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COMPUTED TOMOGRAPHY EVALUATION OF PATIENTS WITH TRAUMATIC HEAD IN JURIES

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ABSTRACT

Background and Objectives: - The aim of this study was to evaluate the role of CT scan in evaluation of patients with traumatic head injury, to study the imaging spectrum of traumatic head injury, to study the relative prevalence of different traumatic head injury lesions.

Methods: The study was prospective and was carried out between December 2019 and January 2020 at the Department of Radiology, AMC MET Medical College and Sheth L.G. Hospital, Ahmedabad. Total 50 patients having clinical history of traumatic head injury and sent to department of radiodiagnosis and diagnosed having abnormal findings on CT scan were included in the study. Confirmation of diagnosis by CT Scan done prior to data collection. (Only those patients were included who had traumatic head injury confirmed with history correlation and then were confirmed by CT scan.)

Results: Out of 50 patients diagnosed by CT scan, the most common traumatic head injury seen in our study were- subarachnoid hemorrhage, subdural hematoma, epidural hematoma, skull fractures, pneumocephalus, scalp injures and focal areas of contusions/laceration. CT scan had an average specificity of 94%, with 100% specificity for common traumatic head injury like subdural hematoma.

Conclusion: CT scan is a safe and effective method of detecting traumatic head injury. It aids in defining therapeutic decision quickly and allows predicting outcomes of the patient. High degree of specificity of CT scan diagnosis in the present study confirms the value of CT scan evaluation of traumatic head injury and suggests that it can be effectively used in the routine diagnostic work.

Keywords: subarachnoid hemorrhage (SAH), subdural hematoma (SDH), epidural hematoma (EDH), skull fractures, scalp injures and contusions/laceration.

Introduction:

Head injury can be caused by direct or indirect trauma. Direct trauma involves a blow to the head and is caused by automobile collisions, falls or injury inflicted by an object such as hammer or cricket bat. Scalp laceration, extraxial hemorrhages, brain parenchymal injures are common. Significant forces of acceleration/deceleration, rotational loading can be applied to brain without direct head blows, such indirect trauma is due to angular kinematics and typical occurs in high-speed motor vehicle collision, the brain undergoes rapid deformation and distortion. Depending upon site and direction of the force applied, significant injury to the cortex, axons, penetrating blood vessels and deep gray nuclei may occur. Severe brain injury can occur in the absence of skull fractures or visible scalp lesions.

Aims and Objectives of The Study

- To identify the major CT scan findings in suspected cases of Head injury.
- To study the relative prevalence of different traumatic head injury lesions detected by CT scan during the study period.

Roles for CT imaging

Rapid imaging helps differentiate patients who require urgent/emergent neurosurgical intervention from those who can be safely monitored or sent home. Noncontrast multi-detector CT (MDCT) has become the consensus choice for the initial imaging study after acute moderate to severe Traumatic head injury because it is fast, ubiquitous, very sensitive to calvarial injury and radio-opaque foreign bodies (e.g., gunshot fragments), and it is highly accurate for detecting injuries requiring emergent neurosurgical attention--namely haemorrhage, herniation and hydrocephalus. MDCT has also been shown to be useful for predicting clinical outcomes, and the NCCT findings have been incorporated into a number of outcome prediction rules.

REVIEW OF LITERATURE

Traumatic head injury includes a variety of scalp lesion, skull fractures, hemorrhage, parenchymal brain injury. In cross sectional imaging, two basic issues relate to a traumatic head injury: characterization of known brain lesion (what is it?) and location (where is it?). The answer to either question requires a focused examination, often adjusted according to the clinical situation.

Subdural hematoma: A subdural hematoma (SDH) is a collection of blood below the inner layer of the dura but external to the brain and arachnoid membrane (see the images below). Subdural hematoma is the most common type of traumatic intracranial mass lesion.

Epidural hematoma: Epidural hematoma (EDH) is a traumatic accumulation of blood between the inner table of the skull and the stripped-off dural membrane. EDH results from traumatic head injury, usually with an associated skull fracture and arterial laceration. The inciting event often is a focused blow to the head, such as that produced by a hammer or road traffic accident. In 85-95% of patients, this type of trauma results in an overlying fracture of the skull. Blood vessels in close proximity to the fracture are the sources of the hemorrhage in the formation of an epidural hematoma. Because the underlying brain has usually been minimally injured, prognosis is excellent if treated aggressively. Outcome from surgical decompression and repair is related directly to patient's preoperative neurologic condition. [1]

Subarachnoid hemorrhage: The term subarachnoid hemorrhage (SAH) refers to extravasation of blood into the subarachnoid space between the pial and arachnoid membranes. It occurs in various clinical contexts, the most common being head trauma. Tearing of cortical arteries and veins, rupture of contusion and laceration into contiguous subarachnoid space and choroid plexus bleeds with intraventricular hemorrhage may all result in blood collecting within the subarachnoid cisterns.

