MAR Neurology, Neurosurgery & Psychology (2023) 7:3
Research Article

Traumatic Brain Injury in Sudanese Pediatric Population, the Sole Centre Experience.

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Received: 04 September 2023

Published: 15 September 2023

DOI:10.1027/marne.2023.0256

Abstract

***Introduction**: traumatic brain injury represents one of the common causes of morbidity and mortality in the different age groups of populations in the modern communities. the motor vehicles accidents, assaults, sport and falls from heights represent the most common causes.*

***Methods:** This is both demographic and descriptive study of Sudanese children in the age group from one day to 18 years who presented to our ER in Khartoum and Alshaab teaching hospitals, representing the only tertiary neurosurgical hospital in Sudan, the study period extended from January 20th 2000 to March 8th,2008. All patients with traumatic brain injuries, who were admitted to that center were included in the study. Special data form was filled for each patient containing the demographic and clinical data. Follow up till discharge of the patient, and in the referred clinics was the rule.*

All data were transferred to special SPSS sheet and the results which were analyzed.

***Results**: 228 patients were included in the study, their mean age was 10.73 years, with median age 12.00 years, the sex was predominated by males representing 80%, The most common type of trauma noticed was motor Vehicle accident in (46.1%) while assaults came in the second place in (22.4%). Falls from heights came next (21.1%), other modes of trauma like fall of heavy objects on the patient head (4.8%), sport in (2.2%), other unspecified types of trauma were also encountered (3.5%).*

The neurological clinical presentation was headache in. (34.6%), vomiting in (27.2%), extremities Weakness in (19.3%), neck pain in (14%), fever in (12.7%), seizures in (11.8%) and mental change in (10.1%), while scalp wounds were present in (44.7%) of the patients.

The investigations used in diagnosis were plain X ray and Ct scan in 82% and 59.6% respectively, Plain x rays were performed for 177 patients (82%) of them (61.4%) have normal plain x ray, while (11%) have fissure fractures , (8.8%) have depressed fractures, while the main lesions encountered in CT were fractures in (8.8%), parenchymatous lesion like cerebral contusion were encountered in (6.1%), followed by edema and hemorrhage each in (4.4%), some patients 29 patient (12.7%) were requested to do CT brain but they did not show.

207 patients (90.8%) were managed conservatively, while 22 patients (9.2%) were treated surgically. The operations performed were elevation of depressed fractures, burr hole evacuation of subdural hematomas, craniotomies, or debridement for scalp wounds.

GCS was utilized for assessment of the outcome, the result was mild disturbance with GCS 15 -13 in (91.7%), moderate disturbance with GCS 12 -9 (3.9%), severe disturbance with GCS less than 9 in (4.4%). the final outcome achieved was cure without any residual neurological dysfunction in (42.6%), improvement in neurological status of the patient with some residual neurological dysfunction in (53.9%) and death of 8 patients (3.5%).

Conclusions

1. Traumatic brain injuries affecting pediatric population is a serious condition that must draw the attention.

2. In most instances these injuries are preventable if the preventive measures were initiated and followed.

3. The role of CT and Palin X ray in diagnosis is important but strict guidelines are needed.

5. The role of conservative management and follow up is predominating, but surgical conditions should not be missed.

6. Early management of those conditions is associated with better outcome,

7. The outcome in these conditions is favorable if adequate care is provided.

Key words: Traumatic brain injury, Sudanese children, Head injury, Head trauma, Motor vehicle accidents, Assaults.

Introduction

Pediatric traumatic brain injury (TBI) causes substantial morbidity and mortality. Disability following pediatric neurotrauma is common, with a profound impact on functional long- term outcomes [1, 2].

Over 500,000 children suffer traumatic brain injury each year in the United States, resulting in more than 35,000 hospitalizations and greater than 2,000 deaths[3], and up to 2,685 children with (TBI) per year don't survive their sustained injuries[4]. In developed countries, (TBI) is one of the most common reasons for presentation to the emergency department [5].

Injury patterns due to (TBI) vary by age. In infants, in a rear-facing child-safety seat, the resultant injury causes skull fractures, brain contusion, and hemorrhage, whereas in a forward-facing front-seat, child injuries are not just confined to the cranium, and additional fractures or ligamentous injuries of the cervical spine are common[6]. Falls are the primary mechanism of TBI presented to emergency departments in children below 4 years. In school-age children, falls decrease with age, with a rise in bicycle accidents [7]. In adolescents, there is a dramatic rise in TBI due to motor vehicle accidents, sports-related injuries, and violence [8, 9].

The distribution of damage after TBI may be focal or diffuse. Focal injury is produced by direct impact forces acting on the skull, resulting in compression of brain tissue at the site of impact (coup) or opposite the site of impact (contrecoup). Focal injuries may cause parenchymal contusions, intraparenchymal hemorrhage, subdural and epidural hematomas, and subarachnoid hemorrhage. Diffuse injuries are more widely distributed, involving the axons and/or vascular structures, and can be associated with hypoxic ischemic injury and cerebral edema. It is typically caused by rapid acceleration-deceleration movements of the head. Diffuse axonal injury is caused by widespread insult to cerebral white matter and may result in prolonged loss of consciousness [10].

Following TBI, 10-15% children are classified as severe with an associated mortality rate of 50%[11]. TBI severity has classically been defined by using the Glasgow Coma Scale (GCS)[12] or Pediatric GCS on admission[13]. A GCS of 13 to 15 is considered mild TBI, 9 to 12 is considered moderate; and GCS less than 9 is considered severe. Frequent repeated assessments of the patient's neurologic examination and GCS are fundamental to understanding the severity and progression of illness, and to guide clinical management[8].

Diagnostic strategies for pediatric traumatic brain injury include clinical assessment, clinical decision rules, skull radiography, CT scanning and biochemical markers[14].

The initial assessment and management of patients with severe head trauma according to the ATLS principles is based on physiologic stabilization rather than treating a definitive diagnosis. A detailed history is not essential to begin the evaluation of a patient with acute injuries and focused information should be collected on patient's Allergy, Medications, relevant Past medical history, Last meal and characteristics of the traumatic Event (AMPLE)[15].

The ABCD approach is essential to provide timely treatment of hypoxia and hypotension in order to prevent ischemia-related secondary brain injury in patients with traumatic brain injury. In the absence of coexisting penetrating injuries blood pressure should be maintained at normal age-based values to ensure good cerebral perfusion[15, 16].

Assessment of the neurologic status (D) includes a careful evaluation of the patient's level of consciousness using the Glasgow Coma Scale (GCS), the assessment of pupillary size and reaction, lateralizing signs and spinal cord injury level. The GCS, with its pediatric version for preverbal children, is predictive of patient outcome, particularly the best motor response [17].

Computed Tomography (CT) scanning of the head, performed after respiratory and hemodynamic stabilization of the injured patient, is the diagnostic tool of choice in the acute phase of managing moderate and severe traumatic brain injury (TBI)[18]. The CT scan serves primarily to detect life-threatening abnormalities requiring urgent neurosurgical intervention due to its ease of access, rapid acquisition and for its sensitivity for detection of acute hemorrhagic lesions for surgical intervention, and it can be used to decide whether to monitor intracranial pressure (ICP) in the pediatric intensive care unit (PICU). MRI is typically reserved for the detection of lesions that may explain clinical symptoms that remain unresolved despite initial CT. This is especially apparent in the setting of diffuse axonal injury, which is poorly discerned on CT[19].

Glasgow coma score, brain CT findings, combined brain pathologies, hypotension, high liver enzymes and low serum albumin significantly predict outcome after TBI in this pediatric age group[20].

