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Child Skull Fractures at the Neurosurgery Unit of Joseph Ravoahangy Andrianavalona University Hospital

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Abstract

Introduction: Cranial fractures are defined by the presence of a continuity solution at the bone wall of the skull arch with or without sinking. Our study aims to determine the epidemiological and clinical profile of cranial fractures in children in the neurosurgery department of the CHU-JRA.

Methods: This is a 13-month retrospective and descriptive study (May 2015 to May 2016) collate 105 cases.

Results: We noted a male predominance of 61.90% with a sex ratio of 1.62 and an average age of 5.88 years. Etiology is dominated by domestic accidents at 63.81%. Initial knowledge loss was the most common functional signs at 43.81% and the evidence of examination found were mostly wounds of the face and scalp at 69.99%. Unlocked linear fractures accounted for 70.48% of cases and the fronto-parietal regions were the most affected at 64.77%. Brain CT scans were performed in 24.76% and the most found intracranial lesions were hematomas. Surgery was performed in 15.24% of cases. The trend was favourable in 87.62% of cases.

Conclusion: Strengthening the prevention of head injuries remains paramount for Madagascar given the still low socio-economic level of the population, which does not allow optimal management.

Keywords: *Child; Skull; Fractures; Loss of Consciousness; Recovery*

Introduction

The cranial fractures reflect the presence of a continuity solution at the bone wall of the skull arch [1] with or without sinking. Although the child's cranial box is more elastic than in adults, skull fractures remain more common [2]. In the literature their frequencies vary from 25 to 41% for all head injuries combined, between 1 and 8% in specific studies of minor head injuries [2,3]. They are found in 25% of cases in children and 40% in infants, all types of head injuries combined. Mortality on all head trauma patients is 3 to 6% but can reach 30 - 70% in severe forms [4]. The evolution of skull fractures will depend mainly on the severity of associated brain injuries, the quality and speed [5] of management. Studies of the child's skull fractures were, for the most part, used to be part of head injuries. In Madagascar,

there is little data on these fractures, which led us to initiate this study. The objective of our study was to determine the epidemiological-clinical and therapeutic profile of cranial fractures in children.

Methodology

We conducted a retrospective and descriptive study, covering clinical records, radiological snapshots, surgical reporting of patients with head injuries, taken care of in the neurosurgery department of the CHU-HJRA on a 13-month period. We included in this study all patients with head trauma, under the age of 18 who received an X-ray of the skull in incidence of face, profile and or cerebral CT, with a brain X-ray and or cerebral CT fracture and or a gap, operated or not. We analyzed the sociodemographic, clinical, paraclinical, therapeutic and evolution variables on the XLSTAT2003 software.

Results

In our 13-month study, 2097 patients were hospitalized in the ward: 547 belong to the pediatric population, representing 26.08% of the hospitalized. Of these children, 409 suffered head trauma (74.77% of hospitalized children) of which 105 had skull fractures (25.67% of traumatized children and 19.19% of hospitalized children). The sex ratio was 1.62.

There was a spike in frequency for the 0 - 5 age group, or 61 cases (58.10%). The average age is 5.88 years (median 4 years; standard deviation - 59.11) with age extremes ranging from 2 months to 17 years.

Domestic accidents are the most common causes (63.81%), followed by public road accidents (23.81%), assaults (8.57%) and traffic accidents (3.81%).

Domestic accidents and road accidents are dominated by falls (80.43% or 70.48% of etiologies), ranging from a height of 0, 5 to 7 m. Note that in our study, no cases of abuse were mentioned.

The majority of patients (80%) had come to the hospital by car. Only 2.86% were transported by ambulances. In other cases, patients had arrived either on foot (5.71%), or by motorbike (0.95%), or by rickshaw (0.95%).

The vast majority of patients (72.38%) had arrived in consultation at the hospital within 6 hours of the trauma. The average time being 420 minutes (7 hours) ranging from 15 minutes to 7 days.

The concepts of initial loss of consciousness (43.81%) and vomiting (19.05%) dominated the functional signs motivating the consultation. Seizures and headaches each accounted for 8.57% of cases. The other signs were represented by drowsiness, restlessness, dizziness achieving 4.76%. In 15.24% of cases, functional signs were absent.

On the neurological condition, the majority of patients under 3 years of age had a Blantyre score of 5/5 or 92.11% (Table 1).

