



Understanding Delays in CT Management for Traumatic Head Injuries: The Impact of Social Factors

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Head injury is defined as any injury that causes lesion or functional damage to the cranium, meninges and brain. It is an important cause of morbidity and mortality worldwide. Young males are mostly involved in cases of head injury, likely due to increased activity associated with this group. Common causes of head injury include road traffic accidents (RTA), assaults, and falls from height and stab wounds. In Nigeria, road traffic accidents are the leading cause of head injuries. Cranial CT has been established as an accurate and fast diagnostic imaging modality in the management of head injury. Many factors have been seen to affect the management of head injury with the leading factors being admission into a private/peripheral hospital lacking CT facility, followed by financial constraints.

Objective: The main goal of this study was to determine the major causes of delay in patients' presentation for CT examination following head injury.

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Methodology: This was a prospective study of head injury patients referred for cranial CT evaluation at the Department of Radiology, NAUTH, Nnewi, carried out for a period of two years from 2017 to 2019. A total of 170 patients were involved in the study. A written informed consent was obtained from the patients or their relatives. The patients were scanned with a GE Bright speed 4-slice CT machine.

Data Analysis: Data processing and statistical analysis was done using Statistical Package for the Social Sciences (SPSS), version 20.0. Socio-demographic and other relevant characteristics were displayed in tables and charts.

Results: 77.6% of subjects in this study were males. The mean age of the patients was 34.31 ± 21.08 years, with an age range of 6 months to 90 years. The modal age group affected was 21 – 30 years which constituted 23.5% of the study population. Motor-cycle road traffic accident (42.3%) was the most common mechanism of head injury seen in our setting, while sports-related injury (0.6%) was the least common mechanism of injury in this study. The leading social factor that causes delay in CT management of head injury is admission into a private/peripheral hospital lacking CT facility followed by cost of the investigation.

Conclusion: The leading cause of delay to CT management of patients with head injury is admission into a private/peripheral hospital followed by financial constraints and other factors like the lack of awareness of the role of CT in the management of head injury by patients and their relatives, the fact that the few CT centers available are not easily accessible to many of the referring doctors and the pitiable transport facilities with unavailability of ambulance services. Adequate awareness of role of CT and government intervention in subsidizing the cost in Government hospitals is advocated. We also recommend introducing targeted interventions in health care that will address health care access, health literacy, cultural beliefs and communication barriers. These measures in our health care systems can remarkably reduce these causes of delays, and improve the efficiency of care delivery for patients with traumatic head injury.

Keywords: Head injury; social factors; cranial CT management.

1. INTRODUCTION

Traumatic brain injury (TBI) is a form of brain damage caused by external mechanical force, such as rapid acceleration or deceleration injury, direct impact, blast waves or penetration by a projectile, leading to temporary or permanent impairments, functional disability or psychosocial maladjustment [1].

Head injury is considered a major health problem and a frequent cause of death and disability, thus placing considerable demands on health services [2]. Thousands of patients are involved annually. Young males are mostly affected, likely due to increased activity associated with this group [3]. Common causes of head injury include road traffic accidents (RTA), assaults, fall from height and stab wounds [4].

Most of the head injury patients in our environment do not present for CT evaluation on time. Some of the factors contributing to late presentation for CT management include financial constraints on the part of patients and the fact that many physicians are reluctant to refer these patients for CT because of the financial burden, and the fear of referring

physicians losing their patients to other doctors in the CT centers when they send the patients for CT scan there. Others include; the lack of awareness of the role of CT in the management of head injury by patients and their relatives, the fact that the few CT centers available are not easily accessible to many of the referring doctors, and the pitiable transport facilities and unavailability of ambulance services. All these factors make the transfer of ill patients to hospitals with CT facilities particularly challenging [5] thereby worsening the outcome of these patients [6].

