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Original Research Article

Findings of Computed Tomography in Head Injury and Its Correlation with the Glasgow Coma Scale in Sokoto North-Western Nigeria

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Abstract: ***Background*:** Head injury means trauma to the head with or without injury to the brain. Its incidence is on the rise in Nigeria owing to the rapid increase in vehicular traffic, interpersonal violence, political unrest, and rise in incidences due to urbanization. Young adults who form the bulk of the work force in any society are the most commonly affected group. ***Aim and Objectives*:** To determine the computed tomographic (CT) findings in head injured patients, and to establish the relationship between CT finding and GCS score as the degree of head injury. ***Materials and Methods*:** A prospective cross sectional study was carried out on 231 adult patients with head injury who had cranial CT scan performed following trauma at Usmanu Danfodiyo University Teaching Hospital Sokoto, Nigeria from August 2014 to August 2015. A GE BrightSpeed 4slice spiral CT scanner was used to acquire images. Clinical information included demographic data and GCS. Statistical analysis was carried out using SPSS version 20. ***Results*:** Majority (90%) of head injuries were seen among victims of RTAs, followed by assaulted patients (6.9%). Majority of head injury victims were in age group of 21-30 year. Most (85.3%) of study population were males. Majority (49.3%) of the study population sustained severe head injury (GCS<8), moderate (34.2%) and mild (16.5%). Predominant CT findings included intracranial hemorrhage (34.9%) followed by cerebral edema (28.6%) and midline shift (13.1%). Midline shift of 5mm or more stronglycorrelated with severe head injury (p=0.001). There was a positive correlation between GCS severity and CT findings. ***Conclusion:*** RTA constitutes the major predisposing factor for head injury in our environment. Both GCS and CT parameters are complimentary in assessment of head injury victims. MLS of 5 mm or more are good predictors of severe head injury.
Keywords: Head Injury, Computed Tomography, Glasgow Coma Scale, Road Traffic Accident.

INTRODUCTION

Head injury is physical trauma to the scalp, skull, and/or brain cause by an external force [1]. The applied force can be direct or indirect, and injuries may be open or closed depending on whether the dura mater is breached or not [1]. Head injury is a significant cause of morbidity and mortality worldwide, being one of the leading causes of death amongst young adult males, with an estimated male-to-female ratio of about 3.5 [1-5].

Patterns and etiology of head injury vary different geographical areas due to differences in the infrastructure, transport system, civil violence, crime, and warfare, however, in Nigeria it is accepted that road traffic accidents (RTAs) are the most frequent cause [6]. Primary brain injuries occur at the time of injury and are concussion and cerebral contusion of varying types and degree of intracranial hemorrhage. These are sometimes followed by secondary injuries such as cerebral edema and herniation, or infarction which can contribute significantly to increase morbidity and mortality if not managed promptly [7, 8].

The Glasgow Coma Scale (GCS), proposed by Teasdale and Jennet in 1974 is the most widely employed for assessing consciousness level and classifying head injury into mild, moderate, or severe [8, 9]. While CT scan represents the gold standard in detecting intracranial pathology in head trauma and provides accurate grade of severity and prognosis, with continued improvement with the use of helical and multislice CT [8, 9].

This study was therefore designed to quantify the clinical severity of head injury using GCS, highlight CT findings, and examine the relationship between CT findings and GCS among head injury patients in Sokoto North-western Nigeria.

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METHODOLOGY

Study Design: A prospective, cross-sectional study was conducted among 231 adult patients with head injuries who underwent cranial CT at Usmanu Danfodiyo University Teaching Hospital Sokoto, Nigeria, from August 2014 to August 2015. The GE BrightSpeed 4-slice spiral CT scanner was used for the acquisition of the images. Clinical information included is demographic data and Glasgow coma score. Statistical analysis was performed with SPSS version 20.

Study Area: The study was conducted at the Usmanu Danfodiyo University Teaching Hospital (UDUTH), Sokoto which is a tertiary health facility with a regional neurosurgical center which serves Sokoto and neighboring states.

