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RESEARCH ARTICLE

Closed Head Injury in Childhood: Experience at a Tertiary Centre in North Central Nigeria

Blessure à la Tête Fermée Pendant l'Enfance: Expérience dans un Centre Tertiaire du Centre-Nord du Nigéria

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ABSTRACT

BACKGROUND: **Closed head injury (CHI), occurs commonly in childhood, which when trivial may not be associated with brain injury or long-term sequelae. A small number of children who appear to be at low risk in minor head trauma may have a clinically important traumatic brain injury (ciTBI) with associated mortality and morbidity**

OBJECTIVE: **To determine the pattern of management procedures and outcomes of CHI in children in a resource-limited centre in north central Nigeria.**

METHODS: **This was a five-year retrospective review of 104 children admitted with closed head injured at the Bingham University Teaching Hospital (BhUTH) Jos, North Central Nigeria from 2013 to 2018. Using the patient records, data extracted for analysis included patient demographics, indication for admission and management outcome.**

RESULTS: **One hundred and six children were admitted during the period, of these 104 had sufficient data for analysis. Of the 104 children 83(79.8%) were boys. The commonest cause of closed head injury was road traffic accident accounting for 78.8% of the cases. Eighty-six (82.7%) got well and were discharged home. Seven children died, giving a case fatality rate of 6.7%.**

CONCLUSION: **With dedication and commitment to qualitative health care even in a low-resource setting in a developing country, satisfactory outcomes in management of CHI in the child are achievable. BJM 2020; 2(1): 22–26.**

Keywords: **Childhood, closed head injury, traumatic brain injury, Glasgow coma scale, road traffic accident, Jos, Nigeria.**

ABSTRAIT

CONTEXTE: Les traumatismes crâniens fermés (CHI), surviennent fréquemment dans l'enfance, qui, lorsqu'ils sont insignifiants, peuvent ne pas être associés à des lésions cérébrales ou à des séquelles à long terme. Un petit nombre d'enfants qui semblent présenter un faible risque de traumatisme crânien mineur peut avoir un traumatisme crânien (CITI) cliniquement important avec mortalité et morbidité associées.

OBJECTIF: Déterminer le modèle des procédures de gestion et les résultats des CHI chez les enfants dans un centre aux ressources limitées du centre-nord du Nigeria.

MÉTHODES: Il s'agissait d'un examen rétrospectif de cinq ans de 104 enfants admis avec une tête fermée blessée à l'hôpital universitaire de Bingham (BhUTH) Jos, centre-nord du Nigéria de 2013 à 2018. indication de l'admission et résultat de la prise en charge

RÉSULTATS: Cent six enfants ont été admis au cours de la période, dont 104 disposaient de données suffisantes pour l'analyse. Sur les 104 enfants, 83 (79,8%) étaient des garçons. La cause la plus fréquente de traumatisme crânien fermé était un accident de la route représentant 78,8% des cas. Quatre-vingt-six (82,7%) se sont rétablis et ont été renvoyés chez eux. Sept enfants sont décédés, soit un taux de létalité de 6,7%.

CONCLUSION: Avec un dévouement et un engagement envers des soins de santé de qualité, même dans un environnement à faibles ressources dans un pays en développement, des résultats satisfaisants dans la prise en charge de l'ICS chez l'enfant sont réalisables. **BJM 2020; 2(1): 22–26.**

Mots clés: L'enfance, traumatismes crâniens fermés, traumatismes crânien, échelle du coma de Glasgow, accident de la route, Jos, Nigéria.

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Abbreviations: BhUTH, Bingham University Teaching Hospital; **CSF,** Cerebrospinal Fluid; **CHI,** Closed Head Injury; **ciTBI**, clinically important Traumatic Brain Injury; **DAI,** Diffuse Axonal Injury; **EPU,** Emergency Paediatric Unit; **ICP,** Intracranial Pressure; **SCBU;** Special Care Baby Unit.

