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ORIGINAL ARTICLE

Computed Tomography Scan Findings in Various Modes of Head Injury, using Ge Optima 128 Slice CT Scanner

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ABSTRACT

Background: Head injury is a global health problem that can cause disability and may result in death. CT scan detects and precisely localizes the skull fractures, epidural/subdural/subarachnoid hemorrhages, brain contusions and cerebral edema etc. CT has proven to be a valuable tool in the early diagnosis and prompt management of head trauma patients.
Methods: A descriptive cross-sectional study, including 380 patients, presented to the radiology department of Hayatabad medical complex witha history of head trauma for computed tomography examination, from October 2019 to October 2020. The nature of the brain and skull lesions was analyzed in our study and the frequency of various findings was recorded.
Results: Among 380 patients, the majority were males (248) making the male to female ratio to be around 2:1. The most prevalent finding was skull fractures (23.4%) followed by cerebral contusions (17.1%). Among extra-axial brain hemorrhages, extradural hematoma (15.2%) was observed more than subdural hematoma (6.8%) while only 3.4% presented with subarachnoid hemorrhages which also included intraventricular hemorrhages.
Practical Implication: As road traffic accidents are the most common cause of head injuries so road traffic safety measures ought to be strictly enforced. Most of the CT scan done during head injuries were normal so CT guidelines for ordering should be implemented to scale back extra patient irradiation, unnecessary waste of resources
Conclusion: Our study concluded that younger populations and males are more prone to head injury and road traffic accident is the most common mode of head trauma. So, ensuring proper traffic rules along with educating the more prone population will significantly reduce the incidence of serious head injuries.
Keywords: Head Injury, Computed Tomography (CT), Road Traffic Accidents (RTA), Skull Fractures, Epidural Hematoma.

INTRODUCTION

Head injury is a significant health problem globally that may result in disability and even death. It is responsible for the majority of deaths following motor vehicle accidents.[1] Due to rapid urbanization and busy lifestyle more and more trauma cases present to the hospital resulting from accidents. Road traffic accidents (RTAs) are the primary cause of head injuries in adolescents and young adults. Other traumas resulting in head injury are falls, firearm injuries, assaults and blast injuries etc.

The most frequent assessment after any trauma for patients presenting to the emergency is of head injury,a common method used to assess head injury is Glasgow Coma Scale (GCS),[2]head injury is also assessed by the history of loss of consciousness, episodes of vomiting, any Ear Nose Throat (ENT) bleeding, rhinorrhea, otorrhea, raccoon eyes, andecchymosis behind ear.

Historically, the Skull radiograph was an important diagnostic tool in the management of patients withhead injuries, with the recent advent of computed tomography (CT), skull radiographs are now consideredless valuable in the management of head trauma. Although plain films may show the majority of skull fractures, they are inadequate in the evaluation of the intracranial structures. A normal skull radiograph doesn't exclude brain injury, hemorrhage, or even fractures.[3] The arrival of CT in the 1970s transformed the diagnosticapproach and management of head injury among many other things. Early diagnosis and rapid treatment, for which CT has shown to be an invaluable tool, can reduce the likelihood of fatality or impairment in individuals who have suffered head trauma.This has made possible emergency neurosurgical interventions, resulting in significant improvement in morbidity and mortality in head trauma cases[4].On the other hand, Magnetic Resonance Imaging (MRI) can accurately evaluate intracerebral lesions but unlike CT, it is not readily available in an emergency setting.

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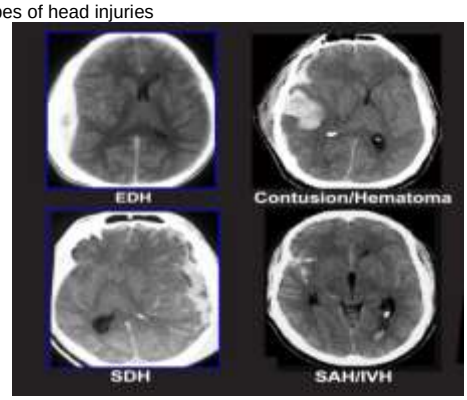
For cerebral lesions requiring quick neurosurgery choices, such as the early detection and care of extra-axial hematomas, CT is faster at capturing images, extremely sensitive and accurate, and is not contraindicated in the presence of metallic foreign bodies such as gunshot fragments5. [5] Additionally, it is more prevalent and less expensive compared to magnetic resonance imaging. Multislice CT has significantly reduced scan time, which greatly benefits poly-traumatized patients.[6]Because of these advantages, CT is regarded as the gold standard for identifying head and brain traumas.

