

Frequency Of Differential Diagnosis on CT Following a Traumatic Brain Injury

Amna Babar¹, Rida Zulfiqar², Rana Muhammad Athar shams³

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Corresponding Author:

1. amnababar18@gmail.com

Affiliations:

¹University of Lahore, Lahore (University campus)

³University of Lahore, Lahore (University campus)

ABSTRACT

Traumatic brain injury is the vigilant insult of brain after a collisional trauma that leads to series of pathophysiological events. Traumatic brain injury is an exceeding chemical process that leads towards a wide variety of brain pathologies. There are multiple brain pathologies that are triggered by trauma and can easily be visualized on the computed tomography. And there are wide spectra of clinical manifestation that is associated with each and every pathology that manifests after brain trauma such as dementia, vomiting, headache, gait disturbances and sensory and visual disturbance. And the Glasgow comma score interprets the severity of the disease in the mild, moderate and severe category. The CT features of the skull fracture, epidural hemorrhage, subdural hemorrhage, subarachnoid hemorrhage and intraventricular hemorrhage can be described normally by the compression of normal cortical tissue and compression of mid line structure and raised intracranial pressure.

Keywords: TBI, CT, CNS



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Original Research Article

Introduction:

Traumatic brain injury (TBI) has become the most emergent medical condition worldwide causing considerable amount of mortality that in most of cases leads towards morbidity for an extensive amount of time, the most recurrent subjects that falls under this category are mostly under 44years .According to an American report incidentally prevalent traumatic brain injuries round about 1.6 million per year in the USA, causing >50,000 deaths and >70,000 patients with lasting disability infirmity. TBI is an expanding process with different biochemical variation that after following series of different mechanically dynamic process leads towards the development of primary lesions that would eventually forms the basis of the physics that would expand towards secondary injury .Therefore to rule the presence of intra – or extra lesion in the short window process of traumatic brain injury , we use the gold standard modality CT as the 1st line of investigation . according to most usually common emergency CT report 25–45% of parenchymal contusions enlarges in size and 16% of diffuse injuries exhibits the variety of changes which will eventually leads towards TBI .(1)There is huge spectra of clinical manifestation of head trauma patients in the acute and subacute phases of recovery .the spectra is mostly divided into 3 majors categories which also make the neurophysiological test easier , the three most major categories are somatic that constitutes physical sensations and cognitive that constitutes mental abilities and the third one is the affective that constitutes emotional. The symptoms that fall in the somatic category include headache, sleep disruptions, dizziness, nausea, visual disturbance, photophobia, and phonophobia.

And the symptoms that falls in the category of cognitive include problems with attention and memory, slow processing speed, difficulty multitasking, increased distractibility, losing one's train of thought, and feeling foggy. And symptoms associated with Affective include increased irritability, emotional lability, anxiety, and depression (2). The most prior consequence of traumatic brain injury are skull fractures that in most of the active prevalent cases do not falls under the paradigm of severe traumatic brain injury but have been proven to be fatal in 25 % of the cases according to a universally verified autopsy reports. And in most cases the ration contusions and hematomas are significantly higher in skull fracture than a TBI without a skull fracture. The main complications with a fracture of the skull base are cerebrospinal fluid (CSF), cranial nerve damage and nerve sinus injury, infection of the jugular vein or internal carotid artery (ICA). (3) The 2nd most frequent disruption that occurs consequently after traumatic brain injury is EDHs as it occurs in about 0.2–12% of acute head-injured patients, and expanded mortality rate is 5%. Most types of EDHs most commonly occur at the site of impactful injury and it mostly end up in impactful stress fracture in >90% of cases. On CT it is most often found when it extends beyond the cranial sutures toward the sinus reflex and sometimes passes under the tentorium cerebellum or crosses the midline. 95% of EDH is very transient or parietal and is usually displaced between the middle meningeal artery and one of its branches. And it largely exhibits itself on the non-enhanced CT as biconvex, hyperattenuating extra-axial collections. Another severe consequence of TBI are SDHs which is mostly seen in 12–29% of patients. (4) SDHs pathologically arise due to the