INTRODUCTION

Closed Head Injury (CHI), even in its mild form when it is known as mild traumatic brain injury (mTBI) occurs commonly in childhood and can be devastating; it is the single most common cause of death from childhood trauma.[1–3] Minor head trauma in children is usually not associated with brain injury or long-term sequelae, yet mTBI can be symptomatic such as brief loss of consciousness, or disorientation. The apparent minor head trauma in children of about two years who are alert or awaken to voice or light touch may actually conceal a more severe brain injury.[1–5] Some of the common patterns of CHI include concussion, contusion, and diffuse axonal injury (in which children could be totally asymptomatic in the lucid phase).[6]

Usually CHI results from blows to the head and occurs frequently in traffic accidents, minor falls or falls from height, assaults in sports as in boxing or inflicted injury or battery in children as in child abuse. Skull and dura mater are intact such as are found in a concussion, intracranial haematoma, and coup-contre coup injuries.

Brain injuries can range in scope from mild to moderate and severe. A trauma to the head with a Glasgow Coma Score (GCS) of 13–15 has a mild head injury, whereas moderate brain injury results in a loss of consciousness from 20 minutes to 6 hours with a Glasgow Coma Scale of 9 to 12; A GCS of ≤ 9 is found in most unconscious CHI of the child; being then severe.[6 8]

A study at the Jos University Teaching Hospital reported that 786 cases of head injury occurred between 2010 and 2013, translating into an average of 197 cases per year, 83% being males.[6 7] The same study found that 1 out of every 5 reported cases resulted in death and that road traffic accidents accounted for more than three quarters of all cases seen.

The objective of this paper was to determine the incidence of CHIs and the outcome of management in a hospital with limited resources .

METHODS

This was a 60-month retrospective study of children hospitalized in BhUTH with CHI, from February, 2013 to October, 2018. BhUTH is a 300-bed hospital with 20-beds in the male surgical ward, 12-female surgical beds and 12-beds in the paediatric surgical ward shared by physician. and surgeons. The facility is located in North Central Nigeria and receives referrals from North Eastern, North Western and parts of South Eastern Nigeria with occasional referrals from the South Western part of Nigeria. Its Accident and Emergency Unit with four cubicles and facilities for emergency interventions and the EPU handle all paediatric emergencies inclusive of and especially the CHI of the child.

All the children whose parents consented and who had CHI during the period of review from any type of trauma and alive were studied. We defined a child using the World Health Organisation definition as "a young human being below the age of puberty - 18 years – or below the legal age of maturity". A patient with head injury and a Glasgow Coma Score (GCS) of ≥ 13 was presumed to have a mild head injury.

Patients with penetrating head injuries or open head injuries or those older than 18 years were excluded and referred to other tertiary centers in Jos.

Management and Procedures

This study population consisted of 4 neonates, 16 infants, 12 toddlers, one was a child of 17 years. 72 were pupils. All were examined, admitted and managed as appropriate.

A patient who had Glasgow Coma Score (GCS) of ≥ 13 had a mild head injury following trauma to the head and could be discharged home the same day with the proviso that the child was returned to the A & E or EPU if there wasa recurrence of headaches or vomiting. The red flags and symptoms of headaches, vomiting, somnolence and frank loss of consciousness at any time and GCS < 9 on arrival at the A & E indicated more severe brain injury.[1]

All admitted patients were managed conservatively after initial examination and if need for ward management was established.

We did not include children who had brain injury or skull opening. The initial evaluation of CHI patient followed the guidelines of advanced trauma life support (ATLS). The first three elements of the ABCD of ATLS resuscitation – airway, breathing, and circulation – were assessed and patient was stabilized. Management was along our guidelines, algorithm and protocol used for conservative management of the child with CHI as well as those by Unden and colleagues, which have been modified for management of children with CHI.[1,9,10] See Figure 2.

Patients who could not follow commands were given intubation for airway protection, ventilatory control and protection from aspiration of vomitus.

The fourth element, assessment of "D," for disability, was undertaken next. Motor activity, speech, and eye opening were assessed repeatedly, and GCS, obtained within the first 6–8 hours after injury was used to assess state of consciousness. See Table 1.

All unconscious patients were assigned GCS of ≤ 9 and managed in the EPU We stabilized the cervical spines as for a polytraumatized patient, passed NG-tubes as carefully as possible for control of vomiting and early GIT- alimentation, created two wide bore iv-lines for necessary parental fluids and electrolyte balance and replacement and passed a bladder catheter to monitor exact urine output. The patients were given iv frusemide, mannitol(R), and phenobarbital(R) according to worked-out APLS - formula for age and body weight of children.

Patients who were admitted initially with GCS ≥ 13 were at retriage asked to say their names such as "tell me your name". If they answered promptly and correctly, we knew patient was oriented to time, place and person and were discharged home. Repeated triaging of the admitted patients was continued, such that if patient became less visually or verbally responsive, peripheral blood perfusion was determined by pulse-oximetry on previously warmed phalanges several periods. Any new external signs of head injury, which were missed at outset or had now become manifest, indicated that the skull may have been broken and dura breeched.

Pain was not a major feature as only mild recurrent headaches occurred relatively frequently necessitating the use of acetaminophen. Some patients

presented with altered mental status and transient loss of consciousness. Memory difficulties, especially amnesia of the event, became common on day 1 or 2 of admission, which were not initially present. Without CT-Scan/MRI facility, we were not able to investigate for diffuse axonal injury (DAI) as caused by damage to axons throughout the brain, resulting from rotational acceleration and then deceleration.[13]

Laboratory investigations were performed as indicated. Presence of malaria parasites was regularly examined for and treated if present. Damage by the primary injury, which caused signs of increased intra-cranial pressure (ICP) like lateralizing signs, pupillary reactions, papilledema and vomiting, were closely looked for. Since intra cranial pressure (ICP) is directly proportional to the sum of mean arterial pressure (MAP) and cerebral perfusion pressure (CPP); MAP was easily calculable, which if it was raised, the ICP would also rise.

We calculated cerebral perfusion pressure (CPP) which depends on the mean systemic arterial pressure (MAP) and ICP, as follows: MAP – ICP = CPP where MAP = (1/3 systolic BP) + (2/3 diastolic BP). As ICP is directly proportional to the sum of MAP and CPP, we therefore put our clients on medications and physiotherapy to reduce ICP once we noted raised MAP. The upper body and head of patients were raised with 2 pillows, about 30 degrees, to forestall increase in intracranial pressures,[13–15] Raised ICP was reduced using Mannitol® as indicated for its osmotic diuresis. Patients regained consciousness after these measures. We abstained from using steroids.

We found most common cause of fever to be secondary to an underlying infection and so treated fever bouts and malaria with regular antibiotics, anti-pyretics and anti-malarial drugs. We routinely gave prophylactic anti-convulsants early to prevent intracranial hemorrhages however for less than seven days.

Statistical Analysis

The retrieved data were collected and analyzed using Statistical Package for Social Sciences software version 22.0.

Ethical Considerations

Written informed consent from parents/guardians was secured for every child. Ethical approval was obtained from the Human Health Research Ethics Committee of Bingham University Teaching Hospital, Jos.

RESULTS

We admitted 106 children with CHI for management; two of them had incomplete data for analysis. Of the remaining 104, 83(79.8%) were males. The mean (range) age was 1.9(0.3–14 years. We recorded a case fatality of 7 (6.7%) of the remaining 104 children. 11 children (10.6%) left the study for various reasons. The largest group of patients was in the age-bracket of 6 to 10 years followed by the age group of 0 to 5 years. See Table 2.

Cause of Head Injury

As shown in Figure 2, pedestrian road traffic accident (77.4%) predominated as the cause of the head injury in the children; this was followed by falls from trees (4.7%).

Outcome of Hospitalisation

Of all those admitted, 86(82.7%) were discharged home while 11(10.8%) left the study. The case fatality was 7(6.7%). The length of hospital stay ranged from 1 40 hours. Table 3 shows a summary of the treatment outcomes foe our patients.

