ORIGINAL RESEARCH PAPER

Radiodiagnosis

EVALUATION OF NCCT HEAD FINDINGS IN ACUTE HEAD TRAUMA PATIENTS

KEY WORDS: NCCT Head, acute head trauma

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ABSTRACT

Introduction : One of the most common causes of mortality and morbidity in most parts of the world is Head trauma. In tertiary care centre, a common cause of hospital admission is Head Trauma. Patient age is usually associated with mode of head trauma. CT head is the investigation of the choice as well as first line investigation in patients with head trauma because it takes less time and provides accurate findings.

Head trauma can be classified into primary and secondary injuries.

Epidural, subarachnoid, subdural, and intraventricularhemorrhage are included under primary extra-axial lesions; however Primary intra-axial lesions usually include intracerebral contusions and hematomas, axonal shearing injuries and vascular injury.

Aim of the Study - Evaluation of NCCT Head findings in acute head trauma patientsin a tertiary care centre.

Material and methods : We have included the head trauma patients came for CT head imaging during the period of three months between 1 October 2017 and 31 December 2017 in department of Radiodiagnosis in SAIMS, Indore. This is a retrospective study.

NCCT Head scans were performed on a True 64-slice volume CT scanner (Somatom definition AS, Siemens) in a straight axial plane.

RESULTS : In our study, 150 patients underwent CT head for head trauma. The male to female ratio was 3:1. About 100 patients (~74%) out of 150 came for CT head were in age <40 years.

In 16% cases, CT was unremarkable, while 84% cases had abnormal CT findings. Many patients had more than one finding. The most common CT findings were: cerebral contusions 42%, subdural hematoma 37%, extradural hematoma 11.3%.sub-arachnoid haemorrhage 21% and associatedskull fractures 63%.

CONCLUSION: CT Head is an investigation of choice as well as first line of investigation in all head trauma patients. Early and accurate diagnosis of primary lesions of head trauma is very helpful in deciding the early neurological intervention in golden hours to reduce the morbidity and mortality.

Introduction

One of the most common causes of mortality and morbidity in most parts of the world is Head trauma. In tertiary care centre, a common cause of hospital admission is Head Trauma. Patient age is usually associated with mode of head trauma. Accidental falls mainly results head trauma in the elderly age group. In young patients Road traffic accidents and assault are common causes. Accidental falls, abuse and neglect are common reasons in children. Immediate neurosurgical intervention is necessary to reduce mortality and morbidity, this needs CT head to provide accurate diagnosis[1]. CT head is the investigation of the choice as well as the first line investigation in patients with head trauma because it takes less time and provides accurate findings.

MRI is the other imaging modality to diagnose parenchmal pathology which cannotbe diagnosed on CT. However it is less readily available, more expensive and takes more time as compared to the CT.

Head trauma can be classified into primary and secondary injuries. Direct trauma to the head is considered as primary lesions, however secondary lesions arise as complications of primary lesions.

When patients come to the hospital; primary extra-axial lesions like Epidural, subarachnoid, subdural, and intraventricularhemorrhage and Primary intra-axial lesions like intracerebral contusions and hematomas, axonal shearing injuries and vascular injury have already occurred. However secondary injuries like Cerebraledema, brain herniation and ischemia occur later on, so can be preventable.

Clinically the severity of head injury is assessed by Glasgow Coma Scale.

Aim of the Study: Evaluation of NCCT Head findings in acute head trauma patientsin a tertiary care centre.

Material and methods:

We have included all patients who presented with head trauma and had come for CT head imaging during the period of three months between 1 October 2017 and 31December 2017 in department of Radiodiagnosis in Sri Aurboindo Institute of Medical Sciences, Indore. This is a retrospective study.

Exclusion criteria- exclusion of all secondary lesions

Imaging Protocol

NCCT Head scans were performed on a True 64-slice volume CT scanner (Somatom definition AS, Siemens) in a straight axial plane. Axial CT are acquired in 0.6mm slice thickness and reconstructed into magnified sagittal and coronal images.

RESULTS

The age of patients in our study ranged from 1 to 95 years, the mean age of all patients was 32.29years. Peak age of incidence in our study was noted in <40 years age group constituting 100 patients (74%) out of 150 of the cases, among these maximum no. of patients was in the age group 21-40years which consisted of 73 patients (48.6%).[Table/figure 1]

Table / Figure 1: Distribution of the patients on the basis of age:

S.No.	Age [yrs]	No.Of Patients	Percentage (%)
1	<20	37	24.6
2	21-40	73	48.6
3	41-60	29	19.3
4	>60	11	7.3
Total		150	100

Patients were distributed on the basis of gender:

Table / Figure 2:Genderwise distribution of cases:

S.NO.	Gender	No. Of cases	PERCENTAGE (%)
1	MALE	125	83.3
2	FEMALE	25	16.6

Majority of the patients in our study were males (125%), showing a strong male predilection, as opposed to only 25% of cases in the female category, with Male: Female ratio of 3:1. [Table/Figure2]

In our study, 126 patients out of 150 had significant primary CT lesions, however no significantCT lesions werefound in 24 patients. [Table/Figure 3]

Table / Figure 3:Distribution of patients on basis of diagnosis.

