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Research article

ROLE OF COMPUTED TOMOGRAPHY IN THE EVALUATION OF ACUTE TRAUMATIC BRAIN INJURY

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ABSTRACT

Objective: To evaluate role of CT in patients with acute TBI attending in BRIMS Teaching Tertiary care hospital, Bidar, Karnataka, India. Materials and Methods: A CT study was done in 100 patients with acute TBI over a period of one year. The plain brain CT scan was performed. The patients were scanned using 16 SLICE PHILIPS helical CT machine with slice thickness-5mm and 1mm. Result: The age range of the patients was 05 to 80 years and male: female ratio was 10.1:1. The most common causes of head injury were RTA (80%), fall injury (15%) and physical assault (5%). 91 patients had skull fractures, 9 patients had no fractures, 12patients had pneumocephalus, 31patients had EDH, 10 patients had SDH, 55patients had SAH, 44patients had Intra cerebral hematoma, 50 patients had brain contusions and 8patients had diffuse cerebral edema Conclusion: The role of CT as the primary modality of choice in the initial assessment of head injury patients as it is widely available, faster and highly accurate in detecting skull fractures and brain parenchymal lesions.

Key words:- Acute TBI (Traumatic brain injury), SDH(subdural hematoma), EDH(Extra dural hematoma), SAH(sub arachnoid hemorrhage), GCS(Glassgow coma scale), CT(Computed tomography), RTA(Road traffic accident).

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INTRODUCTION

Trauma is a leading cause of death in the age group 1 to 45 years. Traumatic brain injury (TBI) is an extremely common and potentially devastating problem. TBI is the leading cause of death among adolescents and young adults. The primary causes of TBI vary according to age of the patient. Falls are the leading cause of TBI in children up to 4 years of age and in others people older than 75 years of age. Road traffic accidents (RTA) are the leading cause of head injury followed by falls, assaults, firearm wounds and others.

Traumatic Brain Injury needed a multidisciplinary approach of management. The initial assessment of a patient with TBI includes the GCS, data regarding the accident and CT. According to the GCS, traumatic brain injuries are classified as mild, moderate or severe. In present study we have included all the patients with head injuries with external wound on head and face irrespective of GCS [1,2].

The primary goal of imaging the trauma patient is to quickly and accurately identify treatable lesions before secondary injury to the brain occurs. CT scan is very well characterized imaging modality of choice in the evaluation of TBI, because it is fast, simple, non-invasive radiological procedure that gives images with excellent spatial resolution [3].

AIMS AND OBJECTIVES:

1. To assess the role of computed tomography scanning in patients with acute traumatic brain injury.

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2. To asses spectrum of CT findings in a case of head injury, its location, nature, size and extent.
3. To evaluate the value of early CT imaging with patient prognosis.
4. To determine the frequency of different lesions.
5. To asses common associations of various lesions.

MATERIAL AND METHODS

Prior to the study, ethical approval from the institutional ethical committee was taken. Informed consent was taken from all the patients' relatives willing to participate in the study and confidentiality was maintained

SOURCES OF DATA:

All 100 patients admitted to the emergency department at BRIMS teaching hospital, Bidar, Karnataka, India. All cases that were referred for CT scan with acute cranio-cerebral trauma amongst the admitted patients at emergency department from 26th November 2016 to 7th December 2017 were studied.

This is a time bound prospective study in which patients referred for CT scan with acute traumatic brain injury in BRIMS teaching tertiary care hospital, Bidar, were taken into study.

- The period of study was from 26th November 2016 to 7th December 2017.
- 100 acute traumatic brain injury cases were taken up for study.

INCLUSION CRITERIA

1. All patients of acute traumatic brain injury irrespective of age and sex willing to participate in study.
2. Only those patients with positive findings on brain and skull bones or either of these on MDCT scanning were included.

EXCLUSION CRITERIA

1) Patients with acute traumatic brain injury but not ready to participate in study.

