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Research Article

Role of Computerized Tomography in Acute Traumatic Brain Injury

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Abstract

Traumatic brain injury (TBI) is a common and probability devastating problem. Developing country like India, road transportation is the most commonly used transport. Head injuries due to road traffic accidents have become a routine route to take the human lives. CT

- To study the various clinic – radiological patterns of head injuries.
- To correlate the CT features with clinical operative findings.

This is a hospital based cross sectional study carried out in patients of head injury referred to the Sree Balaji Medical College and Hospital, Chromepet, Chennai from March 2016 to February 2017.

Keywords: Computerized Tomography; Acute Traumatic Brain Injury

Introduction

Traumatic brain injury (TBI) is a common and probability devastating problem. Developing country like India, road transportation is the most commonly used transport. Head injuries due to road traffic accidents have become a routine route to take the human lives. CT is the most useful and commonly used modality in the evaluation of patients with head injury as it is readily available and cost effective. First CT machine was developed by the late Sir Godfrey Hounsfield and it was installed at the Atkinson Morley Hospital, London, in the early 1970s. In olden days to take a single image it takes several minutes to acquire and days to reconstruct at the laboratories of the record company EMI. Over the years, CT machines had become faster as the process of computers improved [1].

With the advanced technique of computed tomography, neuro -radiological diagnosis has become easy. With short scan time and recent software imaging technology CT had been ideal diagnostic tool for emergency situations [2].

Conventional CT is readily available and cost effective. It requires shorter imaging time and is easier to perform on patients who are on ventilator support or agitated. CT is the initial imaging modality of choice during the first 24 hours after the injury [3-5]. With the recent advent of fast multi -detector CT the scanning time has been reduced and allows for quick selective rescanning of slices that are affected by motion artifact [6]. CT is also useful in finding bones abnormality and in detecting acute subarachnoid or acute parenchymal hemorrhage [7].

Because prompt proper management of TBI sequelae can significantly alter their course especially within 48h of the injury, neuro-imaging techniques, which can determine the presence and extent of the injury and guide surgical planning and minimally invasive interventions, play important roles in the acute therapy of TBI [8].

Aim and Objectives of the Study

1. To study the various clinic – radiological patterns of head injuries.
2. To correlate the C.T features with clinical operative find ings.
3. To identify Neuro imaging indicators of poor clinical outcome.
4. To highlights the importance of CT in early diagnosis of post traumatic lesions.
5. To compare the data with previous studies.

Material and Methods

Study Design

This is a hospital based cross sectional study carried out in patients of head injury referred to the Sree Balaji Medical College and Hospital, Chromepet, Chennai from March 2016 to February 2017. The present study includes 246 people with traumatic brain injury of both sexes, according to the inclusion and exclusion criteria, 23 patients are excluded from the study and 223 were included in this study.

Inclusion Criteria

All patients with head injuries and cranio -facial trauma who underwent CT scanning.

Exclusion Criteria

Patients on ventilators and with Glasgow coma scale < 6.

Preparation of Patient

No preparation was required as only plain study was indicated in these patients.

Plan of Study

Details were noted down on proforma either immediately before or after the procedure was carried out, depending on the status of the patient.

Equipment

Using a 16 SLICE multi -detector CT machine (HITACHI - ECLOS), CT of the abdomen and pelvis including the lower portion of the chest was done for all the included cases.

Figure 1: CT scan machine of our department

CT Technique

Proper immobilization and positioning of head was achieved in all patients. The gantry tilt was given in the range of +/- 0 - 20 degrees, so as to parallel the scan plane to the orbito-meatal line. All the images were interpreted in axial sections in addition to coronal and sagittal reconstruction The obtained images were studied at brain and bone window settings. Average duration between scan and head injury was 6 to 8 hours. The patient was evaluated as per the proforma.

Follow Up

All patients were followed up for a period of examination to final outcome during hospital stay after head injury to detect any bleed increased/decreased volume of hematoma.

Statistical Analysis

All statistical analysis will be done by using Ms-Excel-2007 value will be presented as mean + or – SD and in percentage. Chi square test and Spearman's correlation co-efficient were used for comparison of CT findings of different variables and parameters, P value was calculated.

All statistical analyses were conducted using the SPSS statistical package.

On the CT scans the location and extent of the lesions was identified. Search was made for the presence of blood within the ventricular system or in subarachnoid space or epidural space or subdural space. Further bone windowing imaging was also done to locate the skull fractures.

Results

The present study was carried out to describe CT imaging characteristics of acute traumatic head injuries. CT scans were done in 223 patients with acute traumatic brain injury after fulfilling the inclusion and the exclusion criteria. Findings of the patients were studied and tabulated using Microsoft Excel. All statistical analyses were conducted using the SPSS statistical package.

Two twenty three patients were evaluated for head trauma and each of them is evaluated for each type of lesions, location, associated fractures of skull bon, age incidence, and outcome.

The prognoses of the patients were expected with CT features with midline shift and type of hematoma.

Most susceptible age group to head injuries with intracranial hematoma is 21 - 40 yr and 41 - 60 years. People above 60 yr and below 20 yr are less prone for head injuries. The mortality rate was at its peak in patients of the age group of more than 61 years.

The incidence of intracranial traumatic pathologies

In this study the incidence of normal scans was 59 (26.5%) cases and abnormal scans were 164 (73.5%). Among all intracranial traumatic lesions the incidence of multiple intracranial traumatic lesions are most common (35%), in which contusions associated with extra axial hematomas are most common, in their most common are CSA (contusions, subdural hemorrhage, subarachnoid hemorrhage) followed by CA (contusions, subarachnoid hemorrhage), SA (subdural hematoma, subarachnoid hemorrhage).

Next common intracranial traumatic lesions are contusions (13%) followed by epidural hematomas (9%) and subdural hematomas (6.7%).

Least common are subarachnoid hematomas (4.9%) and intra cerebral hematomas (4.9%). The incidence of fractures was 52.5%

	Normal scans	Abnormal scans	Contusions	SDH	EDH	SAH	MICTL	ICH	Fractures
	59	164	29	15	20	11	78	11	123
Percentage	26.5%	73.5%	13%	6.7%	9%	4.9%	35%	4.9%	55.2%

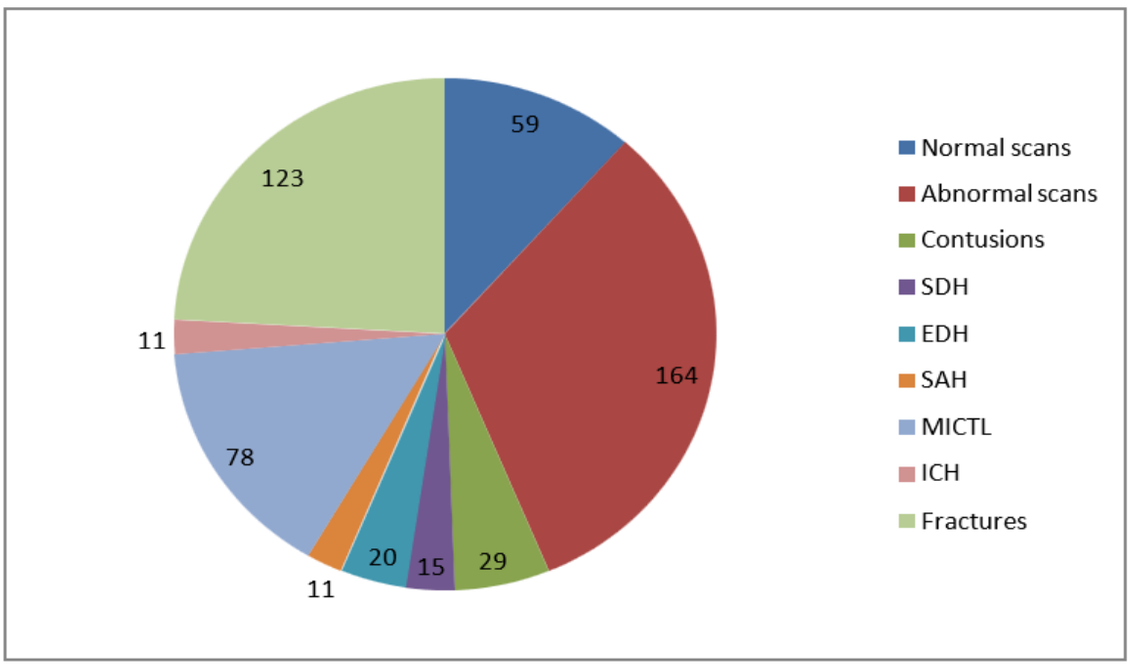

Table 1: Frequency distribution of various intracranial traumatic lesions.

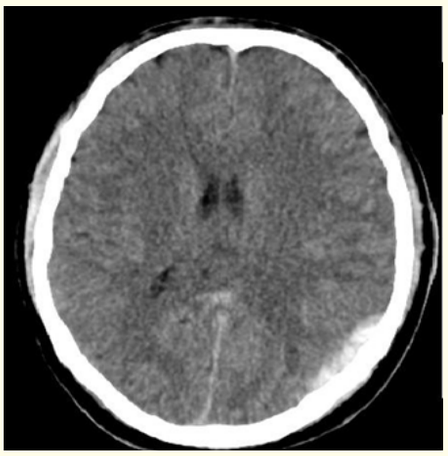

Figure 2: Axial CT section shows cerebral contusions and epidural hematoma.

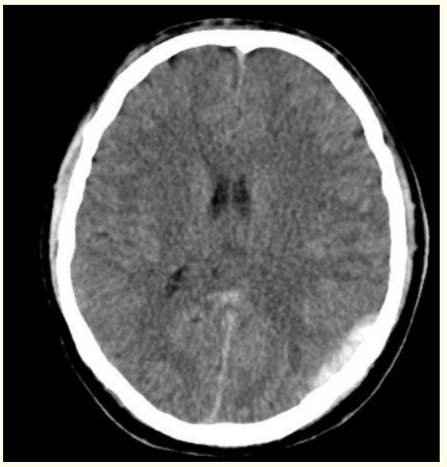

Figure 3: Axial CT section shows epidural hematoma.

