EVALUATION OF COMPUTED TOMOGRAPHY SCAN FINDINGS OF THE HEAD AMONG CHILDREN WITH HEAD INJURIES IN A TERTIARY HEALTH INSTITUTION IN NORTH EASTERN NIGERIA

Luntsi G[1], Onyia C.E[1], Muhamed S. A[2], Nwobi I.C[1], Aminu U.U, Abubakar G.M[3] and Abba M[1].

Address: [1]Department of Medical Radiography College of Medical Sciences, University of Maiduguri, Borno State.
[2] Department of Radiology, University of Maiduguri Teaching Hospital, Maiduguri, Borno State.
[3] Department of Radiology, Federal Teaching Hospital Gombe, Gombe State.

Corresponding Author: Luntsi Geofery **E-mail:** geostuffy@yahoo.com. **Tel:** +2347035512622

ABSTRACT

BACKGROUND: Computed Tomography scan of the head has become the imaging modality of choice to identify intracranial injuries due to its sensitivity for demonstrating pathologies from the soft tissue (brain) to the skull (cranium).

OBJECTIVES: To evaluate the pattern of Computed Tomography (CT) scan findings of head among children with traumatic and non-traumatic injuries and their age and sex distributions.

METHODS: A retrospective study was conducted reviewing 67 head scans on Computed Tomography of patients with age ranged from 6 months to 18 years with traumatic and non-traumatic injuries, using 16-Slice Phillips brilliance scanner, for a period of 2 years, 11 months (May 2011 to April 2014). Permission to carry out the research was obtained from the research and ethical committee of Federal Teaching Hospital Gombe. Information on age, sex, clinical indications and CT findings were obtained from the radiology archive and recorded on a data capture sheet. Descriptive statistics such as mean, percentages, frequencies and standard deviation were generated using the Statistical Package for Social Sciences (SPSS) version 19.0.

RESULTS: A total of 67 reports were reviewed, with 64.18% (43) males and 35.9% 24 females. Participant's ages ranged from 6 months to 18 years with mean age 3.5±1.8. The most affected age group was 0-6 years, with 37.3% (25). Nontraumatic injury findings had higher occurrence with 61.2% (41) compared with traumatic injury findings with 38.8% (26). Cerebral infarction was more among the males with 5.97% (4).

CONCLUSION: The incidence of head injury is generally higher in males. Non-traumatic injury has a higher incidence of occurrence and younger children (0-6 years) were seen to be more affected in the study.

KEYWORDS: Children, traumatic injury, non-traumatic injury, Computed Tomography.

INTRODUCTION

Head injury is very common among children, a small number of children that appear well, may have serious injury with potential for deterioration, though a vast majority of children with head trauma have minor injury[1]. Some anatomical feature that predisposes the younger child to head injuries includes; large head-to-body ratio, a relatively weak neck, a thinner skull, and a larger subarachnoid space in which the brain is free to move[2].

Traumatic Brain Injuries (TBI) are among the most common types of brain injuries. They usually occur when the head is hit hard or whipped violently back and forth, that is when something happens outside the body. Non-Traumatic Brain Injuries (NTBI) occur when something from within alters the healthy functioning of the brain or as a result of things going on within the body. Non-Traumatic Brain Injuries are less common than TBI[3,4]. Non-Traumatic Brain Injury is also referred to as acquired brain injury[5].

In the field of brain injury, acquired brain injuries are typically considered any injury that is non-traumatic. It is an injury to the brain which is hereditary, congenital, degenerative or induced by birth trauma[4,6].

Computed Tomography scan of the head is usually carried out in peadiatric patients in all cases of moderate and severe head trauma as it has become the imaging modality of choice to identify intracranial injuries in injured patients due to its sensitivity for demonstrating mass effect, ventricular size and configuration, bone injuries and acute haemorrhage[7, 8]. Current published clinical guidelines recommend that CT should be the initial investigation in the acute situation when inflicted brain injury (IBI) is suspected[9]. The use of CT scan has greatly improved diagnostic work up of children with traumatic and non-traumatic brain injuries[10].