damage of cortical bridging veins because of angular acceleration or deceleration of the head in the sagittal plane. On axial CT, acute SDHs usually represents as crescent-shaped hyperdense gathered between the cerebral hemisphere and inner table of the skull, frequently expanding along the entire hemispheric convexity. (5) SAH is demonstrated in approximately 40% of patients with moderate to severe TBI. It may apprehend as a consequence of the injury to small subarachnoid vessels or from disruption of hemorrhagic contusions or hematomas into the subarachnoid space. SAH appears as curvilinear foci of raised attenuation within sulci and cisterns on NECT (6) The prevalence of traumatic IVH mostly lies between 1.5% and 3%, with the frequency preceding towards 10% in those patients who had severe TBI. IVH may expand the injury towards the subependymal vessels that lies parallel with the walls of the lateral and third ventricles or it can also expand from bleeding of the choroid plexuses..(8) CT has a wide spread diagnostic role in detecting traumatic brain injury in the emergency setting and gives better resolution images which not only depict the structural abnormality that is introduced due to impactful injury such as in the case of traumatic fracture which is impressively depicted by Multidetector CT which have near-isotropic voxel acquisition that be generate high-quality two-dimensional multiplanar reformation and three-dimensional (3D) images. . In fact, due to vast efficacy of CT in detecting in traumatic brain injury many researchers have divided the CT diagnostic features of traumatic brain injury in different CT scoring test to detect the severity of traumatic brain injury. the 1st CT scoring diagnostic criteria was Marshall CT classification that divides the patients with head trauma into six groups on the basis of the presence of a focal mass lesion (evacuated or non-evacuated) and/or diffuse intracranial abnormalities including brain swelling and midline shift. The Rotterdam score is another classification system which represents single CT abnormalities to be scored separately by including two additional parameters such as traumatic subarachnoid hemorrhage and intraventricular hemorrhage. Another classification system is the Helsinki CT score, which identifies head trauma patients on the basis of bleeding type and size, intraventricular hemorrhage and suprasellar cisterns. The major important reason behind this diagnostic scoring classification system is that neurological examination is considered unreliable because of sedation in patients with severe TBI, so these CT scoring system plays the major role in the primary care of traumatic brain injury patients and aids in planning the treatment plan of the patient. (13) For this research purpose , we have investigated different pathologies that is associated with the pathophysiology of a traumatic brain injury on CT , CT has increased the paradigm of visualization for emergency physician and surgeons to not only diagnose the pathology in an emergency system but also being able to come up with a management plan to treat the patients with trauma in the emergency setting, CT has increased diagnostic credibility due to the power of reconstruction algorithm which makes 3d model of pathology investigated which allows for a better diagnostic evaluation of head trauma and also understand the physiology of an underlying pathology. Our research will provide wide paradigm to the radiologist, clinicians and emergency doctor

to investigate the traumatic brain injury patients with wide variety of differential diagnosis of brain injuries that occurs physiologically as a consequence of traumatic brain injury on computed tomography.

In this observational descriptive cross sectional study total 30 patient's data was collected with 22 males (73.3%) and 8 females (26.6%) patients were undertaken from different age group and gender

Objective:

To derive the frequency of differential diagnosis of different pathologies on computed tomography after a traumatic brain injury.

