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DIAGNOSIS AND MANAGEMENT OF COMPUTED TOMOGRAPHY IN HEAD INJURY

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ABSTRACT

Introduction: In human body there are many causes of the injuries. Among all the injuries head injury is also one of the most important injuries which may cause morbidity and mortality. Craniocerebral injuries or Traumatic brain injury (TBI) is defined as any structural skull traumatic injury with alterations of cerebral physiology as a result of an external force either in the form of chemical energy, mechanical energy, electrical energy or thermal heating. Globally craniocerebral injuries or Traumatic brain injury (TBI)is cause of disability in young patients, especially those <40 years of age. TBI is classified as mild, with most showing adequate and quick recovery. Nevertheless there are some kinds of TBI which showed persistent disabling symptoms that interrupt with their normal daily routine activities. Brain imaging is very important for the patients who suffer traumatic brain injury. In the emergency services Computed tomography (CT) is recommended as first assessment that provides initial information and diagnosis to identify the need of surgery. It also helps in the following of the patient and the evolution of pathology. Many studies suggest that CT can be used to predict patient outcomes. Computed tomography (CT) is an imaging technique which uses as dynamics of injected contrast material, allows rapid quantitative and qualitative evaluation of cerebral perfusion by generating cerebral blood volume (CBV), cerebral blood flow (CBF) and mean transit time (MTT) maps providing clinically important information with stroke subarachnoid hemorrhage (SAH)and head injury.

Aim: The main aim of this study is to evaluate the computed tomography findings sustaining head injury and role of computed tomography scan in head injury.

Material and Methods: During the study total 90 patients with head injury were included with different age group from 20 to 70 years old. Glasgow coma score (GCS) range 4–15 (mild head injury: GCS >14; moderate head injury: GCS = 9–13; severe head injury GCS <8) were also included in this study. For all the patients with head injury Computed tomography (CT) image were performed with siemen's somatom spirit dual slice spiral CT machine and a protocol of contiguous axial 5-mm sections through the posterior fossa and a contiguous 10 mm axial sequential scans for the rest of the brain and thinner cuts were also taken whenever required. For visualize any fractures of the skull bone algorithms with wide window settings were studied. After initial resuscitation, severity of the cranio-cerebral trauma was graded with the help of Glasgow Coma Scale (GCS) into mild head injury (GCS13- 15), moderate head injury (GCS 9-12) and severe head injury (GCS 3-8).

Result: Among total patients sixty five (72.2%) patients were male and twenty five (27.8 %) were female with age range from 20 to 70 years old. In the age group 31-50 year group showed highest frequency of head trauma. The most common causes of head injury were RTA (65.6%) followed by fall injuries (20%) and physical assaults (14.4%). Among patients with head injuries Loss of consciousness and vomiting were the commonest clinical features brought to emergency. Out of 90 cases 59 (65.5%) cases showed mild head injury followed by 14(15.6%) cases sustained moderate head injury and 17(18.9%) had severe head injury. In all types of severity of head injury RTA was the prime etiological factor. Out of total cases 31(34.4%) had normal CT findings and 59(65.6%) had abnormal CT findings. Abnormal CT findings were seen in 59(65.6%) sustaining mild head injury and in all the patients with moderate and severe head injury. Out of 90 cases 13 cases with severe head injury had mortality. The most common mode of injury to cause the mortality was RTA. Five patients with severe head injury also had cervical spine injury

Conclusion: This study concludes that use of CT in head trauma can finds high prevalence of head trauma related to CT. Therefore CT should be done when clinically necessary that helps to reduce cost and avoids unnecessary exposure to radiation.