A retrospective study of 61 patients aged between 20 and 39 years in Benin city, Nigeria by Eze *et al.* showed that most of the patients (68.9%) presented after one week of injury and none presented within the first six hours of injury [7]. Adeyekun *et al.* [8] also in a study in Benin city reported that only 1/3rd of their patients with head injury presented within the first one week while 2/3rd presented after one week of injury. The late presentation was apparently due to cost, thus making them to present when they became symptomatic. Obajimi *et al.* in a similar study at Ibadan Nigeria reported a time interval of fifteen days between occurrence of injury and CT scan

examination [9]. Ohaegbulam *et al.* [5] also noted in a study done in Enugu, that delayed CT management was unfortunately the rule rather than an exception and that ultra-early presentation CT was rarely done. A similar study by Emejulu *et al.* [6] on head trauma in a newly established neurosurgical center in Nigeria, in 2008, observed that lack of CT scan facilities in a center, contributed a great deal to a high mortality rate of 19.8% in head trauma. Adekanmi *et al.* in a 10-year retrospective and descriptive study carried out at the University College Hospital, Ibadan on 2143 patients, documented features of chronic head injury, possibly due to late presentation, or affected patients seeking medical treatment only after the clinical symptoms of the sequelae of head injury have manifested [10].

However, some studies have shown that early presentation of patients with head injury for CT management will reduce the morbidity and mortality seen in such patients [11]. Ziemmerman *et al.* [11] reported that the prognosis of epidural hematoma is poor but with prompt identification of localized or multifocal collection on CT scan and direct surgical drainage within four hours of trauma, resulted in an observed remarkable decrease in mortality by about 30 to 60 percent [11].

In the past, imaging of head injured patients was dependent on skull radiograph. But the role of skull radiography has greatly reduced, because of the decrease in its yield in the management of patient with traumatic brain injury. Computed tomography scan is believed to be an excellent imaging modality of choice in the management of traumatic head injury. It provides clear and precise, diagnosis of skull fractures, intracranial haemorrhages and other sequelae of head injury such as cerebral oedema.

Magnetic resonance imaging (MRI) has been shown to be more sensitive than CT in the detection of non-haemorrhagic contusions, diffuse axonal injuries and subdural hematomas, but it is equal to CT in the demonstration of haemorrhagic contusions. CT however is still preferable over MRI in the evaluation of acute head trauma. Disadvantages of MRI that limits its use in the evaluation of acute head injury include long scan time and its inability to detect fractures [12]. Lack of CT facility as well as delays in early presentation for CT management of head injury ultimately worsens the outcome of the head injured patient, hence the aim of this study is to

assess the social factor that affects the delay in management of patients with head injury especially regarding delays in CT management of these patients. This will enable us make recommendations to the appropriate authorities so as to help curb the high prevalence of mortality associated with head injury in our setting and improve their outcome.

2. MATERIALS AND METHODS

This is a prospective study of patients with head injury presenting for CT scan, for a period of two years 2017 to 2019, in the Radiology department of the Nnamdi Azikiwe University Teaching Hospital (NAUTH), Nnewi involving a total of 170 patients. The interval between the time of injury to the time of presentation for CT scan was documented as well as possible causes for delayed presentation. Consecutive sampling method was used in this study as all the patients referred for CT evaluation during the study period, were recruited.

Patients' biodata and other relevant clinical and social information were obtained completely before the scan or completed after the scan, depending on the patients' state and the urgency demanded by the scan.

All patients were scanned using (General Electric (GE), HANGWEI MEDICAL SYSTEMS CO. LTD - BrightSpeed Excel 4 Slices CT Scanner.

Data obtained were analyzed using IBM SPSS (Statistical Package for Social Sciences), version 20.0. Armonk, NY. Quantitative data e.g. ages of the subjects, were analysed using frequency, measures of central tendencies (mean and mode), and measures of dispersions (range and standard deviation). Simple nominal categorical data were analysed using frequency. Charts were also obtained of the appropriate variables.

