CT FINDINGS IN PATIENTS WITH HEAD INJURY AT A TEACHING HOSPITAL IN NIGERIA

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ABSTRACT

Background: There is paucity of data on computed tomography findings in head injury patients from this part of Africa inspite of the high number of trauma cases seen.
Objectives: The objective of this study was to determine the pattern of findings on Computed Tomography (CT) scan of the head in patients with head injury in our locality, with the aim of detecting the pitfalls to help make improvements.
Material : Seventy-eight patients with head injury, who had CT scan of the head conducted in the Radiology department, University of Maiduguri Teaching Hospital between September 2011 to December 2013 were retrospectively reviewed by two Radiology residents and a Consultant Radiologist. Data was retrieved from the CT record book in that unit.
Results: Head injury sustained as a result of road traffic accident (RTA) is the most frequent indication for CT head imaging in our study, with the lowest coming from request in bomb blast patients. Linear skull fractures were the most frequent finding, while rupture of the globe and frontal sinomucoceole, amongst others were the least. Gender variation showed that males were four times more affected than females and the age range of patients was 9 -70 years.
Conclusion: RTA was the most common cause of head injury for which request for CT scan was made, and linear skull fractures were the most frequent finding. Males between 20-40 years were the most affected. CT is the most efficient imaging tool for detection of injuries in acute cases.

Keywords: Computed tomography, head injury, RTA

INTRODUCTION

Trauma is the commonest cause of death in the early decades of life and majority is as a result of neurological damage.[1] Head injury is a spectrum of clinical conditions which occurs as a result of trauma that involves various degrees of damage to the cranium, its contents and the surrounding tissues.[2]

Head injury is an important and increasing cause of morbidity and mortality worldwide and youths are the most affected.[3, 4] Its severity can be classified using the Glasgow Coma Scale (GCS) of assessment or the type of cranial hemorrhage.[5,6] Thirty to 50 percent mortality rate has been documented in patient with severe head injury and those with less severe injury are often left with varying degrees of neurological deficit.[2,4]

North-eastern Nigeria, in particular Borno state, has seen an increase in head injury from gunshot wounds resulting from the increasing insurgency in this region. However, road traffic accident (RTA) still remains the commonest cause of this condition.[2]

Computed Tomography (CT) scan of the head is utilized to image the skull and the brain and it depicts the anatomy and pathology much faster than magnetic resonance imaging (MRI). Unenhanced CT studies remain an important diagnostic step in the emergency management of patients with acute head injury with a primary goal of identifying life-threatening and treatable injuries. Its advantages over MRI stem from the fact that it is more readily available, has a shorter procedural time and high accuracy in detecting cranial fractures.[4,5]

This study is aimed at determining the pattern of findings seen in head injury patients in the CT unit in this hospital, to assess the various types of head injuries, the age and gender of these patients and to compare our study with that of earlier researches seen in literature.

MATERIAL AND METHODS

CT requests and findings of 78 patients who had head CT scans for head injury between September 2011 and December 2013 were retrospectively reviewed.

The study was conducted at the Radiology Department, University of Maiduguri Teaching Hospital (UMTH) in Nigeria, using an Extended Brilliance 16 slice CT scanner. Images were acquired in axial and reconstructed to coronal and sagittal planes with slice thickness of 3.0mm at 0.5sec. Per 360° gantry rotation. Matrix size used was 354 x 512.

Data was obtained from UMTH CT record book. A data capture sheet designed to include the CT number, age, sex, clinical presentation of patients and findings was used. All CT scan images were reviewed by two Radiology residents and reported by at least one consultant Radiologist. The data was analyzed using SPSS version 16.0 and the results were presented in tables and figures where appropriate.