Cerebral contusions and lacerations: cerebral contusions are basically bran bruises. They evolve with time and often are more apparent on delayed scans than at the time of initial imaging. Cerebral contusion is also called gyral crest injuries. Most cerebral contusions are from blunt head injury. Closed head injury induces abrupt changes in angular momentum and deceleration. Less commonly a depressed skull fracture directly damages underlying brain.

Cranial fractures: Cranial fractures are present on initial CT scans in about two- thirds of patients with moderate head injury. Skull fractures can be simple or comminuted, closed or open. Several types of acute skull fracture can be identified on imaging studies: linear, depressed, elevated diastatic fractures.

Materials and Methods

- **Place of study**- AMC MET MEDICAL COLLEGE & SHETH L.G. HOSPITAL, AHMEDABAD
- **Duration of Study**- Dec '19 to January' 20
- **Type of Study**- Prospective Study
- **Computed tomography Machine**–PHILIPS MX16 SLICE
- **Inclusion criteria**- Cases of traumatic head injury during the study period and confirmed by history taking and sent to department of radiodiagnosis, L.G. Hospital and patient showing abnormal findings on CT scan were included**.**
- All patients with traumatic head injury were included irrespective of age and gender.
- **Exclusion criteria**- Patients with injury secondary to stroke were excluded from the study

Methodology

The study participants were placed in the supine position in the CT gantry and plain CT scan images were taken from the skull base to the vertex with contiguous axial slices. Intravenous contrast medium was not administered for all the patients. This is to prevent further damage to the brain as the blood–brain barrier has been compromised and also to avoid masking any hyper density which is a typical CT appearance of acute hemorrhage. Both the bone and soft tissue windows were viewed and images were reformatted into Sagittal, coronal, and axial planes as were necessary. The images acquired were analyzed. The radiological features and anatomical distribution of the lesions on the CT Images were assessed and documented. The demographic data of the patients were also recorded.

Results and Analysis

The study comprises of 50 cases of traumatic head injury lesions detected by CT scan. A total of 50 CT scan images of patients that sustained head injury were analyzed. The male to female ratio was4:1. The age range was from birth till 80 years, with a mean age of 21-30years. About 68% of the patients were in the third and fourth decades of life with the age range of constituting 23.87%. The major causes of head injury were RTAs in 70%; the cause of injury could not be ascertained in 1% of cases.

Table 1: Age and gender distribution of traumatic head injury.

Age	Male	Female	Total
<1-10	1	0	1
11-20	2	1	3
21-30	16	4	20
31-40	11	3	14
41-50	5	2	7
51-60	2	0	2
61-70	1	1	2
71-80	1	0	1
TOTAL	39	11	50

Highest number of cases are seen between age of 21 to 30 years.

Table 2 frequency of computed tomography findings.

CT findings	Male	Female	Total
Subdural hematoma	14	5	19(38%)
Cerebral Contusion/laceration	10	3	13(26%)
Subarachnoid hemorrhage	9	2	11(22%)
Epidural hematoma	6	1	7(14%)
Pneumocranium	8	4	12(24%)
Fractures	27	12	39(78%)

Most common finding was subdural hematoma followed by cerebral contusion and laceration.