Blantyre Score (Out of 5)	Effective (n = 38)	Percentage (%)
5	35	92,11
3 to 5	3	7,89
0 to 2	0	0

Table 1: *Breakdown of patients 0 to 3 years by Blantyre score.*

The majority of patients aged 3 and over had a Glasgow score of 13 to 15, or 91.04% (Table 2).

Glasgow Score (Out of 15)	Effective (n = 67)	Percentage (%)
13 to 15	61	91,04
9 to 12	5	7,46
3 to 8	1	1,49

Table 2: *Distribution of patients over 3 years of age by Glasgow score.*

Local physical signs were present in 75.23% of patients. Scalp and face wounds accounted for 35.55% and 34.44% of the signs, respectively. Post-traumatic swelling (17.77%) and head cuts (8.88%) were less frequent. The other signs are represented by epistaxis and otorrhagia achieving 3.33%.

Neurological signs of location were found only in 4 patients 3.81%. One of them had hemiplegia, another had hemiparesis and the remaining 2 had anisocoria.

In the majority of cases (62.50%), head injuries were isolated. The association with trauma of the face was the most common found in 29.52% of cases, then the association with a trauma of the limbs (at 3.81%), then of the thorax (at 5.77%).

The majority of our patients (66.67%) is ranked in Group II of Masters. Patients in Masters Group I and III account for 16.19% and 17.14% respectively (Table 3).

Classification De Masters	Number of People (n = 105)	Percentage (%)
Group I	17	16,19
Group II	70	66,67
Group III	18	17,14

Table 3: *Breakdown of Patients by Masters Classification.*

The skull x-ray alone was the most performed imaging with a percentage of 75.24%. The association with cerebral CT was 17.14%. Patients who achieved CT scans alone accounted for 7.62%.

Patients with an unlocked linear fracture were the majority achieving 70.48%. Fracture-embups accounted for 28.57%. The combination of these two types of fracture was found in a patient.

The parietal regions were the preferred seats of the fractures with a percentage of 46.67%. The fronto-parietal and temporal regions each accounted for 10.48%. The temporo-occipital regions were the least frequent seats representing 0.95% of cases.

Intracranial lesions were found in 18 out of 105 patients (17.14%) 6 of the 31 patients who had a bottle (19.35%). Extradural hematomas were the most found accounting for 50% of intracranial lesions, followed by edemato-hemorrhagic contusions (31.82%). Subdural hematomas, meningeal and intra-parenchymatous hemorrhages accounted for 18.18% of the intracranial lesions found. It should be noted that some patients had several types of lesions at the same time.

All patients received medical treatment with at least painkillers, 68.56% of which were peripheral venous. The analgesics were used to compensate according to the visual pain scale but often the pain was relieved by paracetamol started by peripheral venous.

Antibiotic therapy was prescribed in 22.86%. It has been systematically instituted in patients operated on. Anti-edematous (mannitol 20%, glycerotone) was prescribed in 11 patients (10.48%).

Surgical intervention was performed in 16 patients (15.24% of cases) including: 9lifts, 4 extradural hematoma evacuations, an extradural hematoma evacuation with emstring recovery, anextradural hematoma evacuation and subdural hematoma, an intra-parenchymatous hematoma discharge. 10 out of 31 patients (32.25%) who had a slur and 6 of the 11 (54.55%) patients who presented an extradural hematoma. Functional rehabilitation (passive and active mobilization, stimulation of the limbs) for motor recovery was prescribed in 2 patients. One with right hemiparesis, the other a right hemiplegia.

The majority of cases (87.62%) have shown a good evolution. Complications were noted in 2 patients (1.90%) including hemiplegia and hemiparesis. In 11 patients (10.48%), the evolution was undetermined: ten came out on his request (against medical advice) and one escapee.

More than half of patients (53 patients or 50.48%) were hospitalized for between 3 and 7 days. The 39.05% were hospitalized for at least 2 days and 10.48% more than 7 days. Extremes ranging from 1 to 12 days with an average of 3.6 days (median 3 days; standard deviation -2.45).

Discussion

The study by Sieyamdji [6] showed 23 cases of skull fractures objectified on the standard head x-ray and profile on 92 patients who suffered severe head trauma or 25%. The embars accounted for 17.39% of these fractures.

In Mali, out of 81 cases of head trauma in children aged 0 to 15 years, 9.88% of patients were shown to have a head fracture [7].