3. RESULTS

Among all the patients enlisted for this study, 132 were males, accounting for 77.6% of all head injury cases while 38 were females, accounting for 22.4% making a total of 170 (Fig. 1). Their ages ranged from 6months to 90 years (6months to 90 years for the male sub-population and 6 months to 80 years for females). The mean age of the participants was 34.31 ± 21.08 years. The predominant age group affected in the study population was 21 – 30 years (23.5%) followed by the 31 – 40 years age group (18.2%). Among

the male subpopulation, the predominant age group affected was 21 – 30 years. In this subpopulation, 36 subjects were involved, accounting for 27.3% of that sub-population, while among the females, predominant age group affected was 0 -10 years. In this subpopulation, 11 subjects were affected, accounting for 28.9% of that subpopulation. The age range that was least affected was the 81 – 90 years. Three (3) subjects were affected in this age range and all were males, accounting for 1.7% of the study population and 2.3% of the

male sub-population). No female of this age group was affected.

The interval between occurrence of the head trauma and CT examination ranged from 2 hours to 1 year. As can be seen from Fig. 2, seven of the subjects (4.1%) presented for CT within 4 hours of the occurrence of the head injury, 140 (82.4%) presented in less than one week, while 22(12.9%) presented between a week and a month of the injury, and 8 (4.7%) presented beyond 1 month.