DISCUSSION

Pedestrian RTA accounted for the greater portion of accidents in this study which is in keeping with reports from other centres.[2] The mortality rate in our study of 6.7% which differs from some other reports[1,5,7] is similar to the study of Udoh and Adejumo in Benin City where 11 (8.7%) children died. In another report one out of every five CHI cases was due to RTA which accounted for or more than three quarters (75%) of all cases seen.[7]

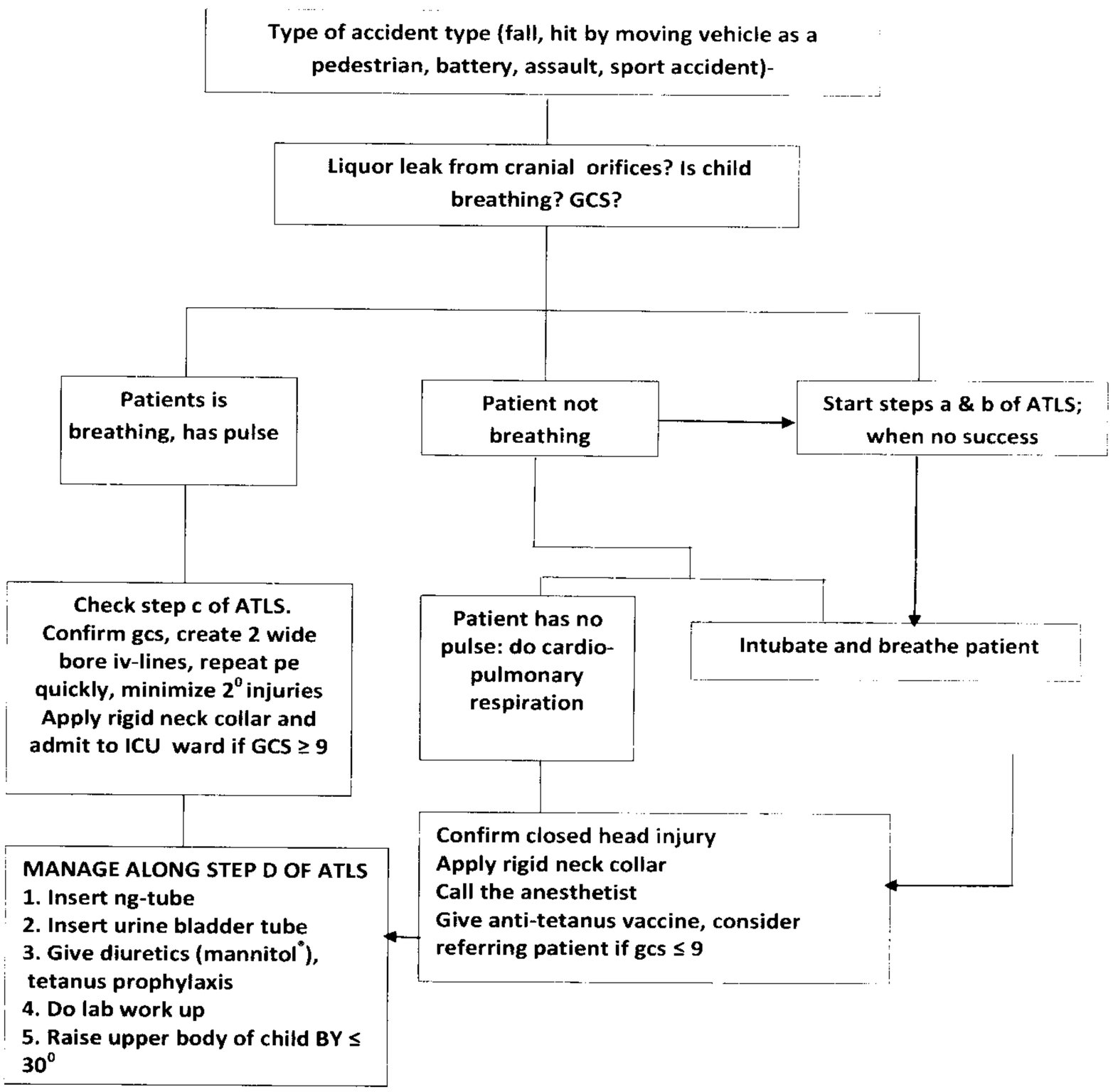

Fig. 1: Protocol, Algorithm, and Guidelines for Management of a Child with a Closed Head Injury.

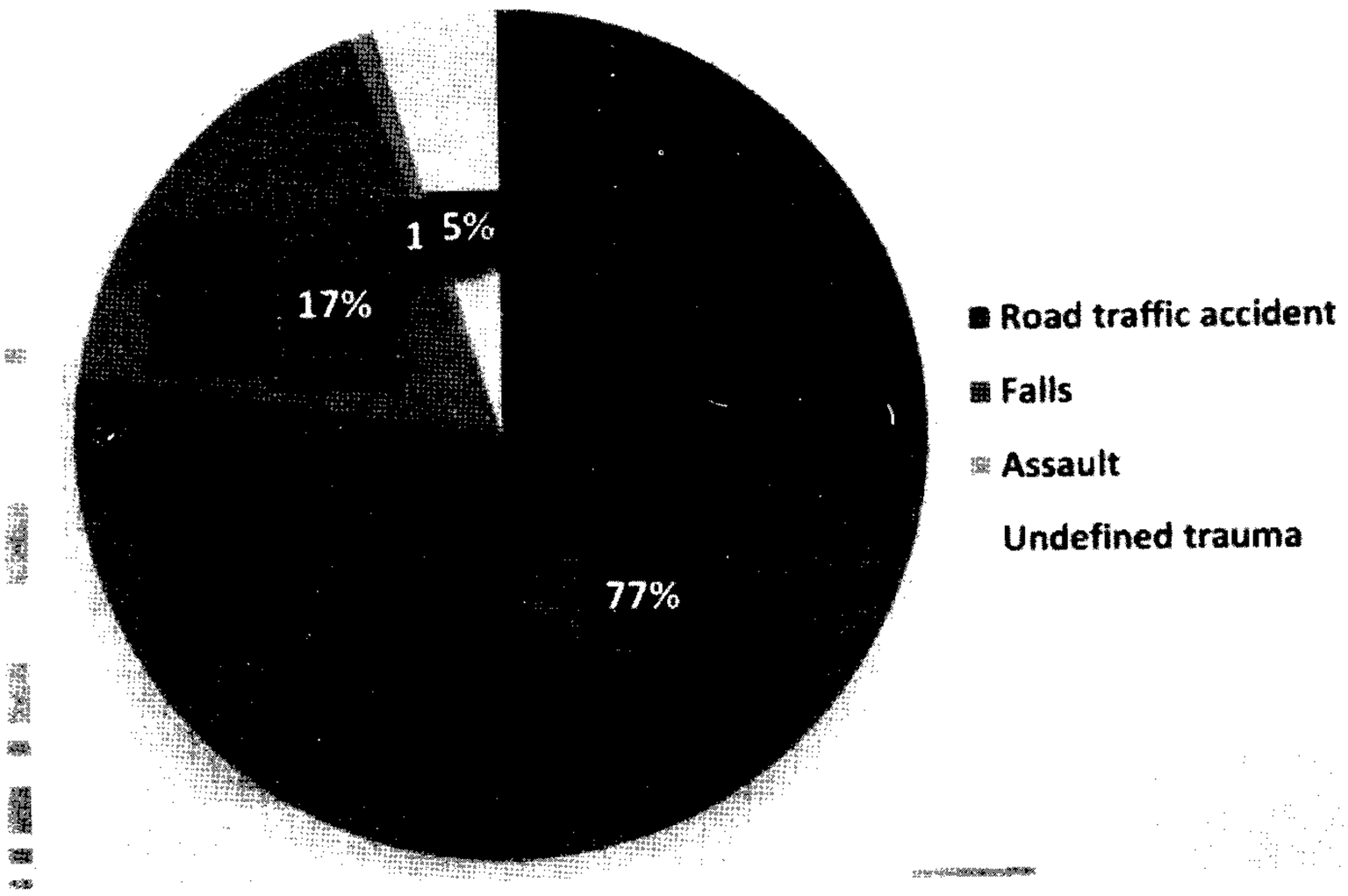

Fig. 2: Aetiology of Closed Head Injury in 106 Children. The Large Majority was Pedestrian Road Traffic Accidents followed distantly by Falls from Trees.

Table 1: Definition of Severity of Head Injury Using Glasgow Coma Scale

Severity	Glasgow Coma e Scal	Post Traumatic Amnesia	Loss of Consciousness
Mild	13 - 15	< 24 hours	0 – 30 Minutes
Moderate	9 – 12	2 6 days	30 min – <24 h
Severe	3 8	> 7 days	>24 h

Table 2: Distribution of Study Participants by Age

Age Group (years)	Number (%)		
	All	Males	Females
0 – 5	36 (34.7)	27 (26)	9 (8.7)
6 - 10	46 (44.2)	38 (36.5)	8 (7.7)
10 - 14	22 (21.1)	18 (17.3)	4 (3.8)
Total	**104(100)**	**83 (79.8)**	**21(19.2)**

Many of the poor outcomes described in the literature were averted in our study by preventing the secondary insults that typically occur following traumatic brain injury.[15, 16] In doing so, the severity of injuries was minimized. Interestingly, young and pre-school children had worse outcomes both in mortality and long-term disability than older adolescents in the study from Benin.[17]

Our study, as well as others[2] show that the 6 10-year age group, which represents the school age group that walk mostly to school has the highest rate of pedestrian road traffic accidents. Many African urban children commute to school on foot, are involved in street hawking and street sides shops and thereby get more involved in pedestrian road traffic accidents.[24]

Measurable deficits are reported to occur even after mild to moderate head injury but are markedly greater after severe injury and are said to include chronic headaches, impaired memory and cognition, language difficulties, motor impairments, disruption of attention and information processing Our study was short on these deficits measurable only after long controls. Only headaches, treated by self-medication were locularly reported, which parents thought of as not worth to present for hospital care Those patients with initial GCS 8 are reported to have good long-term outcomes, while those with initial GCS 8 have high morbidity and case mortality