A study conducted in Antananarivo by Bemora [8] showed that fracture-containment accounted for nearly 6.37 percent of surgery in the block and 1.99 percent of hospitalization in the neurosurgery ward over a 5-year study period.

In our study, the frequency of skull fractures is higher than that found by Sieyamdji and Youssouf with a rate of 25.67%. The rate of entanglement found in our study also higher compared to the sieyamdji result representing 29.52% of fractures. These findings may be related to the larger size of our study population of 105 cases of skull fractures out of 409 children with head trauma. The higher rate at 5.67% of hospitalized patients with emputure in our study compared to that found in the Bemora study could be explained by the fact that the latter included in his study only patients with surgery.

As with all head injuries, male predominance was demonstrated by all studies in cranial fractures, Check [9] found a sex ratio of 5.7 and Bemora [8] also found a sex ratio of 7.3.

In the study conducted by Adetayo., *et al.* [10], involving 923 cases of cranial fractures in patients under the age of 18, the average age was 5.97 years. The results of our study are consistent with those of the aforementioned study. The frequency of skull fractures for this age group is probably related to different acquisitions as well as to the curious attitude of children during this period.

In the literature, the most common causes of skull trauma in general are represented by road accidents, falls, assaults and projectiles [11]. Abuse is also a cause not to be overlooked in children with head trauma especially in the presence of skull fractures. In North America, it is accepted that about 10% of head injuries in children under 2 years of age are not accidental and cranial fractures are found in nearly 45% of cases [12].

Adetayo., *et al.* [10] found that falls were the most common causes of cranial fractures with 53.7% followed by collisions with 20.8%.

Sieyamdji [6] found that 71.73% of the barriers are due to road accidents on 92 samples.

Check [19] found that only 52.5% of the valve fractures are due to road accidents, 25% to involuntary falls and 22.5% to assaults.

The Bemora study [8] showed that in 60% of cases, these were assaults, 20% of traffic accidents and 12% of domestic accidents.

Transportation must be as traumatic and comfortable as possible in relation to the many painful outbreaks and the hemodynamic state of the victim. In developed countries, the transport system is well organized and the means are efficient, whether by land or helicopter [13].

For developing countries, such as madagascar, these means of transport are still limited and the cost of medical transport is not within the reach of the majority of the population. This would explain the fact that only 2.86% of our patients were transported by ambulances.

Regarding the time it took to take care, Bensousan's study [14] showed that out of 800 head trauma patients, the average time to take care was 45 minutes.

Karembe's study [15] reported that out of 150 cases of head injuries, the delay was 60 minutes. Lamiree's study [16] showed that the average response time was 120 minutes, of which 56.89% of cases were treated within 0 to 6 hours.

In our study, the average response time was 420 minutes long. Nevertheless, the vast majority of patients (72.38%) came to the CHU in an early period of less than 6 hours. This delay in care is said to be linked to the inadequacy of the rescue and collection system, as well as the lack of financial means. On the other hand, many patients are admitted in second attention, referred by other health facilities.

Early management in some of our cases is said to be related to the proximity of the trauma site to the hospital.

Check [9] found that 78.6% of the most common reasons for consultation are represented by headache, dizziness, convulsions and initial loss of consciousness. Bemora [8] found that the circumstances that lead patients to consult are mainly headaches (64%), initial loss of knowledge (56%) and dizziness (16%).

In our study, the results differ from those of previous studies. The notions of initial loss of consciousness dominated the functional signs motivating the consultation. Headaches and dizziness were less common. Since the majority of our patients were in the 0 - 5 age group, these results could be explained by the fact that at that age, children are not yet able to express certain signs such as headache, dizziness. In 15.24% of cases, functional signs were absent. This would be related to the non-acquisition of speech in many of our patients.

Neurologically, Check [9] found that the majority (55%) patients had a Glasgow score of 9 to 12 and 7.5% a score of 3 to 8. Bemora [8] found that the majority of patients (92%) had a Glasgow score of 13 - 15 and 8% a score of 3 - 8.

