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Original Research Article

Comparative Study of Antemortem CT scan and Autopsy Findings in Head Injury Cases in Jodhpur Region – A Significant Disparity

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Abstract

Introduction: Head injury is a significant public health problem worldwide and is predicted to surpass many diseases as a major cause of death. Data indicates that majority of traumatic brain injury cases (60%) are a result of road traffic accidents, followed by falls (20-30%), and violence (10%). Worldwide, traumatic brain injury (TBI) is the single largest cause of death and disability following injury. Computerized tomography (CT) is the primary screening modality of investigations in head trauma victims. Studies are needed to know the precision and accuracy of a CT scan, which can be achieved only by comparing a CT Scan with post-mortem findings in non-survivor cases.

Aim of the study: The aim of this study was to make a comparison in findings of antemortem CT Scan and findings of post mortem examination with calculation of disparity in head injury cases with their causative factors.

Material and Method: All fatal cases of head injury subjected for post-mortem examination where antemortem CT scan reports were available taken up for study. Post mortem examination of each case was carried out as per the standard process and the various types of injuries to the scalp, skull bone, haemorrhage in meninges and injury to the brain was recorded and photographed and the respective CT Scan report was collected. Further a comparative evaluation of post mortem finding of the head injury with antemortem CT Scan report was analysed and disparity in antemortem CT Scan and post-mortem findings was calculated.

Result: Out of 100 cases, the most interesting causative factor which was came across during the study was the Road Traffic Accidents (90%) followed by assault (6.00%) and rest 4.00% fall from height. Disparity in CT Scan findings and autopsy was observed in all cases. The disparity was maximum 100% seen in laceration cases followed by 50% in ICH cases. Minimum disparity 8.57% was seen in SDH cases.

Conclusion: Disparity in CT Scan findings and autopsy was observed in all types of cases during the study. The disparity was maximum 100% seen in laceration cases followed by 50% in ICH cases. Disparity can be minimised by using good quality CT Scan machines and properly trained medical and paramedical staff, who deals with reporting of radiological images and machine operating procedures.

Keywords: Traffic accidents; Head injury; CT scan; Autopsy; Disparity.

Introduction

Head injury is a significant public health problem worldwide and is predicted to surpass many diseases as a major cause of death. Among all the regional injuries, the injury to the head and neck are most common and important in Forensic Medicine practice. Data indicates that majority of traumatic brain injury cases (60%) are as a result of road traffic accidents, followed by falls (20-30%) and violence (10%). Traumatic head injury is a leading cause of death and disability in children and adults. Each year in India nearly 2 million people are injured with about 1 million deaths due to head injury. [1] Worldwide, traumatic brain injury (TBI) is the single largest cause of death and disability following injury. Most TBI's are due to road side accidents. According to WHO data, head trauma will be third largest killer in the developing world after ischaemic heart disease and unipolar depression. [2] In trauma cases the external injury on the head and the face may or may not be

representative of internal injury and the extent of danger of the impact. A thorough interpretation from the external and internal injuries to skull and its contents in light of the modern non-invasive diagnostic tools available at hand with the treating doctor is necessary, so that timely diagnosis can help in accurate treatment to save the life of injured. A CT Scan is recommended for all patients with mild head injury because one in five will have an acute lesion detectable by the scan. [3] The CT Scan of head is indispensable in the diagnosis of the various traumatic lesions and their management because it also carries prognostic value. [4]

Computerized Tomography (CT) is the primary screening modality of investigations in head trauma victims. [5] Often conflicts arise in the court of law, when a CT Scan report show no fracture and no brain injury, while autopsy report reveals a skull fracture and brain injury. Many times forensic evaluation of clinical cranial CT is only reliable source of morphological evidence in head injury cases. Moreover, when the injured survives, the evaluation of CT images is only the valuable source of evidence of head trauma available to Forensic experts to conclude the nature of injury. So studies are needed to know the precision and accuracy of a CT Scan, which can be achieved only by comparing a CT Scan with post-mortem findings in non-survivor cases. If death of the injured occurs, it is essential to corroborate and correlate the findings of ante mortem CT Scan of deceased at the time of autopsy. [6] Therefore present study is planned to assess precision and accuracy of CT Scan versus autopsy findings among head injury patients.

Aim of the study: The aim of this study was to make a comparison in findings of antemortem CT Scan and findings of post mortem examination with calculation of disparity in Head injury cases with their causative factors.