Table 3 frequency of distribution of cranial bone fractures

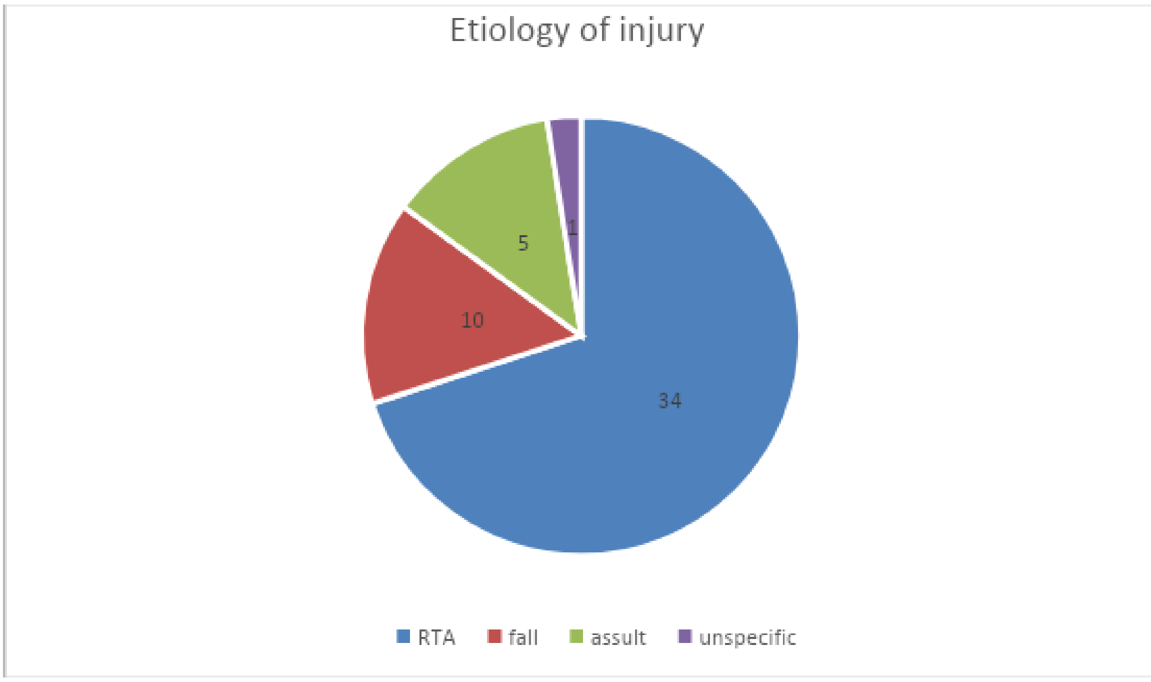
Cranial bones	Number of cases
Parietal bone	13
Temporal bone	12
Occipital bone	8
Frontal bone	5
Mastoid bone	1

TOTAL 39

Table 3 frequency and types of cranial bone fractures

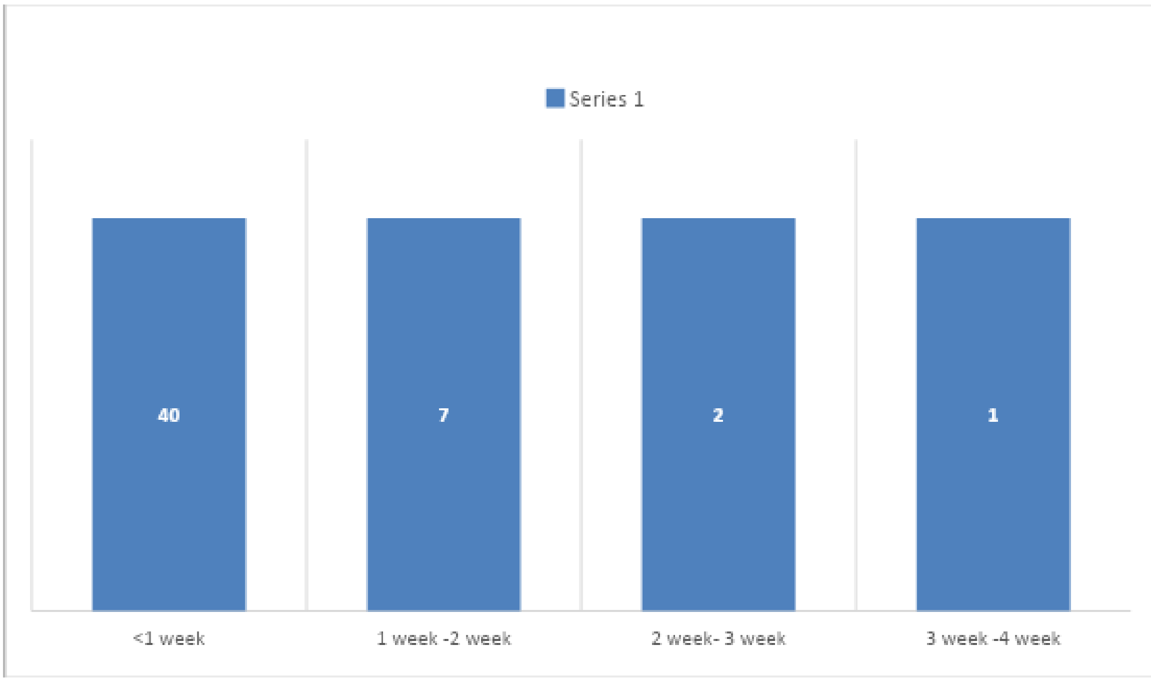
Type of fracture	Number of cases
Linear fracture	36
Depressed fracture	3

Most common fracture seen is linear farcture.



Most common etiology is road traffic accident.

Time period of patient's presentation



Discussion

Head injury remains the most common cause of death following trauma; with particularly high mortality and morbidity. Radiologic imaging especially CT facilitates a comprehensive diagnosis and permits early and targeted management.

All age groups were affected by head injury, but it was more common in the third and fourth decades of life. These age groups constitute the active, productive, and adventurous group of our society and are more likely to be exposed to the risk factors for head injury. In this study, males are more affected than females with male to female ratio of 4:1. The male preponderance can be explained by the fact that more males are involved in occupations and activities which predisposed them to trauma and injuries compared to the females. This demographic data from our study which had shown that more than 60% of people involved in traumatic head injury were between 20 to 40 years of age.

The leading causes of TBI in most cases are RTAs, violence, and falls. The prevalence of RTAs as the most common cause of head injury in this study. The report found falls from height or falls as the cause of head injury in 20% of their participants, and was observed to be the second most common cause of head injury. Of these cases of fall in this study, mostly were in the first decade of life. This high incidence in paediatric age may be attributable to their involvement in high-risk activities and adventures at home and in schools.

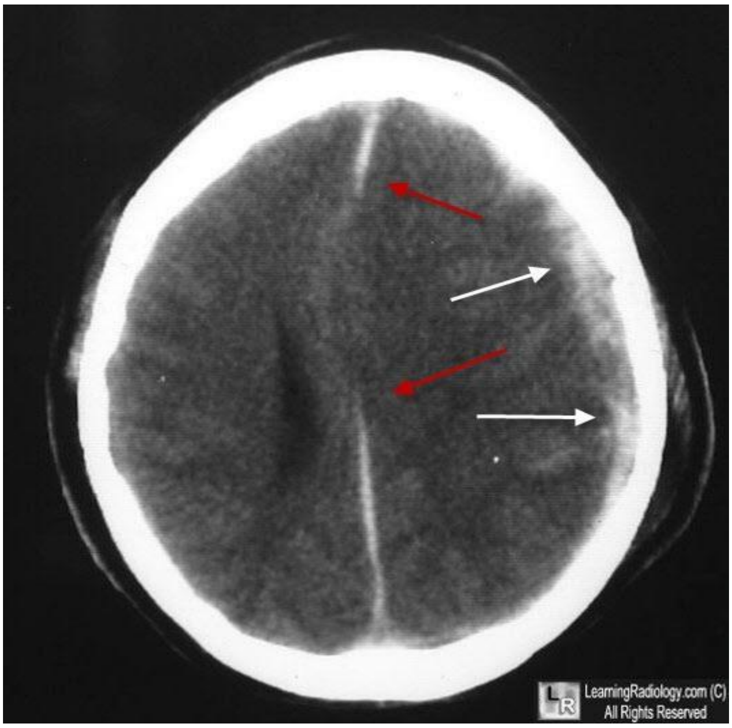
The period between the injury and CT scan evaluation in most (80%) of the patients were within 7 days. However, only 25 (50%) had CT scan done within the first 24 h of the injury. Many patients could not have the CT done until they developed symptoms that necessitated verification. This restricted use of CT may be as a result of high costs and distance from the facility/location.

Those with an apparently normal CT scan finding but who had clinical evidence of severe head trauma that necessitated CT evaluation may have diffuse axonal injury which is not easily diagnosed by CT scan were excluded from the study.

The most frequent abnormality seen in this study was intracranial haemorrhage constituting majority of the abnormal cases, [17] of which subdural hematoma was the most common, constituting 38%, followed by cerebral contusion constituting 26% of the patients.

The incidence of 28.06% of skull fractures was found in the abnormal CT images. Many of these are associated with intracranial lesions, especially intracerebral haemorrhage. These lesions were ipsilateral to the fractures. The parietal bone was the most involved in fractures. This could be explained by the prominence of the parietal bone as the most convex surface of the cranium. Fracture of the base of the skull was associated with paranasal sinus collection and cerebrospinal fluid leakage.