Keywords: Head injury, Traumatic brain injury (TBI), computed tomography (CT), Glasgow coma scale (GCS)

Introduction

In human body there are many causes of the injuries. Among all the injuries head injury is also one of the most important injuries which may cause morbidity and mortality. Craniocerebral injuries or Traumatic brain injury (TBI) is defined as any structural skull traumatic injury with alterations of cerebral physiology as a result of an external force either in the form of chemical energy, mechanical energy, electrical energy or thermal heating[i]. Craniocerebral injuries are a common cause of hospital admission following trauma which associated with significant morbidity and mortality worldwide. For the detection of craniocerebral lesion CT remains important that require immediate neurosurgical intervention as well as those that require in-hospital observation and medical management[ii]. Globally craniocerebral injuries or Traumatic brain injury (TBI)is cause of disability in young patients, especially those <40 years of age[iii]. In year 2005 in India data had shown that road traffic injuries resulted in economic losses of up to 3% of the gross domestic product as estimated for the year 2005. There are many types of brain injuries which are most important predictor of unfavorable outcome in patients even with associated multiple extra-cranial injuries[iv]. TBI is classified as mild, with most showing adequate and quick recovery.

Nevertheless there are some kinds of TBI which showed persistent disabling symptoms that interrupt with their normal daily routine activities[v]. TBI is not only structural damage diffuses axonal injury or in form of contusions, it also causes secondary alterations in hemodynamic parameters which lead to ischemia and cellular dysfunction. In pathophysiology of ischemia following TBI Multiple mechanisms are involved which included paucity of nitric oxide or cholinergic neurotransmitters, direct vessel autoregulatory failure leading to hypotension and vasoconstriction[vi].

Brain imaging is very important for the patients who suffer traumatic brain injury. In the emergency services Computed tomography (CT) is recommended as first assessment that provides initial information and diagnosis to identify the need of surgery. It also helps in the following of the patient and the evolution of pathology. Many studies suggests that CT can be used to predict patient outcomes[vii, viii]. Many researchers have proposed to predict clinical outcomes with traumatic brain injury using computed tomography though there are still some limitations to find best tool to perform an accurate prognosis[ix]. Computed tomography (CT) is an imaging technique which uses as dynamics of injected contrast material, allows rapid quantitative and qualitative evaluation of cerebral perfusion by generating cerebral blood volume (CBV), cerebral blood flow (CBF) and mean transit time (MTT) maps providing clinically important information with stroke subarachnoid hemorrhage (SAH)and head injury[x,xi]. Computed tomography (CT) remains as centerpiece for initial diagnostic evaluation of head trauma. CT the diagnostic have made minimize examination time, available widely, lack of contraindications and high accuracy for detecting hemorrhages for initial evaluation of head injury[xii].

The main aim of this study is to evaluate the computed tomography findings sustaining head injury and role of computed tomography scan in head injury.

MATERIAL AND METHODS:

This study was conducted in the department of Radiology in at .M. Medical College and Hospital, Mathura (UP). During the period of 1 year total 90 patients with head injury were included with different age group from 20 to 70 years old. Glasgow coma score (GCS) range 4–15 (mild head injury: GCS >14; moderate head injury: GCS = 9–13; severe head injury GCS <8) were also included in this study. For all the patients with head injury Computed tomography (CT) image were performed with siemen's somatom spirit dual slice spiral CT machine and a protocol of contiguous axial 5-mm sections through the posterior fossa and a contiguous 10 mm axial sequential scans for the rest of the brain and thinner cuts were also taken whenever required. For visualize any fractures of the skull bone algorithms with wide window settings were studied.

From all the patients complete clinical history was taken as age, sex, type of injury, principal presenting complaints. General physical examination and detailed examination of the central nervous system were also done. Injuries involving the other body part were also noted. The type of trauma was further classified into falls, Road traffic accidents, assaults and miscellaneous. After initial resuscitation, severity of the cranio-cerebral trauma was graded with the help of Glasgow Coma Scale (GCS) into mild head injury (GCS13- 15), moderate head injury (GCS 9-12) and severe head injury (GCS 3-8)[xiii].

RESULTS:

In this study total 90 Patients were included who presented head injury in emergency room were analyzed. Among total patients sixty five (72.2%) patients were male and twenty five (27.8 %) were female (Sex ratio M: F = 2.6:1) with age range from 20 to 70 years old. In the age group 31-50 year group showed highest frequency of head trauma. The most common causes of head injury were RTA (65.6%) followed by fall injuries (20%) and physical assaults (14.4%). Among patients with head injuries Loss of consciousness and vomiting were the commonest clinical features brought to emergency. Table no 1 below showed Clinical picture of patients included in this study.