Discussion

The present study consists of 246 people with traumatic brain injury were admitted to Sree Balaji Medical College and Hospital, between March 2016 to February 2017. After exclusion criteria applied 223 patients out of 246 were included in this study.

Head injury is a major health problem and common cause of disability and death. In developing countries like India the incidence of traumatic brain injury is increasing as traffic increases, besides other puzzling factors such as industrialization, falls and airborne trauma. CT facilitates a comprehensive diagnosis and targeted interventions.

An earlier study by Asaleye CM in 2005, from Nigeria, in patients with moderate to severe head injury showed that 87% of the patients had abnormal CT findings. In this study, 73.5% had abnormal findings due to head injuries.

In this study the incidence of traumatic brain injuries is common among the 21 - 40 years (48.9%) of age group followed by 41 - 60 years age group (28.3%) and below 20 years age group (11.7%). The incidence among the above 61 years age group is 11.2%.

This is similar to a study done by Zimmerman and Bilaniuk (1978) and Satish Prasad BS, Sharma M Shetty (2009) in which they found maximum injuries in the age group of 19 - 50 years (79%), people above 50 were 21%. These are in contrast to the study by KJ Van Dongen., *et al.* (1983) in which the maximum incidence was noted in the age group below 20 years (40%) followed by 21 - 40 years and 40 - 60 years.

The increased incidence in this study among the age group of 21 - 40 years can be explained by the fact that these are the people who are active in life and who ride motorized two wheelers and four wheelers and are hit by the heavy vehicles in the road traffic accidents.

In this study we found significant association between age group and outcome of the patient. Surprisingly no mortality was found in patients below 20 years age group. Out of 28 deaths high mortality rate found among older people > 61 years of age, 15 deaths noted in these age group (60%). Mortality rate in 41 - 60 years age group is 12.7% (8 deaths out of 28).

The study shows highly significant 'P values (0.000)' in association between age group and outcome of the patient. This can be explained by the time elapse between the injury and medical care and associated systemic insult that are more likely to result in poor outcome.

Similarly a study done by Seelig JM and Becker (1981) found patients under 21 years have better outcomes than older people.

Narayan RK., *et al.* (1981) showed that study age is important determining in outcome.

In this study males had higher incidence (76.2%) of head trauma compared to females (23.8%), Consistent with Clifton GL., *et al.* (1980) in their study found male to female ratio 5:1. And also Satish Prasad BS and Shama M Shetty., *et al.* in their study reported a male to female ratio of 9 [9-12].

Conclusion

CT scan helps in identification of majority of intracranial hematomas. CT scan has precisely localized the parenchymal damage of the brain of head trauma victims rapidly and non-invasively, for prompt and effective management as patients with head injury deteriorate suddenly. Evidence of parenchymal damage on CT is predictive of poor outcome.

The common age groups affected in head injuries are 21 - 40 years (48.9%), followed by 41 - 60 years (28.3%) age group.

The incidence of mortality rate is more in the age group above 61 years.

Incidence of head injuries is more common among the males (76.2%) as compared to females.

Of all intracranial hematomas, multiple intracranial traumatic lesions (MICTL) are most frequent type (35.5%) in which contusions associated with other hematomas are common, followed by contusions (13%) and EDH (9%), SDH (6.7%), SAH (4.9%), ICH (4.9%).

In EDH occipital region was most commonly affected followed by temporal and parietal. 21 - 40 years age group were most commonly affected, mortality rate 10.7%.

In SDH fronto-temporo-parietal regions (50%) followed by hemi-calvarial regions (42.6%) were the most common locations affected. The most frequent age group affected in SDH was 41 - 60 years age group. The mortality rate was 25%.

In contusions bilateral frontal lobe involvement (62.5%) is most frequent. The age group commonly affected is 21 - 40 years. Mortality rate due to contusions 7.1%.

In ICH most common location is temporal -occipital- parietal (50%) followed by bilateral frontal. Most common age group affected is 21 - 40 years. Third highest mortality rate noted in cases with ICH, the mortality rate was 21.4%.

Of all skull fractures temporal bone fractures was most common followed by multiple bony fractures.

Skull fractures are most common when associated with MICTL.

Road traffic accidents were most common mode of head injury and 21 - 40 years ago group was the most frequent group involved.

Shift of mid line structures and type of intracranial traumatic pathology were the most power full prognostic indicator determining the outcome of head injury patients.

Shift of midline structures more than 10 mm has a worst prognosis; the mortality rate is highest in these cases.

CT scan head and brain helps in assessing the extent of damage to the intracranial structures and there by helps in assessing the prognosis by accurate evaluation of type of hematoma, site, size and extent and mid line shift and mass effect, the age of the patient also helps in determining the prognosis.

CT scan helps in the modifying the line of management of patients and review CT scan can be useful in patients who show normal CT scan initially but suddenly start deteriorating it can be also used as a tool for follow up.

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