RESULTS

Out of 78 patients who presented with head injury, 63 (80.8%) were males and 15 (19.2%) were females as shown in Table 1. The age range was 9 to 70 years (mean age 34.12 ±12.9). The most involved age group was 30 - 39 years, accounting for about 30.8% of the total study population (Table 2).
Table 3 shows the frequency distribution of age in relation to gender where the age group 30-39 years was the most affected in males followed by the 20-29 age group. The age group 30-39 is also the most affected in females followed by the 10-19 year age group. RTA (75.6%) was the major cause of head injury followed by assault (10.3%) and the least seen was from bomb blast injuries (2.6%). (Figure 1)

The result showed that 20% of our patients had normal findings whilst the most common abnormal finding seen was skull fracture (16.4%), followed by cerebral infarction (10%). The least common findings were classified as others, each having a frequency of 1 (0.9%) which when combined, accounted for about 8.2% of the total findings (Table 4).

Our study showed that males have the highest frequency of all findings; the most common finding seen in males was skull fracture (14.5%), whilst cerebral contusion/edema and cerebral atrophy (4.5%) were the most common findings in females. Cerebellar infarction was the least common finding seen in both males and females (0.9%). (Table 4). Figure 2 shows that cerebral contusion (CC) (10%) was the most frequent of the intracranial hemorrhages in this study, and the least was Intraventricular hemorrhage (IVH) at 1.8%.

TABLE 1: GENDER DISTRIBUTION

SEX	NO. (%)
MALE	63 (80.8)
FEMALE	15 (19.2)
TOTAL	**78 (100)**

TABLE 2: AGE DISTRIBUTION

AGE RANGE (Years)	NO. (%)
0-9	1 (1.3)
10-19	8 (10.3)
20-29	20 (25.6)
30-39	24 (30.8)
40-49	12 (15.4)
50-59	10 (12.8)
60-69	2 (2.6)
70-79	1 (1.3)
TOTAL	**78 (100)**

TABLE 3: CORRELATION OF AGE WITH GENDER

AGE RANGE	GENDER	
	MALE	FEMALE
0-9	-	1
10-19	5	3
20-29	18	2
30-39	20	5
40-49	9	2
50-59	9	1
60-69	1	1
70-79	1	-
TOTAL	**63**	**15**

TABLE 4: PATTERNS OF FINDINGS IN RELATION TO GENDER

FINDINGS	GENDER		
	MALE	FEMALE	NO. (%)
Normal	16	6	22 (20.0)
Skull fracture	16	2	18 (16.4)
Cerebral contusion/edema	6	5	11 (10.0)
Cerebral infarction	9	2	11 (10.0)
Cerebral atrophy	4	3	7 (6.4)
Cerebellar infarction	1	1	2 (1.8)
Intracerebral Hemorrhage	8	2	10 (9.1)
Intraventricular Hemorrhage	2	-	2 (1.8)
Epidural Hematoma	4	-	4 (3.6)
Subdural Hematoma	8	-	8 (7.3)
Aerocoele	3	-	3 (2.7)
Lodged foreign body	3	-	3 (2.7)
Others	8	1	9 (8.2)
Total	**88**	**22**	**110 (100%)**

