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Management of Children's Head Trauma in the Neurosurgery Department of the Gabriel Toure University Hospital (Bamako)

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ABSTRACT

Introduction: *Traumatic brain injuries are the leading cause of death in young people, particularly children, and can also lead to disabilities, sometimes debilitating, in survivors.*

Objective: *The aim of this study was to evaluate the management of traumatic brain injuries in children.*

Methodology: *This was a prospective descriptive study conducted over 12 months (December 2020 to November 2022) in the neurosurgery department of the Gabriel Touré University Hospital. All 202 hospitalized children's medical records were reviewed. Data related to epidemiological, clinical, and therapeutic characteristics were analyzed.*

Results: *The average age of the children was 7.5 years, with a range from 2 months to 15 years. The sex ratio was 2:1. Road traffic accidents were the leading cause, accounting for 38.1% of cases (11-15). On admission, 69.8% of cases had a Glasgow Coma Scale (GCS) score between 13 and 15. Seizures were observed in 17.8% of cases, and motor deficits in 44.1%. Cerebral contusion was the most frequent injury, occurring in 42.9% of cases. Surgical treatment was performed in 24.8% of cases. Depressed skull fracture release was the most common surgical technique, used in 33% of cases. The mortality rate was 3.5%.*

Conclusion: *Head injuries are common in children in Mali. Road traffic accidents and falls are the main causes. The outcome depends on the GCS score on admission.*

Keywords
Trauma, Head injury, Contusion, Child.

Introduction
Traumatic injury represents a significant socio-economic scourge and a major public health problem worldwide. It is the leading cause of death among young people, particularly children, and can also lead to severe disabilities in survivors [1]. Among traumas, traumatic brain injuries are very common and largely determine the prognosis. However, the overall prognosis appears to be better in children than in adults. Road traffic accidents and domestic accidents account for a large proportion of the causes. Analysis of the circumstances of the accident has shown that it could have been avoided in the vast majority of cases [2]. In Mali, traumatic brain injuries in children are very poorly documented.

The aim of this work was to evaluate the management of traumatic brain injuries in children.

Patients and Method
This was a prospective descriptive study conducted over a 12-month period, from December 2020 to November 2021, in the neurosurgery department of the Gabriel Touré University Hospital. We analyzed the medical records of 202 children, aged 0 to 15,

admitted for traumatic brain injury.

The parameters studied were demographic data, the mechanism of trauma, the reason for consultation, the time to admission, clinical, paraclinical, therapeutic and outcome data.

For our study, we included all children aged 0 to 15 years admitted for traumatic brain injury during the same period.

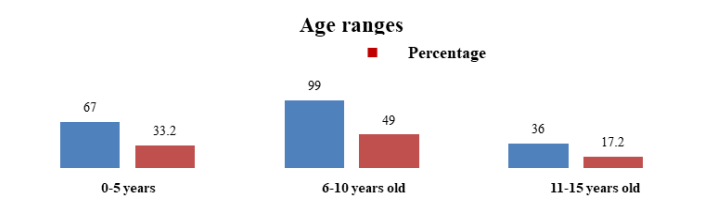
Children aged 0 to 15 years admitted for a condition other than a traumatic brain injury (TBI), and deaths occurring upon admission, were excluded from our study.

The data was processed on Epi info and entered using Microsoft Word 2013 and Excel 2013, on an HP Windows 10 laptop.

Results

During the study period, 921 patients were admitted for traumatic brain injury, of whom 202 were children (18%). The average age of these children was 7.5 years, with a range from 2 months to 15 years. The 6–10-year age group represented 49% (Graph 1).

Graph 1: Shows the distribution of patients according to age group.



The sex ratio was 2. The children were in school in 53.5% of cases. Road traffic accidents were the main cause among children aged 11 to 15 with 77 cases or 38.1% and falls among children aged 0 to 5 years with 12 cases or 5.9% (Table 2).

Table 2: Shows the distribution of patients according to etiology and age.

Age (year)	AVP	Domestic accidents	Falls	CBV	Sports accident
0-5 years	2	2	12	-	-
6-10 years old	15	28	8	1	-
11-15 years old	77	41	5	7	4
Total	94	71	25	8	4

The pre-hospital personnel who ensured the transport of children from the accident site to the hospital were family members or witnesses in 5 6.9% of cases were followed by firefighters with 41.9%. The time frame for admission within the first 24 hours was 84.2% of cases (Graph 2).

A history of initial loss of consciousness was found in 79.2% of cases. Headache was the most frequent reason for consultation (54.5% of cases). On admission, 69.8% of cases had a Glasgow Coma Scale (GCS) score between 13 and 15, and 7.4% had a GCS score below 8 (Table 2).

Graph 2: Shows the distribution of patients according to the time to admission.