In our study, 92.11% of children under 3 years of age had a Blantyre score of 5/5 and 91.04% of children aged 3 and over had a Glasgow score of 13 to 15. As a result, the majority of our patients have suffered minor head trauma. This high rate can be explained by the fact that severe head injuries are mostly admitted to surgical resuscitation (not included in our study population). For cases of entanglements in our study, the majority were classified as minor head trauma (93.55%). Only 1 in 31 cases (3.23%) had a severe head injury (Glasgow score of 3 - 8). This lower rate, which differs from those found by Check and Bemora, is probably due to the fact that in their study populations, all patients were operated on, thus being exposed to more violent shocks. The presence of a skull fracture does not affect the state of consciousness, represented by the initial Glasgow score. The alteration of this score would be suggestive of other pathologies, notably intracranial injury, hence the interest of regular and rigorous monitoring of the Glasgow score.

A study in Mali [9] found that hemiparesis (1.6%), aphasia (1.6%) and anisocoy (0.8%) are the most common neurological signs. In Antananarivo, Bemora [8] found similar results, but with a higher rate, with hemiparesis at 16% and other signs of 8%. In our study, motor deficit (including hemiparesis, hemiplegia) and anisocoria were also the most found neurological localization signs accounting for 1.90% each.

According to the literature [17], patients classified in Masters Group I have a low risk of intracranial injury, group II a moderate risk and group III a high risk. Group I does not require hospitalization unless home monitoring is not possible.

According to Masters classification management [17], skull x-rays are unnecessary for Group I patients and are unnecessary if a group II scannographic device is available. For Group III, the CT scan is indicated as a contingency.

Check, Mali [9] in 2004 found that 80% of patients with a skull implant were able to benefit from a brain scan and the remaining 20% received only a standard X-ray due to lack of means.

In a study by Ersahin [18], 7 - 10% of children admitted to the hospital for head trauma had an emputorce and 15 - 25% of children with skull fractures. Sieyamdji [6] found that the embarrures accounted for 17.39% of the skull fractures in patients with severe head trauma.

The Yavuzen Turkey study [19] showed that the majority of skull fractures sits at the fronto-parietal part in the 77.5% of cases.

Check [9], as well as Bemora [8] revealed similar results with 70% fronto-parietal seat.

Our study joins previous studies as well as other studies on cranial fractures [20], showing that parietal and frontal bones were the preferred seats of these fractures with a total percentage of 64.77%.

In the Yavuz study [19], the most found intracranial lesions in cranial injuries with entanglements are ostemeningea breach craniobrain wounds, epidural hematomas, parietal hematomas and bruises. Brain. A study by Bonfield [20] on the child's skull fractures showed that hematomas were the most found intracranial lesions.

Medical management is similar for all head injuries.

In Youssouf's study [7] on child head trauma in 81 cases, medical treatment was adopted in 72.84%. The most commonly used drugs were painkillers, antibiotics and salt serum.

For Lamiree [16], in a study of head injuries in 392 cases, analgal therapy and antibiotic therapy were the most used with 96.43% and 45.92% of cases respectively.

Our study joins previous studies with prescription of painkillers in 100% of cases, antibiotics in the 22.86%. The systematic use of painkillers is explained by the permanent presence of post-traumatic pain. On the other hand, antibiotic therapy was systematically instituted only in surgical patients, hence the lower rate in our study.

According to the literature [20], the majority of the child's skull fractures can be treated conservatively. In paediatric patients, the majority of head injuries are minor, do not require special treatment and leave no sequelae [21]. The onset of sequelae is directly proportional to the severity of the associated lesions [22], but not to the fracture itself.

According to Coulibaly's study of head trauma in 80 cases [23], the average length of hospital stay was 6 days. The shortest stay is 2 days and the longest is 19 days. The majority of patients (55.9%) stayed between 1 and 5 days.

According to Fatigba's study of cranio-brain injuries, the average length of hospitalization was 7.25 days [24].

According to Lamiree, [16] the average length of hospitalization for head trauma patients was 10 days with extremes of 5 hours and 159 days. Most patients who stayed between 1 and 7 days.

Conclusion

Head fractures are injuries frequently encountered during childhood head injuries. They increase the risk of intracranial lesions that make them severity. Their evolution will depend on it as well as on the quality and speed of the care.

Domestic accidents were the most recovered etiologies and a delay in management was noted. Initial loss of consciousness was the motivating signs of consultation and local physical signs were dominated by facial wounds, scalp and post-traumatic swelling.

However, our results reflect only part of the reality in Madagascar because our study is monocentric and the data are strictly hospitable.

Although a good development is observed in the majority of cases during hospitalization, long-term follow-up is recommended to detect possible after-effects.

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