Method: All patients with head injuries aged 16 years or over, who were admitted to UDUTH Sokoto were assessed for GCS and were referred for brain CT scans during the study period. Using a GE Brightspeed spiral computed tomography scanner (CT) manufactured in 2007, each subject was scanned from the vertex to the base of the skull in supine position without contrast administration. Head immobilization pads with straps were used to support the head on the CT headrest. Head CT was performed at an angle parallel to the infra-orbital line to avoid unnecessary irradiation of the orbit. Slice thickness of 5mm and matrix size of 256x256, field of view of 250, window width of 80 and window level of 40 were used. The bone window as well as reconstructed sagital and coronal views were also obtained. Exclusion criteria were patients with polytrauma, patients on sedation or with history of alcoholic intoxication. Statistical analysis was carried out using SPSS version 20.

Ethical approval was obtained from ethical and research committee of the Usmanu Danfodiyo University Teaching Hospital Sokoto.

RESULTS

A total of 231 patients (197 males, 34 females; ratio 5.8:1) with head injuries aged between 19 and70 years were recruited to the study and mean age was 38.1 ± 13.6 years. Majority of those seen were in age bracket of 21-30 years as shown table 1. Severe head injury (GCS < 8) was the most common injury type (49.3%), followed by moderate (34.2%) and mild (16.5%) injuries respectively as shown in table 2 and fig 1. RTA was the commonest cause of head injury (90%), followed by assault (6.9%), fall from height (2.2%), and gunshot (0.9%) as shown in table 7.

Computed tomography scan revealed the following findings as shown in table 3; Intracranial hemorrhage: 34.9% (dominant type intracerebral hemorrhage, 66.8%), cerebral edema 28.6%, midline shift: 13.1% (≥5 mm strongly significant for severe head injury, p = 0.001) as in table 6. Skull fractures 6% (comminuted exclusively in severe cases, p = 0.031). Positive correlations was established between the dimensions of the ICH, IVH, EDH, SDH, and midline shift respectively (p < 0.005) as shown in table 5.

Table 1: Socio-demographic distributions of study population

Variable	Frequency N=231	Percentage (%)
Age group (in year)		
≤20	22	9.5
21-30	66	28.6
31-40	59	25.5
41-50	42	18.2
51-60	24	10.4
>60	18	7.8
Sex		
Male	197	85.3
Female	34	14.7
Marital status		
Single	92	39.8
Married	138	59.8
Widow	1	0.4
Religion		
Islam	217	93.9
Christianity	14	6.1

Table 2: Severity of head injury based on GCS

Severity of head injury	Frequency	Percentage (%)
Mild (GCS=13-15)	38	16.5
Moderate (GCS=8-12)	79	34.2
Severe (GCS <8)	114	49.3

Table 3: Computed tomographic findings in the studied patients

CT Findings	Frequency	Percentage %
Intracranial hemorrhage	205	34.9
Mid line shift	77	13.1
Cerebral edema	168	28.6
Cerebral contusion	40	6.8
Skull fracture	35	6.0
Scalp swelling	62	10.6
TOTAL		100

Table 4: Dimensions of CT findings

CT FINDINGS	fx	Mean dimensions in mm		
		Mild	Moderate	Severe
Intracerebral hemorrhage	137	16	30	35
Epidural hemorrhage	15	_	13	15
Subdural hemorrhage	26		13	15
Intraventricular hemorrhage	24	_	10	13

Table 5: Correlation of intracranial hemorrhage and midline shift with head injury severity

		Diameter ICH	Diameter EDH	Diameter SDH	Diameter IVH	Degree MLS
Severity	r	0.231	0.505	0.381	0.702	0.690
	P	0.007	0.055	0.055	0.000	0.000

Key: IH- Intra-cerebral hemorrhage, EH- Epidural hemorrhage, SH- Subdural hemorrhage, IVH- Intra-ventricular hemorrhage, MLS- Midline shift, CT- Computed tomography, GCS- Glasgow Coma Scale.

Table 6: Association between midline shift and severity of head injury

Degree of midline shift	Severity base on GCS Mild Moderate Severe	Test statistic
Midline shift < 5mm	16(100%) 4(6.6%)	Fishers exact
Midline shift ≥ 5mm	0(0.0%) 57(93.4%)	P<0.001

Table 7: Showing prevalence of causes of head injury

Causes of head injury	Frequency	Prevalence
RTA	208	90.0
Fall from height	5	2.2
Assault	16	6.9
	2	0.9

Key: RTA- Road traffic accident

DISCUSSION

Head injury is a major global health challenge and it is a significant cause of morbidity and mortality in Nigeria. Clinical evaluation still provides a useful guidance as to whethera computed tomography of the head needs to be done as the diagnostic value of CT in neuroradiology has been well established as a safe and useful procedure [10].

