



## Original Article

## Management of Pediatric Traumatic Brain Injuries at The Regional Hospital of Ziguinchor (Senegal)

### *Prise en charge des traumatismes cérébraux de l'enfant à l'Hôpital Régional de Ziguinchor (Sénégal)*

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#### ABSTRACT

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**Key words:** Traumatic brain injury, children, Ziguinchor, Senegal.

**Mots clés :** traumatismes cérébraux, enfants, Ziguinchor, Senegal.

**Objectives.** The purpose of our study was to describe the diagnostic, therapeutic, evolutive and prognostic features of children's traumatic brain injury (TBI) at Ziguinchor Regional Hospital. **Methods.** This cross sectional retrospective study was based on 77 children age 6 months up to 16 years, suffering from traumatic brain injury admitted to our unit over a one-year period (from April 1, 2019 to March 31, 2020). Diagnostic, therapeutic, dynamic and prognostic aspects were evaluated. **Results.** Out of 147 children who were casualties of road traffic accident during our study period, 77 (52.38%) had a TBI. The average age was 8.96 years. The sex ratio was 3.27 boys to one girl. Street accidents (53.25%) followed by falls (35.06%) were the most common causes. Forty-seven patients (61.04%) were admitted within 4 hours of trauma. The Glasgow Coma Scale was less than or equal to 8 in 9 cases (11.69%), lied between 9 and 13 in 18 cases (23.38%) and between 14 and 15 in 50 cases (64.94%). Motor deficit was noted in 7 cases (9.09%) and mydriasis in 5 cases (6.49%). Fractures of the arch (23.38%), followed by contusions (16.88%) were the most frequent lesions on brain CT scan. Eight patients (10.39%) underwent surgery. The evolution was favorable in 83.11% of cases. We recorded 10.39% of deaths and 3.89% of minor sequelae.

**Conclusion.** TBI in children occur frequently in our context. The main etiology is road accidents. They must be managed as early as possible by a specialised team.

#### RÉSUMÉ

**Introduction.** Le but de notre étude était décrire les aspects diagnostiques, thérapeutiques, évolutifs et pronostiques des traumatismes crânio-encéphaliques (TCE) de l'enfant au centre hospitalier régional de Ziguinchor. **Matériels et méthodes.** Il s'agissait d'une étude transversale rétrospective portant sur 77 enfants âgés de 6 mois à 16 ans admis dans notre structure pour TCE sur une période d'un an (du 1<sup>er</sup> avril 2019 au 31 mars 2020). Les aspects diagnostiques, thérapeutiques, évolutifs et pronostiques ont été analysés. **Résultats.** Parmi 147 enfants victimes d'un accident avec traumatisme durant la période d'étude, 77 (52,38%) ont présenté un TCE. L'âge moyen était de 8,96 ans. Le sex ratio était de 3,27 en faveur des garçons. Les accidents de la voie publique (53,25%) suivis des chutes (35,06%) étaient les étiologies les plus fréquentes. Quarante-sept (61,04%) patients ont été admis dans les 4 heures suivant le traumatisme. Le score de Glasgow était inférieur ou égal à 8 dans 9 (11,69%) cas, compris entre 9 et 13 dans 18 (23,38%) cas et entre 14 et 15 dans 50 (64,94%) cas. Un déficit moteur a été noté dans 7 (9,09%) cas et une mydriase dans 5 (6,49%) cas. Les fractures de la voûte (23,38%), suivies des contusions (16,88%) constituaient les lésions les plus fréquentes au scanner cérébral. Huit (10,39%) patients ont bénéficié d'une intervention chirurgicale. L'évolution était favorable dans 83,11% des cas. Nous avons enregistré 10,39% de décès et 3,89% de séquelles mineures. **Conclusion.** Les TCE de l'enfant sont fréquentes dans notre contexte. L'étiologie reste dominée par les accidents de la voie publique. La prise en charge doit être précoce avec des équipes spécialisées.

#### INTRODUCTION

Children's traumatic brain injuries (TBI) are one of the most common reasons for hospital visits [1]. Their incidence can vary depending on the age and the country [2]. In industrialized countries, TBI is the leading cause of accidental death and disability in infants and teenagers [3, 4]. According to autoptic data, these

injuries are responsible for 40-50% of deaths in the United States [5]. In Senegal, multiple studies have been conducted on children traumatic brain injuries in different neurosurgical units, but there is no documented data at the national level [6]. The etiologies may vary according to age or geographical origin, but remain

dominated by road traffic accidents [7, 8]. The purpose of our work was to evaluate the diagnostic, therapeutic, evolutive and prognostic aspects of children traumatic brain injury in the neurosurgery unit of the Regional Hospital of Ziguinchor over a one-year period.

## MATERIALS AND METHODS

We conducted a retrospective study from April 2019 to March 2020 at the neurosurgery unit of Ziguinchor regional hospital center which is a Level II Public Health Establishment in the Senegalese health pyramid. This unit is the second one created in a rural area and receives, among other neurosurgical pathologies, local brain traumas, from the surrounding regions (Kolda, Sédhiou, Tambacounda) and neighbouring countries (Guinea Bissau, Gambia). With 6 beds in the general surgery unit, and 3 other beds in the Emergency Department, the unit possess all in all 9 beds. Ziguinchor is a landlocked region with a high road traffic accident rate due to the poor quality of the roads but also to the proliferation of motorcycle taxis and seasonal fruit picking activities that often cause children to fall from trees..