Table 1: Clinical presentations of cases of head injury

Clinical presentations	Frequency	Percentage
LOC	52	57.8
Vomiting	30	33.3
Alcohol consumption	16	17.8
Seizure	15	16.7
Black eyes	14	15.6
Headache	13	14.4
ENT bleeding	8	8.9
CSF rhinorrhoea	5	5.6

Out of 90 cases 59 (65.5%) cases showed mild head injury followed by 14(15.6%) cases sustained moderate head injury and 17(18.9%) had severe head injury. In all types of severity of head injury RTA was the prime etiological factor as shown in table below.

Table 2: Severity of head injury (GCS) based on mode of head injury

GCS	Mode of injury			
	RTA	Fall	Assault	Total
Mild (13-15)	38	13	8	59
Moderate (9- 12)	9	3	2	14
Severe (3-8)	12	2	3	17

In the cases skull fractures were the most common noted in 43 cases (47.8%) followed by EDH 34 cases (37.8%), contusion 21 cases (23.3%), SDH 20 cases (22.2%), SAH 19 cases (21.1%), pneumocephalous 16 cases (17.8%), cerebral edema 14 cases(15.6%), DAI 13 cases (14.4%), subcortical hematoma 11 cases (12.2%) cerebral herniations 5 cases (5.6%) and IVH 3 cases (3.3%) as shown in table no 3 below.

Table 3: Various lesions in patients with craniocerebral trauma

lesions	no	percentage
Facture	43	47.8
EDH	34	37.8
Contusions	21	23.3
SDH	20	22.2
SAH	19	21.1
Pneumocephalous	16	17.8
Cerebral edema	14	15.6
DAI	13	14.4
Subcortical hematoma	11	12.2
Cerebralherniation	5	5.6
IVH	3	3.3

Out of total cases 31(34.4%) had normal CT findings and 59(65.6%) had abnormal CT findings. Abnormal CT findings were seen in 59(65.6%) sustaining mild head injury and in all the patients with moderate and severe head injury as shown in table no 4 below. Out of 90 cases 16

Table 4: Correlation of CT findings with severity of head injury

Severity of head injury	no. of cases			
	Mild	Moderate	Severe	Total
Normal CT	29	1	1	31
Abnormal CT	32	12	15	59

Out of 90 cases 13 cases with severe head injury had mortality. The most common mode of injury to cause the mortality was RTA. Five patients with severe head injury also had cervical spine injury as shown in table no 5 below.

Table 5: Mortality based on mode of injury

Mode of injury	No. of cases	
	Yes	No
RTA	5	54
Fall	1	17
Physical assault	1	12

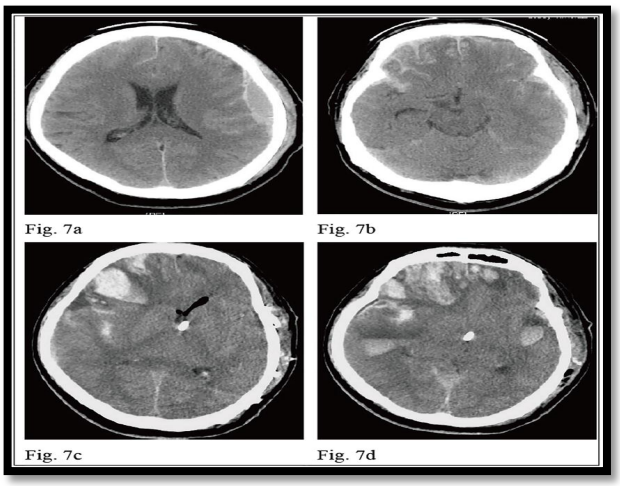

Figure 1: Showing progression of brain CT scans in a traumatic brain injury patient.