Aims of the study

The aims of this study are:

To study the pattern of traumatic brain injury in Sudanese children presented in the study area and during study period.

To evaluate the medical and surgical services offered to the patients.

To study and evaluate the outcome.

To study any deficiencies or shortenings faced during the study.

To put recommendations to improve those services.

Methodology

The study is both demographic and descriptive study of Sudanese children in the age group from one day to 18 years who present to our emergency room (ER) in Khartoum and Alshaab teaching hospitals, representing the only neurosurgical tertiary hospital to which serios patients with traumatic brain injuries are referred during the study period from January 20th 2000 to March 8th,2008.

All patients with traumatic brain injuries who were admitted to that center were included in the study.

Special data form was filled for each patient with the demographic and clinical data by the presenting residents and then revised or corrected by the consultant (One of the authors of this paper) within 24 hours of the child presentation.

Follow up was made by the consultant in the ward or ICU or after the discharge in the referred clinic till the discharge of the patient from the follow up.

All data is transferred to special SPSS sheet and results were analyzed.

Results:

In the period extending from January 20th 2000 to March 8th,2008. 228 pediatric patients whose ages are below 19 years, and whose have traumatic brain injury were seen and admitted at the ER neurosurgical department at Khartoum teaching hospital. Seventy-one patients were excluded due to incomplete data while 228 patients were included in the study.

Age: mean age was 10.73 years, with median age 12.00 years

Sex distribution: Males represent more than (80%) of the head injured pediatric population in this study while females represent about (20%) of the victims.

Gender	Number	%
Male	183	80.3
Female	45	19.7

Table 1

Occupation

Most of the patients (89%) were either students (62.7%) or children below six years without occupational character. (7.9%) were workers.

Occupation	Number	%
Student	143	62.7
Child	62	27.2
Worker	18	7.9
Farmer	3	1.3
Business man	2	0.9
Total	228	100

Table 2

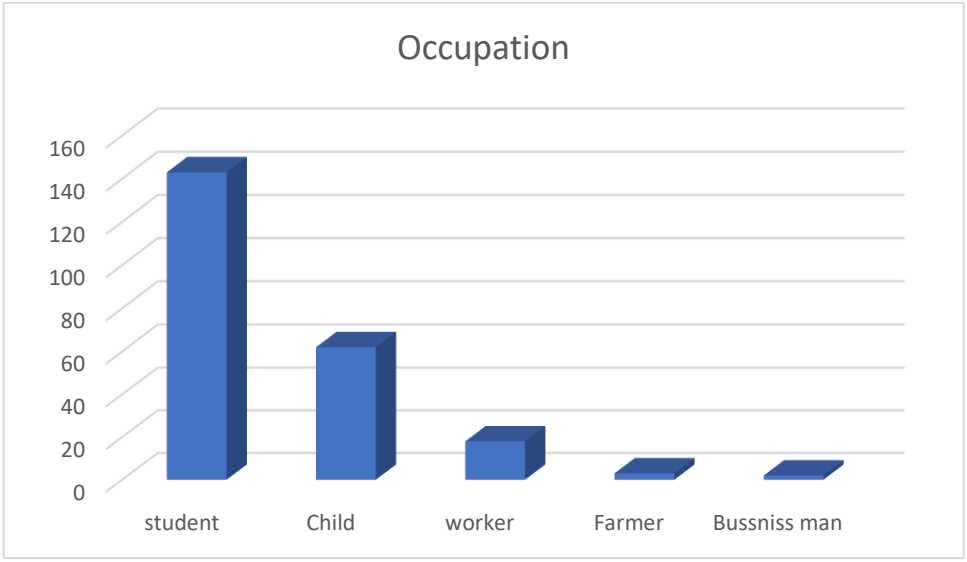

Figure 1

Place of origin

The majority of the patients (89.1%) were coming from the central area of Sudan (Khartoum and Jazeera) followed by Northern states (3.5%), South Sudan (3.1%), Eastern states (1.8%), two patients (0.9%) original

residence was unknown.

Origin	Number	%
Central	203	89.1
North	8	3.5
South	7	3.1
East	4	1.8
West	4	1.8
Unknown	2	0.9
Total	228	100

Table 3

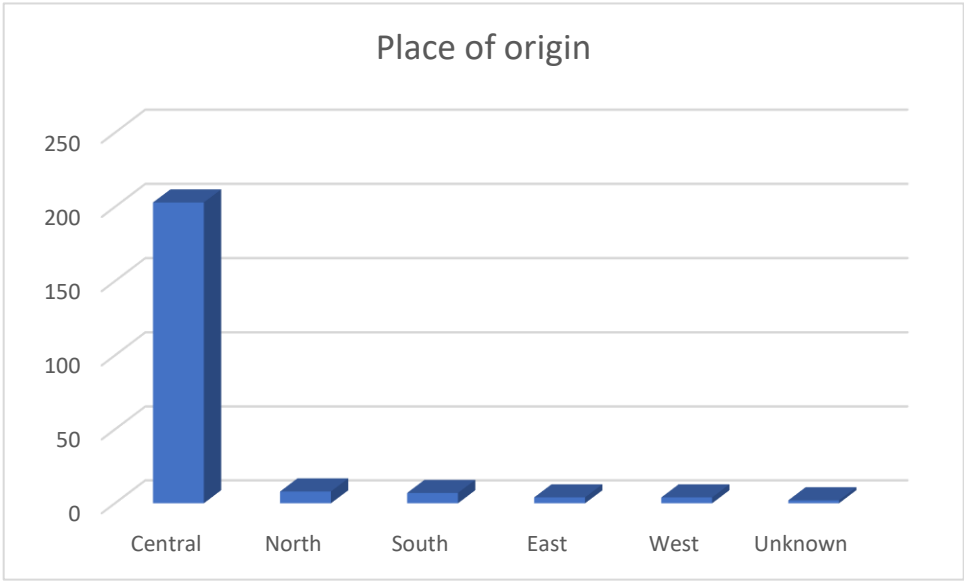

Figure 2

1.Mode of Trauma:

The most common type of trauma faced in this study was motor Vehicle accident in (46.1%) while assaults came in the second place in (22.4%). Fall from height came next (21.1%) other modes of trauma like fall of heavy objects on the patient head (4.8%), sport in (2.2%), other unspecified type of trauma is also encountered (3.5%).

Mode of trauma	Number	%
RTA	105	46.1
Assault	51	22.4
Fall from Height	48	21.1

Fall of heavy Object on patient	11	4.8
Other	8	3.5
Sport	5	2.2
Total	228	100

Table 4

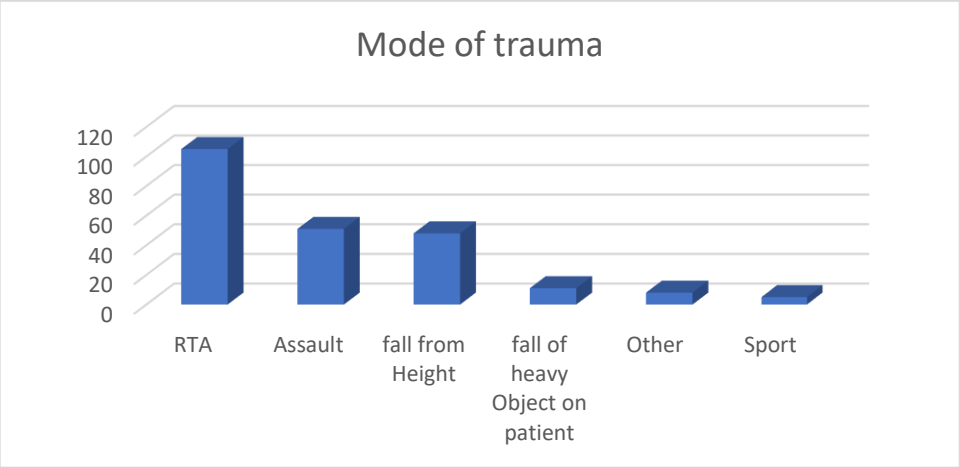

Figure 3

A. Mode of trauma (RTA):

We further studied victims of RTA, we found that pedestrian hit by motor vehicles representing the majority of the victims in this group 52 patients (27.2%), other modes of RTA were present but with less percentages.

Mode of trauma (RTA)	Number	%
Knocked	49	21.5
Walker	13	5.7
Fall from Car	11	4.8
Turn over	9	3.9
Car crash	8	3.4
Motorcycle	7	3.1
Cycling	6	2.6
Other	1	0.4
Knocked	1	0.4
Total	105	46.1

Table 5

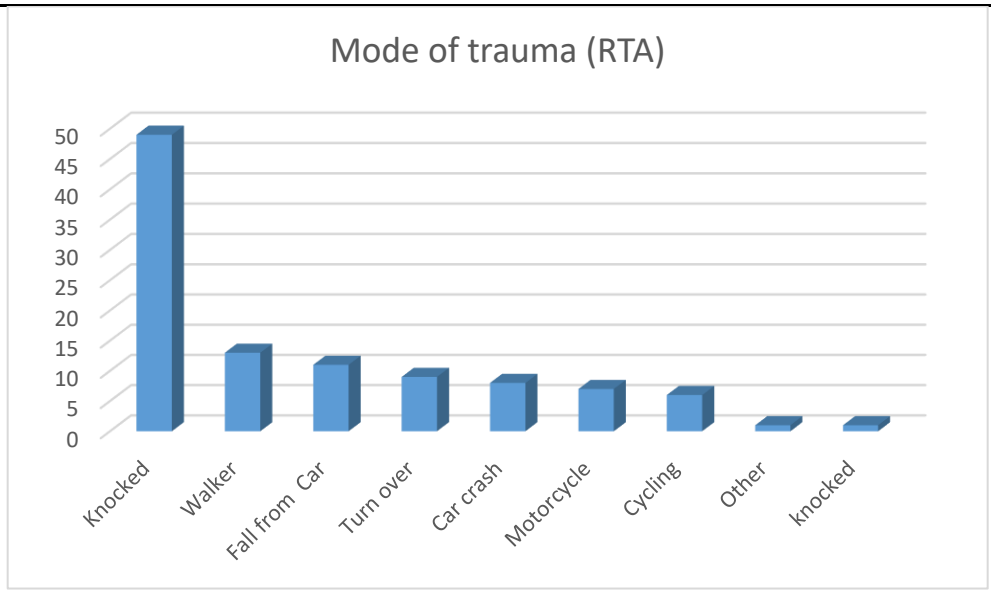

Figure 4

B. <u>Mode of trauma (Assault):</u>

Assaults came in the next position to RTA represented by 51 patients (22.4%) mostly by stones, sticks, iron bars and many other causative agents.

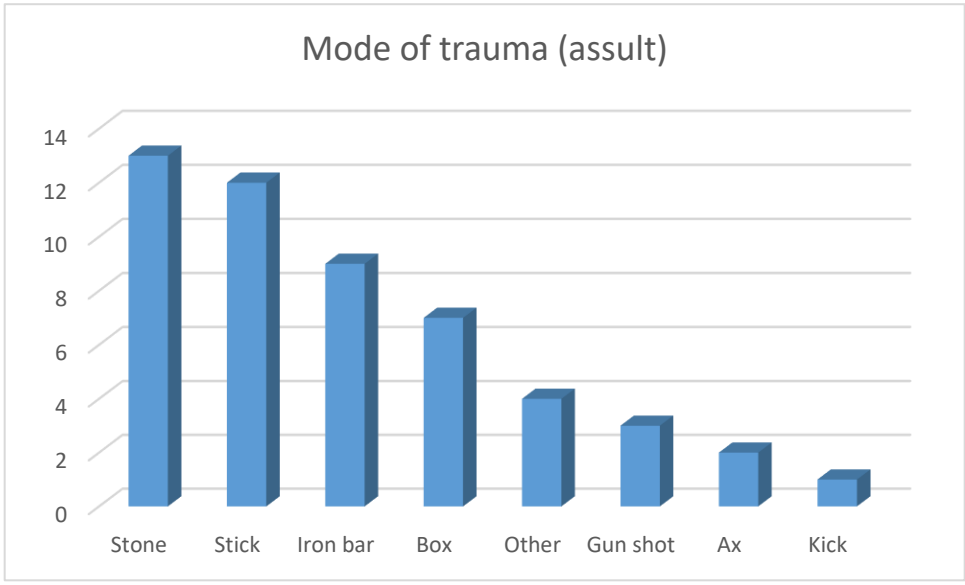

Figure 5

Mode of Trauma (Assault)	Number	%
Stone	13	5.7
Stick	12	5.3
Iron Bar	9	3.9
Box	7	3.1
Other	4	1.8
Gun Shot	3	1.3
Ax	2	0.9
Kick	1	0.4
Total	51	22.4

Table 6

C. Fall from height:

The third major cause of pediatric traumatic brain injuries was due to falls from height the commonest was falls from beds in very young babies 20 patients (8.8%). followed by falls from walls, trees, an animal in the older children the total reached up to 48 patients (21.1%).

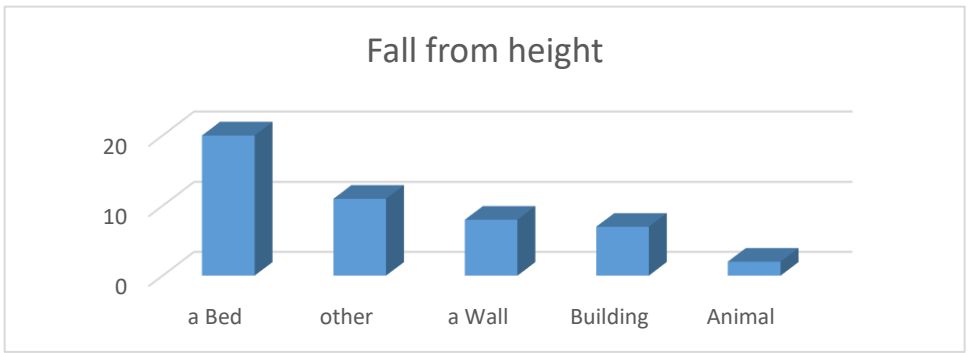

Figure 6

Fall from Height	Number	%
A Bed	20	8.8
Other	11	4.8
A wall	8	3.5
Building	7	3.1
Animal	2	0.9
Total	48	21.1

Table 7

2.Loss of consciousness:

Loss of consciousness was the main symptoms that brought the patients to seek medical advice, it was present in majority of the patients 151 patients (66.2%)

Loss of consciousness	Number	%
Yes	151	66.2
No	77	33.8

Table 8

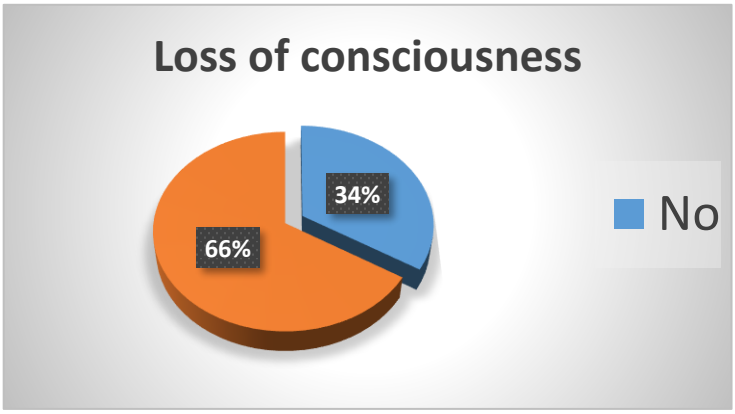

Figure 7

Duration of loss of consciousness:

The duration of the loss of consciousness observed was so brief in most patients ranging from 2-5 minutes, and that was noticed in 80 patients (35.1%), another peak was noticed for the duration of few hours which was observed in 56 patients (24.6%).