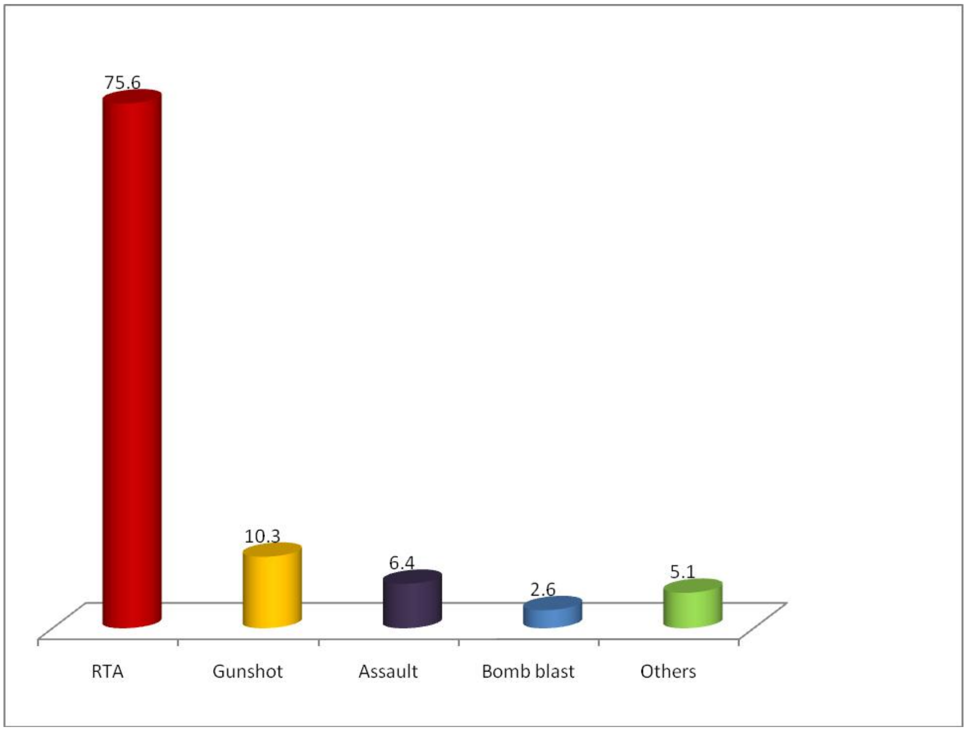

FIGURE 1: CAUSES OF THE HEAD INJURY IN THE STUDY POPULATIONS

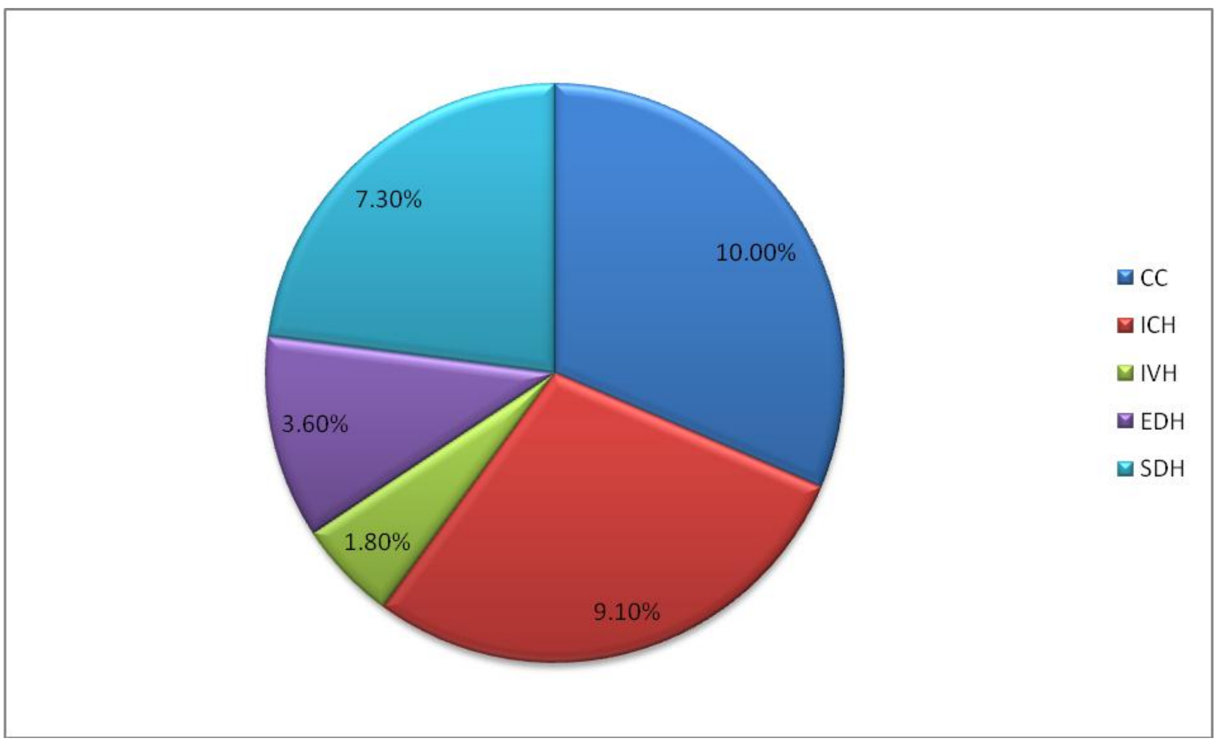

FIG 2: DISTRIBUTION OF INTRACRANIAL BLEED

LEGENDS:
Cerebral contusion (CC)10% , Intracerebral hemorrhage (ICH) 9.10%, Intraventricular hemorrhage (IVH) 1.8%, Epidural hematoma (EDH) 3.6%, Subdural Hematoma (SDH) 7.3%.