Fig 7a and **7b** show that initial brain CT revealed left fronto-temporal EDH and bilateral frontal and temporal small contusion hemorrhages, and SAH.
Fig 7c and **7d** show that follow-up brain CT after left craniotomy on POD 1 revealed right frontal and temporal contusion hemorrhage progression and right SDH with a midline shift to the left, left frontal and temporal contusion hemorrhages, pneumocephalus, diffuse brain swelling and bilateral slender ventricles.

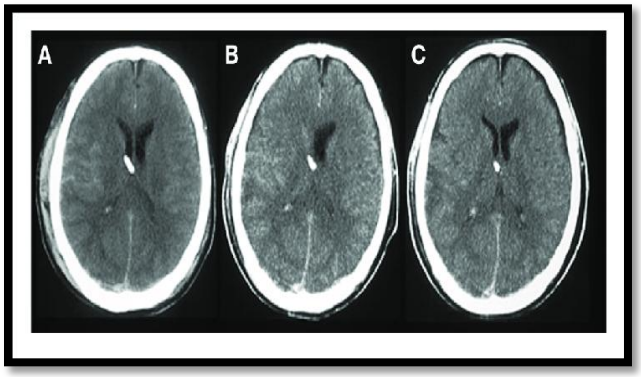

Figure 2: Showing CT scans of the brain from a 45-year-old man after a severe traumatic brain injury. (A) CT scan before the start of drainage at an intracranial pressure of 32 mmHg.
(B) CT scan after 1 day of ventricular drainage, at a drainage level of 22 mmHg.
(C) CT scan 2 days after drainage was stopped. Ventricular size was reduced by the drainage, and partly restored after the drainage was stopped.
This figure supports presented principles for transvascular fluid exchange in the injured brain with disrupted blood–brain barrier.

DISCUSSION:

TBI causes various structural injuries as well as hemodynamic changes which may not be visible using conventional NCCT[xiv, xv]. When there is a mild head injury which is also associated with physical and psychosocial dysfunction leading to significant disability with persistent headaches and memory deficits[xvi]. Globally Head injury is an increasing health problem that is a leading cause of death and disability in their most productive years. Precise assessment of the patients presenting with head injury will be very useful in the management of the patients. Head injuries may be varies from age 1 to 85 years but in this study age from 20 to 70 years old were included.

This study found that majority is in third and fourth decade of life. This may be because they spend most of their time out of their houses for work and to earn the livelihood are more prone to accidents. In this study the ratio if male: female is 2.6:1 which is similar to the study conducted in the USA with an incidence ratio of >2:1for males compared to females[xvii]. Many studies showed as male is more predominance to female. This may be due to that male has to move out of their homes more frequently and are more actively working outdoors than females. Other studies in Ghana and Nigeria showed road traffic accidents were the commonest causes of head injury[xviii]. Loss of consciousness and vomiting were the most common clinical presentation showed by patients in this study which was similar to the study done by Bhandari et al[xix] and Agrawal et al[xx]. Studied carried out in Brazile by Borczukp et al[xxi] showed that positive CT findings in a quarter of cases mild head trauma whereas in Ghana by Asaleye C.M et al[xxii] showed nearly half of the mild head injury cases with positive CT findings and in Nigeria by Jeret JS et al[xxiii] showed patients with moderate to severe head injury showed abnormal CT findings in 87 % patients in which this study showed 59(65.6%) abnormal CT findings.

According to the study of Yattoo et al[xxiv] in 547 patients only 8.9% CT findings displayed skull fracture and another studied done by Zimmerman et al[xxv] in 286 patients showed hemorrhagic contusions as the most common intracranial lesion which showed less then this study. In this study total 7 (7.8%) patients were expire. Those who expired had severe head injury (GCS 3-8) and which shows RTA was the commonest mode of injury that expired which was

similar to the studied of Yattoo et al[xxvi] and Agrawal et al[xxvii] showing 6.4%and 7% respectively.

CONCLUSION:

This study concludes that use of CT in head trauma can finds high prevalence of head trauma related to CT. Therefore CT should be done when clinically necessary that helps to reduce cost and avoids unnecessary exposure to radiation.

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