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Computed Tomography Imaging Findings in Patients Presenting With Craniocerebral Trauma in A Tertiary Health Facility In South-South Nigeria

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Abstract
Background: *Craniocerebral trauma is a major cause of death and disability around the world. In most Nigerian cities, poor conditions of roads and increasing urban congestion have led to more road traffic accidents (RTAs). Computed tomography (CT) is an essential tool in the management of head trauma. This study evaluated the CT imaging findings in patients presenting with craniocerebral trauma.*
Materials and methods: *This was a retrospective study which involved radiological CT reports of 139 patients conducted at a tertiary hospital in Uyo metropolis, Akwa Ibom state, Nigeria. Only records of patients who underwent non-contrast cranial CT following head trauma were included this study. Data generated was analysed using descriptive statistics.*
Results: *More males, n =103 (74.1%) than females, n = 36 (25.9%) were affected. The group with highest incidence was aged 21- 40 years. Road traffic accident was the major cause of craniocerebral n =129 (92.8%). There were more patients with severe head injury, n=92 (66.2%). There were n = 9 (42.4%) unconscious patients while n = 76 (54.8%) had a history of bleeding from one or more orifice. Skull fracture was the most common finding n = 79 (56.8%) outside facial/soft tissue injuries. Intracerebral haemorrhage, n = 46 (33.1%), was the most common intracranial bleed.*
Conclusion: *Male population was highly affected and the majority were young adults. Road traffic accident was the major cause of cranio-cerebral trauma. Intracerebral haemorrhage was the common form of haemorrhage.*
Keywords: *Head trauma, TBI, intracranial haemorrhage, brain injury*

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I. Introduction

The human brain is complex in design and function yet very vulnerable to injury especially resulting from trauma to the head [1]. Craniocerebral trauma, also known as traumatic brain injury (TBI) is trauma to the head which may lead to injuries involving the scalp, the brain and the skull bones. Studies have shown that craniocerebral trauma is a leading cause of mortality and disability among trauma patients [2-6]. Adults aged 20 to 50 years are mostly affected, making TBI a huge burden to humanity by its prevalence in the most productive age groups [1, 3, 7-9].

Craniocerebral trauma contributes to financial distress of the patient, family and even society due to the cost of treatment and the patient's inability to return to work in some cases [3, 10]. There is an abundance of TBI-focused studies in the developed world measuring inter alia incidence, imaging, treatment, treatment outcome, post treatment quality of life [4-5,11-13]. There are fewer such studies in low-income countries and the studies are mostly centred around characterisation of cranial injuries without looking at the nature and outcome of treatment [1,14]. In the United States, craniocerebral trauma is estimated to affect about 1.7 million people annually, with approximately 52,000 deaths per year [15]

Low-income countries tend to have higher mortality and morbidity from craniocerebral trauma due to the effects of poverty, lack of adequate medical insurance and absence of advanced imaging facilities and clinical expertise [2, 3]. The global incidence of craniocerebral trauma was estimated at about 369 per 100,000 populations per year while the incidence in Nigeria was estimated at about 319 per 100,000 per year in 2016[6].

Population explosion around major cities in Nigeria has led to an increase in the number of road users with different means of transportation including bicycles, motorcycles, tricycles and motor vehicles even when road infrastructure has not improved significantly over the past few years. Road Traffic Accidents (RTAs) are a common occurrence due to non-adherence to traffic rules by some road users. Meanwhile domestic violence, occupational injuries, communal clashes, armed robbery, police brutality among others also contributes to the incidence of head trauma in the Nigerian context [1, 7, 16, 17].

CT is seen as the imaging modality of choice in head injury patients because it is readily available, less expensive and compatible with metallic equipment when compared with magnetic resonance imaging (MRI), this is because most trauma patients may have life-sustaining devices attached to their bodies that are no MRI compatible[18.19,20]. The superior soft tissue contrast, multi-planar image reconstruction and 3-Dimentional (3D) imaging capabilities of modern CT units also make it more appropriate for cranial injury imaging compared to 2-dimensional skull x-ray, which cannot adequately demonstrate the brain tissue. This study was designed to evaluate non-contrast CT imaging findings in patients presented with cranio-cerebral trauma in Uyo metropolis, Nigeria.

II. Materials And Methods

This retrospective study, which involved 139 patients' radiological records (request forms and cranial CT reports) selected using convenient method, was carried out at the Radiology unit of University of Uyo Teaching Hospital (UUTH), Uyo Akwa-Ibom State, Nigeria. Uyo is the administrative capital of Akwa Ibom State and is home to about 430,000 people [21] and the hospital serves as a major referral centre in Akwa Ibom State. Ethical approval (**UUTH/AD/S/96/Vol. XXI/329**) for this study was obtained from the Institutional Health Research Ethical Committee (IHREC) of the University of Uyo Teaching Hospital.

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The sample size of 139 was drawn from patients' population of 213 who presented to the Radiology unit of the Hospital with request for cranial CT secondary to head trauma between January 2013 and December 2017 using the formula for known population by Yamane cited by Ogolodom *et al*[22] and Ukaji *et al* [23] below

$n= N/1+N(e)^2$

Where: **n** is the required sample size from the population under study

N=(213) is the whole population that had undergone non-contrast cranial CT due to trauma from January 2013 and December 2017 at this study centre as obtained from the CT reports' archive and **e** is the sampling error, which is 0.05

$n= 213/1+213(0.05)^2$

n = 139

The CT examinations were performed with Toshiba Activion-16 slice CT scanner (Toshiba Japan, 2012) using the departmental standard protocols and parameters in axial plan with coronal and sagittal reformatting, which include; slice thickness of 3-5mm, fov = 25cm, slice interval of 3-5mm, reconstruction algorithm = standard and bone plus, matrix size= 512 x 512, 200-300mAs, kVp = 80-120, scan type: helical scan, window width 80 and window level 40 for brain tissues, and window width: 2500 and window level of 300-500 for bony structures. The acquired images were interpreted by experienced radiologists with over seven years of cranial image reporting.

Information such as age, gender and CT radiological findings were obtained and recorded on data capture sheet. The obtained data analyzed on statistical package for social sciences (SPSS) version 21 (IBM Corp, Amornk, NY, 2012) using descriptive statistic (mean, percentage, frequency and tables).

III. Results

The majority 74.1% (n=103) of the patients were males with female patients accounting for 25.9% (n=36). The majority (n = 64) of the patients were found to be in their third and fourth decades of life. The minimum age was 1 year while the maximum was 75 years. The mean age was 34.68 ± 17.85 years (table 1).

Table 2 shows the causes of head trauma in the sample. RTAs were responsible for 92.8% of TBIs in the study sample, whilst falls accounted for 3.6%, followed by assault 2.9%, and 0.7% of unknown causes

Table 3 shows a breakdown of the different findings on computed tomography in head injury patients. The three most common findings in this sample of patients were facial injury n = 99 (71.2%), skull fractures n = 79 (56.8%), intra-cerebral haemorrhage n = 46 (33.1%). The least common finding was intra-ventricular haemorrhage n = 16 (11.5%).

Table 1: Gender and age distributions of cranio-cerebral trauma patients

Age groups (years)	Frequency (n)	Percentage (%)
0 – 10	10	7.2
11 – 20	20	14.4
21 – 30	34	24.4
31 – 40	30	21.6
41 – 50	16	11.5
51 – 60	20	14.4
61 +	9	6.5
Total	139	100
Gender		
Male	103	74.1
Female	36	25.9
Total	139	100

Table 2: Frequency and percentage distributions of mechanism of head injury

Mechanism	Frequency (n)	Percentage (%)
Road Traffic Accident (RTA)	129	92.8
Fall	5	3.6
Assault	4	2.9
Other	1	0.7
Total	**139**	**100**