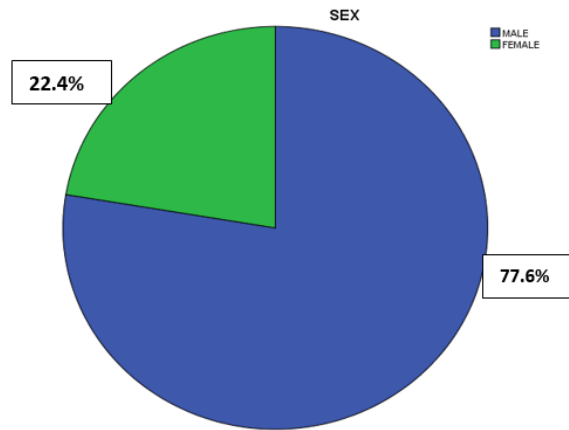


Fig. 1. Pie chart showing the sex distribution of the subjects

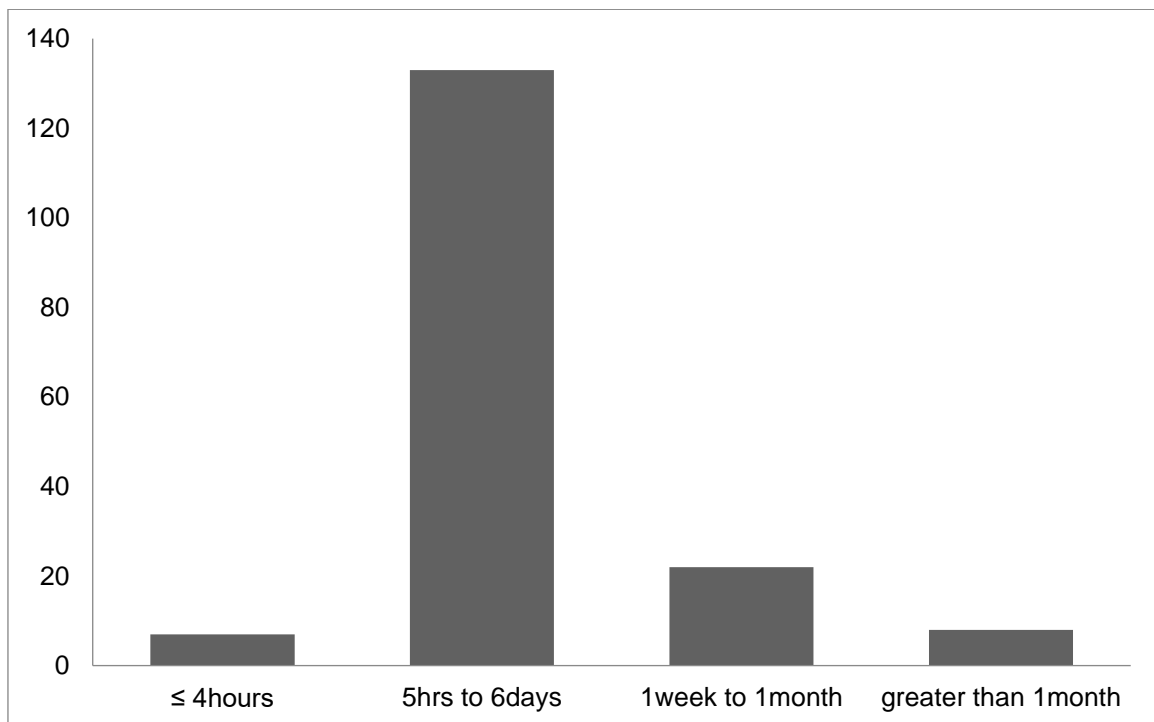


Fig. 2. Bar chart showing the time interval between occurrence of the traumatic event and CT examination

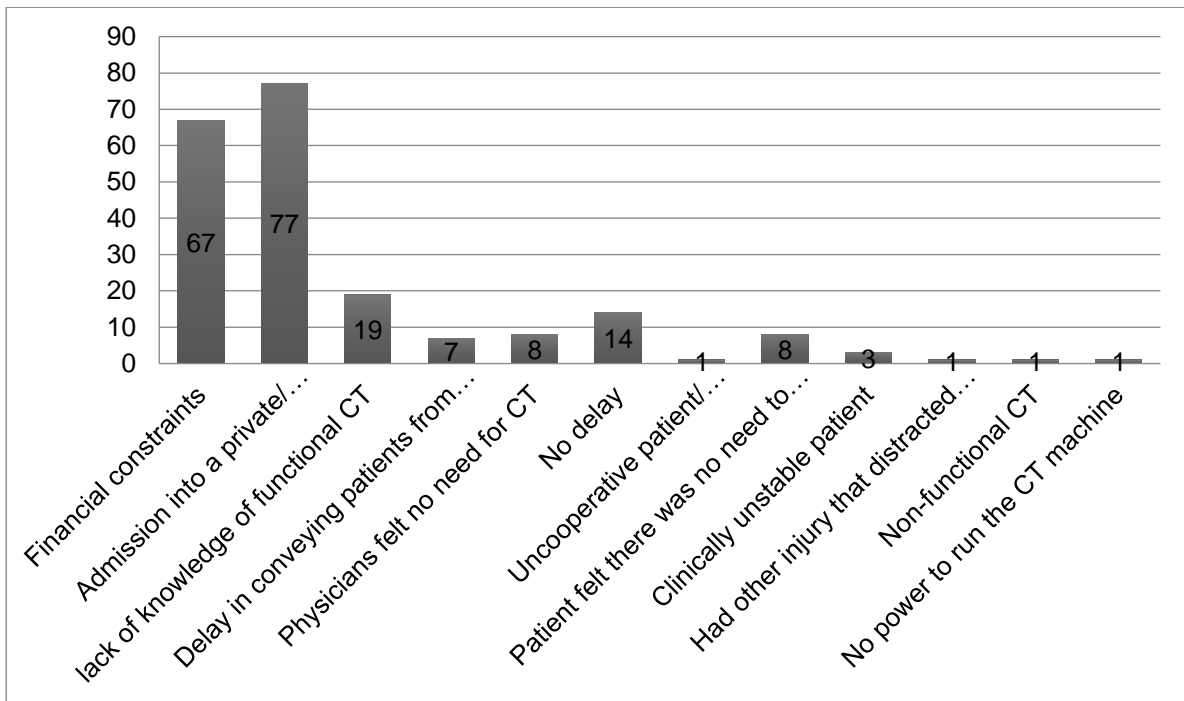


Fig. 3. Bar chart showing the different causes of delay among the participants

The commonest cause of the delay in presenting for a CT examination following head trauma were admission into a private/peripheral hospital lacking CT facility which comprised 77 (45.3%) cases followed by financial constraints comprising 67 (39.4%) cases (Fig. 3). As can also be seen from Fig. 3, other causes include lack of knowledge of functional CT, referring physicians not seeing the need to refer the patients, patients not seeing the need to go for CT, and, delay in conveying patients for the CT due to factors like bad road networks.