In this study, we used the definition of minor head trauma in previously healthy neonate and older children as CHI with GCS of between 13 15 at the initial physical examination, in contradistinction to the team in Benin City. These children did generally well within a few days of management as asserted by parents guardians after discharge home and confirmed by their improved states of health at return to the children's SOP clinic. They had reportedly returned to school and coped well with their classmates in academic work and sports. Our study was short on long-term disability control which offers a wide area for research.

The strength of this study was the ability of the small clinical Staff, in a staff to children ratio of about 2:9, to manage such a number of patients well with only locally developed neuro-surgical protocols and had case fatality rates similar to those of well established centres where better diagnostic tools and neurosurgeons and specially trained nursing staff were available. Even though the non-availability of radio-diagnostic equipment, CT-Scan MRI, was thought of as a handicap, their absence did not seem to have impacted our results.

Our data have shown that reasonably good results of management of CHI of the child can be achieved in a resource- limited setting when previously well drawn up protocols of neurosurgical management by experts are adhered to. Policy makers should work with children's social workers to find out what more can still be done to reduce pedestrian vehicular road traffic accidents of these young earthlings.

The health burden of CHI on parents and health workers is too heavy to be left on the hands of any of the group of workers alone no matter how well trained. Not even a good ratio of staff strength to

patient numbers could sufficiently reduce this burden. Parents and guardians must be equally involved in initiatives aimed at reducing pedestrian RTA and injuries.

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Duality of Interest

None.

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