Material And Methods:

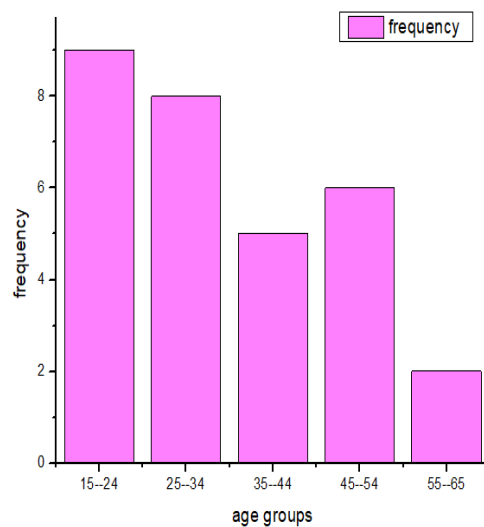
A total 195 subjects were considered for this retro prospective analytical study. All the patients who were admitted with the history of brain trauma and had computed tomography scan as the 1st line of investigation after the clinical diagnosis were considered prime for this study

Results:

According to our descriptive observational research study we have concluded that. there were multiple age groups in which different number cases that were frequent in different age group such as from age 15-24 we had 9 cases, 25 -34 we had 8 cases ,35-44 we had 5 cases ,45-54 we had 6 cases ,55-65 we had 2 cases. According to our research the most frequent cases of TBI pathology was associated with intraventricular hemorrhage with 11 cases followed by subdural hemorrhage with 9 cases, followed by epidural hemorrhage with 6 cases and the least number of cases was associated with skull fracture and hydrocephalus

	N	Range	Minimu	Maximu	Mean	Std.
	Statistic	Statistic	m	m	Statistic	n
	c	c	Statistic	Statistic	c	Error
						Statistic
Age	30	40.00	16.00	56.00	33.666	2.2855
e					7	5
						9

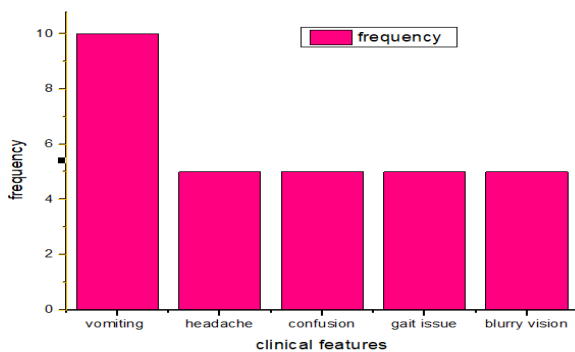
Table 1: Descriptive statistics of gender-based distribution of cases. According to descriptive statistic the of 30 patient data ,the minimum age was 16 and maximum age was 56 with 12.5 standard deviation.



Graph 1: Representing the frequency of cases according to age groups

Age Groups	Frequency	Percent
15—24	9	30.0
25—34	8	26.7
35—44	5	16.7
45—54	6	20.0
55—65	2	6.7
Total	30	100.0

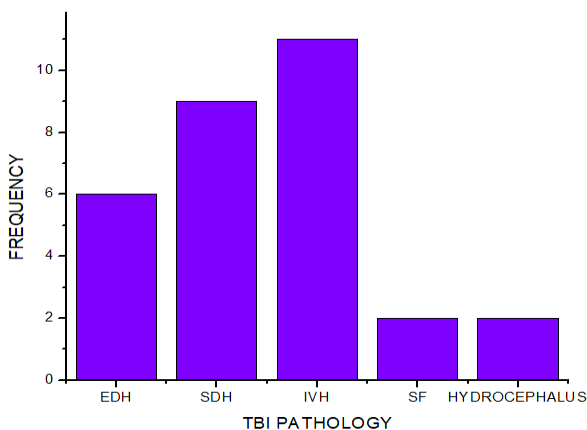
Table 2: Crosstabulation of frequency of cases according to age group
 In this research we have also arranged our data of different number of cases according to their age specifically. there were multiple age groups in which different number cases were configured such as from age 15-24 we had 9 cases, 25 -34 we had 8 cases ,35-44 we had 5 cases ,45-54 we had 6 cases ,55-65 we had 2 cases.