The medical records of all children aged 6 months up to 16 years who had suffered a traumatic brain injury in the meantime were investigated. All the children were admitted to our unit through the emergency department. Among the variables studied, there were: age, sex, origin, admission time, and circumstances of occurrence, along with clinical, radiological, therapeutic, and evolutionary aspects. For each patient, we assessed hemodynamic and ventilator status as well as the clinical examination. The state of consciousness was assessed using the Glasgow Coma Scale adapted to the child. Each patient was checked for ocular signs (pupillary abnormalities), focal neurological deficit and seizures. On admission, patients with severe and/or hemodynamic or respiratory instability were transferred to the intensive care unit. The request for a Brain CT Scan without injection of contrast, with bone and parenchymal windows, was based on the patient's interrogation and the clinical examination. The surgical indication have been addressed in the following circumstances: a craniocerebral wound, a symptomatic and/or a compressive extradural hematoma, an acute subdural hematoma beyond 5 mm thin with a midline deviation of at least 5 mm, a compressive depressed fracture. The evolution was evaluated on clinical criteria (Glasgow, focal neurological deficit, seizures) and paraclinical criteria (cerebral control CT scan) with a time period follow-up varying from 1 to 11 months after treatment. The data were analyzed using Epi info software, French version 7.2.2.6.

## RESULTS

Over the study period, we received 77 children who had suffered a traumatic brain injury, accounting for 52.38% of all children admitted for accidental injury. The average age of the children was 8.96 (Std Dev 4.85) with extremes ranging from 06 months to 16 years (Figure 1). The sex ratio was 3.27 boys to one girl. Forty-two

(54.54%) patients came from the commune of Ziguinchor, 31 (40.25%) from the surrounding regions and 4 (5.19%) from neighbouring countries. Road traffic accidents (53.25%), followed by falls (35.06%) were the most common cause regardless of the age range (Figure 2). Forty-seven patients (61.04%) were admitted within 4 hours after trauma. The admission delay was greater than 24 hours in 9% of cases. 51.94% of patients were transferred by non-medicalized ambulances, by firefighters in 25.97% of cases, private vehicles in 15.58% of cases and in 6.51% of cases, the means of transport was not specified. At admission, hemodynamic and ventilatory status was stable in 90.90% of patients and unstable in 9.10%. Two children (2.59%) presented with severe anemia at the unit. Clinically, the Glasgow Coma Scale was less than or equal to 8 in 9 cases (11.69%), lied between 9 and 13 in 18 cases (23.38%) and between 14 and 15 in 50 cases (64.93%). Twenty-nine patients (37.66%) showed signs of intracranial hypertension, 6 (7.79%) : pupillary disorder including an anisocoria in 3 cases, reactive bilateral mydriasis in 2 cases and areactive bilateral mydriasis in 1 case. A motor deficit was found in 7 cases (9.09%) and a notion of convulsive seizure in 10 cases (12.98%). Craniofacial examination showed a scalp haematoma in 37 cases (48.05%), a scalp wound in 23 cases (29.87%), periorbital ecchymosis in 10 cases (12.98%), rhinorrhage in 6 cases (7.79%) and otorragy in 4 cases (6.7%). Other injuries associated with brain trauma were observed in 25 cases (32.46%). The lesions which prevailed were: maxillofacial trauma (12.98%), followed by limb fractures (9.09%), spinal trauma (5.19%), thoracic injuries (3.90%) and one pelvic injury (1.30%). Brain CT scan was performed in 67 cases (87.01%). Scanned lesions were dominated by fractures of the arch (23.38%), followed by cerebral contusions (16.88%). The CT scan was normal in 21 cases (27.27%) (Table 1).

**Table 1 - Patient Distribution by Scanning Signs**

Injuries	Frequencies	Percentage
Vault fracture	18	23,38%
Depressed skull fracture	10	12,99%
Skull base fracture	5	6,49%
Contusion	13	16,88%
Pneumencephaly	2	2,60%
Edema	2	2,60%
Epidural hematoma	6	7,79%
Acute subdural hematoma	6	7,79%
Suture disconnection	1	1,30%
Diffuse axonal lesions	2	2,60%
Intraparenchymal hematoma	3	3,89%
Subarachnoid hemorrhages	4	5,19%
Hémosinus	2	2,60%
Facial fracture	1	1,30%
Normal	21	27,27%

All children admitted with a Glasgow Coma scale rated to 8 or less were transferred to the intensive care unit, the others received medical treatment with analgesics, antiemetics in the event of vomiting, antiepileptics in the event of seizures, isotonic saline and neurological

monitoring. Eight (10.39%) of our patients underwent surgery, including 5 in emergency and 3 in scheduled surgery. The surgical procedure was performed under general anaesthesia in all cases and consisted of: a surgical elevation for depressed skull fractures, in 3 cases, trimming of a craniocerebral wound in 3 cases, the removal of an acute subdural haematoma in 1 case and of an epidural haematoma in 1 case. The postoperative follow-up was simple for all our operated patients. The average length of hospitalization was 6 days with extremes ranging from 1 to 34 days. Follow-up was from 1 to 11 months. The evolution was favorable in 64 patients (83.11%) with recovery without after-effects. Three of the non-operated patients presented a persistence of motor deficit after hospital discharge, one of them recovered correctly and the others two had a discrete hemiparesis deficit. One patient had persistent seizures at 3 months after discharge. There were 8 deaths (10.38%). Two patients were lost to follow-up (2.59%).