4. DISCUSSION

Head injury is documented as the leading cause of death following trauma worldwide, with particularly high mortality and morbidity in developing countries, due to poor health infrastructure [13]. Radiological imaging especially CT, brings about a detailed diagnosis which enables prompt and targeted management. The age of the participants ranged from 6 months to 90 years but the 3rd and 4th decades of life (21 – 30 years) were predominantly affected with involvement of more males 132 (77.6%) than females 38 (22.4%) in this study.

This age group has been described as the active, productive and adventurous group in the society

and are more predisposed to the head injury. This predilection by young males aged 21 to 30 years as seen in this study, is similar to the findings of by several authors [13-20]. This is so because of the greater exposure of males to traffic and outdoor activities than females [19]. Motor-cycle RTA (42.3%) was the most common mechanism/ aetiology of head injury in this study followed by Motor vehicle RTA (17.6%) with the least common mechanism of head injury being sports related injury (0.6%), missile injury (1.1%) and gunshot injury (1.7%). A finding that is similar to other reports in Nigeria [15 21,22]. but at variance with reports in the united states where fall from height was noted to be the leading aetiological factor [23-24]. The high burden of motor-cycle RTA in this setting where the ban on motor-cycle has not been effected is primarily responsible for this. Males were more involved in motor-cycle RTA than females (65 males vs 7 females involved in motor-cycle RTA). This significant male predominance in motor-cycle related head trauma was also observed by Ogbeide *et al.* [15]. The reason for the male predominance being that commercial motor-cyclists in Nigeria are almost exclusively males.

The predominant time interval between occurrence of the injury and the CT examination seen in this study (over 82% of the patients) was

less than 1 week, but only 4% of the patients presented in the first 4 hours. This predominant time interval was also slightly similar to that reported by Onwuchekwa *et al.* [13] in a study done in Niger Delta, Nigeria on CT pattern of traumatic head injury, in which majority of their patients (33%) had CT evaluation within 1 week of the injury. In terms of week of presentation, Adeyekun *et al.*¹⁴ also recorded the highest proportion of patients (37%) presenting in the first one week of injury, however about 2/3rd of their patients presented after one week of injury for CT evaluation. Our findings vary slightly from an interval of 15 days observed by Obajimi *et al.* [25] in a similar study, as well as Eze *et al.* [18] who found that most patients (68.9%) presented after one week of injury. The reason for early presentation for CT evaluation in our study, in comparison to previous local studies may be due to increasing awareness of the role of CT as well as easy accessibility to the CT facility in our setting. Most of the studies done in developed countries recorded a much earlier presentation for CT examination than that in our setting. Some were less than 1 hour in some cases [26]. This may be due to availability and accessibility of CT facilities as well as good health insurance system and awareness of patients and their relatives, about the role of CT in the management of head injury.

There are several causes of delay in presenting for a CT examination following head injury, found in our study, with the commonest being admission into a private/peripheral hospital lacking CT facility. In this setting, some of the doctors will hold the patient for too long for many reasons including ignorance on the role of CT in the management of head injured patient. Other reasons may be to avoid increasing the hospital bill for the patients and sometimes even for fear of losing the patients to centers with CT if they refer for them to have CT done in such centres [14,5,27-29]. This also involves some cultural context and learned family behaviours and in some settings the trust they have on their family doctors make them stick to them until condition deteriorates leading to delayed referral for CT and other specialized services. This leads to poor outcome with attendant increased morbidity and mortality [28].