Graph 2: Representing the clinical manifestation of patients after TBI
 According to our research ,our inclusive patients also represented with wide spectra of clinical manifestation .the most common clinical manifestation which was very common in most of the patient was vomiting, which was reported in about 10 cases followed by headache 5cases,confusion in 5 cases,blurry vision in 5 cases and gait issue in 5 cases

Clinical manifestation	Frequency of cases
Gait issue	5
Confusion	5
Headache	5
Vomiting	10
Blurry vision	5

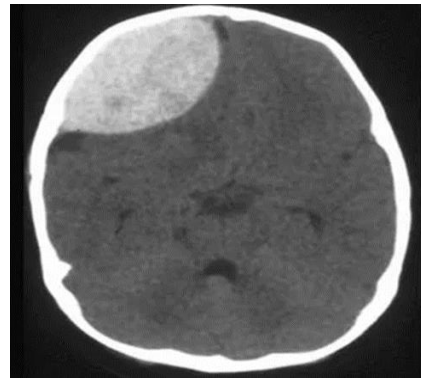
Table 3: Representing the descriptive statistics of clinical manifestations



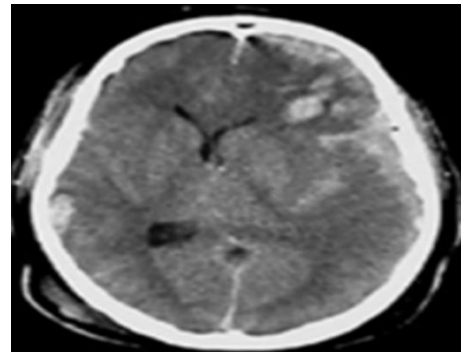
Graph 3: Representing the frequency of different TBI pathologies

TBI pathology	Frequency of cases
Epidural hemorrhage	6
Subdural hemorrhage	9
Intraventricular hemorrhage	11
Skull fracture	2
Hydrocephalus	2

Table 4: Tabs representing TBI pathology according to the frequency
 According to our research the most frequent cases of TBI pathology was associated with intraventricular hemorrhage with 11 cases followed by subdural hemorrhage with 9 cases, followed by epidural hemorrhage with 6 cases and the least number of cases was associated with skull fracture and hydrocephalus.



After motor vehicle accident an 18 year old man brought to the emergency department with severe head collisional injury. the CT showed a large lemon shaped hyperdense blood collection in the right frontal region of brain causes epidural hemorrhage. The patient presenting symptoms was severe headache with GCS score of 10.



After a fall from the stairs with severe head injury a 51-year old male was presented in the emergency department. The CT showed a hyperdense blood collection in the left frontal region of brain that was now in the sub-acute phase progressing towards the ventricular system of brain causing compression of the ventricular system and it was diagnosed as subdural hemorrhage. patient was unresponsive during clinical examination with multiple fractures.

DISCUSSION

In the United States, traumatic brain injury (TBI) is estimated to affect 1.7 million people annually, leading to approximately 52,000 deaths and 275,000 hospitalizations. TBI plays a role in approximately one third of all injury related deaths¹. Patients who survive the initial event can have debilitating long-term sequelae. TBI actually consists of