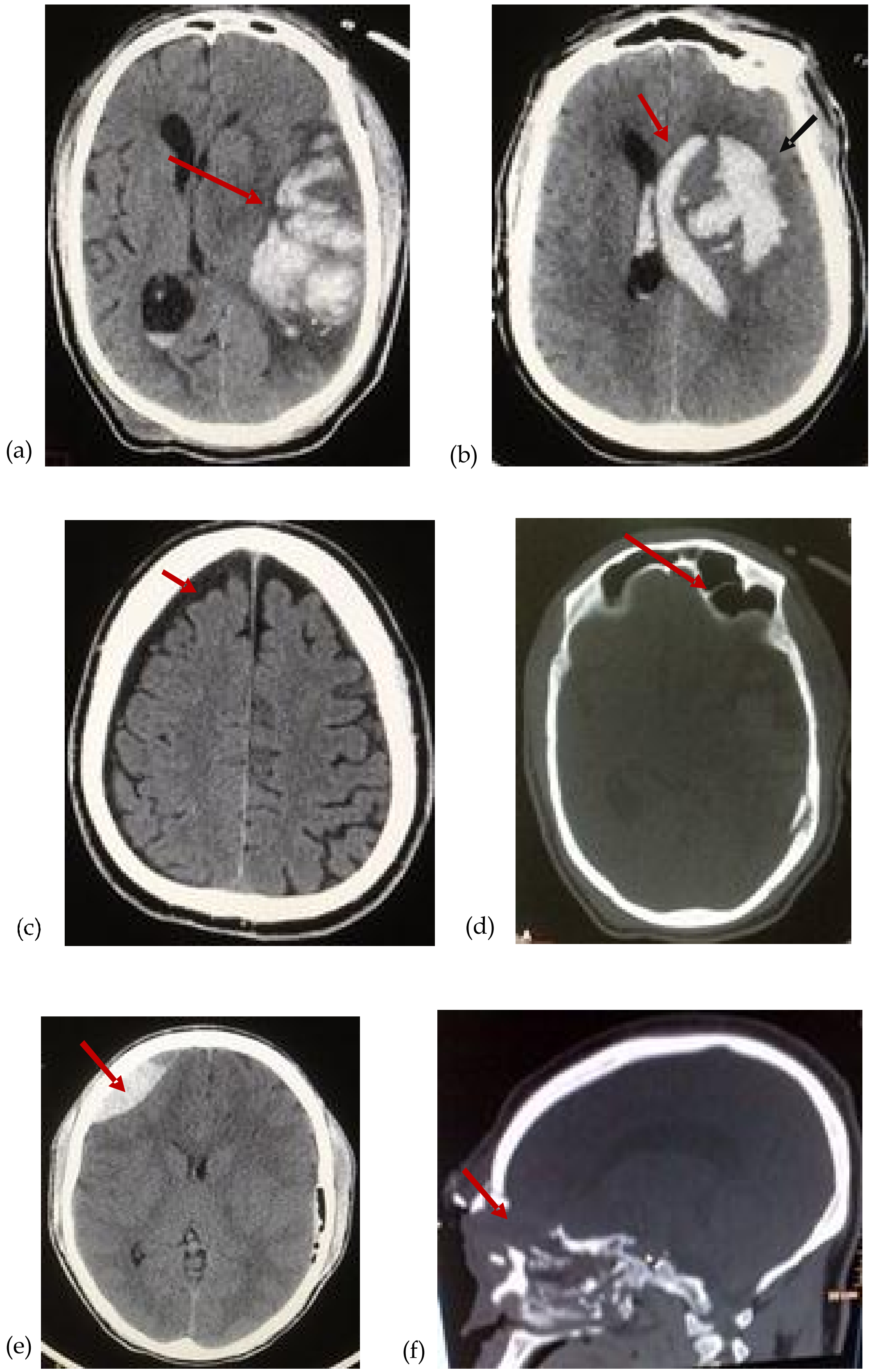

Figure 3: **(a)** Intracerebral hemorrhage; **(b)** Intra-ventricular & intracerebral hemorrhage (black arrow); **(c)** chronic subdural hemorrhage. **(d)** Red arrow indicates fracture of the parietal bone **(e)** Epidural hemorrhage **(f)** Fracture of the supra orbital bone with fragments

DISCUSSION

Before the advent of CT, rapid, accurate, complete and reliable imaging of head trauma was virtually impossible.[7] Today, CT has become the diagnostic modality of choice for head trauma and its increased availability has resulted in more experienced and accurate reporting. Though no single universal protocol has been adopted, most Radiology departments have a functional and acceptable protocol for imaging head injury patients. In our department, all CT scans are adequately reported by a registrar, a senior registrar and at least 1 consultant Radiologist.

The youngest patient recorded in this study was 9 years old, and the oldest 70 years. Majority of patients presenting to our facility with head injury were young (20-40 years of age). Asaleye et al and Khanzada et al all showed results in keeping with ours.[4, 8] Our findings concurred with most researchers in the conclusion that a reasonable explanation for such high incidence in this age range is the fact that they are youthfully exuberant, more adventurous, and thus more prone to accidents and other forms of injuries. In this locality, this age group is actively involved in combating insurgence activities. In contrast to this, however are the findings of Ali M. et al,[9] that about 50% of patients in their study were in the 0 – 1-year age group The male preponderance of head injury patients in our study concurred with the finding of earlier researchers,[1, 7, 10, 11] with one in Benin showing identical male: female to ours of 4.3:1.