## DISCUSSION

Traumatic brain injuries of children are extremely frequent in daily practice. In our series, they accounted for 56.38% of all the children admitted to the emergency unit, who suffered accidental trauma during our study period, which is fitting with data in the literature [3,4,9]. The average age of 8.96 (Std Dev 4.85) in our study is comparable to Ekouele's et al in Brazzaville, who reported a mean age of 9.73 [10]. However, the age distribution is variable in the literature and depends on the mode of recruitment and the cause of the head injury [1,11]. In our study, we found a higher proportion of TBIs in the 12-16 year age group. The predominance of males, which is classic in trauma [6, 10, 12], was found in our study with a sex ratio of 3.27. This male predominance is more pronounced in children starting from the age of 8 years. This can be explained in our context by the fact that boys use more often motorcycle taxis as a mean of transportation and are also the most active ones in fruit-picking activities, which expose them to fall from trees. The distribution of the causes of TBI differs depending on the age range and also the socio-economic and cultural profile of countries. However, these etiologies remain dominated by road traffic accidents in most series [6, 9, 10]. In our study, road traffic accidents followed by falls were the most frequent causes. This can be explained on the one hand by poor road conditions and the proliferation of motorcycle taxis, and on the other hand by the importance of fruit-picking activities in the area exposing children to the risk of falling. However, Adelson et al. had observed a predominance of domestic accidents among children [13]. Forty-seven patients were admitted within 4 hours of the trauma with extremes of 30 minutes and seven days. This delay in management is often reported in African series [9, 10, 14]. In our context, it is due to the remoteness of neurosurgical services and the under-equipment of the structures, especially regarding picking up and transferring patients. The majority of our children

(64.93%) had a mild TBI. This is consistent with the data in the literature, with mild TBIs being the most frequently found in the various studies [12,14]. The proportion of severe form (11.69%) in our series is comparable to Lupin's findings (11.70%) in Benin [9]. Examination of the pupils is an important part of the initial examination, but also a subsequent surveillance element [15]. In our study, the frequency of pupillary abnormalities was 7.79% compared to 13.8% in Levi's [16]. This low rate of pupillary abnormality in our study was probably related to a low frequency of compressive intracranial lesions. Motor deficit was found in 9.09% against 11.1% in the Ekouele's series [10]. Convulsive seizures were present in 12.98% of the patients in our study and were reported in the literature at frequencies ranging from 0.2% to 17.8% [17, 18, 19]. Lesions associated with brain trauma were observed in 32.46% in our study. This is compatible with the data in the literature [20]. The indication for brain CT scan is required for all moderate to severe TBI. However, there is controversy about patients with minor TBI [21]. In our study, brain CT scans were performed in all children with moderate or severe TBI and in 52% of children with minor TBI. Hemorrhagic lesions were dominated by brain contusions (16.88%). Ekouele [10] also found a predominance of contusions with 46.7%. The incidence of skull fractures varies from 5% to 48% depending on the series [16]. These bone lesions were found in 42.86% of our patients. The frequency of these bone lesions is explained by the immaturity of the skull and the absence of protective reflexes in the event of a falling [22].

From a therapeutic standpoint, there is no consensus regarding the time frame of an early surgical indication in cases of brain trauma. On the other hand, it is commonly accepted to perform emergency surgery for symptomatic epidural haematomas and compressive subdural haematomas, open depressed skull fractures and hydrocephalus [23]. In our study, eight patients (10.39%) underwent surgery compared to 8.90% in the Ekouele's series [10]. The surgery consisted of: surgical elevation in 3 cases, trimming of a craniocerebral wound in 3 cases, removals of an acute subdural hematoma in 1 case and an extradural hematoma in 1 case. Follow-up ranged from 1 to 11 months. 64 patients (83.11%) had favorable course showing a recovery without sequels. Three of the non-operated patients had persistent motor deficit after surgery.

## CONCLUSION

Children brain injuries are common in Ziguinchor, and road traffic accidents are the main cause of these injuries. However, falls are also a significant cause. Improving the prognosis of TBI depends significantly on the quality of its management. It is therefore necessary to develop a health policy facilitating the accessibility of care and the equipment of peripheral hospitals. The most important thing, nonetheless, remains the strengthening of preventive measures, especially against traffic accidents, and the monitoring of children during seasonal fruit-picking activities.

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**CONFLICTS OF INTEREST**

On behalf of all author, the corresponding author states that there is no conflict of interest.

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