Cranial CT is a common tool used to evaluate patients in the emergency department with a wide variety of suspected intracranial disorders[11]. The increase in the number of children being referred for CT scan and other radiologic examinations in North Eastern Nigeria has being on the upswing due to the insurgency (Boko haram) and other reasons ranging from traumatic (domestic and RTA) and non-traumatic head injuries where the young children are not speared. This study is aimed at evaluating the pattern of Computed Tomography findings in children with traumatic and non-traumatic head injuries and their age and sex distributions in Federal Teaching Hospital Gombe.

MATERIALS AND METHODS

A retrospective study was conducted reviewing 67 head CT scan findings of children aged 6 months to 18 years with traumatic and non-traumatic injuries, using 16-Slice Phillips Brilliance Scanner; (Model 453567078851, Ohio 44143 USA, 2010) was conducted for a period of 2 years and 11 months from May 2011 to April 2014. Permission to carry out the research was obtained from the research and ethical committee of Federal Teaching Hospital Gombe. Information on date of examination, patient CT number, age, sex, clinical indications and CT findings were obtained from the radiology archive and recorded on a data capture sheet by the researchers. Descriptive statistics such as mean, percentages and frequencies and standard deviation were generated using the Statistical Package for Social Sciences (SPSS) version 19.0.

RESULTS

A total number of 67 patients record with traumatic and non-traumatic head injuries CT scan report were reviewed in the study. Participants' age ranged from 6 months to 18 years with a mean age of 3.5±1.8.

Males were found to have a higher occurrence among the population studied with an overall frequency of 64.18% (43) than females with 35.82% (24). There were 17.9% (12) males and 19.4% (13) females within age range from 0-6 years, about 23.81% (16) males and 7.46% (5) females within the age group of 7-12 years and 22.4% (15) males and 8.96% (6) females within the age group of 13-18 years (Fig 1).

Head injury due to trauma (domestic) had the highest occurrence with 18.4% (13) as the reason for request of examination, other indications include, injury due to Road Traffic Accidents (RTA) with 14.9% (10), abnormal mental status with 13.4% (9), neoplasm and seizure with 10.4% (7) each, headache with 9.0% (6), convulsion with 6.0% (4), encephalopathy with 4.5% (3), signs of fracture and stroke both had 1.5% (1) (Table 1).

Other findings in the study ranged from normal study with the highest frequency of 38.80% (26) subdural haematoma with 8.96% (6) skull fracture, neoplasm and cerebral infarction with 57.46% (5) each, oedema and cerebral atrophy with 5.97% (4) each, intracerebral haemorrhage with 4.48% (3), maxillary sinusitis and contusion with 2.99% (2) each and hydrocephalus, epidural haematoma, encephalocele sinus thrombosis and meningitis with 1.49% (1) each for both traumatic and non-traumatic cases (Table 2).

The distribution of findings in relation to sex include, normal findings with 22.34% (15), in the males and 16.42% (11) in the females, cerebral infarction and oedema with 5.97% (4) each in the males and 1.49% (1) and 0% (0) each respectively in the females, subdural haematoma and neoplasm and skull fracture with 4.48% (3) each, in the males, and 4.48% (3), 2.99% (2) and 2.99% (2) each respectively in the females (Table 3).

On the distribution of traumatic and non-traumatic findings among the age groups, participants within the age groups of 0-6 years, had traumatic findings with 10.45% (7), and non-traumatic findings with 26.86% (18), and those within the age group of 7-12 years had traumatic findings with 16.42% (11), non-traumatic findings with 14.93% (10), while those within the age group of 13-18 has traumatic findings had 11.94% (8) and non-traumatic findings with 19.40% (13) (Table 4).

Non-traumatic findings had a higher occurrence among the study population with 61.2% (41), while traumatic findings had 38.8% (26) (Fig 2).