Material and Method

This study was carried out in the Department of Forensic Medicine and Toxicology Dr. S. N. Medical College Associated, Mathura Das Mathur Hospital, Jodhpur, Rajasthan, after institutional ethical clearance. This study was conducted on total 100 cases from January 2020 to June 2021.

All fatal cases of head injury subjected for post-mortem examination, where antemortem CT Scan reports were available taken up for study. The data related to causative factors or manner of injury were collected from relatives of the deceased, police person, panchnama and bed head ticket. Post mortem examination of each case was carried out as per the standard process and the various types of injuries to the scalp, skull bones, haemorrhage in meninges and injury to the brain was recorded and photographed and the respective CT Scan report was collected. Further a comparative evaluation of post mortem finding of the head injury with antemortem CT Scan report was analysed. These data along with the findings of antemortem CT Scan of head and post mortem examination were recorded in specially designed proforma. Finally the details were analysed and the conclusions were drawn after comparing and discussing with similar type of the works carried out by Foreign and Indian authors. The percentage of disparity is calculated by taking the total number of cases observed during autopsy in denominator and the difference that is observed between the number of autopsy and CT Scan findings is taken in numerator, multiplied by 100.

Inclusion Criteria: All cases with acute head injury subjected to CT Scan examination, admitted in Dr. S. N. Medical College Associated, Mathura Das Mathur Hospital, Jodhpur, Rajasthan were included in the study.

Exclusion Criteria:

1. All those cases that have sustained head injuries received dead in mortuary.

2. The cases who were not subjected to CT Scan examination.

3. The cases that have been operated for head injury during their course of admission.

Results

The most interesting causative factor which was came across during the study was the handful contribution of 90 cases (90%) of the Road Traffic Accidents followed by 6 cases of assault (6.00%) and rest 4 cases (4.00%) fall from height (Table-1). Out of total 88 male cases, 80 cases (90.90%) were traffic accident, 3 cases (3.40%) were fall, 5 cases (5.68%) were assault, out of total 12 female cases 10 cases (83.33%) were traffic accident, 1case (8.33) was fall, and 1 case (8.33) was assault (Table-2). In this study EDH was observed in 16 cases at autopsy, and same was documented only in 12 cases on CT Scan, thus making disparity in 25.00% cases. SDH was observed in 70 cases at autopsy and 64 cases on CT Scan making disparity in 8.57% cases. SAH was observed in 82 cases at autopsy and 60 cases on CT Scan making disparity in 26.82% cases and similarly, ICH was observed in 12 cases at autopsy and 6 cases on CT Scan making disparity in 50.00% cases (Table-3). In this study brain oedema was observed in 28 cases at autopsy, and same was documented only in 18 cases on CT Scan, thus making disparity in 35.71% cases. Cortical contusions were observed in 46 cases at autopsy and 34 cases on CT Scan making disparity in 26.08% cases. Similarly, laceration of brain was observed in 1case but was not observed in any case on CT Scan, making disparity in 100%

cases (Table-4). In this study Skull fracture was observed in 77 cases at autopsy and the same finding observed only 68 cases in CT Scan, making disparity in 11.68% (Table-5).

Table 1: Distribution of Cases of Head Injuries by External Cause

External cause	No. of cases	Percentage (%)
Traffic accident	90	90.00
Assault	6	6.00
Fall	4	4.00
Unknown	0	0.00
Total	100	100.00

Table 2: Manner of Injury in Acute Head injury Vis-A-Vis Sex

Manner of injury	Male		Female	
	No.	%	No	%
Traffic accident	80	90.90	10	83.33
Fall	3	3.40	1	8.33
Assault	5	5.68	1	8.33
Unknown	–	–	–	–
Total	88	100	12	100

Table 3: Comparison of Intracranial Haemorrhage Observed at Autopsy and CT scan

Haemorrhage	Autopsy	CT Scan	Disparity	
			No.	%
EDH	16	12	4	25.00
SDH	70	64	6	8.57
SAH	82	60	22	26.82
ICH	12	6	6	50.00

Table 4: Comparison of Traumatic Brain Injury Observed at Autopsy and CT scan

Brain Injury	Autopsy	CT Scan	Disparity	% of Disparity
Brain oedema	28	18	10	35.71
Contusion	46	34	12	26.08
Laceration	1	0	1	100

Table 5: Comparison of Skull Base Fracture Observed at Autopsy and As Reported on CT scan