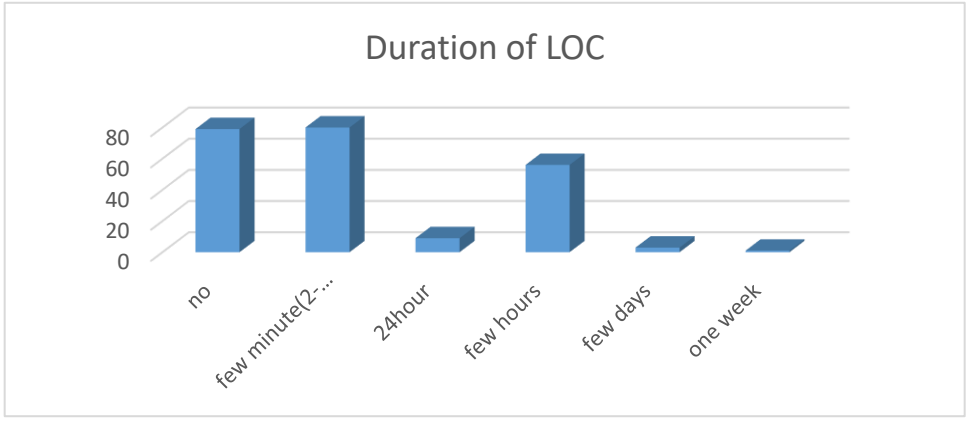

Figure 8

Duration of LOC	Number	%
No	79	34.7
Few Minute (2-To 5) Min	80	35.1
24hour	9	3.9
Few Hours	56	24.6
Few Days	3	1.3
One Week	1	0.4
Total	228	100

Table 9

3.Site of the bleeding

170 patients (74.6%) were having no bleeding points, bleeding from nose was present in 21 patients (9.2%), from ears in 17 patients (7.5%) or from mouth in 10 patients (4.4%). Other bleeding points were scalp wounds and that was observed in one patient.

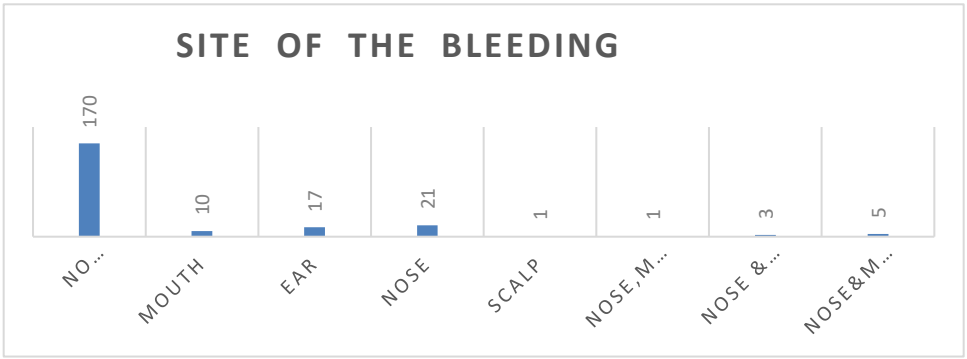

Figure 9

Site of bleeding	Number	%
No Bleeding	170	74.6
Mouth	10	4.4
Ear	17	7.5
Nose	21	9.2
Scalp	1	0.4
Nose, Mouth &Ear	1	0.4
Nose & Ear	3	1.3
Nose & Mouth	5	2.2

Table 10

4.**Clinical presentation:**

The clinical presentation of neurological dysfunction observed in patients was as follows:

1. Headache which was observed in 79 patients. (34.6%)
2. Vomiting was observed in 62 patients (27.2%)
3. Weakness of the extremities in 44 patients (19.3%)
4. Neck pain in 32 patients (14%)
5. Fever in 29 patients (12.7%)
6. Seizures in 27 patients (11.8%)
7. Mental change in 23 patients (10.1%)

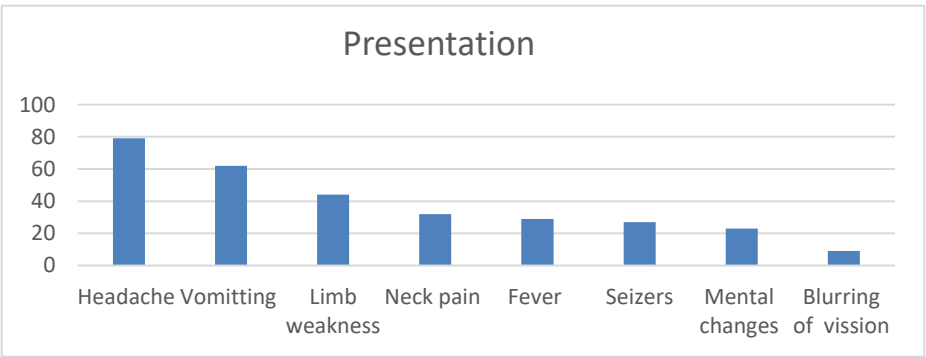

Figure 10

Symptoms	Number	%
Headache	79	34.6
Vomiting	62	27.2
Limb weakness	44	19.3
Neck pain	32	14
Fever	29	12.7
Seizers	27	11.8
Mental changes	23	10.1
Blurring of vision	9	3.9

Table 11

A. Wounds:

New scalp wounds were noticed in 96 patients (42.1), while old wounds were present in 6 patients (2.6%)

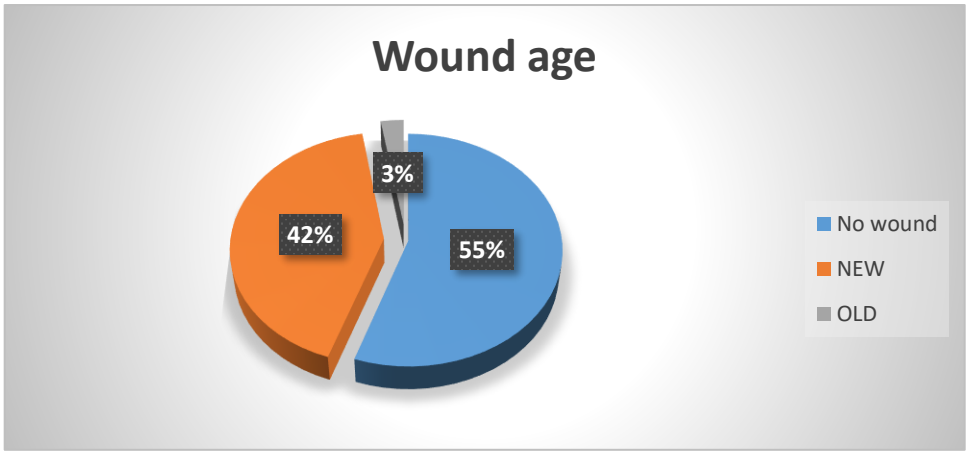

Figure 11

Wound age	Number	%
No wound	126	55.3
New	96	42.1
Old	6	2.6

Table 12

B. Wound site:

Most of the wounds were present in the frontal area and are mostly abrasions in 41 patients (18%) followed by parietal area in 27 patients (11.8%), temporal area in 24 patients (10.5%), then occipital area in 10 patients (4.4%)