multiple pathological entities broadly defined by an “alteration in brain function, or other evidence of brain pathology, caused by an external force.”⁽³⁴⁾ Skull fracture and TBI are the main RTCs of blunt impact head injuries. On the basis of the impact location or the direction of impact skull fracture pattern is generated which is classified into three main groups known as anterior, lateral, and posterior, that is, frontal, lateral–parietal, and occipital respectively. Focal brain injuries and diffuse brain injuries is the two main classification of TBI according to the Injury distribution. In focal brain injuries there is a partial brain function loss with contusions, intracranial hematomas and so on. Mild concussion, moderate concussion with brief coma occurs due to DBIs, and with long-term coma or death occurs due to diffuse axonal injury. Approximately 50% and 25.8% of patients who suffered skull fractures and cerebral contusions respectively according to the RTC data demonstrated by real world. While 35% DBIs suffered severe head injury which caused death. There are multiple studies regarding using CT as the first line of investigation. A similar study was conducted by Samuel .C in. 2011 in which he investigated traumatic brain injury in head trauma patients in Africa is influenced by factors such as cost. Computed tomography is not provided to some patients rather they are blindly considered or the approach of CT is not provided at the appropriate time. This paper discusses about the findings of CT scan which are obtained in the mentioned cases. For head trauma case (171 new cases and other 33 follow-up) a total 204 CT scan were obtained. All CT scans of head were performed in this unit taking about 34%. 3.5:1 was the male to female ratio. Third and fourth life decades patients were fallen into about 33.9%. For about 80.1% the cases had abnormalities in CT findings while 19.9% cases findings were common. The findings of CT scan was not surely indicating the head trauma for about 7% cases while it showed more than one finding in about 13% cases. Subdural hematoma with 30%, cerebral contusions and edema with 30.7%, skull fractures with 23.4% and extradural hematoma with 8.0% occurrence is the most common findings of CT scan. Surgical interventions were required for about 64% of CTs findings. Among the 137 patients the overall mortality rate was 11.1% which had unusual CT findings. In the region of Nigeria a total 13.9% was of patients with had trauma in the total cases of 147 patients. CT scans findings having high diversity and yield of head trauma patients indicates the importance of utilizing CT in diagnosing of head trauma cases patients even in developing countries⁽³⁵⁾His study was very similar to our study with similar result like ours according to our research the most common differential diagnosis seen on CT after TBI was Skull Fracture 60 cases(30%) followed by subarachnoid hemorrhage 30 cases(15%), epidural hemorrhage 30 cases(15%),subdural hemorrhage 29 cases (14%),hydrocephalus 25 cases(15%) and the least amount of cases falls into the category of intraventricular hemorrhage with 20 cases(10%). In the study conducted by Yuh et al. on the patients who got enrolled by the emergency department to evaluate the acute head injury of 135 mTBI patients with three individual level 1 in trauma centers located in the US. These patients were assessed by the Extended Glasgow Outcome scale abbreviated as GOS-E for the month outcome of

patient’s neurobehavioral. For With 2 weeks of post injury MRI was performed on average although DOI CT imaging was performed intensely. For the classification of both acute and chronic abnormalities the national institutes of Health developed the common data of TBI elements including all abnormalities of scan which were recognized by the criteria of CDE. Skull fracture, hematoma (either epidural and/or subdural), traumatic axonal injury (known as one to three foci), and diffuse axonal injury (DAI; known as at least four foci) are the findings on DOI CT of Pathoanatomica TBI or early MRI according to the CDE guidelines. Identification of the visibly contusions or intra parenchymal which identified petechia is characterization of DOI CT foci. Such foci appearance on MRI is in white matter form i.e. showed signal abnormalities. Also the characteristics signal changings that consider prior hemorrhage as the gray matter (GM)-WM link. The macroscopic pathologies associated with all these types is going to be depicted in the present chapter. Essentially in the Yuh et al.

Of the 135 mTBI patients assessed in the Yu et al. investigation, only one had a Glasgow Coma Scale (GCS) of 13, with 26/135 (19%) assessed with a GCS of 14 and 108/135 (80%) with a GCS of 15. As such, the majority had a classically defined maximum GCS score, yet almost half had some positive neuroimaging finding. This observation underscores the frequency with which MRI may identify structural pathology in mTBI, even with a GCS of 15.⁽³⁶⁾

His study also showed very similar results regarding GCS score like our research 94 cases had fall into the category of mild GCS scale category and 60 cases falls into the category of moderate GCS scale category and 40 cases falls in to the category of severe GCS scale category. Computed tomography proves to be the most advanced modality to detect different pathophysiology that manifest after a traumatic brain injury irrespective of the type of trauma whether its coup or countercoup injury that have triggered the traumatic brain injury.

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