COMPUTERIZED TOMOGRAPHIC FINDINGS IN CHILDREN WITH HEAD TRAUMA IN A NIGERIAN TERTIARY HOSPITAL
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SUMMARY

Objective:
To describe the computerized tomographic findings in children with head trauma who presented at the University of Benin Teaching Hospital, Benin City, Nigeria.

Methods:
It is a retrospective review of patients aged 0 – 15 years with suspected intracranial injury (ICI) following head trauma, who presented for CT scan at the University of Benin Teaching Hospital, Benin City, Nigeria from October 2006 to September 2010. SPSS version 16 software was used for data analysis.

Results:
The CT films and reports of 88 patients which comprised 47 boys and 41 girls were reviewed. The mean age of the children was 6.9 ± 4.6 years. The most common mode of injury was road traffic accident (69.3%) followed by falls (22.7%). The specific abnormalities seen in these patients were fractures in 35 (76.1%), intracranial bleeds in 26 (56.5%), cerebral oedema in 3 (6.5%) while aerocele was seen in only one (0.2%) patient. The fractures were linear in 16 (45.7%), depressed in 10 (28.6%) and comminuted in 9 (25.7%) patients. Intracerebral bleeds were by far the most common intracranial bleeding occurring in 18 (69.2%) patients. Intracranial bleeding was associated with linear fractures in 47.0% of the patients and depressed fractures in 12.5%.

Conclusion:
Computed tomography is a valuable tool in the management of pediatric patients with head trauma in the acute setting. Caution must however be exercised in children because of their sensitive nature to the hazards of ionizing radiation.

Keywords: Computerized tomography, head trauma, intracranial injury, children.

INTRODUCTION

Head trauma is a significant cause of morbidity and mortality worldwide and poses significant public health problems. It is responsible for the majority of deaths following motor vehicle accidents. Specifically in children, physical, cognitive, emotional and social functioning may be affected.1

Cross sectional imaging is the mainstay of diagnosis in patients with head trauma with suspected intracranial injury (ICI). Although plain films may show the majority of skull fractures they are inadequate in the evaluation of the intracranial structures. Magnetic Resonance Imaging (MRI) is accurate in the evaluation of intracerebral trauma but it is not as readily available as computed tomography (CT) and may not be practicable in the acute setting. CT is now considered the most available gold standard for detection of intracranial injury.2 It has been suggested that children younger than two years of age have a greater risk of head injury following blunt
head trauma and that there should be a lower threshold for performing CT in younger children. In addition it has also been suggested that head injured children under the age of two years may present in a more subtle manner than their older counterparts. Computed tomographic scanning is a valuable tool in the evaluation of head trauma and it a more complete and consistent examination than conventional radiography. It provides a rapid, accurate means of diagnosis of various complications of head trauma and selection of those patients in which neurosurgical intervention will be of benefit. It has become more widely available over the last decade worldwide and with the advent of multislice CT, significantly reduced scan times are possible which is of great benefit in polytraumatized patients. This study of paediatric patients with head trauma documents our experience at the University of Benin Teaching Hospital with regards to causative factors, age and gender distribution and imaging findings on CT.

METHODS
A retrospective study of patients aged 0 – 15 years with suspected intracranial injury (ICI) following head trauma who presented for CT scan over a period of four years, from October 2006 to September 2010, was carried out. The study setting was the Radiology Department of the University of Benin Teaching Hospital (UBTH). The hospital is a tertiary health facility which serves as a referral centre especially for special radiological investigations like CT scans for the people of Edo State and other neighbouring States in the Southern part of Nigeria. Most of the patients were re-ferred from the Accident and Emergency Department of the hospital. Data reviewed were from the request forms, CT reports and CT films of the patients, and included age, sex, indication for the CT scan (mechanism of trauma) and the CT findings. The machine used for the scans was a Siemens 1998 Somatom ART. Slice thicknesses of 5 and 10 mm were used and patients were scanned in the supine position. The data were analyzed with the use of SPSS version 16 software programme.

RESULTS
Eighty eight patients aged 0 – 15 years were evaluated in this study. They comprised 47 boys and 41 girls giving a ratio of 1.15 boys to 1 girl. The mean age of the patients was 6.9 ± 4.6 years. Table 1 shows the ages of the patients and how they sustained the injuries. The most common mode of injury was road traffic accident (RTA) which constituted 69.3%, followed by falls (22.7%) and assault (6.8%). The mechanism of injury was not specified in one (1.1%) patient. Patients within the age group of 1 to 5 years were most commonly involved in head injury following RTA (37.7%) and falls (50.0%). Regarding the CT findings, in 42 (47.7%) patients no abnormalities were detected while in 46 (52.3%) there were abnormalities. As shown in table 2, the specific abnormalities seen in these patients were fractures in 35 (73.9%), intracranial bleeds in 25 (54.3%), cerebral oedema in 3 (6.5%) and aerocele in only one (0.2%) patient. Of all the patients with fractures, 16 (45.7%) also had intracranial bleeding. Fifty percent of the intracranial bleeding were associated with linear fractures while only 2 (12.5%) were associated with depressed fractures. Table 3 shows that 68.8% of the intracranial bleedings were intracerebral in nature.
### Table 1: Age distribution and mechanism of injury of the patients

