EVALUATION OF NCCT HEAD FINDINGS IN ACUTE HEAD TRAUMA PATIENTS

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 intraventricular hemorrhage 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 patients in 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.

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% subarachnoid haemorrhage 21% and associated skull 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.

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 patients in 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 31 December 2017 in department of Radiodiagnosis in Sri Aurobindo 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.

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% subarachnoid haemorrhage 21% and associated skull 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.

MRI is the other imaging modality to diagnose parenchmal pathology which cannot be 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 intraventricular hemorrhage and Primary intra-axial lesions like intracerebral contusions and hematomas, axonal shearing injuries and vascular injury have already occurred. However secondary injuries like Cerebral edema, brain herniation and ischemia occur later on, so can be preventable.
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.

**Intra axial injury**

**Intracerebral Hematoma and Contusion**

There are two types of brain contusions - hemorrhagic and non hemorrhagic. The main cause of contusions are blunt trauma to head as well as sudden head acceleration and deceleration, causing coup or contre-coup injuries. Early diagnosis and management of brain contusions, significantly reduces morbidity and mortality in patients presenting clinically with low GCS scores, anisocoria, trauma in elder patients (>60) years.

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 sheared induced rupture of intra-parenchymal blood vessels. Most of the traumatic ICH involves fronto-temporal white matter. ICH is a hyperdense lesion with perilesional edema. ICH usually associated with fractures, contusions and diffuse axonal injury.

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

**Extra axial injury- Subdural Hematoma (SDH)**

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

SDH is extra-axial concavo-convex hyperdense collection 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.

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

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.

**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 with male predilection because this group of patients are more active insocial and economic life.

Spectrum of primary intracranial lesions on NCCT head

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

<table>
<thead>
<tr>
<th>S.No</th>
<th>Age [yrs]</th>
<th>No. Of Patients</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>&lt;20</td>
<td>37</td>
<td>24.6</td>
</tr>
<tr>
<td>2</td>
<td>21-40</td>
<td>73</td>
<td>48.6</td>
</tr>
<tr>
<td>3</td>
<td>41-60</td>
<td>29</td>
<td>19.3</td>
</tr>
<tr>
<td>4</td>
<td>&gt;60</td>
<td>11</td>
<td>7.3</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>150</td>
<td>100</td>
</tr>
</tbody>
</table>

Patients were distributed on the basis of gender:

Table / Figure 2: Genderwise distribution of cases:

<table>
<thead>
<tr>
<th>S.NO</th>
<th>Gender</th>
<th>No. Of cases</th>
<th>PERCENTAGE (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MALE</td>
<td>125</td>
<td>83.3</td>
</tr>
<tr>
<td>2</td>
<td>FEMALE</td>
<td>25</td>
<td>16.6</td>
</tr>
</tbody>
</table>

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.

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 with male predilection because this group of patients are more active in social and economic life.

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 intracerebral contusion/ hematoma and accounts in 63 patients (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 these in our study.

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

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

**Discussions:***

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 with male predilection because this group of patients are more active in social and economic life.

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

**Extra axial injury- Subdural Hematoma (SDH)**

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

SDH is extra-axial concavo-convex hyperdense collection 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.

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

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.

Table / Figure 5- ICH, SDH, & SAH

**Epidural Hematoma (EDH)**

An EDH is an extra-axial hyperdense collection with biconvex (elliptical) shape and 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 meningeal artery. Its incidence in our study is 11.3%, but in other earlier studies 9% (Holmes, E.J et al), 23% (Tomar S.S et al) patients and 2.9% (Ogbeide E) patients.

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-arachnoid hemorrhage 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 hematoma 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%( ) patients. Ogbeide E

Table/Figure 8 - Skull bone fractures

Pneumocephalus [Table/Figure 6]
On CT head pneumocephalus are 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[14]. 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 matter interface, corpus callosum, dural 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 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.

REFERENCES: