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Radiographic images study of skull injuries in children in two Nigerian tertiary hospitals

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Abstract

Context: Children skull injury is one of the most common types of trauma to the head, and epidemiological data available vary in the percentage and distribution of the occurrence in age groups and sexes.
Objectives: This study was to investigate the incidence of trauma in children skulls based on two tertiary hospitals records, the University of Calabar Teaching Hospital (UCTH) and the University of Uyo Teaching Hospital (UUTH) in two South-South States of Nigeria.
Study Design: Skull injuries in children of 0-13 years of age for a period of five years were studied. The incidence, etiology, age and sex distribution of children skull injuries were assessed.
Results: Of a total of 135 children diagnosed of head injuries, only 13 (9.6%) cases were actual skull injuries. The UUTH had a higher record (11 cases, 84.6%) of skull injuries, and the most common etiology were road/pedestrian accidents (30.8%). It was also observed that the older children (10-13 years) had the highest frequency of injury, with the females (61.5%) being the most affected, while the frontal bone (38.4%) and linear skull fracture (46.2%) were the most affected part and injury type, respectively.
Conclusion: The incidence of skull injury was low in the study period; however, other parameters conformed to already reported cases.

Key words: Skull injury, children, radiographic images, tertiary hospital, Nigeria

Introduction

Skull injury is a traumatic head injury that involves any break or fracture in the cranial bones, usually occurring as a result of blunt force trauma, and often accompanied with distortion of the vasculature of the skull/brain resulting in mild to severe brain injury.[1] This often leads to hematoma, alteration of mental status and disruption of the normal functions of the brain.[2] It is most common during road traffic accident as well as falls, with an estimated one million and six hundred thousand to three million and eight hundred thousand sport related injuries.[3,4]

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Skull injuries can be classified according to their presentation into linear, depressed, diastatic and basilar fractures among others (Figure 1). These skull injuries cut across ages, from infant to senescence. Infants are unique in that they are under the immediate care of adults and most injuries can be prevented by the individual attention of the responsible care giver. However, most infant skull traumas that occur in homes is attributed to lapses in attention, the presence of household hazards and enhanced mobility of older infants as they develop.[5] Non-domestic accidents that result in skull injuries in children such as accidental falls have been reported as the leading cause of skull injuries in children in some societies.[5,6] In other climes, the common cause of skull injuries in children is road traffic accident.[7] Other causes include childbirth

equipment (such as vacuum extractor and delivery forceps), sports, child abuse, and falls.[8] These injuries often lead to morbidity and disability during childhood.[5,6,7,8]

The skull is covered with a rich vascularised scalp and acts as a protective helmet for the delicate brain.[6] Immediate symptoms of skull injury that can indicate a fracture in the infant includes; swellings and tenderness around the impact area. Others include; facial bruising and bleeding from and around the eyes, nose and ears, as well as bruising, swelling and redness around the site of trauma. The post traumatic or systemic symptoms include; headache, nausea, vomiting and blurred vision.[8] The duration of these symptoms depend on the type and severity of the child skull injury.[9]

Skull injury in children depending on the impact on the skull at that particular time is a life threatening condition that has a high emotional, psychosocial and economic impact on the child and the society, and can lead to morbidity or mortality. The distribution of the occurrence of skull injury in children varies between studies, age groups and sexes.[8] Thus this study was to assess the incidence and types of children skull injury managed in two tertiary hospitals in South-South States of Nigeria from 2010-2014.

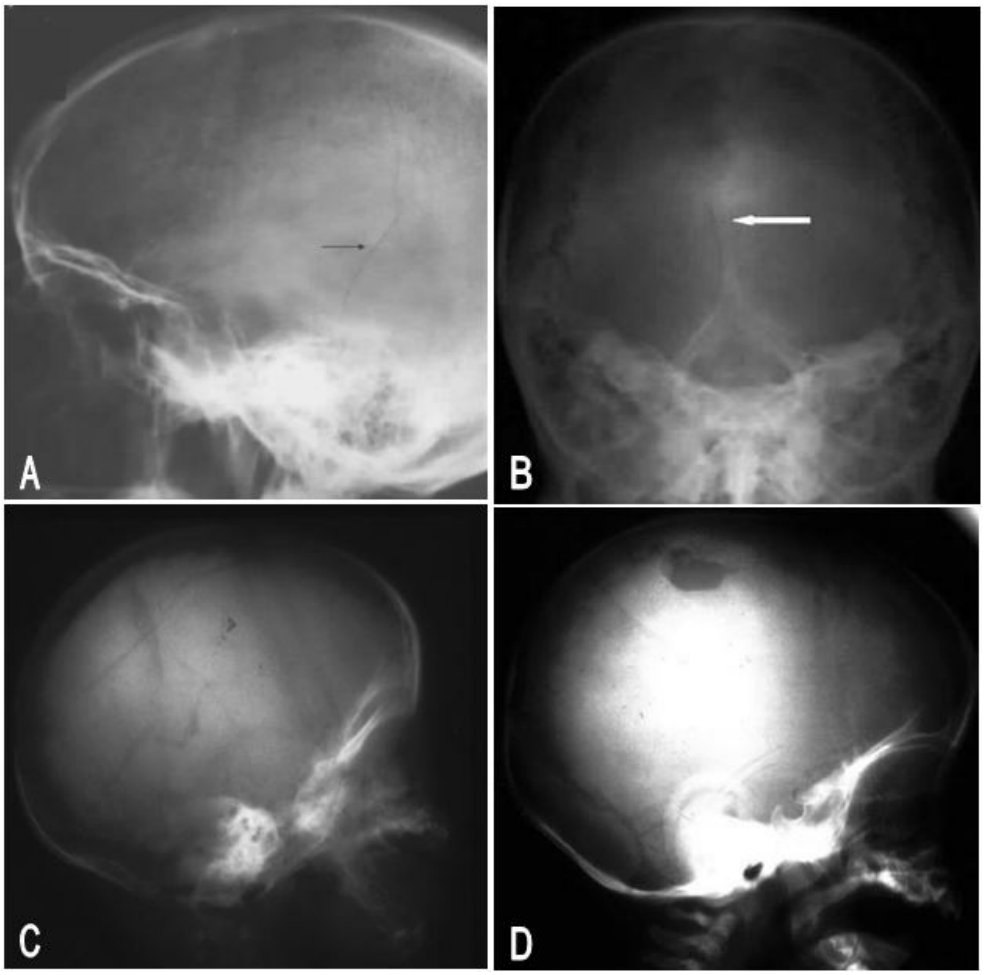

Figure 1: Skull radiographs

a. Lateral skull radiograph in a child showing a long, linear fracture running across the occipital bone. Note radiolucency and straightness and the lack of branches from it (arrow).
b. Plain radiograph of the head of an adult man showing a curvilinear shadow (arrow) indicating a depressed fracture.
c. Skull radiograph of a child with multiple fractures due to wrong used of delivery equipment show a diastatic fracture of the sagittal suture.
d. Lateral skull radiograph in a child with a growing fracture. (10).

Materials and methods

This was a retrospective study of skull injuries in children of age 0-13 years from January 1, 2010 to December 31, 2014 in two tertiary hospitals in Nigeria, the University of Calabar Teaching Hospital (UCTH) and the University of Uyo Teaching Hospital (UUTH). These two hospitals are located in two South-South (Akwa Ibom and Cross River) States of Nigeria.

The study was carried out on all patients between ages 0-13 years, who had been diagnosed of skull fracture in relation to head injury and had undergone a radiographic imaging of the head over a period of five years (2010-2014). Approval for this study was obtained.

The children skull radiographs were collected from filing cabinets of the X-ray units of the two hospitals. These were used to identify the etiologies and different forms of skull injuries in children. The ages and sex of the children were obtained from their records, and the incidence of skull injuries, ages and sex distributions in these children were determined.