Table 3: Computed tomography findings in head trauma patients

Findings	Frequency (n)	Percentage (%)
Facial injury	99	71.2
Skull fracture	79	56.8
Intra-cerebral haemorrhage	46	33.1
Cerebral contusion	44	31.7
Cerebral oedema	38	27.3
Subdural haemorrhage	31	22.3
Sub-arachnoid haemorrhage	20	14.4
Extradural haemorrhage	18	12.9
Mid-line shift	17	12.2
Intra-ventricular haemorrhage	16	11.5

IV. Discussion

The majority of the victims of traumatic head injuries in this study were males when compared to their female counterparts. Similar trends have been reported in other studies as follows: (71.8% male; 28.3% female)[2]; (64.18% male; 35.9% female)[24]; (66% male; 34% female)[25]; (59.4% male; 40.6% female)[14] and (82.6% male; 17.3% female)[24]. This could be because males are more involved in occupations and activities that predisposes them to head trauma when compared to females.[1]

Findings in this study has shown that a greater proportion of the patients were those in their third and fourth decades of life. These age groups represent the most active and productive group of our society and are more likely to be exposed to both occupational and social risks. This demographic criterion is also corroborated by two studies in other parts of the country.[1,3] The second and fifth decades of life have the next highest incidence of head trauma. Altogether, this study indicated that people aged 21-60 years were more vulnerable to craniocerebral trauma as they constituted about 71% of the total number of cases.

The most common cause of traumatic head injuries as identified in this study was road traffic accidents (RTAs) and it was responsible for 92.8% of all head trauma cases. This could be attributed to the fact that road transport is the commonest mode of transportation among the study population with motorcycles and tricycles been widely available and affordable for use. Due to the sharing of the same road networks with larger vehicles like cars and trucks, motorcycle and tricycle users have constituted majority of the victims of RTAs In this study. The poor road safety adherence of road users, especially drivers of heavy-duty vehicles may also have contributed to RTA's. Other issues raised in relevant studies include drunk driving, poor vehicle maintenance culture and use of substandard or unserviceable car parts and tyres.[1,2,14,25] Falls were the second highest cause of head trauma (3.6%) and was either observed in the very elderly population or building construction workers.

Skull fractures were seen in 56.8% of patients. Multiple fractures occurred in 25% of these patients with 100% mortality. Linear skull fracture was more frequent and involved mostly the temporal and parietal bones. Deepak [27] reported associated fractures in 80% of 100 patients with craniocerebral trauma studied. Onwuchekwa et al.[1] reported that 43.7% out of 199 patients with abnormal cranial CT finding following head trauma had one or more skull fracture. Priya [28] reported skull fracture in 61% of 150 craniocerebral trauma patients studied. Intracranial hematomas and cerebral contusions are closely associated with fractures of cranial bones during head trauma.

In this study, Injury to the facial soft tissue and/or bones occurred in up to 71.2% patients. Cerebral contusion occurred in 31.7% patients while cerebral oedema was seen in 27.3% patients. Cerebral oedema and contusion of the brain are closely related as the nature of injury that causes brain contusion also causes cerebral oedema in most cases.[32] Cerebral contusion has been noted as a very common finding in most studies of cranial trauma. Akanji et al.[2] noted 35%; Priya[28] reported 44% while Ogbeide and Isara[14] reported 18.7% of participants with cerebral contusion.[14,28] In the present study 80% cases of cerebral contusion occurred with associated skull fractures. This association has also been reported in related studies.[27,29]

V. Conclusion

Male population was highly affected and the majority were young adults. Road traffic accident was the major cause of craniocerebral trauma. Intracerebral haemorrhage was the commonest form of haemorrhage

Conflict of interest

The authors declare no potential conflicts of interest with respect to this research.

Contributions of authors

AAJ conceptualized the research, was involved in literature review, data collection and drafting of the manuscript; HUC and MPO supervised this research, proofread the manuscript and approved the final copy, IEO, SB and UMU assisted in data collection, data organization and analysis, proofreading and clinical supervision, VCI provided critical comments, participated in literature review and reviewed initial drafts.

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