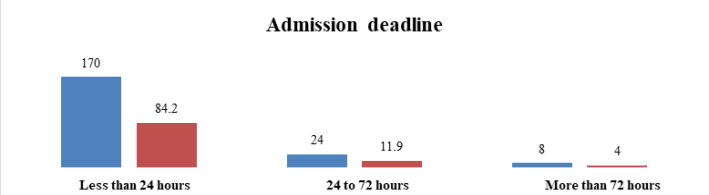
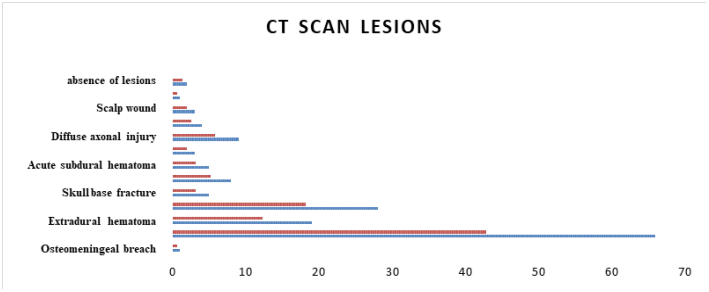


Table 2: shows patients following the Glasgow Coma Scale score.

Glasgow score	Staff	Percentages
13-15	141	69.8%
9-12	46	22.8%
3-8	15	7.4%

Anisocoria was present in 7.4% of cases. A seizure was observed in 17.8% of cases. Contralateral motor deficit was found in 44.1% of cases. Associated injuries were predominantly extremity trauma in 23.8% of cases, followed by maxillofacial and thoracic trauma at 22.8% and 5.9%, respectively. Computed tomography (CT) scans were performed in 154 patients, representing 76.2% of cases. Cerebral contusion was the most frequent injury in 42.9% of cases, followed by depressed fractures and extradural hematoma at 18.2% and 12.3%, respectively (Graph 3).

Graph 3: Distribution of patients according to the CT scan lesion.



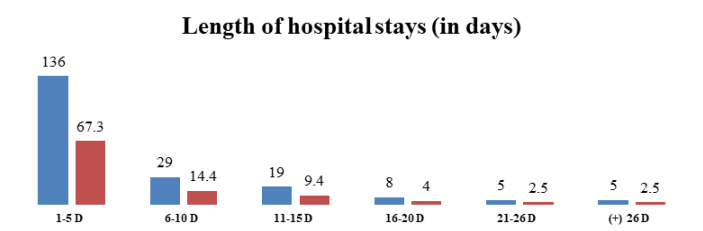
In terms of treatment, all patients received analgesics. Antibiotics were used in 89.1% of cases, anticonvulsants in 17.8%, and mannitol in 23.8%. Surgical treatment was performed in 24.8% of cases. Depressed fracture was the most frequently used surgical technique, in 33% of cases, followed by bone-loss craniectomy in 12.1%, while craniotomy with flap and evacuation was used in 30.8% of cases of intracranial hematoma (Table 3).

Postoperative complications were dominated by anemia in 5% of cases, followed by wound suppuration and meningitis in 3.5% and 2.5%, respectively. The length of hospital stay ranged from 1 to 5 days in 67.3% of cases, with a range of 1 to 67 days (Graph 4). We regret to report 7 deaths, representing 3.5% of cases.

Table 3: Shows the distribution of patients according to the surgical technique.

Pathologies	Techniques	Staff	Percentages
Fracture denture	Lifting of the berth	30	33%
	Craniotomy with repositioning of the fragment	8	8.8%
	Lost bone craniotomy	11	12.1%
Extradural hematoma	Craniotomy with flap	15	16.5%
	Enlarged drill bit hole	10	11%
Acute subdural hematoma	Craniotomy with flap	3	3.3%
	Trepanation	2	2.2%
Intra-intraparenchial hemorrhage	Craniotomy with flap	5	5.5%
Head injury	Trimming	4	4.4%
Scalp wound	Trimming	3	3.3%
Total		91	100%

Graph 4: The distribution of patients according to the length of hospital stay.



Discussion

Childhood traumatic brain injuries (TBIs) represent a public health problem in all countries due to their frequency, mortality, and morbidity [3]. Indeed, in recent years, despite the development of diagnostic and therapeutic management tools, morbidity and mortality remain high [1]. Among traumatic injuries observed in childhood, TBIs are the most frequent. Thus, a TBI is found in nearly 80% of children involved in an accident [4]. The annual incidence of this condition, across all ages and severity levels, is estimated at 2 to 5 per thousand [2]. An increase in frequency is noted with age (1.5/1000 in children under 5 years old and 5.5/1000 in those over 5 years old) [5]. In our series, TBIs in children accounted for 18% of the reasons for consultation.

It affects all age groups (infants, young children, older children, and adolescents). The average age of victims is consistent across all studies: 7 ± 4 years for MEYER [6], and 8 years for ODEBODE [7]. In our study, the average age of the children was 7.5 years, with a range from 2 months to 15 years.

Boys are more frequently involved in bodily injury accidents than girls [8]. This male predominance could be explained by various phenomena: different education levels for the two sexes, more or less active social lives, and intrinsically different risk-taking patterns. In our series, the sex ratio was 2.