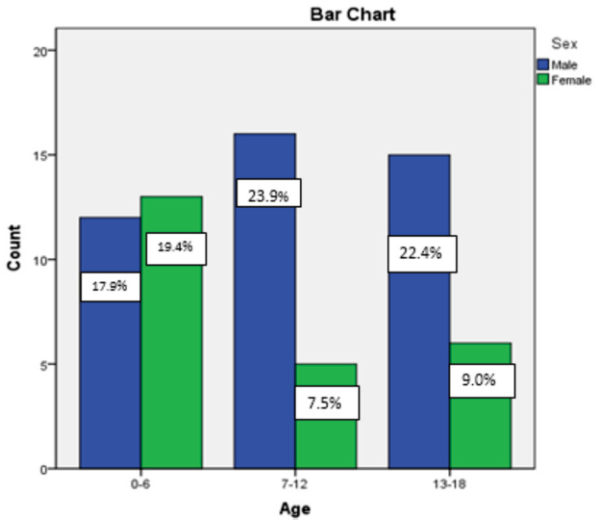

Fig 1: Frequency of Age and Sex Distribution of Participants

Table 1: Indications for Head CT Scan

Indications	Frequency	Percentage (%)
Headache	6	9.0
Seizure	7	10.4
Abnormal Mental Status	9	13.4
Signs of Fracture	1	1.5
Neurological deficit (Stroke)	1	1.5
Infections	6	9.0
Encephalopathy	3	4.5
Neoplasm	7	10.4
Injury due to RTA	10	14.9
Domestic Trauma	13	19.4
Convulsion	4	6.0
Total	67	100

Table 2: Distribution of Traumatic and Non-traumatic Findings

Findings	Traumatic	Non-traumatic	Total
Normal Study	5 (7.46%)	21(31.34%)	26(38.80%)
Maxillary Sinusitis	0 (0%)	2 (2.99%)	2 (2.99%)
Contusion	2 (2.99%)	0(0%)	2(2.99%)
Subdural Hematoma	6(8.9%)	0(0%)	6 (8.96%)
Hydrocephalus	0 (0%)	1(1.49%)	1(1.49%)
Skull Fracture	5(7.46%)	0 (0%)	5(7.46%)
Neoplasm	0 (0%)	5(7.46%)	5(7.46%)
Intracerebral Hemorrhage	3(4.48%)	0 (0%)	3 (4.48%)
Cerebral Infarction	1(1.49%)	4 (5.97%)	5(7.46%)
Epidural Hematoma	1(1.49%)	0 (0%)	1(1.49%)
Oedema	2 (2.99%)	2 (2.99%)	4 (5.97%)
Encephalocele	0 (0%)	1(1.49%)	1(1.49%)
Cerebral Atrophy	1(1.49%)	3(4.48%)	4 (5.97%)
Sinus Thrombosis	0 (0%)	1(1.49%)	1(1.49%)
Meningitis	0 (0%)	1(1.49%)	1(1.49%)
Total	**26 (38.80%)**	**41 (61.20%)**	**67 (100%)**

Table 3: Distribution of Findings among Gender

Findings	Male	Female	Total
Normal Study	15(22.39%)	11(16.42%)	26(38.81%)
Maxillary Sinusitis	1(1.49%)	1(1.49%)	2 (2.99%)
Contusion	1(1.49%)	1(1.49%)	2 (2.99%)
Subdural Hematoma	3(4.48%)	3(4.48%)	3 (4.48%)
Hydrocephalus	1(1.49%)	0 (0%)	1(1.49%)
Skull Fracture	3(4.48%)	2 (2.99%)	5(7.46%)
Neoplasm	3(4.48%)	2 (2.99%)	5(7.46%)
Intracerebral Hemorrhage	2 (2.99%)	1(1.49%)	13(4.48%)
Epidural Hematoma	1(1.49%)	0 (0%)	1(1.49%)
Oedema	4 (5.97%)	0 (0%)	4 (5.97%)
Encephalocele	1(1.49%)	0 (0%)	1(1.49%)
Cerebral Atrophy	2 (2.99%)	2 (2.99%)	4 (5.97%)
Sinus Thrombosis	1(1.49%)	0 (0%)	1(1.49%)
Meningitis	1(1.49%)	0 (0%)	1(1.49%)
Total	**43 (64.18%)**	**24 (35.82%)**	**67 (100%)**