Our study is a one centre study in which there was available CT. This CT machine was functional at the time of this study. From the study pro-forma part of the reason given by the patients for delayed presentation for CT include

non- functionality of the machine at the time of referral, other CT related causes include no power to run the CT and the financial constraint to pay [30]. This finding is also similar to the finding by Ohaegbulam *et al.* [5]. Their finding that the cost of CT was about \$120 and higher than the minimum wage thus making it fairly unaffordable. This is also similar to the findings by Abdelgadir *et al.* [31]. and Uganda Bureau of Statistics [32] showing lack of functional CT and the high cost of CT as their own reason for delay. In yet another study in Uganda Vaca *et al.* [33] dealing with the issue of Temporal Delays Along the Neurosurgical Care Continuum for Traumatic Brain Injury Patients at a Tertiary Care Hospital in Kampala, Uganda, they found decreased ownership of CT machine and poor maintenance of the machine at breakdown as reasons for delay in service delivery. It was in their study that the Biomedical Engineer at the facility was not able to maintain the machine at breakdown. The high cost of CT in our poor resource setting leads to its reduced use or non use as some of patients cannot afford the cost as they have to pay from their pocket. This also leads to unequal access to health care services thereby increasing morbidity and mortality in head injured patients. There is very limited utilization of CT scanning in the management of head trauma in Nigeria.

Ohaegbulam *et al.* [5] found that the number of CT scan centers is small and are widely apart and therefore not easily accessible for emergencies. The cost of acquiring and running a CT scan service is high. For establishment interested in CT scanning facilities as a business, bank loans are difficult to secure and remain unattractive because of very high interest rates that exceed 20% per year. These factors contribute to the high cost of obtaining a CT scan in Nigeria and subsequently leading to high cost of services.

Financial constraints are the second most common reason for delayed presentation CT in our study constituting 39.4% of the cases. It is already known that cost of CT is higher than the minimum wage in our Nigerian society. This makes it difficult for many patients who will need CT to agree to do. This is very close to the finding in Uganda [34] and Rwanda [35] where despite the availability of Health insurance services, the few other cost of services like transportation and ambulance services with food and accommodation that is not covered by insurance makes the cost higher than many individuals and families can bear therefore

leading to delayed presentation for CT or outright refusal to carry out the procedure increasing adverse outcome and delayed interventions to save life.

The solution to these financial problem as a delay in CT management of the head injured in our environment will be in the availability of the much needed functional health insurance scheme, charity organisations or nonprofit groups that can intervene in provision of CT in hospitals and help in reducing the service cost. The African family support systems can also be built up to help indigent members of their families. This will go a long way to reducing financial constraint as reason for delay in CT Management of head injured patients.

In our study we found that delay for patient presentation to CT can be for many other reasons other than the ones already discussed previously. These include (not in any order) delay in conveying patients to CT centers, clinically unstable patients, or that the physician felt there is no need to refer and in cases where there are other injuries that act as distraction from the seriousness of the head injury. All these factors when pulled together form what Raykar *et al* in their study called pre-hospital reasons for delay in patient presentation for CT and other intervention services [36]. The pitiable state of our roads and the unavailability of ambulance services make referral and inter facility transfer of head injured patients to CT centers very difficult. Improvement in our road network and infrastructure and the availability of ambulance services and efforts at improving the universal access to health services through health insurances will reduce delays and markedly improve outcome there reducing morbidity and mortality among the head injured in our environment [37,38,39,40].

5. CONCLUSION AND RECOMMENDATION

The prevalence of traumatic head injury in this study is high with majority of the patients having abnormal CT findings, with the ratio of abnormal to normal CT findings being 4.15 : 1. Motor-cycle RTA is the leading cause of head injury in our study, followed by MVRTA. Males are predominantly more involved in head trauma with a male to female ratio of 3.5 : 1, with the predominant age group affected been people in their third and fourth decades of life. The predominant cause of delay in presenting for CT

was admission into a private hospital lacking CT facilities followed by financial constraints.

From the findings in this study we recommend for increase in number of computed tomography centres available to enable for easy access to such centres. Provision of and increase in good road networks in our communities will go a long way to improve access, thereby reducing the number of RTA and also its consequent morbidity and mortality. It is also our opinion that increase in awareness of the role of CT among the doctors and other health professionals and even the general population will definitely lead to better CT management of head injury patients in our locality and other places with similar challenge.

CONSENT

All patients recruited into the study gave a written informed consent. In the case of unconscious and indisposed patients, a written informed consent was given by the relatives.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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