The highest number that suffered head injury was found in between 21–30 year age (28.6%). The findings of this study are consistent with those of Isiyaku, Akanji and Ehimwenmo, who reported that head injury occurs predominantly in the second to fourth decade [11-13]. Majority of patients in this study were male (85.3%), with a male to female ratio of 5.8:1. This is in keeping with other studies in Nigeria with their ratios ranging from 4.3:1 to 6.2:1 [12, 13]. The muslim majority among the patients studied (93.9%) represent the demographic factor of our population.

Severe head injury (GCS < 8) account for the largest proportion of head injured patients (49.2%) in the index study, an observation that was supported by Ehimwenma *et al*., [13], who also found a higher proportion of severe injuries. This finding differs from that reported by Emejulu, Jeret and Adeyekun who found that mild head injury was more frequently observed among patients with head injury [10-16]. A possible reason for a higher number of severe head injuries in our study could be due to referral bias (the institution for this study is a tertiary hospital, with a dedicated regional neurosurgical center). More so, financial constraint may make mild head injury patients not to undergo CT scan.

Intracranial hemorrhage was the most common CT (34.9%) finding, intracerebral hemorrhage being the most common intracranial bleed (23.3%). Cerebral edema was the second most common CT finding (28.6%). Our study was found comparable to an earlier report by Isyaku and Saidu in Sokoto [11], and Adeyekun

[17], as well as Ogunseyinde [18], although subdural hematoma was found the most common intracranial bleed in the latter. Conversely, a study in India reealed common intracranial finding was cerebral edema [8]. When comparing the types of intracranial pathology and GCS, multifocal epidural hemorrhage (100%), subdural hemorrhage (84.6%), and intraventricular hemorrhage (79.2%) were predominantly found in severe head injury. This is similar to findings by Naseri [18], and Moppett [19]. There was a higher prevalence of subarachnoid hemorrhage among severe head injury patients in our study. This was in line with the observation of Toyoma *et al*., [8]. The most common intra-axial lesion in patients with severe head injury was cerebral edema (63.1%), which is in agreement with the observation of Morgado [9]. Among mild head injury patients, positive findings were fractures (22.9%), edema of the scalp (14.5%), and cerebral contusion (12.5%), while highest proportion recorded normal CT scan. This was similar to findings by Margado [9], Sedat [20], and Naseri [18].

We found a midline shift of 13.1% in this study. Midline shift ≥5 mm was almost entirely seen in patients with severe head injury (93.4%) and was strongly correlated with decrease GCS ($p < 0.001$). Similar observations have also been made by Chiewvit *et al*., [21]. With increasing severity of head injury, the number of additional positive findings on CT also increases, which is consistent with the reports by Morgado [9]. Saurabah [22], and Abhishek [23].

The GCS had a good correlation with most of the CT findings, which is similar to observations made by another study in Nigeria [9]. Adeyekun also confirmed a statistically significant correlation between abnormal CT findings and low GCS scores ($p = 0.018$) [16].

Road traffic accidents (RTA) cause the vast majority of head injuries in our study, accounting for (90%) an observation that is different from a reports by Adeyekun [16], and also a study from the United States that reported Fall as the commonest cause of head injury [25]. However, our finding is in agreement with Asaleye in Ile-Ife [12], which stated this was due to increasing number of vehicular/ motorcycles and poorly constructed and maintained roads as well as maintained vehicles. Assault was second (6.1%) cause of head injury in this study, a finding similar to report from Tanzania [6]. Falling from height (2.2%) and gunshot injury (0.9%) were other causes in our study. Patients were more likely to have positive CT findings if injury was sustained from RTA than other causes of head injury as reported by the findings of Obajimi *et al*., [26], and Akanjietal [12].

CONCLUSION

Road traffic accidents have been a leading cause of head injury in Sokoto with predominant pattern of severe head injuries seen mainly in the young male population. Significant CT scan finding notably midline shift ≥5 mm has been reported in this study and shows a positive correlation with GCS severity and therefore may be use in guiding clinical management.

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