[12] Research from northwestern Nigeria showed a much higher male preponderance to female of 5.2:1,[2]while studies from Enugu, Ile Ife and India showed lower ratio.[4, 10, 11] This male dominance comes as no surprise due to the fact that males are more prone to injury as they travel more frequently and take greater risks than their female counterparts and this statement holds true across all the age ranges.

Studies from Ghana and Nigeria[1, 12] showed RTA to be the most common cause of head injury, with it being responsible for 75.6% of indications for imaging of these injuries in our study. The cases of head injury as a result of gunshot and bomb blast in this study, though significant, are not representative of all the cases occurring in this region, due to the high fatality associated with these severe injuries.

Of the 78 patients who had CT head scans, 80% showed abnormal findings which are very similar to those from Enugu[3] which showed 80.1% of pathological CT scans. Slightly higher values of 87% were recorded in Sokoto and Ile Ife (Nigeria).[2, 4, 13] All the above research support the use of CT as a valuable investigation in the management of head injury patients.[1, 2, 3, 4, 5]

We grouped the CT findings into those occurring as a result of direct acute trauma and those arising as sequelae of trauma. Skull fracture, intracerebral hemorrhage, intraventricular hemorrhage, epidural hematoma, subdural hematoma (Figures 3a-f), cerebral contusion, subarachnoid hemorrhage, ruptured globe and foreign body in the globe were all demonstrated as findings in patients with acute head injury in this study.

Skull fracture (16.4%) is the most frequent finding in patients imaged in this study and this is in close keeping with work done by Ali M. et al in Pakistan who documented 17% of skull fractures.[9] We however did not give details of the regions of the skull fractures in our study. The one case of depressed skull fracture seen was as a result of assault.