Table 4: Distribution of Findings in Relation with Age

Age (Years)	Traumatic	Nontraumatic	Total
0-6	7(10.45%)	18 (26.86%)	25 (37.31%)
7-12	1(16.42%)	10 (14.93%)	21 (31.34%)
13-18	8 (11.94%)	13 (19.40%)	21 (31.34%)
Total	**26 (38.8%)**	**14 (61.2%)**	**67 (100%)**

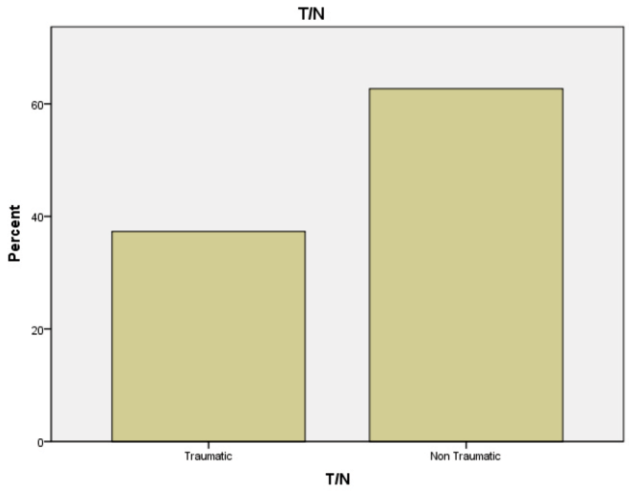

Fig 2: Percentage of Traumatic and Non-traumatic Findings

DISCUSSION

This study reviewed the reports of 67 patients records with their indications and CT findings.

A high occurrence of male patients in comparison to female patients was seen with 64.18% males and 35.82% females giving a male to female ratio of 1.8:1. This high prevalence of male was also seen in the studies conducted by Atabaki et al.[12] and Rogers et al.[13] where males had high prevalence of 64.1% (ratio 1.8:1) and 69% (ratio 2.2:1) each. This could be attributed to the more adventurous nature of boys and more likelihood to been involved in risky sports compared to females especially in growing children.

Age group of 0-6 years had the highest incidence of non-traumatic injuries with 18 (26.87%), while traumatic injuries were the highest among those within 7-12 years with 11 (16.42%). There could be an age related etiology as non-traumatic injuries was seen to be high among participants within the age range of 0-6 years, while children within the age group 7-12 years are mostly school kids who are involved in more play and active movements that could predispose them to sustaining traumatic injuries.

The study found a greater occurrence of non-traumatic injuries with 61.20%, and neoplasm had the highest occurrence with 7.46%, followed by cerebral infarction with 5.97%, hydrocephalus with 1.49% and meningitis with 1.49%. This is in contrast with the findings in a prior report where obstructive hydrocephalus had 13.2% and general brain atrophy with 91% dominate the non-traumatic findings[12].

Among traumatic injuries seen 37.80%, subdural haematoma had (8.96%), skull fracture with (7.46%) epidural haematoma with (1.49 %) having the least occurrence. This is similar to the traumatic findings in Dietrich et al.,[14] study where intracranial injuries had 12% and concomitant fracture had 5% of the findings. Trauma with (17.9%), and RTA with (14.9%), accounts for the major cause of injuries as also obtained in similar studies by Ogbeide et al.[15] where most of the injuries 60.3% of the cause of traumatic injuries was RTA and 22.7% and in Adeyemo and Udoh,[16] study with motor accidents having a frequency of 60.3% and falls 22.7%. The incidence of normal findings 38.80% in our study draws attention to the justification of the examination considering the age and dose received during CT scan examinations.

The positive findings in this study was relatively high with frequency of 61.2%, this is in contrast with studies by Atabaki et al.[9] where positive findings were recorded in only 6.5% of the CT scan and Fundario et al.[17] with 31% of positive findings. This however, could be due to the fact that cranial CT is obtained liberally in patients with head trauma in developed countries, where they are readily available[9], which is not the situation obtained in the region of study where CT scans are mostly carried out in patients presenting with obvious indication for study and if the socioeconomic status of the patient can afford the cost as the examinations are relatively expensive.. Although the sample size in this study was small, the study however, provides baseline information in the study location, and studies using larger population are suggested by the researchers.

