Diversity in imaging findings of head injury patients: Our experience in a tertiary level hospital

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ABSTRACT

Background
Head injury is a major cause of mortality and morbidity worldwide. It can occur in isolation or in association with multisystem injuries. Proper and prompt imaging evaluation in head trauma can help in the triage and management of the patients.

Material & methods
A hospital-based study using a non-interventional study design was employed. A total of 219 patients with head trauma who underwent CT were evaluated for various possible injuries using different window settings and algorithms. Data was entered in a predesigned proforma, and analysis was done using IBM SPSS version 20.

Results
The most common age group involved in head trauma was 20 to 40 years of age. Male patients were more frequently involved than female patients. Most common finding associated with the head trauma was calvarial fracture followed by cerebral hematoma/ contusions. Diffuse axonal injury and intraventricular hemorrhage were the least common findings in patients with head trauma.

Conclusions
Road traffic accidents are the leading cause of head trauma in our part of the world. They commonly involve young males exposed to the vulnerable environment. Proper road safety measures, if undertaken cautiously, can help prevent significant mortality and morbidity associated with these kind of injuries.
Key words: **Head injury, skull fracture, epidural hematoma, subdural hematoma, pneumocephalus, cerebral contusion**

Introduction

Head injury is a major cause of mortality and morbidity worldwide. It can occur secondary to several causes such as road traffic accidents, physical assaults, and fall from heights. It can occur in isolation or in with multisystem injuries[1]. More than half of the cases of head trauma are caused by road traffic accidents, leading to 70% of all deaths due to brain injury[2]. Imaging plays an important role in the triage, diagnosis, and management of these patients. CT is the imaging modality of choice for the evaluation of post-traumatic head injuries due to its fast-acquisition time, accuracy, reliability, and wide availability[3,4]. In this study, we have attempted to present the various CT findings in patients with head trauma.

Material and methods

Ours was a hospital-based non-interventional retrospective cross-sectional study. It was carried out in a tertiary level hospital - Grande International Hospital, Kathmandu, Nepal. The inclusion criteria were all trauma patients undergoing CT for evaluation of the head injuries between 2016 and 2020. A total of 219 patients were included in the study. Non-contrast CT imaging of the head was done in the axial plane on a multidetector CT scanner. Various forms of head injuries were evaluated using soft tissue and bone window for every patient included in the study. An axial slice thickness of 2.5 mm was employed for evaluating the brain parenchyma. Thin section reformation (0.625 mm) using a bone algorithm was done for the detection of the subtle fractures. Multiplanar reconstruction and Volume Rendering Technique (VRT) was implemented for better evaluation of the parenchymal and bony injuries. Data were then entered in a predesigned proforma and analysis was done using SPSS.

Results

The most common age group involved in trauma, according to our study, was 21 to 30 years (22%) followed by 31 to 40 years (21%) (Fig 1). Age groups on either extreme i.e. 1-10 years and 71-80 years comprised the smallest population in our study, 4% and 2% respectively. The most common cause of the head trauma was a road traffic accident (87.6%) followed by physical assault (7.3%). Males were far more commonly involved in trauma in comparison to the females. The study population comprised 73% males and 27% females (Fig 2).