Our study showed that there is significant disparity between the documented cases of skull fracture (16.4%) and epidural hematoma (3.6%), bearing in mind that almost all (up to 95% in some cases) of epidural hematomas would have an associated skull fracture.[5] Samudrala et al[14] in his study found that over 90% of patients with skull fracture had an associated epidural hematoma, while Asaleye et al[4] recorded 80% skull fracture associated with epidural hematoma. Our study showed that skull fractures can occur independent of epidural hematomas, or the possibility that skull fractures have been over diagnosed.[4, 5, 7, 14, 15, 16] Our reported cases of epidural hematoma (3.6%) is also lower than that seen by earlier researchers, with some studies recording as high as 48% and most not lower than 9%. However, other researchers recorded only 2% of epidural hematomas in their study.[2, 6, 7, 11]

Cerebral contusions/edema (10.0%) was the second most frequent finding we observed, and

sharing the same values were cerebral infarction which is sequelae of head injury.
Asaleye et al in Ile-Ife, Nigeria and Tayal et al in Nepal documented much higher values at 54 % and 52% respectively.[4, 17] We did not document as separate non – hemorrhagic (appearing as hypo-dense with or without mass effect) from hemorrhagic contusions (appearing as hyper-dense). Intracerebral hemorrhage (ICH) was diagnosed in 9.1% of patients. We also documented findings of much lower values for ICH than other researchers in Nigeria.[2, 4, 18] On the other hand, our result of 1.8% cases of Intraventricular hemorrhage (IVH) was similar to that reported in other studies.[4, 7, 14]

The most frequent sequelae of head injury that we found were cerebral infarction (10%), followed by cerebral atrophy (6.4%), and the least were CSF fistula, pneumo-encephalocoele, and sinomucoloele. In an attempt to explain some of the lower values for our recorded injury in acute head trauma, we realized that authors who documented their findings from acute head injury alone recorded much higher values [9,16] than those who combined acute and long term complications of head injury.[2]

CT scans were normal in 20% of patients with head injury and this is in close keeping with studies by Ali M. et al which documented 29%, and even closer to that by Ohaegbulam et al who documented 19.9%.[3, 9, 19] However, a study carried out in Eritrea showed 45.5% of patient having normal CT head scans while another study in Nepal showed only 5% normal head CT scan in head injury patients.[13,17] It is a well-known fact that Diffuse Axonal injury (DAI) can be missed on CT scans of head trauma patients if done in the acute phase, especially if they are non-hemorrhagic shear injuries. MRI remains the modality of choice for diagnosing DAI with T2 weighted images showing the hemosiderin effect of hemorrhagic shear injuries.[20] It is thus possible that a few "normal" CT head scans reported might have been as a result of such injuries, therefore clinical judgment remains an important parameter especially where imaging is not present. A Radiologist's opinion must be sought before reaching such a decision. Limitations encountered in the study were incomplete patient information as this was a retrospective study.

CONCLUSION

Head trauma is an acute medical emergency and CT scan of the head provides undoubtedly the most thorough, complete and rapid means of assessing the severity, extent and involvement of the various structures in this region. In most cases, it aids in determining the mode of management, thus expediting the treatment of those who need life-saving surgical interventions. CT head scans must be employed when indicated and MRI should be considered in the unconscious head trauma patient when a normal CT head scan done in the acute phase is reported as normal in the setting of severe head trauma. In patients with skull fractures of any type, an extra-judicious search must be employed to detect associated extradural hematomas, which are usually associated with such injuries. The opinion of a Radiologist should always be sought whenever there is doubt as to the best imaging modality for head trauma patients. Clinical judgment should be used where imaging is nit feasible.