Computed tomography of the head is a more effective first line of investigation and detection for structural alterations that are typically linked to head injuries. The fractures are precisely located and identified by CT scan.[7]It also helps in the detection of epidural, subdural, subarachnoid, intraparenchymal and intraventricular hemorrhages, brain contusions and cerebral edema etc. The location & size of the lesion and the secondary findings like sulcal effacement and midline shift can differentiate the severe brain injury from the minor one on CT.

Fig.1: Types of head injuries



Due to its accuracy, dependability, safety, and widespread availability, computed tomography (CT) has taken over as the preferred diagnostic method for head trauma.The purpose of ourstudy is to make a profile of the frequency of various cranial CT scan findings in head trauma and its various causes presenting to the Hayatabad Medical Complex, Peshawar

METHODOLOGY

This Cross-sectional study was carried out atRadiology Department, Hayatabad Medical Complex, Peshawar**,** from October 2019 to October 2020.GE OPTIMA 128 Slice CT Scanner was used for all CT scans.

The sample size was380 and it was calculated using the WHO software for calculating sample sizes for health studies withthe following assumptions:

- Accepted margin of error = 5%
- Confidence Level = 95%

Non-probability consecutive sampling technique was used. The inclusion criteria were all head trauma patients of both genders of any age presenting to the radiology department for a CT scan.Patients with head trauma who were declared brain dead before CT scan andpatients with general contraindication to Computed tomography imaging were excluded from the study.

Data collection and analysis: All head trauma patients presenting to the department of radiology, Hayatabad medical complex, Peshawar for computed tomography scanning whilst fulfilling the inclusion and exclusion criteria were included in the study. The patients were assessed according to the Glasgow coma scale (GCS). The data was collected after informed consent by explaining the study protocol, use of data for research and risk-benefit ratio. Demographic data along with subjective CT findings of the patient were recorded according to a proforma designed particularly for this study to ensure uniformity. All CT scans that were performed between an hour and a week following a catastrophic head injury were included in this investigation. The study excluded discussion of treatment outcomes and techniques.The data collected was entered into and analyzed using SPSS version 20 for statistical analysis.

RESULTS

Among 380 patients, the majority were males 248 (68.89%) while there were only 132 females. This makes the male to female ratio to be around 2:1, with agesranged from 3 months to 86 years. The most number of head injury patients were in the age group “16 to 30 years” (28.9%) and the second most common occurrence was observed in the “31 to 45 years” group (25.5%).

Table 1: Age and gender distribution

Age(Years)	Male	Female	Total	Percentage
0 - 15	43	22	65	17.1%
16 - 30	79	31	110	28.9%
31 - 45	63	34	97	25.5%
46 - 60	26	18	44	11.6%
61 - 75	22	16	38	10%
>75	15	11	26	6.8%
Total	248	132	380	

The most common cause of head trauma in our study was Road traffic accidents (RTA) with more than half the patients presenting with this mode of injury. The second most common was fall (22.9%) followed by assault (11.6%).

Table 2: Causes of Head injury according to gender distribution.

Cause of Head Injury	Male	Female	Total	%age
RTA	142	71	213	56%
Fall	55	32	87	22.9%
Assault	38	23	61	16.1%
Others	13	6	19	5%

Despite having significant Head Injuries, most of the CT scan findings were normal. However,those with only external injuries like scalp edema or hematoma were also considered normal. Around one-thirdof patients (37.1%) were in this category. The most prevalent finding was skull fractures (23.4%) followed by cerebral contusions (17.1%). Among extra-axial brain hemorrhages, epidural hematoma (15.2%) was observed more than subdural hematoma (6.8%). Only 3.4% presented with subarachnoid hemorrhages which also included intraventricular hemorrhages. The distribution of CT findings according to modes of head injury revealed that skull fracture was the most common finding whether the injury was caused by RTA, fall, assault or others.