Skull radiographs were assessed based on the following factors: skull fractures on the different regions of the skull, information on age, sex and types of head injury were obtained from patient's request forms, and registration log books respectively. Data obtained were tabulated and also presented as pie and bar charts, while their percentages were calculated.

RESULTS

A total of 135 children were diagnosed of head injury in the children emergency departments and were assessed for skull injury in the Radiology Departments of the two hospitals. Skull radiographs of 27 children were obtained from UCTH out of which only 2 (7.4%) skull radiographs were confirmed with skull injury. 108 children skull radiographs were obtained from UUTH out of which only 11 (10.2%) skull radiographs were confirmed with skull injury. Hence, a total of 13 (9.6%) skull radiographs presented positively with skull injury (Table 1).

In sex distribution of injury, it was observed that the occurrence of skull injury was more in females (8 cases, 61.5%) than in the male children (5 cases, 38.5%) in the study areas (Figure 2). In age distribution, it was observed that skull injury was low between the ages of 0-4 but increased equally at the age of 5-9 and 10-13 years (Figure 3).

It was also observed that road traffic vehicle/pedestrian accidents was the commonest cause of injury followed by fall, child abuse and wrong use of delivery equipment, respectively. Assault was the least frequent (Table 2).

Regional distribution of the 13 children with skull injuries showed that the part of the skull mostly affected was the frontal bone (38.4%), followed by occipital bone (21.3%); temporal bone (15.4%), facial bone (15.4%) and the parietal bone (7.7%), (Table 3). On the types of skull injury, of the 13 children that experience skull injuries from the radiographs it was observed that 46.1% of the children had linear skull fracture, 38.5% had depressed skull fracture, while only 1% of the children each had diastatic skull fracture and growing skull injury (Table 4).

Table 1: Number and percentage of cases sampled in UCTH and UUTH

Hospital	No. of children with skull injury	No. of children without skull injury	Percentage skull injury (%)
UCTH	2	25	7.4
UUTH	11	97	10.2
Total	13	122	

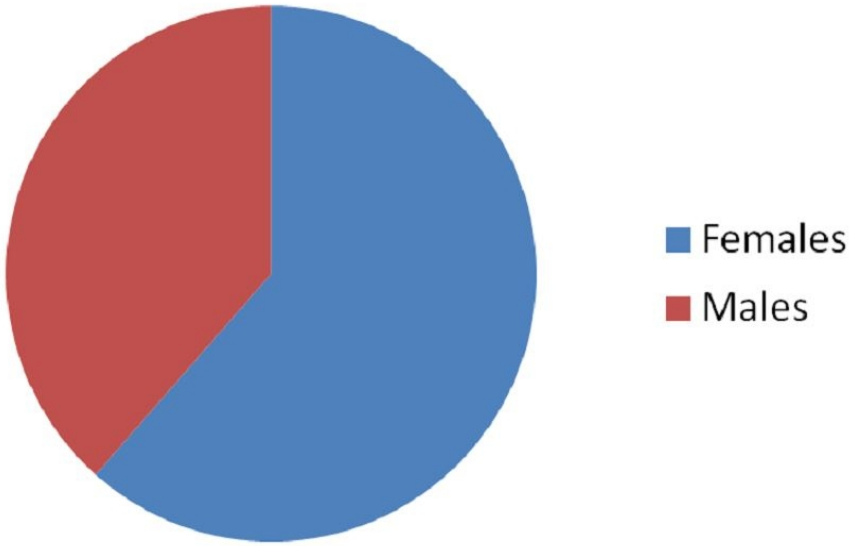

Figure 2: Sex distribution of skull injury

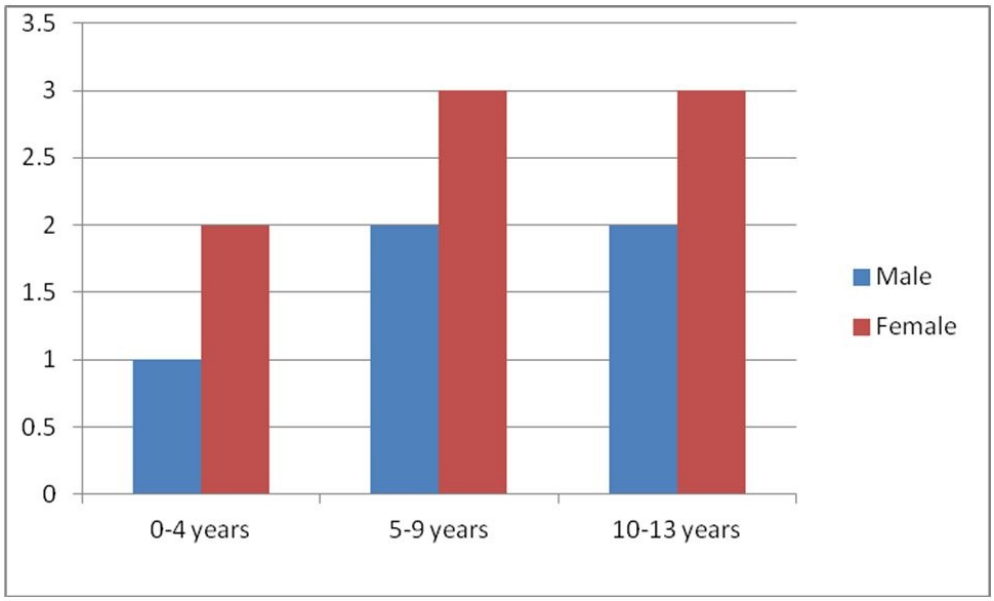

Figure 3: Age distribution of skull injury

Table 2: Clinical indications of skull injury as at when presented in the children emergency departments

Clinical	Frequency -ve	Percentage (%) -ve	Frequency +ve	Percentage +ve
Road traffic vehicle/pedestrian accidents	61	45.2	4	30.8
Fall	28	20.7	3	23.1
Child abuse	20	14.8	2	15.4
Wrong use of delivery forceps	12	8.9	2	15.4
Recreational activities	9	6.7	1	7.7
Assault	5	3.7	1	7.7
Total	135	100%	13	100%

Table 3: Regional distribution of skull injuries from calvaria to the base of the skull

Skull regions	Number of children	Percentage
Frontal bone	5	38.4
Occipital bone	3	23.1
Temporal bone	2	15.4
Facial/base of the skull	2	15.4
Parietal bone	1	7.7
Total	13	100

Table 4: Types of skull injuries indicated

Skull fracture type	Number of children	Percentage (%)
Linear skull fracture	6	46.2
Depressed skull fracture	5	38.5
Diastatic skull fracture	1	7.7
Growing skull fracture	1	7.7
Total	13	100

Discussion

Out of a sample population of 135, only 13 (9.6%) were positive cases of skull injury. This suggests that skull injury is not common in children in these South-South States of Nigeria. This is at variance with other parts of the world where there are high incidence.[10,11,12] Since the diagnosis were based on X-ray radiation, it is possible that some skull injury may have been missed because X-ray imaging is reported as not being most accurate for diagnosis of all skull fracture.[13,14] The limitations of X-ray may also allow for the possibility of persistent unfused suture lines giving false positive impression of skull fractures, and this may also account for the higher incidence reported in other parts of the world.

The incidence of skull injury was higher in the female than the male children where the females showed 8 out of 13 cases and the males showed 5 positive cases. This suggests that female children were more prone to skull injury than male children during the study period. Moore et al[15] reported that the wall of the cranial cavity varies in thickness in different regions and usually thinner in females than males, and are also thinner in children, which may have been a reason for the number of sex related cases in this study. However, Pinkett et al[6], Flavin et al[16], Iranmanesh[17] and Monese et al[18] reported a higher incidence of injury in males than in females in their studies.