REFERENCES

1. Obajimi M.O, Jumah K.B, Brakohuapa W.O, Iddrisu W. Computed tomography features of head injury in Ghanaian children. Nig J Surg Res 2002; 4(3-4): 84-88
2. Isyaku K, Sa'idu S.A, Tabari A.M. Computed tomography findings in head trauma in Sokoto (North western Nigeria). West Afr J Rad 2006; 13(1): 6-12.
3. Ohaegbulam S.C, Mezue W.C, Ani C.O, Cranial computed tomography scan findings in head trauma patients in Enugu, Nigeria. Surg Neurol Int 2011; 2: 182
4. Asaleye C.M, Famurewa O.C, Komolafe E.O, Komolafe M.A, Amusa Y.B, The pattern of computerized tomographic findings in moderate and severe head injuries in Ile-Ife, Nigeria. West Afr J Rad 2005;12: 1-6.
5. Herring W (Ed). Learning Radiology;

Recognizing the basics. 1st Edition. Mosby Elsevier. Philadephia, Pennsylvenia 2007: 275
6. Udoh DO, Adeyemo AA. Traumatic brain injuries in children: A hospital-based study in Nigeria. Afr J Paed Surg 2013; 10(2):154-159
7. Gupta PK, Krishna A, Dwivedi AN, Gupta K, Bala M, Garg G. et al. CT scan findings and outcomes of head injury patients: A cross-sectional study. J Pak Med Stud 2011; 1(3):78-82
8. Khanzada K, Nawaz S, Siddiq M, Rehman RU. Pattern of head injuries in patients admitted in Lady Reading Hospital, Peshawar. KJMS 2011; 3(2):79-82
9. Ali M, Ali G, Usman M, Khan Z, Haider A, Sharafat S. et al. CT scan findings in patients with moderate and severe head injuries. J Med Sci 2013; 21(3):137-140
10. Abbas AD, Bakari AA, Abba AM. Epidemiology of armed robbery-related gunshot injuries in Maiduguri, Nigeria. Nig J Clin Pract 2012; 15(1):19-22
11. Pruthi N, Ashok M, Shiva KV, Jhavar K, Sampath S, Devi BI. Magnitude of pedestrian head injuries and fatalities in Bangalore, South India: A retrospective study from an apex neurotrauma centre. Indian J Med Res 2012; 136:1039-1043
12. Ogbeide E, Isara AR, Akhigbe AO, Ighodaro EO. Computerized tomographic findings in children with head trauma in a Nigerian tertiary hospital. J Coll Med 2010; 15:2-8
13. Ghebrehiwet M, Quan LH, Andebirhan T. The profile of CT scan findings in acute head trauma in Orotta hospital, Asmara, Eritrea. J Eritrean Med Ass 2009; 4(1): 5-8
14. Samudrala S, Cooper P. Traumatic Intracranial Hematomas. Neurosurgery, Newyork: McGraw Hill 1997: 2797-807
15. Dahnert W(Ed). Radiology Review Manual, 6th ed. Lippincott Williams & Wilkins, Philadelphia, USA 2007: 288
16. Sutton D, Stevens J, Miszkiel K(Eds). Textbook of radiology and imaging. 7th edition. Churchhill Livingston; United Kingdom 2003: 1779
17. Tayal A, Chhetri PK. Evaluation of acute head injury by computed tomography scan in college of medical sciences – teaching hospital, Chitwan. J College Med Sci Nepal 2011;7(1):36-39
18. Eze CU, Abonyi LC, Olowoyeye O, Njoku J, Ohagwu C, Babalola S. CT-detected intracranial hemorrhage among patients with head injury in Lagos, Nigeria. Radiol Technol 2013; 84(5):449-56
19. Ikpeme AA, Inah G, Oku AO, Nnadi MON. Computerized tomography findings in patients presenting with head injury in Calabar, Nigeria. Asian J Med Sci 2014; 5(2): 73-79
20. Sartor K, Haehnel S, Kress B (Eds). Trauma. Direct Diagnosis in Radiology, Brain Imaging. 1st edition. Thieme, Hamburg, Germany 2003: 4-5