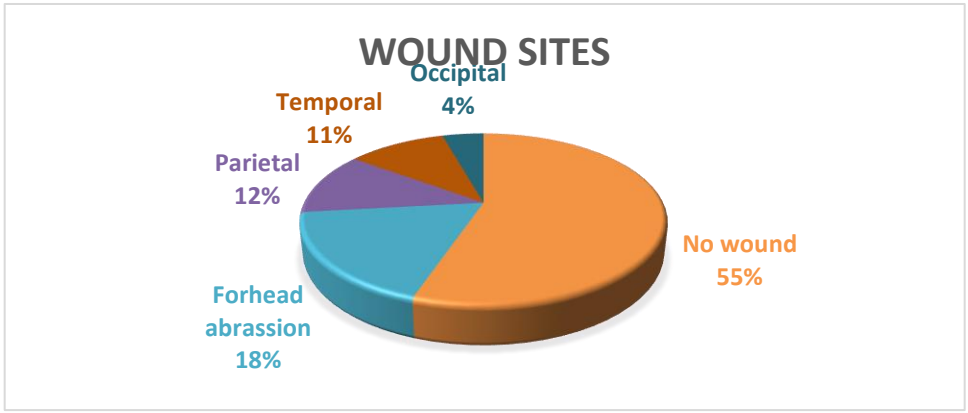

Figure 12

Wound sites	Number	%
No wound	126	55.3
Forehead abrasion	41	18
Parietal	27	11.8
Temporal	24	10.5
Occipital	10	4.4
Total	228	100

Table 13

C. Wounds conditions:

Most of the wounds observed were clean and was found in 81 patients (35.5%) the minority of the wound were dirty in 3 patients (1.3%).

Figure 13

Wound condition	Number	%
Clean	81	35.5
Dirty	3	1.3

Table 14

D. Number of wounds:

Patients with single wound were 62 patients (27.2%) while patients with multiple wounds were 30 patients (13.2%)

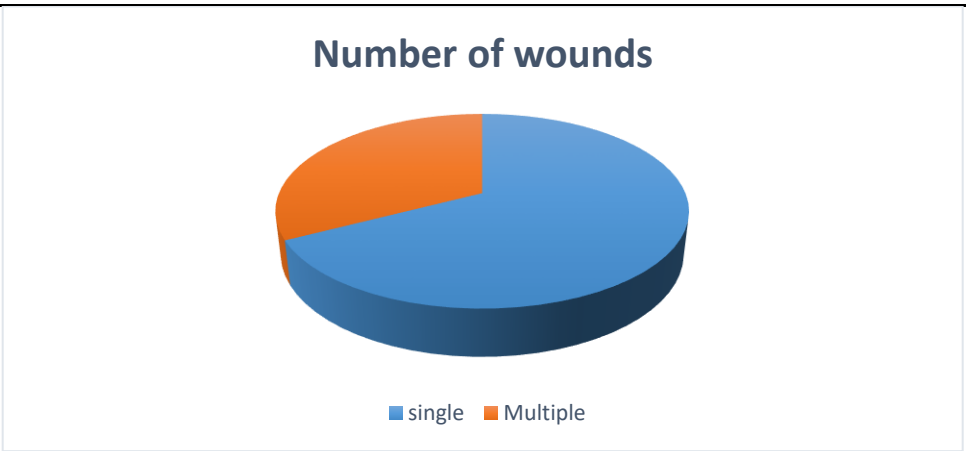

Figure 14

Number of wounds	Number	%
Single	62	27.2
Multiple	30	13.2

Table 15

E. <u>Sizes of wounds:</u>

The wound observed were mostly small wound (less than 2 cm) in length in 67 patients (29.4%), while big wound (more than 2 cm in length) were present in 11 patients (4.8%)

Sizes of wounds	Number	%
big wound	11	4.8
small wound	67	29.4

Table 16

Figure 15

5.Patients conditions:

The majority of the patients were seen in a relatively good condition 163 patients (71.5%) while very ill patients represented 53 patients (23.2%) other patients have relatively bad status,

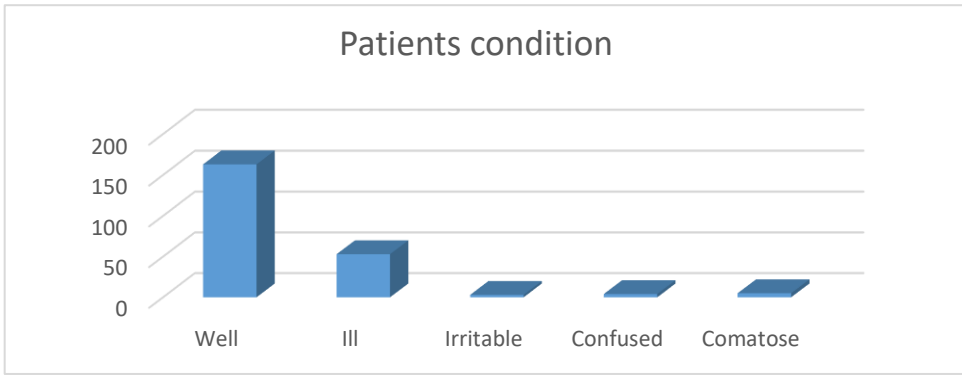

Figure 16

Patients conditions	Number	%
Well	163	71.5
Ill	53	23.2
Irritable	3	1.3
Confused	4	1.8
Comatose	5	2.2
Total	228	100

Table 17

Glasgow Coma Scale (GCS):

GCS was 15 in most of the patients 165 patient (72.2%) , patients with moderate reduction in their GCS 12-14 were 30 patients (2.2%). On the other hand, patients with GCS 9-11 were 11 patients (4.8%), while comatose patients with GCS less than 9 were 22 patients (9.6%)

GCS	Number	%
15	165	72.2
14	22	9.6
13	5	2.2
12	3	1.3
11	4	1.8
9	7	3.1
8	5	2.2
7	4	1.8
6	3	1.3

5	4	1.8
4	2	0.9
3	4	1.8
Total	228	100

Table 18

6.Plain X ray findings

Plain x rays has been performed for 177 patients (82%) of these patients 140 patients (61.4%) have normal plain x rays, while 25 patients (11%) have fissure fractures , 20 patient (8.8%) have depressed fractures.

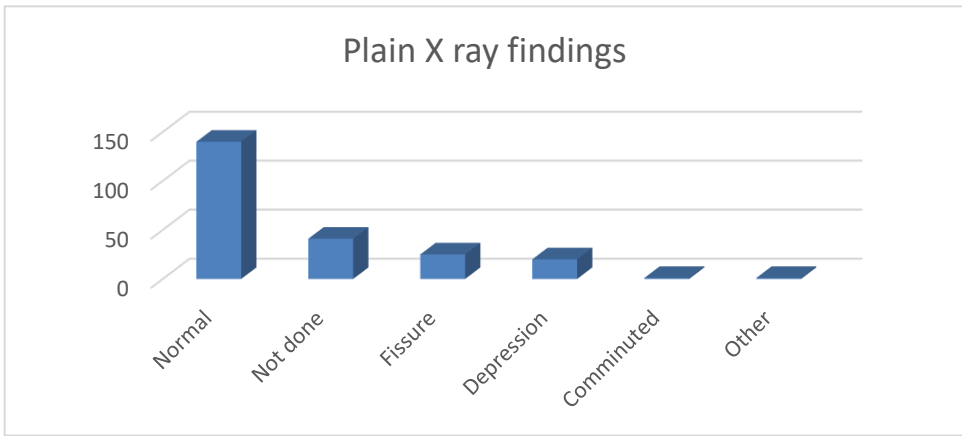

Figure 17

Plain X ray findings	Number	%
Normal	140	61.4
Not done	41	18
Fissure	25	11
Depression	20	8.8
Comminuted	1	0.4
Other	1	0.4
Total	228	100

Table 19

Sites of the fractures:

The most affected sites by the fractures was the parietal area in 23 patient (10.1%) frontal area come after that 10 patients (4.4%) followed by occipital and temporal areas.