Age distribution of skull injury showed a lower incidence in ages 0-4 years, and these were higher in age groups 5-9 and 10-13 years. The low incidence in ages 0-4 years may be attributed to the fact that children in this age group are usually under the care of parents and care givers, which reduces their exposure to injuries.[19] However, it is reported that several sutures and fontanelles of the skull remains membranous for a considerable period of time after birth, before fusion occur, which is usually within the first two years of age, although some suture still remains open at 5-7 years of age and even until adulthood.[20]

The presence of the fontanelles and sutures in ages 0-4 years allow for less resistance on impact that

would have produce fractures in adult. At 5-9 and 10-13 years most of the important fontanelles and sutures have fused, and there is also increased bone matrix resulting in thicker cranial cavity. This increasing thickness thereby reduces the resistivity of the child skull to traumas that can cause skull fracture. This also does not rule out the fact that children of these age groups tend to be more adventurous making them injury prone.[21,22] The present study is in agreement with Pinkett et al[6] and Monese et al[18] who reported similar results. However, our study is at variance with Greenes and Schutzman[23] and Shane and Fuchs[24] who reported the highest incidence of skull fractures and intracranial injuries in children aged under a year.

Road traffic/pedestrian accidents were the most common indication for skull injury among these children. Domestic accidents involving falls, as well as child abuse and wrong use of delivery equipment were less indicated for skull injury. This supports previous assertion that children tend to be more adventurous.[21,22] The commonest clinical indications are attributed to poor road traffic coordination awareness and high mobility of children in our environment. This disagrees with Helfer et al,[5] Pinkett et al,[6] Flavin et al,[16] Osmond et al,[11] and Monese et al,[18] who reported that the most common cause of skull injury in children in South Africa, Canada and the United State of America respectively, was due to falls, but agreed with Akang et al,[25] Adeolu et al,[7] Iranmanesh[17] and Chinda et al,[26] who reported pedestrian/motor vehicle accident as the leading cause of head injury in South-West and North-West regions of Nigeria, and other parts of the world. The reason for this difference in result may be due to the world demographic difference as well as society impact (developed versus developing countries).

Skull injuries as a result of head trauma represented 80% or more of the traumatic injuries leading to death in children older than a year in the United States of America.[9] In a prospective, multicenter study of 43,399 pediatric patients treated for head injuries in US emergency rooms, Quayle et al[1] found that the most common mechanisms of injury in the overall populations were the following: Falls from any distance (27%), fall while standing, walking or running (11%) collisions with a stationary object when walking or running (60%) motor crashes (90%). Fall were the most frequent cause of traumatic brain injury for children under age 12, whereas motor vehicle accidents, sport activity and assault were the most frequent cause of injuries in adults. Overall 98% of the head injuries were classified as mild.

Of all the regions of the skull, the frontal region was the most affected by the skull injury. This may be attributed to the mechanism of injury, the severity of, or the strength of the trauma on that region. In road traffic/pedestrian accidents the forehead is mostly affected, this is because any accident usually involves a fall or collision of the frontal region of the head. Dunning et al[2] reported that a fall of over 90 cm and motor/pedestrian accident usually lead to intracranial injury which may have been the case in the present study.

Most of the children skull injuries happened at homes as fall and has been attributed to lapses in the attention of care giver, the presence of household hazard and enhanced mobility of the older children as they grow.[5] Other attributed factors to skull injuries in children include, motor vehicle accidents, fall, assault, recreational activities, child abuse and wrong uses of child birth equipment.

Linear skull fracture was the most frequent skull injury type followed by depressed skull fracture, while diastatic and growing skull fractures were the least frequent. Linear skull fractures are commonly caused by a blunt force trauma where the impact energy is transferred over a wide area of the skull.[8,13] Our study is agreement with Ciurea et al[8] who reported linear skull fracture being highest of the injury type in pediatrics of 0-3 years.

Conclusion

In conclusion, the occurrence of skull injury in children in the study area/period was low. The skull injury affected more female children than males and was prevalent in ages 5-9 and 9-13 years, with the commonest injury site and type being the frontal region and linear skull fracture respectively. Road traffic/pedestrian accidents were the commonest etiology.

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