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>RTA</th>
<th>Falls</th>
<th>Assault</th>
<th>Unspecified</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency (%)</td>
<td>Frequency (%)</td>
<td>Frequency (%)</td>
<td>Frequency (%)</td>
<td>Frequency (%)</td>
</tr>
<tr>
<td>Less than 1</td>
<td>1 (1.6)</td>
<td>3 (15.0)</td>
<td>0 (0.0)</td>
<td>1 (100)</td>
<td>5 (5.7)</td>
</tr>
<tr>
<td>1 – 5</td>
<td>23 (37.7)</td>
<td>10 (50.0)</td>
<td>3 (50.0)</td>
<td>0 (0.0)</td>
<td>36 (40.9)</td>
</tr>
<tr>
<td>6 – 10</td>
<td>15 (24.6)</td>
<td>3 (15.0)</td>
<td>3 (50.0)</td>
<td>0 (0.0)</td>
<td>21 (23.9)</td>
</tr>
<tr>
<td>11 – 15</td>
<td>22 (25.0)</td>
<td>4 (20.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>26 (29.5)</td>
</tr>
<tr>
<td>Total</td>
<td>61 (69.3)</td>
<td>20 (22.7)</td>
<td>6 (6.8)</td>
<td>1 (1.1)</td>
<td>88 (100)</td>
</tr>
</tbody>
</table>

### Table 2: Specific CT abnormalities in the patients*

<table>
<thead>
<tr>
<th>Abnormality</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fracture</td>
<td>34</td>
<td>73.9</td>
</tr>
<tr>
<td>Intracranial bleeds</td>
<td>25</td>
<td>54.3</td>
</tr>
<tr>
<td>Oedema</td>
<td>3</td>
<td>6.5</td>
</tr>
<tr>
<td>Fracture and aerocele</td>
<td>1</td>
<td>2.2</td>
</tr>
</tbody>
</table>

*Some patients had more than one abnormal CT finding.

### Table 3: Type of fracture and associated intracranial bleeding

<table>
<thead>
<tr>
<th>Fracture</th>
<th>Intracerebral Frequency (%)</th>
<th>Epidural Frequency (%)</th>
<th>Subdural Frequency (%)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear</td>
<td>5 (45.5)</td>
<td>2 (100)</td>
<td>1 (33.3)</td>
<td>8 (50.0)</td>
</tr>
<tr>
<td>Comminuted</td>
<td>4 (36.3)</td>
<td>0 (0.0)</td>
<td>2 (66.7)</td>
<td>6 (37.5)</td>
</tr>
<tr>
<td>Depressed</td>
<td>2 (18.2)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>2 (12.5)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>11 (68.8)</strong></td>
<td><strong>2 (12.5)</strong></td>
<td><strong>3 (18.8)</strong></td>
<td><strong>16 (100)</strong></td>
</tr>
</tbody>
</table>
Figure 1: Unenhanced axial CT scan bone window level in a patient with RTA shows a linear fracture in the left occipital region

Figure 2: Depressed left frontal fracture with associated intracerebral hemorrhage
DISCUSSION
The utilization of CT scanning in the management of head injury has steadily increased over time. In the acute setting in cases of suspected intracranial injury CT is an established means of diagnostic evaluation. Studies have attempted to establish criteria for selection of pediatric patients with head trauma who should undergo imaging.6-9 The use of such criteria may reduce unnecessary CT exposure and by extension decrease radiation dose in the paediatric population and reduce cost. There is significant associated radiation risk, an order of magnitude higher than for adults, of radiation-attributable cancer from a CT in a one-year old child.10 The goals of imaging in those selected include identification of patients who require neurosurgical intervention and follow up in some cases to detect post traumatic complications.

The ratio of boys to girls of 1.15: 1 in our study is at variance with studies of head trauma in adult populations, the trend in adults being towards somewhat higher male to female ratios. A study in Eritrea11 documented male: female ratio of 3:1 and attributed this to males being more active than their female counterparts. Atabaki et al7 in their study of minor pediatric head trauma had 64.1% males which is similar to our series in which 53.4% were males. We opine that the closer gender ratio in the paediatric age group could be attributed to similar levels of activity and predisposition to the causative factors of head trauma in both sexes.

Head trauma is responsible for the majority of deaths following motor vehicle accidents.12 RTA was the most common mechanism of injury in our study. This is in keeping with other African studies on traumatic head injury in childhood.13,14 Bahloul et al13 in Tunisia and Obajimi et al14 in Ghana also found RTA as the most common causative mechanism. A recent study in Nigeria however found equal incidence of RTA and falls.15 The high incidence of RTA related head trauma in this study calls for an urgent review and strict enforcement of traffic laws in Nigeria as has been previously stated.15 Fractures were the most common abnormality found in this study, with the linear variety being the most frequent. Clinical or radiological evidence of skull fracture significantly increases the risk of intracranial injury. In head trauma, the absence of skull fracture does not preclude significant intracranial pathology. Rather, significant finding on neurologic examination is the major indicator of intracranial injury.2 It is noteworthy that the prevalence of intracranial injury in neurologically normal children is 3% to 7%.16 The findings in this study revealed that some children with skull fractures did not have intracranial pathology while conversely some with intracranial lesions had no evidence of fracture. Erlichman et al17 found the presence of a linear fracture an independent risk factor for intracranial haemorrhage, although the haemorrhages were small and neurosurgical intervention was not required. A rare complication of a linear fracture may occur when a leptomeningeal cyst or the so called growing fracture develops.18,19 In such cases a calvarial defect develops and neurologic complications, especially seizures, may occur.18,19

In conclusion, computerized tomography is an established, important tool in the management of paediatric patients with head trauma in the acute setting enabling diagnosis of intracranial injury. However it must be used judiciously because of the particularly sensitive nature of these patients to the hazards of ionizing radiation. The review of road traffic laws and stringent enforcement of existing ones due to the high incidence of RTA related head trauma cases in this series is recommended. Also, development of clinical parameters which will...
serve as predictors of intracranial pathology in mild head injury and thus eliminate needless use of head CT in children and by extension the attendant risk of ionizing radiation should be encouraged in our setting.

REFERENCES