Parameters	Autopsy	CT Scan	Disparity	
	No.	No.	No.	%
Skull Fracture	77	68	9	11.68

Discussion

The most interesting causative factor which was came across during the case study as the handful contribution of 90 cases (90%) of the Road Traffic Accidents followed by 6 cases of assault (6.00%) and rest 4 cases (4.00%) fall from height. Similar observation was made in studies conducted by IJAR Veni Madhav. [7] Comparative study of CT Scan and post-mortem examination of head injury cases in Bikaner region 2018;4(5):01-03. However, Mukesh K Goyal, Rajesh Verma, Shiv R Kochar, Shrikant S. Asawa. [8] Observed that cause of head injury was due to road traffic accident in 62.1% cases followed by fall from height in 30.7% cases, 5% of the cases were due to assault and 2.1% cases were due to other causes. G Gururaj. [1] Observed that RTA constituted 62%, fall constituted 22% and assault constituted 10%. Bordignon K.C, Arruda W.O [9] observed that the most common causes of head injury were fall from height (71.4%), assault (17.9%), automobile accidents (16.2%), fall to the ground (13.1%) and pedestrian's injuries (13%). Out of total 88 male cases, 80 cases (90.90%) were traffic accident, 3 cases (3.40%) were fall, 5 cases (5.68%) were assault, out of total 12 female cases 10 cases (83.33%) were traffic accident, 1case (8.33%) was fall, and 1 case (8.33%) was assault. Similar observations were made in the study conducted by IJAR Veni Madhav.7 comparative study of CT Scan and post mortem examination of head injury cases in Bikaner region 2018;4(5):01-03

In this study EDH was observed in 16 cases at autopsy, and same was documented only in 12 cases on CT Scan, thus making disparity in 25.00% cases. SDH was observed in 70 cases at autopsy and 64 cases on CT Scan, making disparity in 8.57% cases. SAH was observed in 82 cases at

autopsy and 60 cases on CT Scan, making disparity in 26.82% cases and similarly, ICH was observed in 12 cases at autopsy and 6 cases on CT Scan, making disparity in 50.00% cases. These findings are consistent with study conducted by IJAR Veni Madhav.7 comparative study of CT Scan and post mortem examination of head injury cases in Bikaner region 2018;4(5):01-03 shows EDH was observed in 14 cases at autopsy and same was documented only in 12 cases on CT Scan, thus making disparity in 14.28% cases. SDH was observed in 68 cases at autopsy and 60 cases on CT Scan making disparity in 11.76% cases. SAH was observed in 79 cases at autopsy and 60 cases on CT Scan making disparity in 24.05% cases and similarly, ICH was observed in 10 cases at autopsy and 4 cases on CT Scan making disparity in 60.00% cases. Murari A, Sharma R. [10] in their study observed that amongst Extradural haemorrhage (EDH) 66.7% were diagnosed in both CT Scan and autopsy; whereas 33.3% of them remained undiagnosed by CT Scan. The Subdural haemorrhage (SDH) was diagnosed in both CT Scan and autopsy and no mismatch was diagnosed. Amongst Subarachnoid haemorrhage (SAH) 64.3% was diagnosed in both CT Scan and autopsy; whereas 35.7% of them remained undiagnosed by CT Scan. Amongst intra cerebral haemorrhage (ICH) 70% were diagnosed in both CT Scan and autopsy; whereas 30% remained undiagnosed by CT Scan. Among Contusions, 80% were diagnosed in both CT Scan and Autopsy whereas; 20% remained undiagnosed by CT Scan. Pathak A, Singh D, Khandelwal N [11] in their study observed that traumatic subarachnoid haemorrhage was detected in CT Scan in only 10 cases out of 33 cases detected at autopsy. CT Scan revealed thin subdural hematoma (SDH) in 5 cases, however autopsy showed the same in 15 cases. 4 cases were found to have extradural hematoma at autopsy, though it was detected on CT Scan in 3 cases. Srinivasa Reddy P, Manjunatha B [12] in their study observed that among intracranial haemorrhage, Subarachnoid (44%) and Subdural haemorrhage (41%) were observed in majority of cases during the autopsy, whereas, Extradural and Intracerebral haemorrhage were found in 13% and 2%, respectively. A concurrence of 42 (72%) was evident in their study in relation to intracranial haemorrhage.