The causes of traumatic brain injury (TBI) in children vary according to the socioeconomic and cultural profile of the country. However, in most studies [5,9], road traffic accidents remain one of the main causes. Domestic accidents, primarily falls, represent the second leading cause. Assaults, rare in our region, are seen with a significant frequency in some Western studies, accounting for up to 25% of TBI cases [10]. In our study, road traffic accidents were more frequent in the pediatric population aged 11 to 15 years (77 cases), representing 38.1%. Falls, on the other hand, were frequent in children aged 0 to 5 years (12 cases), representing 5.9%.

The admission rate within the first 24 hours was 84.2%. The same finding was reported by DOLEAGBENOU AK et al. [1], who found that 83.4% of their patients were admitted within the first 24 hours.

Clinically, the initial severity of TBI is assessed using the Galasgow Coma Scale [11]. The Glasgow Coma Scale has shown some limitations in young children. It has therefore been adapted according to the age of these children [6]. Furthermore, a Glasgow Coma Scale (GCS) score established at the scene of the accident does not accurately reflect the severity of brain injury [6]. Severe TBI is defined as a score ≤ 8; however, a higher score is not always indicative of a good prognosis. Conversely, a score < 5 in cases of isolated TBI is not always synonymous with a poor prognosis [9]. In our study, we noted that 69.8% of cases had mild TBI (GCS between 13 and 15) and 7.4% of cases were severe (GCS ≤ 8).

Pupil examination should note size, reactivity, and symmetry, bearing in mind that direct ocular trauma can hinder the interpretation of pupillary signs. Pupil examination is an important component of the initial examination, as well as in subsequent monitoring [3]. In the study by Suresh et al. [8], 20.3% of patients had pupillary abnormalities, while in the study by Levi et al. [12], 13.8% presented with these abnormalities. In our study, anisocoria was observed in 7.4% of cases.

Seizures lead to elevated intracranial pressure (ICP) and cerebral ischemia through several mechanisms, including increased cerebral metabolic demand, the Valsalva maneuver, the release of excitotoxic neurotransmitters, hypoxia, and hypertension [9]. Risk factors for seizures include age, severe traumatic brain injury (TBI), cerebral edema, subarachnoid hemorrhage, and skull fracture [13]. In our study, 17.8% of our children developed seizures.

The presence of a contralateral motor deficit can be of diagnostic and prognostic value. Its presence in patients with a traumatic brain injury (TBI) represents a localizing sign. Therefore, its investigation should be systematic. The most commonly assessed element is limb motor function [14]. In our series, contralateral motor deficits were observed in 44.1% of cases.

Head injuries were associated with limb trauma in 23.8% of cases. In a study conducted in adults at the same center 3 years earlier, we found ENT trauma as an associated injury in 29.2% [6].

Brain CT should be widely indicated due to the lack of definitive clinical criteria for confirming or ruling out a brain lesion [15]. It is the preferred examination for the emergency diagnosis of most lesions, particularly those amenable to surgical treatment. A brain CT scan may appear normal when performed early [16]. The incidence of a normal brain CT scan in cases of TBI in the Literature reports have varied from 6% to 29% [9,11]. This can be explained by the early performance of this examination but also by its diagnostic limitations, especially for brainstem exploration, diffuse axonal injury, and the detection of non-hemorrhagic lesions [17]. In our study, it was performed in 76.2% of cases. Cerebral contusion was the most frequent CT lesion in 42.9% of cases, followed by depressed fractures and extradural hematoma at 18.2% and 12.3%, respectively. The same observation was made by EKOUELE MBAKI et al. [4], who found cerebral contusion in 46.7% of their series.

The management of traumatic brain injury (TBI) in children must be multidisciplinary, involving the emergency physician, intensivist, anesthesiologist, radiologist, and neurosurgeon. It should begin at the scene of the accident, continue during transport, and upon admission to the hospital [18]. The goal of initial management, as in adults, is to limit the worsening of primary injuries and prevent the development of secondary injuries. To achieve this goal, the prevention, diagnosis, and treatment of life-threatening conditions to prevent acute traumatic brain injury (ATBI) are fundamental [19]. In our study, all patients received analgesics, antibiotics in 89.1% of cases, mannitol in 23.8% of cases, and anticonvulsants in 17.8% of cases. Similar findings have been reported in other studies, but with varying proportions [20].

Surgical intervention was indicated in 24.8% of cases. The surgical technique was dominated by depressed bone elevation in 33% of cases and craniotomy with bone loss in 12.1% for depressed fractures, while craniotomy with flap and evacuation predominated in intracranial hematomas (30.8%). The same observation was made by PFENNINGER J [21].

Post-operative complications were dominated by anemia in 5% of cases, followed by wound suppuration and meningitis at 3.5% and 2.5% respectively. The same observation was made by KAREMBE B [22]. The outcome was favorable in 76.7% of cases. This result is higher than that of COMPAORE [23], who found a good outcome rate of 64% in his series. The length of hospital stay was 1 to 5 days in 67.3% of cases, with extremes of 1 and 67 days.

Conclusion

Head injuries are common in children in Mali. Road traffic accidents and falls are the main causes. Surgical interventions must be performed promptly. The prognosis depends on the Glasgow Coma Scale (GCS) score at admission. Road safety awareness campaigns must be strengthened.

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