comprised 58% of all forms of trauma. Blunt trauma comprised 71% of the injuries. Trauma mechanism was the only trauma pattern significantly associated with TBI mortality. The risk of dying for patients sustaining RTIs was 2.83 times more likely compared to non-RTI patients [odds ratio (OR) 2.83, 95% confidence interval (CI) 1.62-4.93, $p=0.001$]. The type of transfer to hospital was also significantly associated with mortality outcome, with a public hospital having a two times higher risk of death compared to a private hospital [OR 2.18 95%CI 1.21-3.94, $p<0.009$]. Trauma mechanism (RTI vs non-RTI) and type of tertiary facility patients are transferred to (public vs private) are key factors influencing TBI mortality burden. Strengthening local EMS trauma response systems targeting RTIs augmented by adequately resourced and equipped public facilities to provide quality lifesaving interventions can reduce the burden of TBIs.[26]Tripathi

M et al, a prospective study was conducted on 1545 patients (1314 males and 231 females) between 01 April, 2011 to 31 December, 2011. Male drivers of two-wheeler vehicular accidents (71.4%) were most commonly injured. Among helmeted patients, only 4.8% sustained severe head injuries compared to 23.7% of un-helmeted patients. Only full coverage helmets were effective in preventing head injury. Among helmeted patients with a proper chinstrap, 2.6% suffered critical injuries compared to 14% of non-strapped ones. In 142 patients, helmet was at position after the crash and only 0.7% of these sustained severe head injuries. Drunk driving was noticed among 19% and 6% of two- and four-wheeler vehicular occupants, respectively. Only 7.5% of the four-wheel vehicular occupants were wearing seat belt at the time of accident. Injury profile of two- and four-wheeler vehicular accident victims is entirely different. A ready supply of affordable helmets of appropriate quality and strict legislation for safety constraints is the need of the hour for road safety.[27]The pathophysiology of TBI is a complex process that begins with primary and secondary injuries resulting in short or long-term brain impairments. The primary impairment is directly related to the brain's major external impacts causing compression and shearing of adjacent tissues with or without loss of consciousness. The secondary injury occurs minutes to days after the main impact and is caused by a molecular, chemical, and inflammatory cascade resulting in cranial and systemic complications.[28] Brain injuries incurred in MVAs, assaults, or falls from heights typically result in damage to multiple body sites, including the spine and vertebrae, and these are found to be the prime cause of mortality and disability.[29] One report showed that in an overall major trauma outcome study in cases with severe extra cranialinjury (SEI) alone, the mortality rate was 8.3%; it was three times higher in the SEI with head injury group (14.5%) than in the non-head injury patients (5.1%).[30]

CONCLUSION

Skull fractures are most commonly seen in motor cycleaccidents, followed by assault.