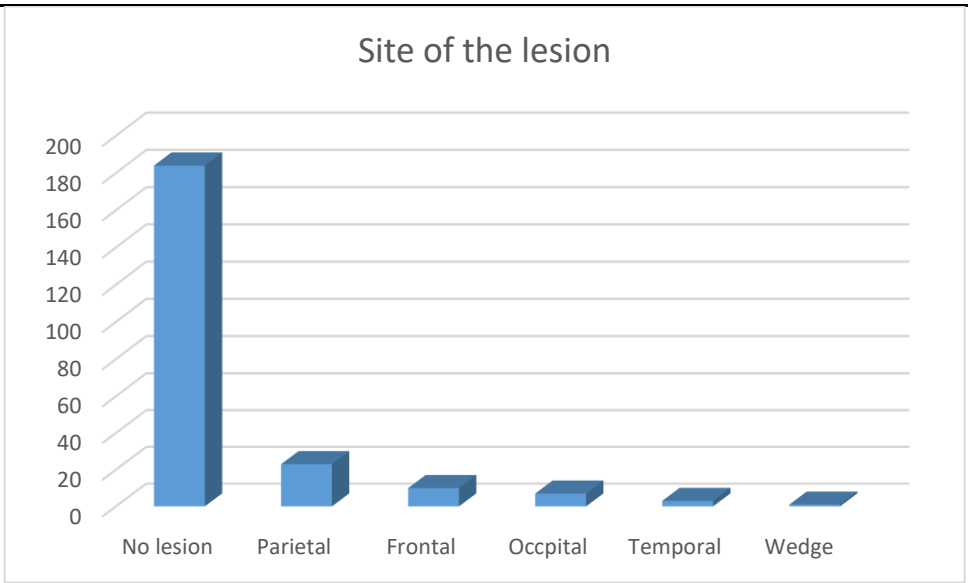

Figure 18

Site	Number	%
No lesion	184	80.7
Parietal	23	10.1
Frontal	10	4.4
Occipital	7	3.1
Temporal	3	1.3
Wedge	1	0.4
Total	228	100

Table 20

7.Types of lesions in CT scans:

136 patients (59.6%) have done CT scans of the brain, in 49 patients (21%) the CT scans were normal, the lesions encountered were fractures in 20 patients (8.8%), parenchymatous lesion like cerebral contusions were encountered in 14 patients (6.1%) followed by edema and hemorrhage each in 10 patients (4.4%), some patients 29 patients (12.7%) were requested to do CT brain but they did not show or did the CT scans.

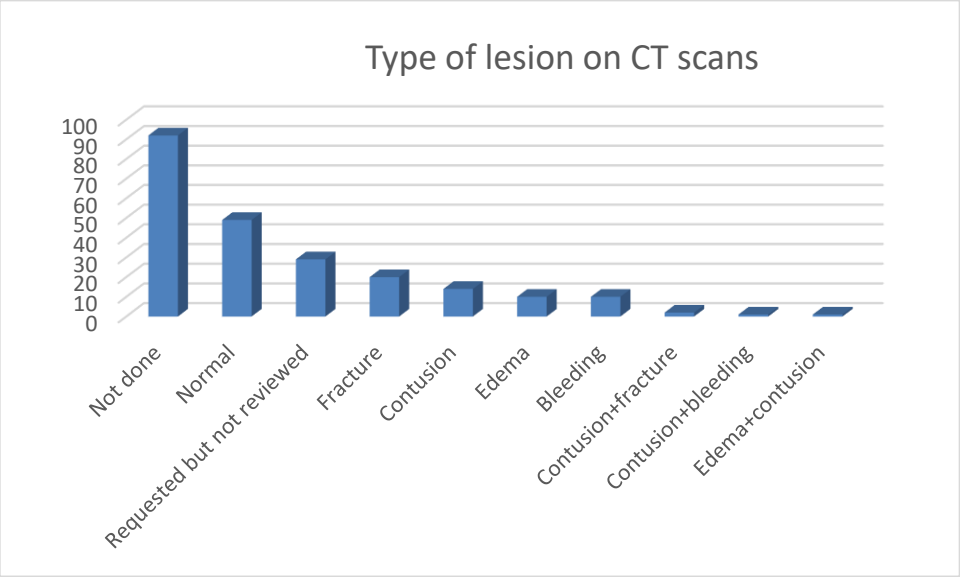

Figure 19

Type of lesion on CT scans	Number	%
Not done	92	40.3
Normal	49	21.5
Requested but not reviewed	29	12.7
Fracture	20	8.8
Contusion	14	6.1
Edema	10	4.4
Bleeding	10	4.4
Contusion + fracture	2	0.9
Contusion + bleeding	1	0.4
Edema + contusion	1	0.4
Total	228	100

Table 21

Types of fractures

Fractures were encountered in 30 patients of them 13 were fissure fractures and in 14 patients there were depressed fractures. Other types of fractures were rarely encountered

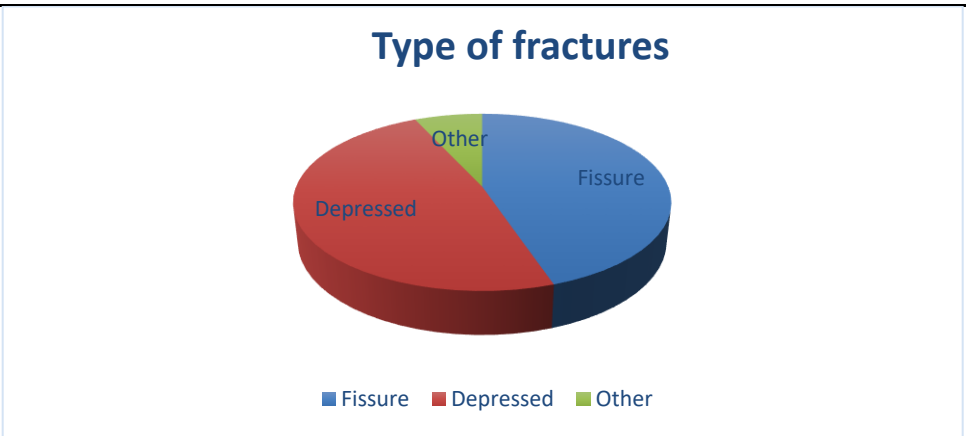

Figure 20

Type of fractures	Number
Fissure	13
Depressed	14
Other	2

Table 22

8.Treatments offered:

A. Conservative

207 patients (90.8%) were managed by conservative management and follow up,

B. Surgical management:

22 patients (9.2%) were treated surgically. The types of operations performed were as follows:

1. Elevation of depressed fracture for 7 patients.
2. Burr hole evacuations of subdural collections for 5 patients.
3. Craniotomy for EDHs in 4 patients.
4. Other operations for 3 patients.
5. Debridement+ removal of foreign bodies for one patient.
6. Removal of foreign body and Cranioplasty for one patient.