S. NO.	CT findings	No. of cases	PERCENTAGE (%)
1	Positive Primary CT lesions	126	84%
2	No significant CT lesions	24	16%
	Total	150	

Out of 126 abnormalities seen on cranial CT scan, most of the patients were having multiple primary lesions.

In our study,the incidence of different types of Primary extra-axial lesions were as follows with 17 patients (11%)Extra-dural haemorrhage, sub-duralhemorrhage in 56 patients(37.3%), sub-arachnoidhemorrhage in 32 patients(21.3%).Pneumocephalus were found in 17 patients (11%). Fractures were associated and was seen in 95 patients (63.3%); however no fractures seen in 55 patients.

Primary intra-axial lesions include an intracerebralcontusion/ hematoma and accounts in63patients (42%).

Common secondary lesions were also found in patients, such as diffuse/localized cerebral edema, mid line shift, brain herniation, Cerebral ischemia and intracranial foreign body, but we have not included thesein our study.

Table / Figure 4: Analysis of Patients on basis of CT characteristics

S.No	Positive Primary CT findings	No. of patients	Percentage (%)
1	Normal	24	16
2	EDH	17	11.3
3	SDH	56	37.3
4	SAH	32	21.3
5	Fracture	95	63.3
6	Intra-Parenchymal Bleed / Contusion	63	42
7	Pneumocephalus	17	11.3

DISCUSSION:

Head injury is the frequent cause of death and disability. According to our study and the previous studies, the most common etiology in head trauma is RTA and the commonest age group was between 21-40 years withmale predilection because this group of patients are more active insocial and economic life [2].

Spectrum of primary intracranial lesions on NCCT head

In modern era, NCCT head is the primary method of assessing head trauma patients as this takes very less time to acquire images and can accurately characterize the lesions[3].

Intra axial injury

Intracerebral Hematoma and Contusion [Table/Figure5]

There are two types of brain contusions - hemorrhagic and non hemorrhagic. The main cause of contusions are blunt trauma tohead as well as sudden head acceleration and deceleration, causing coup or contre-coup injuries[4]. Early diagnosis and management of brain contusions, significantly reduces morbidity and mortality in patients presenting clinicallywith low GCS scores, anisocoria, trauma in elder patients (>60) years[5].
On NCCT head, non hemorrhagic and hemorrhagic contusions are hypodense and hyperdenseareas, respectively.

Head trauma patients with history of lucid interval after initial injury, the most common cause of clinical deterioration is Intra Cerebral Hematoma which occurs due to shear induced rupture of intra-parenchymal blood vessels. Most of the traumatic ICH involves fronto-temporal white matter. ICHis a hyperdenselesion with perilesionaledema. ICH usually associated with fractures, contusions and diffuse axonal injury[6].

In our study, we found a high incidence of Intracerebral Hematoma and Contusionaccounting for 63 patients (42%), however in the previous studies, a low incidence was seen[7].

Extra axial injury-

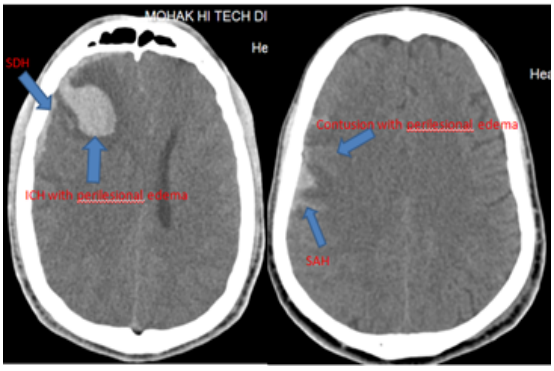
Subdural Hematoma (SDH)[Table/Figure 5,6]

Wider soft tissue CT window (compensate for the partial volume averaging in CT) are usually used for the evaluation of the SDH[5].

SDH is extra-axial concavo-convex hyperdensecollection with outer margin convex (towards the bone) and a inner margin concave (towards the brain). SDH may show fluid-fluid level. Density of this collection may be iso or hypodense. SDH usually present along the convexity but may be present in interhemispheric fissure [8].

In our study 37% patients had SDH (Figure 6), however previous studies had SDH in 18%(Tomar S.S et al)[11], 14%(Holmes, E.J et al) patients[9], 18%(Ogbeide E) patients [10].