REFERENCES

1. Kong SY, Shin SD, Tanaka H, et al.: Pan-Asian Trauma Outcomes Study (PATOS): Rationale and Methodology of an International and Multicenter Trauma Registry. PrehospitalEmerg Care. 2017;22(1):1–26.
2. Curtis K, McCarthy A, Mitchell R, et al.: Paediatric trauma systems and their impact on the health outcomes of severely injured children: Protocol for a mixed methods cohort study. Scand J Trauma ResuscEmerg Med. 2016;24(1):1–8.
3. World Health Organization: Injuries and violence: the facts 2014. 2014.
4. Adeloye D: Prehospital trauma care systems: Potential role toward reducing morbidities and mortalities from road traffic injuries in Nigeria. Prehosp Disaster Med. 2012;27(6):536–542.
5. Traumatic Brain Injury Fact sheets and Policy brief Can affect anyone, anywhere.
6. Dewan MC, Rattani A, Gupta S, et al.: Estimating the global incidence of traumatic brain injury. J Neurosurg. 2019 Apr 1;130(4):1080–97.
7. Leppäniemi A: Trauma systems in Europe. Current Opinion in Critical Care. CurrOpinCrit Care; 2005 [cited 2021 Mar 10]; 11; 576–9.
8. Allgaier RL, Laflamme L, Wallis LA: Operational demands on pre-hospital emergency care for burn injuries in a middle-income setting: a study in the Western Cape, South Africa. Int J Emerg Med. 2017;10(1):1–7.
9. Abelson-Mitchell N. Epidemiology and prevention of head injuries: Literature review. J ClinNurs. 2008;17:46–57.
10. Janett B. Epidemiology of Head Injury. Arch Dis Child. 1998;78:403–06.
11. Kamran, Tabaddor, Mattis S, Zazula T. Cognitive sequelae and recovery course after moderate and severe head injury. Journal of Neurosurgery. 1984;14(6):701–07.
12. Hans, Feickert J, Drommer S, Heyer R. Severe head injury in children. The Journal of Trauma Infection. Injury and Critical Care. 1999;47(1):33–37.
13. Kennedy F, Gonzalez P, Ong C, Fleming A, Scott RS. The Glasgow coma scale. Journal of Trauma. 1993;35(1):75–77.
14. Tabish SA, Shah S, Bhat AS, Bhat FA, Shoukat H, Mir MY. Clinical profile and mortality pattern in patients of ballistic trauma. JIMSA. 2004;13(4):247–50.
15. Valadka AB, Andrews BT. New York: Thieme; 2011. Neurotrauma Evidence-Based Answers to Common Questions.
16. Chesnut RM, Ghajar J, Mass A, et al. [Dec; 2020]. 2021. Early indicators of prognosis in severe traumatic brain injury.
17. Trajano AD, Pereira BM, Fraga GP: Epidemiology of in-hospital trauma deaths in a Brazilian university hospital. BMC Emerg Med. 2014;14(1):1–9.
18. Suryanto, Plummer V, Boyle M: EMS systems in lower-middle income countries: A literature review. Prehosp Disaster Med. 2017;32(1):64–70.
19. Taibo CLA, Moon TD, Joaquim OA, et al.: Analysis of trauma admission data at an urban hospital in Maputo, Mozambique. Int J Emerg Med. 2016;9(1):1–7. 10.1186/s12245-016-0105-8
20. Strnad M, BorovnikLesjak V, Vujanović V, et al.: Predictors of mortality and prehospital monitoring limitations in blunt trauma patients. Biomed Res Int. 2015;2015. 10.1155/2015/983409
21. Chalya PL, Mabula JB, Dass RM, et al.: Injury characteristics and outcome of road traffic crash victims at Bugando Medical Centre in Northwestern Tanzania. J Trauma Manag Outcomes. 2012;6(1):1–8.
22. Adeloye D, Thompson JY, Akanbi MA, et al.: The burden of road traffic crashes, injuries and deaths in

Africa: a systematic review and meta-analysis. Bull World Health Organ. 2016;94(7).
23. World Health Organization W. WHO: Road traffic injuries. World Health Organisation. 2016
24. Alexis RJ, Jagdish S, Sukumar S, Pandit VR, Palnivel C, Antony MJ. Clinical Profile and Autopsy Findings in Fatal Head Injuries. J Emerg Trauma Shock. 2018 Jul-Sep;11(3):205-210.
25. Fernandes TB, Mandrekar PN, Visen A, Sinai Khandeparker PV, Dhupar V, Akkara F. Pattern of associated brain injury in maxillofacial trauma: a retrospective study from a high-volume centre. Br J Oral Maxillofac Surg. 2022 Dec;60(10):1373-1378.
26. Koome G, Thuita F, Egondi T, Atela M. Association between traumatic brain injury (TBI) patterns and mortality: a retrospective case-control study. F1000Res. 2022 Jan 31;10:795.
.
27. Tripathi M, Tewari MK, Mukherjee KK, Mathuriya SN. Profile of patients with head injury among vehicular accidents: an experience from a tertiary care centre of India. Neurol India. 2014 Nov-Dec;62(6):610-7.
28. Traumatic brain injury: current treatment strategies and future endeavors. Galgano M, Toshkezi G, Qiu X, Russell T, Chin L, Zhao LR. Cell Transplant. 2017;26:1118–1130.
29. The epidemiology of traumatic death. A population-based analysis. Shackford SR, Mackersie RC, Holbrook TL, Davis JW, Hollingsworth-Fridlund P, Hoyt DB, Wolf PL. Arch Surg. 1993;128:571–575.
30. Comparison of mortality, morbidity, and severity of 59,713 head injured patients with 114,447 patients with extracranial injuries. Gennarelli TA, Champion HR, Copes WS, Sacco WJ. J Trauma. 1994;37