Table 3: Distribution of CT findings in Head Trauma Patients

Skull fracture	89(23.4%)
EDH	65(17.1%)
Contusions (including intraparenchymal hemorrhages)	65(17.1%)
SDH	26(6.8%)
SAH (includes IVH)	13(6.8%)
Others (DAI, Pneumocephalus)	17(4.5%)
Normal (including patients with only scalp injuries)	141(37.1%)

Table 4: Distribution of CT findings in various modes of Head Trauma

	RTA	Fall	Assault	Others(sports or blast injury)
Skull Fracture	47	23	11	8
Epidural Hemorrhage	29	19	6	4
Contusion (including intraparenchymal hemorrhages)	31	17	9	8
Subdural Hemorrhage	13	8	3	2
Subarachnoid Hemorrhage (includes IVH)	8	4	1	0
Other (DAI, Pneumocephalus)	10	4	2	1
Normal (including patients with only scalp injuries)	88	32	15	6

DISCUSSION

In our study head injury is more commonly found in younger age groups. Approximately 46% of patients in our study are younger than 31 years of age, among these the most affected age group is 16 to 30 years. The second most common age group is 31 to 45 years. Asimilar trend of younger people encountering head trauma more often than the older population is also noted in other studies.[8,10]these age groups engage in more outdoor activities, spend more time away from home for educational or work purposes, and face accidents. After age 25, the incidence of head injuries steadily declines.

The least common age group is above 75 years of age, probably because of their less mobility and fewer outdoor activities.

The results of this study showed that Head injury is more common in males. This could be due to their working pattern and profession as compared to females. It has been observed in other local and international studies as well.[8,9] In our study, there is a 2:1 male to female ratio of encountering head injury. The most numbers of males are in the 16-30 age group (79) while most numbers of females are in the 31-45 age group (34).

The different causes of head trauma are road traffic accidents (RTA), falls, assault and others like sports injuries, blast injuries etc. In our study, the sample population suffering from road traffic accidents encompass more than half of the total sample population (56%). The common findings were skull fractures, cerebral contusions, extradural, subdural, subarachnoid hemorrhages and other findings.RTA as themost common cause of head trauma is

observed in many studies.[8,10,11] These trends have been noted in other parts of the world as well, probably because of urbanization and the growing use of automobiles. [10] This points out the important issue of implementing and following proper traffic rules for decreasing the incidence of head trauma.[12] About 22.6% of people encountered falls making it the second most prevalent mode of head injury which is followed by assault. The other causes like sports and blast injuries etc affected only a small number (5%) of people in our study.

The common CT findings found in our study are skull fractures (23.4%), epidural hemorrhage EDH (15.2%), cerebral contusions including intraparenchymal hemorrhages (17.1%), subdural hemorrhage SDH (6.8%), subarachnoid hemorrhage including intraventricular hemorrhages (3.4%) and others like diffuse axonal injury and pneumocephalus (4.5%), which were somewhat similar to most of the other studies.[13,14] Most common is skull fracture which included linear, depressed and comminuted fractures. Skull x-rays plays a very limited role in head trauma diagnosis because of their poor diagnostic ability while CT is much better at localizing skull fracturesand characterizing intracranial lesions. That is why radiological evaluation with Head CT is now the primary modality of choice in patients presenting with a head injury.[15]

The 2nd most common finding in our study is cerebral contusions. The 3rd most common is epidural hemorrhage followed by subdural hemorrhage. If any of these problems are left untreated or receive delayed treatment, they can all worsen and cause additional neurological difficulties. For example, contusions tend to enlarge over time and potentially occupy a site for large intracranial hemorrhage formations.[16] CT helps in accurately diagnosing the injury, and its severity, and guides the treatment which in turn prevents the development of complications. That is why the Neuroradiology of head trauma has experienced significant alterations since the development of computed tomography, which has dramatically altered the management of head trauma.

About one-third of the patients (37.1%) showed normal CT study or solely scalp injury (scalp edema or hematoma). This indicates that many patients are unnecessarily exposed to radiation.Therefore, not all head injury patients require a CT scan.[17]. To determine which head trauma patients are most likely to have a traumatic brain injury and would therefore benefit from a CT scan, the trauma team receiving head trauma patients and issuing CT scan requests needs a clinical guideline (head trauma CT guideline).This protocol may facilitate in reducingthe proportion of head trauma patients who underwent CT scans, with resultant control of overutilization of computed tomography, and indirectly reducing the unnecessary patient radiation dose, the wastage of resources and the burden on the radiology department.

Recommendations: Road traffic safety measures ought to be strictly enforced. Also, CT guidelines for ordering should be implemented to scale back extra patient irradiation, unnecessary waste of resources and a further burden on the radiology department.

CONCLUSION

Our study concluded that younger populations and males are more prone to head injury and road traffic accident is the most common mode of head trauma. So, ensuring proper traffic rules along with educating the more prone population will significantly reduce the incidence of serious head injuries. Also CT is a crucial and essential component of treating patients with brain injuries because of its outstanding diagnostic ability which helps in making the proper treatment plan

Conflict of interest: Nil

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