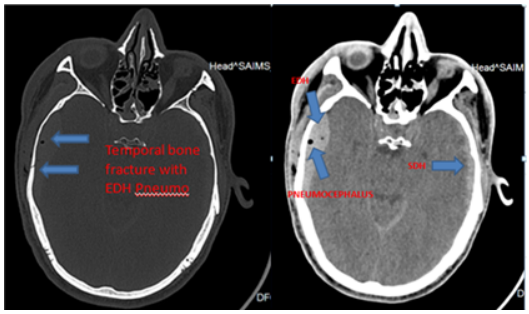
A chronic SDH and subdural hygroma are difficult to distinguish on NCCT head, as both are extra axial, concavo-convex collections and density equal to CSF, but sometimes it may have similar morbidity and morbidity as a subdural hematoma [9,12].



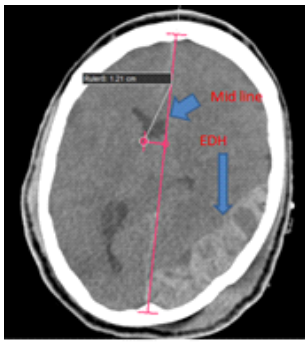
Table/Figure 5- ICH, SDH, & SAH

Epidural Hematoma (EDH) [Table/Figure 6, 7]

An EDH is an extra-axial hyperdense collection with biconvex (elliptical) shapeand a sharply defined edge.This collection occurs in the space between the skull and dura. EDH has association with skull fracture in most of the cases. The etiology of EDH is bleeding from middle meningealartery[9, 12]. Its incidence in our study is 11.3%, but in other earlier studies 9 % (Holmes, E.J et al)[9], 23% (Tomar S.S et al) patients[11]and 2.9%(Ogbeide E) patients [10]SDH were present.



Table/Figure 6- EDH with fracture and SDH as well as pneumocephalus



Table/Figure 7- EDH

Sub-Arachnoid Hematoma (SAH) [Table/Figure 5]

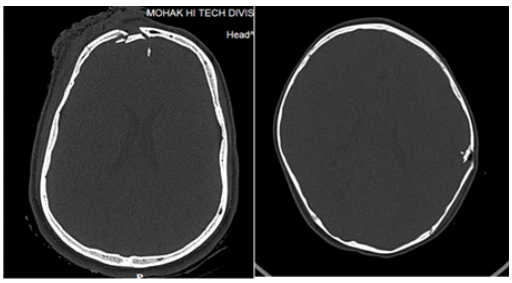
Sub-arachnoidhemorrhage is presence of hyperdensity (blood) in the arachnoid spaces(sylvian fissure, sulci, basal cisterns) on CT Head. SAH commonly occurs in elderly patients as their brain has large subarachnoid spaces.

SAH has close relation to the fracture, local haematoma or hemorrhagic contusions[12]

Acute SAH is more accurately diagnosed on CT as compared to MRI as acute blood has a low deoxyhemoglobin, which has similar intensity to the brain parenchyma on MRI[9].The etiology of the SAH is injury of small arteries and veins on the surface of brain.

Fractures [Table/Figure 6, 8]

For diagnosis of fractures NCCT head is the investigation of choice and guides in surgical interventions. A follow up CT scan is advised in skull base fracture patients to exclude pneumocephalus[13]. In our study fractures were present in 63.3% of patients, however in the study conducted by 44%(Ogbeide E) patients[10].



Table/Figure 8 - Skull bone fractures

Pneumocephalus[Table/Figure 6]

On CT headpneumocephalusare air pockets (low attenuating areas) within the cranial vault. These are usually associated with fractures of any air containing structures of the cranium like mastoid bone and sinuses as well as skull base[12].

Diffuse Axonal Injury

CT is not the investigation of the choice, as in most of the cases with profound neurological deficit, CT head may not have significant findings, because most of the lesions are small and non hemorrhagic[3]. However, DAI on CT head appears as diffuse, bilateral multiple hyperdense foci (size approx. 5-15 mm), most commonly involving white matter at the gray-white mater interface, corpus callosum, dorsal lateral upper brain stem, the basal ganglia or in the posterior limb of internal capsule[14]. We did not find any cases with CT findings of DAI in our study.

Sometimes EDH, SDH and ICH /contusions are large enough to cause Mass effect in the form of effacement of cortical sulci, ventricles and adjacent cisterns as well as may result in to midline shift.

CONCLUSION

CT Head is aninvestigation of choice as well as first line of investigation in all head trauma patients. Early and accurate diagnosis of primary lesions of head trauma is very helpful in deciding the early neurological intervention in golden hours to reduce the morbidity and mortality.

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