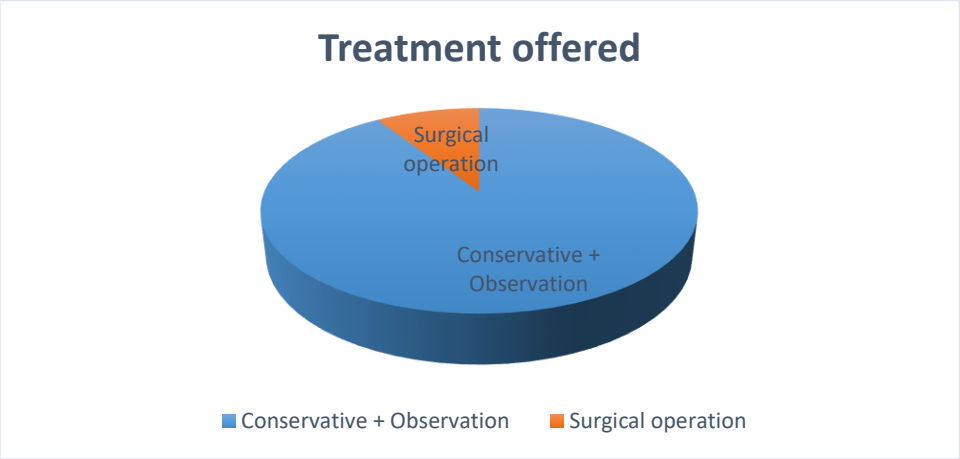

Figure 21

Treatment offered	Number	%
Conservative + Observation	207	90.8
Surgical operation	21	9.2
Total	228	100

Table 23

Types of operations:

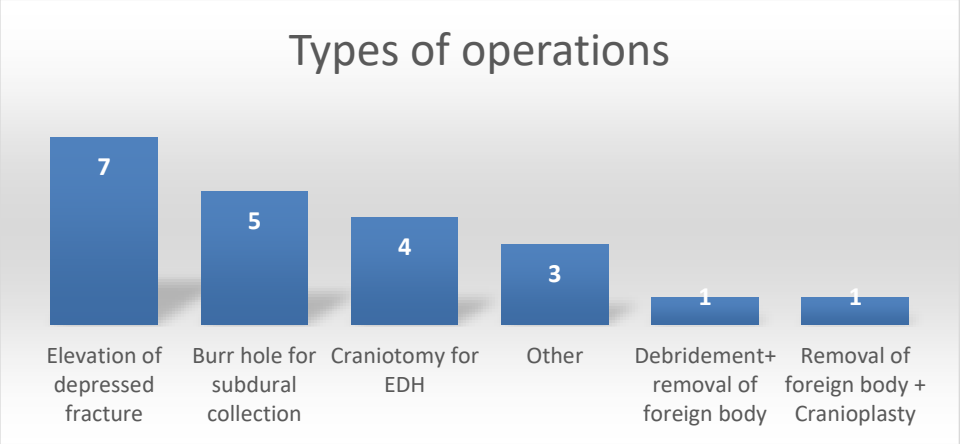

Figure 22

Types of operations	Number
Elevation of depressed fracture	7
Burr hole for subdural collection	5
Craniotomy for EDH	4
Other	3
Debridement+ removal of foreign body	1
Removal of foreign body + Cranioplasty	1
Total	21

Table 24

9.Follow up GCS:

The main tool used in follow up of the patients was GCS

The follow up GCS was as follows:

1. Mild disturbance with GCS 15 -13 in 209 patients (91.7%).
2. Moderate disturbance with GCS 12 -9 in 9 patients (3.9%).
3. Severe disturbance with GCS less than 9 in 10 patients (4.4%).

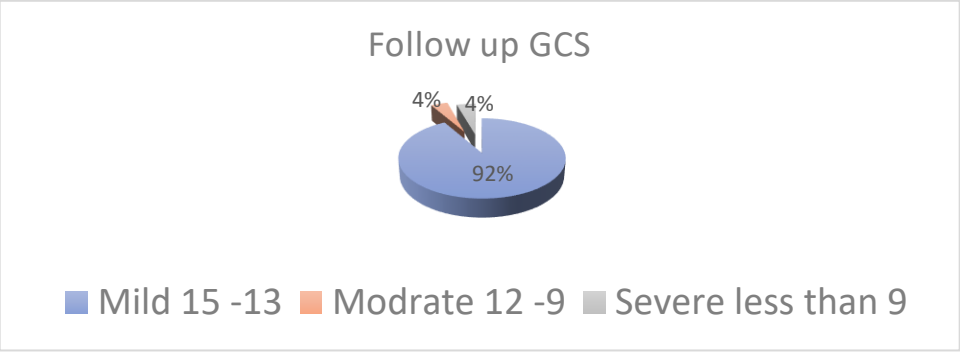

Figure 23

Follow up GCS	Number	%
Mild 15 -13	209	91.7
Moderate 12 -9	9	3.9
Severe less than 9	10	4.4
Total	228	100

Table 25

10. Outcome:

The outcome achieved in this group of the patients (228 patients) was as follows:

1. Cure without any residual neurological dysfunction in 97 patients (42.6%).
2. Improvement in neurological status of the patient with some residual neurological dysfunction in 123 patients (53.9%).
3. Death of 8 patients (3.5%).

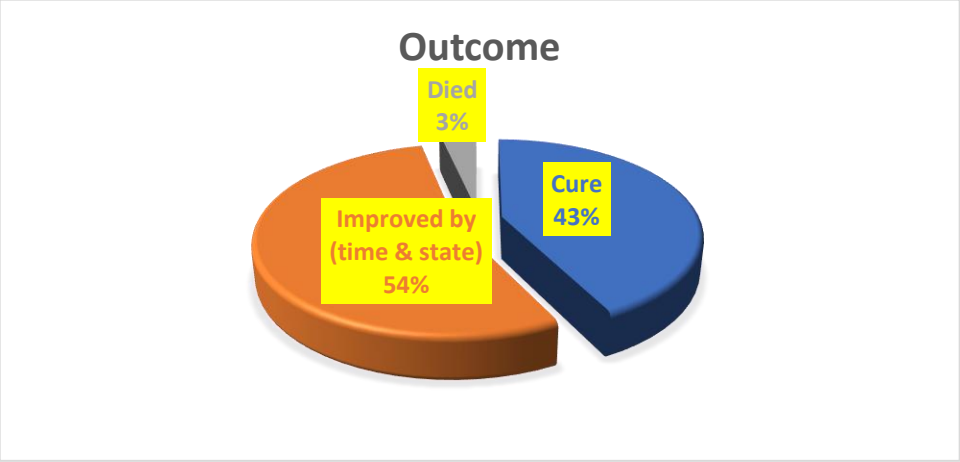

Figure 24

Outcome	Number	%
Cure	97	42.6
Improved by (time & state)	123	53.9
Died	8	3.5
Total	228	100

Table 26

Discussion:

Traumatic brain injury is the well-known cause of morbidity and mortality, the pediatric group is not immune from this problem as trauma can affect any body although the brain of pediatric population has some degree of resilience and plasticity but because head injuries occur usually in combination with other injuries like

chest, limbs, abdomen and spine, this problem might be of serious consequences on the growing children.

The mean age of the affected patients is 10.73 years and the median age is 12 years which suggest that too young population are relatively protected, while the sex distribution shows that males are predominately affected with a percent more than 80%.