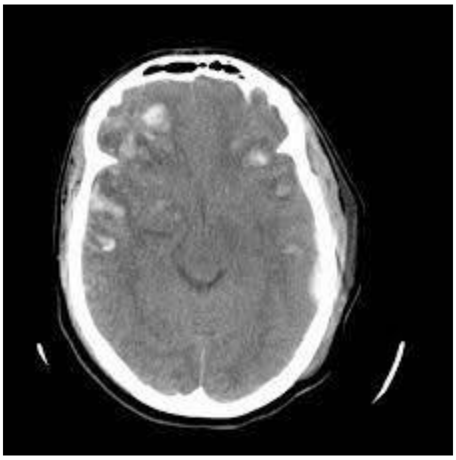
Subdural hematoma: Of total 50 cases of traumatic head injury, 19(38%) patients had subdural hematoma, proved on computed tomography. Out of 19 patients, 11 were male and 5 were female. Subdural hematoma appears hyperdense in approximately 60% of subdural hematoma and mixed attenuation lesions were found in 40% of cases. Pockets of hypodensity within a larger hyperdense subdural hematoma indicate rapid bleeding. Mass effect with SDH is very common and expected. If the difference between the midline shift and thickness of hematoma is 3 mm or more, then mortality is very high. Occasionally an SDH appears nearly isodense with underlying cortex, this is usually found in anemic patients as well as patients with subacute SDH.



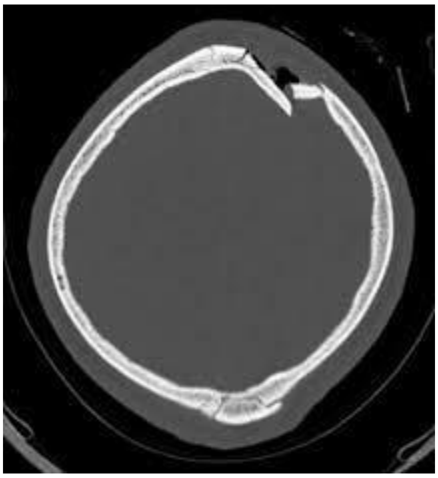
Epidural hematoma: Of total 50 cases of traumatic head injury, 7(14%) patients had epidural hematoma, proved on computed tomography. Out of 7 cases 6 were found in male and 1 in female patients. The classic imaging appearance is hyperdense biconvex extra axial collection, presence of hypodense component is seen sometimes and indicates rapid bleeding. EDH may compress the underlying subarachnoid space and displaces the cortex buckling the gray white matter interface inward. Imaging finding associated with adverse clinical outcome are thickness >1.5 cm, midline shift of >5 mm and presence of hypodense area within. EDH was found to be associated with skull fracture in 90-95% cases. All cases were correctly diagnosed on CT scan, so specificity was considered 100%.

Subarachnoid hemorrhage: Of total 50 cases of traumatic head injury,11(22%) patients had subarachnoid hemorrhage, proved on computed tomography. Out of 11 patients, 9 were male and 2 were female. Specificity of CT scan to diagnose subarachnoid hemorrhage is 100%. Acute tSAH was typically peripheral, appearing as linear hyper densities in sulci adjacent to cortical contusions or under epi- or subdural hematoma. Posttraumatic interpeduncular or ambient cistern hemorrhage is a good marker for possible brainstem lesion in patients with coma and warrants further investigation. In severe cases tSAH spreads diffusely in subarachnoid cisterns and layers over tentorium.

Contusion/laceration: Of total 50 cases of traumatic head injury, 13(26%) patients had contusion, proved on computed tomography. Out of 13 cases, 10 cases where seen in male and 3 in female. The most frequent abnormality on CT scan is presence of petechial hemorrhages along gyral crests immediately adjacent to the calvaria. A mixture of petechial hemorrhages surrounded by patchy ill-defined hypodense areas of edema is common. Over time small lesions may coalesce, forming larger hematomas.



Cranial fractures/pneumocranium: Of total 50 cases of traumatic head injury, 39(78%) patients had skull fractures and 12 (24%) patients had pneumocranium. Quite common out of 39 cases most commonly involved bone was parietal bone followed by temporal bone and occipital bone. CT scan can demonstrate linear skull fractures as sharply marginated lucent lines. Depressed fractures are typically comminuted and show inward implosion of fracture fragments.



Conclusion

This study had demonstrated that majority of head trauma evaluated by CT were associated with cranial and brain injuries and subdural hematoma followed by cerebral contusion were more prevalent. Significant number of the patients had injuries which required immediate intervention to achieve a good outcome. This could be made possible by early evaluation with CT.

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Conflict of Interest:

Nil

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