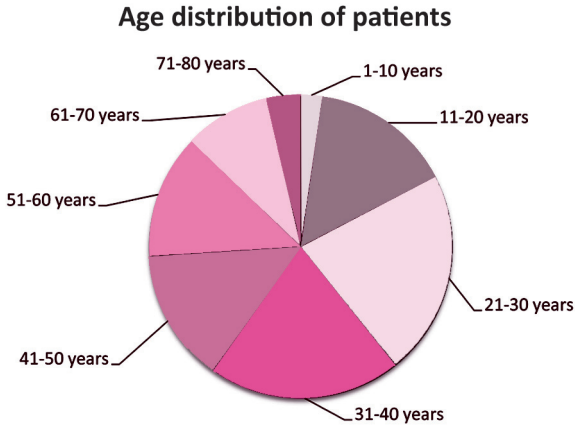

Figure 1: *Age distribution of the study population*

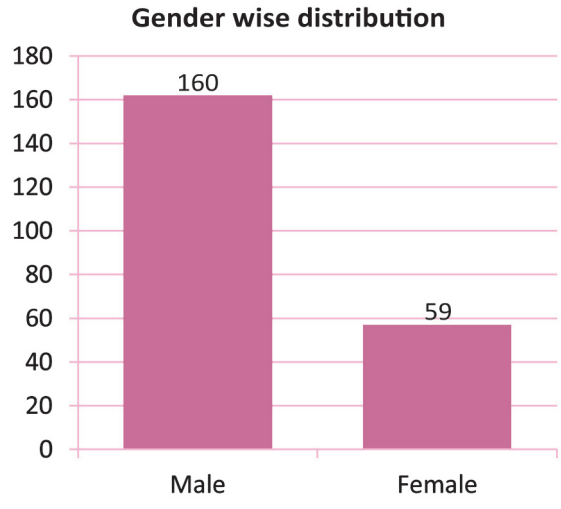

Figure 2: *Distribution of study population according to gender*

The most common CT finding associated with head trauma was skull fracture (59%). The commonest site of skull fracture was noted to be the frontal region followed by the temporal region (Fig 3). Pneumocephalus was noted in 21% of the patients. Among the extra-axial collections, epidural hematoma (19%) was more common than the subdural hematoma (15%) (Fig 4). Extra-axial collections were noted to be common in the temporo-parietal region followed by the frontal region. Intracerebral hematomas/ contusions were the most frequent intraparenchymal findings occurring in approximately 44% of the study population. The most common site of intracerebral contusions was frontal lobe (Fig 5). Subarachnoid hemorrhage was noted in 14% of the patients. Intraventricular hemorrhage and diffuse axonal injury were relatively uncommon as compared to other findings (seen in 5% and 0.9% of the patients respectively).

Table 1: CT findings in patients with head trauma

Findings	No. of patients
Skull fracture	131 (59%)
Intra cerebral hematoma/contusion	98 (44%)
Pneumocephalus	46 (21%)
Epidural hematoma	43 (19.6%)
Subdural hematoma	35 (15.9%)
Subarachnoid hemorrhage	31 (14.1%)
Intraventricular hemorrhage	11 (5.0%)
Diffuse axonal injury	2 (0.9%)

Figure 3: *Non contrast CT head axial view bone window demonstrates linear fracture in right temporal bone (black arrow).*

Figure 4: *Non contrast CT head axial view demonstrates biconvex acute epidural haematoma in the left frontal convexity (black arrow). Associated left frontal bone fracture is also noted (white arrow).*

Discussion

Head trauma is a common encounter in day to day practice and even in this 21st century it continues to be a major public health concern. Globally, and especially in our part of the world, i.e. in south east Asia, it is on the rise[5]. It has been documented that incidence of head injuries is increasing mainly due to surge in usage of vehicles by low and middle

Figure 5: *Non contrast CT head axial view brain window demonstrates multiple post traumatic contusions in the left frontal lobe (black arrow). Minimal adjacent subdural hematoma is also noted (white arrow).*

income countries[6]. The most common cause of head injury is road traffic accidents. Other less common causes include falls, assaults, workplace accidents and trauma during sports or recreational activities. Head trauma following road traffic accidents and assaults are more common in the young population whereas head injury following a fall is more common in the children and in the elderly. In our study, we found that the most common age group involved was 20-40 years of age. Males were more commonly involved than females (male to female ratio of 2.8) likely because of their increased exposure to the vulnerable activities.

Traumatic head injuries can either involve the calvarium, the extra-axial space and the intra-axial structures in isolation, or more commonly in different permutations and combination of these. Skull fractures can be linear, comminuted or depressed. Thin section bone window images need to be meticulously evaluated for these fractures. In our study, we found that the most common finding associated with the head trauma was the calvarial fracture. The most frequent bone involved was the frontal bone. Extra-axial collections include epidural hematoma, subdural hematoma and subarachnoid haemorrhage. Epidural hematoma is biconvex in shape whereas subdural hematoma is concavo-convex. Epidural hematoma is commonly associated with skull fractures and the most common site of

its occurrence is the temporoparietal convexity.[7] We found that among the extra-axial collections, epidural hematoma was the commonest of all.

Among the intra-axial manifestations, cerebral contusions were found to be the most common finding. Cerebral contusions appear as ill-defined areas of hyperdensity in the brain parenchyma with or without surrounding edematous changes. They occur near bony protuberances of skull and skull base, commonly in the frontal and temporal lobes[8]. Pneumocephalus occur in a significant number of patients with calvarial fracture. Especially those fractures involving the sinuses and the mastoid cavities are associated with the pneumocephalus.[9]

Intraventricular hemorrhage occur due to the tearing of subependymal veins. It can also occur as a direct extension of parenchymal hematoma into ventricular system. It is a less common finding in trauma patients[10]. Diffuse axonal injury (DAI) occurs as a result of traumatic acceleration and deceleration and is related to the rotational injuries of the brain. CT is an insensitive modality for the evaluation of DAI[11]. This might explain why DAI was the least common finding noted in our study. Further imaging in the form of susceptibility weighted MR imaging should be carried out in traumatic head injury patients with suspicion of DAI.

Conclusions

Road traffic accident is the leading cause of head trauma in our part of the world. They commonly involve young males exposed to the vulnerable environment. Proper and immediate imaging with CT can not only help in triage but also in prompt management of the patients. Proper road safety measures, if undertaken cautiously, should help prevent significant mortality and morbidity associated with head trauma.

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