Motor vehicle accident represented the main mode of trauma in about half of the patients (46.1%) which draw attention to a preventable cause if injury which can be avoided if proper traffic rules and education of the young generations was considered , assaults came in the second place, Fall from height came next (21.1%) other modes of trauma like fall of heavy objects on the patient head (4.8%), sport in (2.2%), other unspecified type of trauma is also encountered (3.5%).all the previous types of trauma shows the deficiency of protective measures which if followed can help to reduce or prevent many of these accidents with their disastrous consequences on the patients , their families and on the community in general .

Regarding the clinical presentation of the affected patients the majority of them (66.2%) have history of loss of consciousness indicating the magnitude of the severity of such accidents although the majority showed only brief periods of loss of consciousness but this does not exclude the development of the long term effect of such accidents of the growing brains , 27.2% of the patients has vomiting and compressing with loss of consciousness features of generalized brain affection because headache and blurring of vision which are also encountered in a small group of patients cannot be relied on in very young children , 19.3% showed extremities weakness denoting focal brain injury , other features of serious injuries or complications like neck pain , fever , seizers or mental changes are also present but a lesser extent ranging from 10-14% as we noticed from the clinical presentation that is a combination of generalized brain affection is more prominent at the beginning and after the brain became relaxed here the features of local brain dysfunction become more prominent and this is a general observation but it is not absolute as in the minority of patients features of local injury appear from the start while in others features of generalized brain dysfunction continues for long time .

42.1% 0f the patients have new scalp wounds while the minority 2.6% came with relatively old wound indicating early management elsewhere or negligence , most of these wounds 18% are in the frontal which is less protected are due to absence of hair less percentages of wounds are observed as we go backward, the wounds are mostly clean 35.5% and small (less than 2 cm in length) and not multiple (27.2%) .

On the initial presentation of the patients their general condition is mostly good 71.5% the best indicator is Glascogo Coma scale GCS which was 15 in most of the patients 165 patient (72.2%) as most of the patients presented after some time from the injury , while comatose patients with GCS less than 9 were 22 patients (9.6%) which represent the seriously affected patients that need ICU admission or sometimes surgical intervention .

The investigations used in the diagnosis are plain X rays for 177 patients (82%) and /or Ct of the brain for 136 patients (59.6%) in some patients both investigations were ordered mainly CT is performed after initial plain X rays in patients who were suspected to have parenchymatous soft tissue brain in injuries or hematomas, 140 patients (61.4%) have normal plain X rays, while 47 patients (38.6%) have fractures of different types (11%) have fissure fractures , 20 patient (8.8%) have depressed fractures. And some other types are rarely seen. on the other hand, CT of the brain revealed that 20 patients (8.8%), parenchymatous lesion like cerebral contusion , hemorrhage in 14 patients (6.1%) followed by cerebral edema and hemorrhage each in 10 patients (4.4%), the role of CT of the brain was found very effective in diagnosing patients who need surgical intervention .

Conservative treatment

The conservative management was the type of management offered to the patients , 207 patients (90.8%) were managed by conservative management and follow up which include resuscitation and ABC to stabilize patients conditions and to correct and fluid , blood or electrolytes losses , the patients were fully examined to exclude any other associated mainly cervical spine , chest , abdominal and limb or other spinal and pelvic injuries the priority was given to those injuries , wound care was given utmost attention to stop the bleeding and clean or repair the wounds, broad spectrum antibiotics were prescribed in in case of presence of wound namely Ceftriaxone or sometimes other antibiotics other measures like positioning of the patients , analgesia , diuretics were followed according to the patient condition frequent follow up observations on bases of 6 hourly check was followed , the initial other investigations performed were complete blood picture , renal function test and urine analysis . the patients with GCS less than 12 were usually followed in the ICU .

Surgical interventions

22 patients (9.2%) were treated surgically. The surgical procedures were performed after strict selection of the surgical candidates' parameters like the following parameters were used

1. Intracranial hemorrhage which is sizable of more than 25 ml of volume or progressive with deleterious effect on the patient clinical condition.
2. Depressed or comminuted fracture with remarkable depression in the brain or sharp spikes.
3. Big or contaminated dirty wound or cosmetically ugly wound.
4. Expert general anesthesia plus ICU availability and stand by blood reserve.

of the patients operated the types of operations performed were as follows:

1. Elevation of depressed fracture for 7 patients
2. Burr hole for subdural collection for 5 patients
3. Craniotomy for EDH for 4 patients
4. Other operations for 3 patients
5. Debridement+ removal of foreign body for one patient
6. Removal of foreign body and Cranioplasty for one patient.

The outcome

The outcome of the patients was assessed utilizing the GCS so as to unify the assessment pre and post treatment using one tool, as the general status of the brain is very important in assessment for further than the local damage to certain areas which cannot be assessed by a single tool.

The patient with mild brain injury tends to improve more rapidly than patients with severe brain affection, for this reason early discovery and management of the patients is associated with better outcome of the patients and of a group of patients in general See table and diagram)

GCS	initial Number	Follow Number	Diff.	Initial %	Follow up %	Diff.
Mild 15 -13	192	209	17	84	91.7	7.7
Moderate 12 -9	14	9	6	6.2	3.9	2.3
Severe less than 9	12	10	2	5.3	4.4	0.9
Total	228	228		100	100	

Table 27

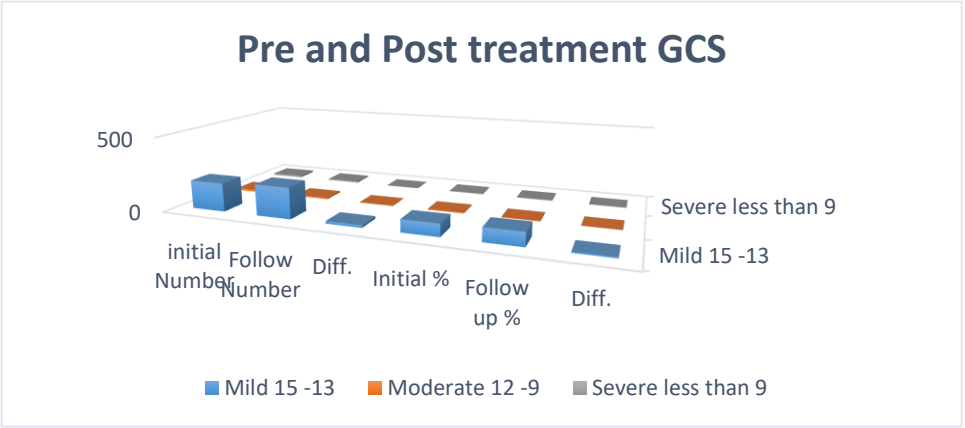

Figure 25

Conclusions

Traumatic brain injuries affecting children is a serious condition that must draw the attention of the community and policy makers to provide attention to this preventable condition.

In most instances these injuries are preventable if the preventable measures are initiated and followed

The role of CT and Palin X ray in diagnosis is important but strict godliness are needed.

The role of conservative management and follow up is predominating, but surgical candidates should not be missed

Early management of those condition is associated with better outcome,

The outcome in these conditions is favorable if adequate care is provided.

Recommendations

Adoption and provision of preventive measures for head injuries is of high demand.

Health education of the medical professionals, mothers, teachers, sport trainer and the general community on the preventive measures and proper early first aids in so important.

Setting protocols and guidelines for the health professionals on the initial management of traumatic brain injury.

Provision of health education programs for the young children utilizing school curricle and the children web facilities to include management message in in an attractive form.

The policy makers should establish laws that make availability of prevention measures and qualified trained health professional as a must in schools, sport areas. Strict traffic laws that help to protect the children like special seats with seats belts and helmets for bicycles or motorcycles rider should be activated.

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