METHODS:

It was a cross-sectional study conducted in the department of Radiology and Imaging, BRIMS Teaching Tertiary care Hospital, Bidar, Karnataka, India. TBI patients are initially diagnosed by MDCT scanning. MDCT used in assessing the spectrum of injuries in soft tissue and bone windows whereas data can be converted to 3D CT sets to look for bony and intracranial injuries. Evaluation of cranio-cerebral injuries of TBI patients was done by using Axial CT scanning with coronal and saggital CT reconstruction. The patients were scanned using 16 SLICE PHILIPS helical CT machine. It is third generation CT scanner, matrix size-512, and slice thickness-5mm and 1mm, having KV of 80 to 130 and mAs 50 to 340.A complete clinical history of the patients was taken. The type of trauma was classified into road traffic accident, falls, and assaults.

This was followed by general physical examination and detailed examination of the central nervous system. Injuries involving the other systems of the body were also noted. After initial resuscitation, severity of cranio-cerebral trauma was graded with the help of GCS as follows:

GCS

Grades

Score Normal	15
Mild head injury	12-14
Moderate head injury	8-11
Severe head injury	< 7

The patients were examined with CT scanner in the supine position having gantry tilt +/- 30 degree parallel to the scan plane to the orbito-meatal line. The scan range included base of skull to the vertex.

RESULTS

In the present study males were predominant comprising of 91 % cases and 9% females resulting male: female ratio of 10.1:1. The age and sex distribution of the cases is represented by table 1. The age ranges from 05 to 80 years. The peak age was in the age range of 21 to 30 years comprising 32% of total number of patients.

The single lesion, multiple lesions and lesions with midline shift were studied on MDCT. The 31% cases were single lesion, multiple lesions comprising of 56% and lesions with midline shift were 6%. The single lesions without midline shift and with small size lesions have mild GCS, whereas medium size lesion have moderate and large size have moderate to severe GCS. Single lesion with large size with midline shift have severe GCS

Multiple small size lesions have mild to moderate GCS, multiple medium size lesions have moderate to severe GCS and multiple lesions with small size, medium size and large size and multiple lesions with large size with mid line shift have severe GCS

18% cases were Mild GCS cases, 20% cases were moderate GCS cases, 50% cases were severe GCS cases and 12% cases were with normal GCS.

50% cases were lost consciousness, 18% cases were complained with vomiting/head ache, 42% cases were with facial injuries and 53% cases were with scalp injuries.

The majority of the 100 patients studied, who have traumatic brain injury caused by Road Traffic Accidents (RTA) 80%, Fall(15%) and (5%)assault

Most of the patients showed more than one lesion. Ninety one (91%) of hundred patients reported skull fractures and the non-fractured cases are nine patients comprising 9%. Twelve patients (12%) had pneumocephalus among which one patient had no fracture and brain lesions very rare occurance. Thirty one patients had extra dural hematoma (31%), ten patients

had Sub dural hematoma (10%), fifty five patients had Sub arachnoids haemorrhage (55%),forty four patients had Intra cerebral hematoma (44%), fifty patients had brain contusions (50%) and eight patients had diffuse cerebral edema (8%) . There are eight patients had cranial and facial bone fractures but revealed no positive CT findings in brain parenchyma.

Table 1. Sex and Age Distribution of Patients

Age (years)	Male		Female		Total N0.
	No	%	No	%	
0-10yrs	02	2%	0	0%	2
11-20yrs	09	9%	2	2%	11
21-30 yrs	32	32%	1	1%	33
31-40yrs	24	24%	2	%	26
41-50yrs	15	14%	2	2%	17
51-60yrs	05	5%	1	1%	06
61-70yrs	04	4%	0	1%	04
>70yrs	0	O%	1	1%	01
Total	91	91%	9	9	100

Table 2. Causes of TBI Among Study Population

Serial No.	Causes of TBI	No. of Patients (%)
1.	RTA	80
2.	Fall	15
3.	Assaults	5

Table 3. Grading of Type of Lesions Based On GCS

CT findings	No.	Percentage	GCS
Single lesion	31	31%	Mild to moderate
Multiple lesions	56	56%	Mild, Moderate to severe
Single lesion+ multiple Lesions+Midline Shift	6	6%	Severe

Table 4. Grading of Head Injury Based on GCS

Type of head injury	GCS	No of Cases	Percentage
Mild	12-14	18	18%
Moderate	8-11	20	20%
Severe	<7	50	50%
Total		88	88%

Table 5. Clinical Presentations Among Studied Population (100 Patients) with Acute Traumatic Brain Injury

Serial No.	Clinical Presentation	No. of Patients
1.	Loss of Consciousness	50
2.	Vomiting/Head Ache	18
3.	Facial Injury	42
4.	Scalp Injury	53

Table 6. MDCT Findings Among 100 Studied Population with Acute TBI

Serial No.	MDCT Findings	No of Patients
1.	Skull Fracture	91
2.	EDH	31
3.	SDH	10
4.	SAH	55
5.	Intracerebral Hematoma	44
6.	Contusion	50
7.	Diffuse Cerebral Edema	8
8.	Pneumocephalus	12

DISCUSSION

Early and precise diagnosis of cranio-cerebral lesions in acute traumatic brain injury is of great importance because of the high mortality caused by these lesions and the fact that early diagnosis and treatment will significantly reduce the complications [4].

CT scan is now the primary modality for evaluation of patients with acute head trauma. MDCT is well used to assess the seriousness of injury using soft tissue and bone windows whereas data can be converted into 3D CT sets to detect bony and intracranial injuries. Evaluation of TBI patents was done by using Axial CT scanning but it is limited in evaluation of the posterior fossa, the middle cranial fossa, and the inferior frontal lobes [5,6]. Coronal and saggital CT reconstruction provides more information of these areas.

An important factor in decision making about the initial treatment and long term complications is the initial GCS of patients.

It is universally noted that the cranio-cerebral trauma is more frequent in the males. Male predominance was also seen in the present study where 91patients were male patients and 9 patients were female. The Male: Female ratio was 10.1:1. 9

Head injuries are more frequent in the younger age group in the United States [7]. The incidence of head injury in 0-20 age group was 30%, 20-40 years was 60% and above 40 years was 10%. In the present study also the incidence of cranio-cerebral trauma was highest in the age group 21-40 which was 59%. In the present study the incidence in the age group 0f 0-20 years was 13%.

In the present study it was found that the incidence of RTA was high i.e.80%. This can be attributed to the reason that participants in this study live in close proximity to the National Highway and due to rapid urbanization in this area there is an increase in the number of vehicles and population leading to more movement of people.

CT scan findings and their correlation with GCS scores is especially important in treatable lesions like mass effects, brain herniation etc [8]. These secondary lesions can cause significant morbidity and mortality. In the present study, low GCS scores were considered as a severity risk factor in association with a greater number of CT findings. Patients having mixed lesions and midline shift had low GCS score than the patients having single lesion. Mild head injury patients have 12 to 14 GCS score, moderate head injury patients 8 to 11 and severe head injury patients less than 7. So, we conclude that severe the head injury lowers the Glassgow Coma Scale. More severe the head injury lesser the GCS score.

EDH was observed under MDCT imaging. It showed as biconvex hyper dense elliptical collection with sharp edge. In present study, it was found that 31% extra dural hematoma of acute traumatic brain patient. It was developed between the skull and dura associated skull fracture. It may be due to injured middle meningeal artery.

SDH was found 10% case of present study of TBI patients. It was showed as hyperdense and concave in shape on CT scan.

SAH was found in 55% of acute traumatic brain injury patients.

Intra cerebral hematoma was observed on CT. It was well defined hyper dense area. It was seen in 44% patients in the present study. ICH cause ruptured of blood vessels in TBI patients.

In the present study, it is revealed that 8% Diffuse cerebral edema of acute TBI patients. Diffuse cerebral edema was made by loss of cerebral auto regulation due to significant increased blood flow and blood volume increased pressure on CSF leading to mildly increased density of white matter. The present finding was also well studied in various TBI patients.

CONCLUSION

Head injury is a major neurological cause of death and disability in young and middle aged patients, with RTAs being the most common cause in adults and fall in children.

Computed tomography is widely available, relatively inexpensive, highly sensitive, safe imaging, most comprehensive diagnostic modality for early and accurate diagnosis, and provides the ability to rapidly evaluate patients with acute traumatic brain injuries thus aiding a better prognosis with head injury

CT aids in surgical planning, prognosis, and recovery time. It can demonstrate significant primary traumatic injuries including extra dural, subdural, intracerebral hematoma, SAH, and IVH, skull fractures, cerebral edema, contusions and cerebral herniations.

Thus, it is justifiable to conclude that CT is the single most informative diagnostic modality in the evaluation of a patient with acute traumatic brain injuries and should be considered the first imaging of choice in the acute head injury as it forms the corner stone for rapid and effective diagnosis.

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