In this study brain oedema was observed in 28 cases at autopsy, and same was documented only in 18 cases on CT Scan, thus making disparity in 35.71% cases. Contusions were observed in 46 cases at autopsy and 34 cases on CT Scan making disparity in 26.08% cases. Similarly, laceration of brain was observed in only 1 case but was not observed on CT scan making disparity in 100% cases. Similar observations were made in study conducted by IJAR Veni Madhav [7] comparative study of CT Scan and postmortem examination of head injury cases in Bikaner region 2018;4(5):01-03 shows Brain oedema was observed in 26 cases at autopsy, and same was documented only in 18 cases on CT Scan, making disparity in 30.76% cases. Contusions were observed in 49 cases at autopsy and 39 cases on CT Scan making disparity in 29.40% cases. Laceration of brain was observed in only 1 case but was not observed on CT Scan making disparity in 100% cases. Murari A, Sharma R [10] observed that Laceration, 83.3% was diagnosed by in both CT Scan and autopsy; whereas; 16.7% remained undiagnosed by CT Scan. Cerebral oedema, 83.3% was diagnosed in both CT Scan and autopsy; whereas 16.7% remained undiagnosed by CT Scan. Pathak A, Singh D, Khandelwal N11 observed Contusions in temporal region in 26, frontal region in 16, occipital region in 5 and cerebellum in 2 patients. However CT Scan was able to diagnose the same in 16 cases in temporal and 10 cases in frontal region. In one patient, CT Scan over diagnosed a parietal contusion which was not evident at autopsy. Autopsy of the brain stem revealed contusions in 30 patients; however only 6 patients could show the same on CT Scan. Contusions involving the thalmus and hypothalamic region were detected in 9 patients at autopsy but the same was revealed on CT Scan in 2 patients. Although petechial haemorrhage in corpus callosum were observed in 11 patients, CT Scan showed this finding in only one patient. None of the 4 patients who had evidence of uncal herniation on autopsy could be diagnosed to have the same on CT Scan. Where in 5% of cases, CT Scan could not detect any of the brain injuries, but same were detected at autopsy.

In our study Skull fracture was observed in 77 cases at autopsy and the same finding observed only 68 cases in CT Scan, making disparity in 11.68%. Similar observation was made in studies conducted by IJAR Veni Madhav [7] comparative study of CT Scan and postmortem examination of head injury cases in Bikaner region 2018;4(5):01-03 shows Skull fracture was observed in 75 cases at autopsy and the same finding observed only 67 cases in CT Scan, making disparity in 10.66% cases. However study conducted by Mukesh K Goyal, Rajesh Verma, Shiv R Kochar, and Shrikant S. Asawa [8] observed that out of 140 cases bony injury was reported in 58 cases at autopsy where as in CT Scan, skull bones were found intact only in 22 cases. Murari A, Sharma R [10] in their study observed that amongst skull fractures, 76.3% were diagnosed in both CT Scan and autopsy; whereas 23.7% remained undiagnosed by CT Scan. Srinivasa Reddy P, Manjunatha B [12] in their study observed skull fracture in 48% of the cases at autopsy whereas the same was observed in only 38% of the cases in the CT Scan. In our study the disparity was maximum 100% seen in laceration

cases followed by 50% in ICH cases. SDH was observed in 70 cases at autopsy and the same finding observed in 64 cases in CT scan, making minimum disparity in 8.57%. In our study we had one case of Diffuse Axonal Injury which went undiagnosed in a CT Scan but was later diagnosed by post-mortem microscopy.

Disparity is justified because mostly traumatic brain injuries, specially haemorrhages and haematomas can pass through, either evolving or resolving stage. The detection of brain lesion by CT Scan is also depends on the type of CT Scan machine from which the radiological images are taken, this one is the other factor which is responsible for such types of disparity.

Conclusion

Disparity in CT Scan findings and autopsy was observed in all types of cases during the study. The disparity was maximum 100% seen in laceration cases followed by 50% in ICH cases. In SAH and EDH cases disparity observed was 26.82% and 25.00% respectively. Disparity seen in skull fracture cases was 11.68%. Minimum disparity 8.57% was seen in SDH cases. Disparity can be minimised by using good quality CT Scan machines and properly trained medical and paramedical staff, who deals with reporting of radiological images and machine operating procedures. Many times cranial CT is only reliable source of evidence in head injury cases. Specially, when the injured survives, the evaluation of CT images is only the valuable source of evidence of head trauma available to Forensic Medicine experts to conclude the nature of injury. So precision and accuracy of a CT Scan, can help a treating doctor for accurate management and Forensic expert to opine the nature of injury.

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