CONCLUSION

Findings from this study revealed high incidence of non traumatic injuries which is more prevalent among males than females with a ratio of 1.8:1. Neoplasm and cerebral infarction were among the most common non-traumatic injuries, while subdural haematoma and skull fracture were the most common among the traumatic injuries and these findings are generally higher in younger children between 0-6 years of age.

ACKNOWLEDGEMENT:

We will like to acknowledge the radiologist, radiographers and other radiology staff who participated in generating the data used for the study.

REFERENCES

1. Shunk J.E, Schutzman S.A. Pediatric Head Injury. Pediatric in Review 2012;33:398-411.

2. Ota F.S. Head Trauma and Hemorrhage Chapter XVIII, in Case Based Pediatrics for Medical Students and Residents. [online] 2002. Available at http://hawaii.edu/medicine/pediatrics/pedtext/s18c13.html Accessed on 20/08/2014.

3. Anas I, Muhammed S.A. Audit of Pediatric Computed Tomography at Aminu Kano Teaching Hospital Kano, Nigeria. West African Journal of Radiology 2012;19: 11-13.

4. Gillette Children's Specialty Healthcare: Brain Injury. Gillette Blog. 2014. Available at http://www.gillettechildrens.org/conditions-and-care/brain-injury/. Accessed on 29/5/2014.

5. The Children's Trust, Nontraumatic Brain Injury. 2014. Available a http://www.braininjuryhub.co.uk/information-library/non-traumatic. Accessed on 28/5/2014.

6. Su F. Traumatic Brain Injury in Children. 2013. Medscape. Available a http://emedicine.medscape.com/article/909105-overview#showall. Accessed on 28/5/2014.

7. Brain Injury Association of America. (BIAA). About Brain Injury. 2012 A http://www.biausa.org/about-brain-injury.htm 28/5/2014.

8. Quayle K. S, Minor Head Injury in the Pediatric Patient. PubMed. 1999;46:1189-99.

9. Kempa A.M., S. Rajaramb, M. Mannc, V. Tempesta, D. Farewelld, M.L. et al., What Neuroimaging should be performed in Children in whom inflicted Brain Injury (BI) is suspected? A Systematic Review. Clinical Radiology 2009;64:473-83.

10. Diana L. M, Eric J, Andrew W, Robert T. G, Sheila W, Leif I. S, Heather S. F, Douglas R, Michael J. F, Nicholas V, Rebecca S. B. The Use of Computed Tomography in Pediatrics and the Associated Radiation Exposure and Estimated Cancer Risk. JAMA Pediatrics. 2013.311. E1-E8.

11. Davis P.C. Head Trauma. American Journal of Neuroradiology 2007;28: 1619-1621.

12. Atabaki M.S, Steill G.I, Bazarian J.J, Sadow K.E, Vu T.T, Camarca M.A, et al Clinical Decision Rule for Cranial Computed Tomography in Minor Peadiatrics Head Trauma. JAMA Peadiatrics 2008;162 439-445.

13. Rogers A.J, Maher C.O, Schunk J.E, Quayle K, Jacobs E, Lichenstein R, et al., Incidental Findings in Children With Blunt Head Trauma Evaluated with Cranial CT Scans. Pediatrics 2013;132 : 356-63.

14. Dietrich A.M, Bowman M.J, Ginn-Pease M.E, Kosnik E, King D.R. Peadiatric Head Injury: Can Clinical Factor Reliably Predict an Abnormality on Computed Tomography? Annals of Emergency Medicine. 1993;22:1535-40.

15. Ogbeide E, Isara A.R, Akhige A.O, Ighodaro E.O. Computerized Tomographic Findings in Children with Head Trauma in a Nigerian Tertiary Hospital. African Journals Online 2010;15: 2.

16. Udoh D.O and Adeyemo A.A. Traumatic Brain Injuries in Children: A Hospital Based Study in Nigeria. African Journal of Peadiatric Surgery 2013;2. 154-159.

17. Fundario C, Caldarelli M, Monaco S, Cota S, Giorgio V, Filoni S, Di Rocco C, Onesimo R. Brain CT Scan For Pediatric Minor Accidental Head Injury. An Italian Experience and Review of Literature. Pub Med 2012; 7:1063-8.