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Epidemiological and Clinical Study of Cases of Cranioencephalic Trauma Admitted to the Neurosurgery Department of the Gabriel Touré University Hospital Center in Bamako

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Abstract **Original Research Article**

Introduction*:** Traumatic brain injury (TBI) remains a major public health problem worldwide. Numerous epidemiological studies conducted in the West and Africa have shown that the incidence of TBI varies from one country to another. This incidence is higher in developing countries where technical and financial management remains difficult. We focused on this subject with the aim of studying its epidemiology and clinical features in the neurosurgery department of the Gabriel Touré University Hospital in Bamako. The methodology used was the retrospective analysis of all the files of patients admitted for TBI. A questionnaire was completed for a comprehensive description of the study variables. ***Results: The study allowed us to identify 334 patients including 272 men and 62 women. The average age was 19 ± 17.5 years. Initial loss of consciousness was observed in 79.6% of cases, wearing caste in 1.2%, road accidents in 67.1% and headaches in 37.4%. Road accidents were the most frequent cause and the collision mechanisms Motorcycle-motorcycle and motorcycle-pedestrian were the most recorded (20.4%). Patients under 15 years old were the most affected with 3.8% while 87.7% were under 50 years old. The most frequently encountered lesions were splint fractures, extradural hematomas, and subdural hematomas. Treatment was medical and surgical, depending on the case. The outcome was favorable in the majority of our patients.

Keywords: Epidemiology, Clinical, Head Trauma, Neurosurgery.

1. INTRODUCTION AND JUSTIFICATION

According to the World Health Organization (WHO), traumatic brain injuries (TBI) are defined as any direct or indirect mechanical aggression responsible or not for a skull fracture and/or disturbances of consciousness or signs indicating diffuse or localized encephalic suffering of secondary or delayed onset [1, 2].

Worldwide, traumatic brain injuries remain a major public health problem with high morbidity and mortality and multiple and varied disabling sequelae [1-3]. According to the CENTER-TBI [4], Fifty million people suffer from a TBI worldwide every year with 80% in developing countries, 57 000 TBI -related deaths and 1-5 million hospitalizations occur in the European Union and the annual global costs of care and consequences of TBI are up to US$ 400 billion [4]. Different other regional or global studies of the incidence of traumatic brain injuries, estimates several tens of millions of people worldwide suffer a head injury each year with varying impacts from one area to another [5-7].

The BIONIC study in New Zeeland estimated the incidence of head trauma to be 790 per 100,000 which is extrapolated globally to more than 50 million head injuries each year of which about 30% do not see acute medical care [5, 6].

Every year, an estimated 1.5 million Americans suffered head trauma, of whom 50,000 died, 230,000 were hospitalized and 90,000 had a long-term disability, with an estimated prevalence of 5,3 million people living with a permanent disability related to head trauma [8].

In France, according to some authors, in 2005, approximately 150,000 head injuries (TBI) are recorded

each year, including 8,000 deaths and 4,000 comas annually [9]. There are currently more than 30,000 TBI patients in France living with serious after-effects of TBI. Caring for these injured people requires very specific and varied skills [9].

In Africa, the exact incidence of TBI is poorly understood, but trauma emergencies are the main reason for admission to emergency departments and the associated mortality is high [1, 2]. The frequency of traumatic brain injuries in the population in African studies varies between 3.5 and 7per thousand inhabitants [10, 11,]. There is a wide etiological variety of TBIs with varying frequencies depending on the country or study area. Thus, the proportion of head injuries resulting from road accidents would be highest in Africa and Southeast Asia (56% in both cases) and lowest in North America (25%) [3].

Low-income and middle-income countries experience proportionally 3 times more cases of head injury than high-income countries [12, 13]. A study conducted in Mali found a frequency of serious cranioencephalic trauma at 53.25% [5].

Addressing this problem still poses significant challenges in developing countries like Mali compared to developed countries; this is due to the limited or inadequate technical platform and the low financial income of the injured.

In Mali, the study on the incidence of TBI was estimated at 2000 per 100 million hospitalizations [6]. With globalization, we observe an increase in vehicle users (cars, two-wheeled vehicles and tricycles). This phenomenon has led to an inflation of the road accident rate and consequently an increased frequency of head injuries. This situation must be associated with the incivility of road users marked by ignorance or non-compliance with the road traffic code of conduct despite Law No. 2023-045 of August 31, 2023 governing road traffic in the Republic of Mali. All these factors lead to an increase in the number of victims of head injuries. The management of these TBIs remains difficult with a high mortality rate (70%) [1-6].

We were interested in this topic with the aim of contributing to the literature on the epidemiological and clinical aspects of TBI in Mali. To achieve this, we decided to carry out an epidemiological and clinical study of TBI in the neurosurgery department of Gabriel Touré University Hospital, a 3rd reference hospital in Mali, general objective of this study.

The specific objectives were to:

- Describe the sociodemographic characteristics of patients suffering from cranioencephalic trauma admitted to the neurosurgery department of the Gabriel Touré University Hospital
- Describe the clinical characteristics of cranioencephalic trauma admitted to the neurosurgery department
- Report traumatic lesions found on brain CT scans of patients with head trauma.

2. METHODOLOGY

2.1 Framework of the Study

The Gabriel Touré University Hospital of Bamako is an internationally renowned healthcare facility located in the heart of the city of Bamako, the capital of Mali, straddling communes II and III and built on an area of 3.1 hectares.

2.2 Type and Period of Study:

This was a retrospective collection study using the records of patients admitted between November 2022 and October 2023.

2.3 Study Population

The study involved patients of both sexes and all ages admitted to the neurosurgery department of the Gabriel Touré University Hospital for cranioencephalic trauma.

2.4 Criteria

Included in this study, regardless of sex or age, were patients with complete medical records treated in neurosurgery for head trauma during the study period.

Patients who had not been regularly monitored and those with incomplete records were excluded from this study.

2.5 Sampling

The sampling was exhaustive and covered all patient files meeting the various criteria and admitted to the neurosurgery department of the Gabriel Toure University Hospital. Thus, 334 files were collected.

2.6 Collection and Processing of Data

The actual data collection was carried out through a questionnaire that was completed for each file. The data was entered using Microsoft Office 2011 and analyzed using Excel and SPSS version 25 software.

3. RESULTS

- **Sociodemographic Characteristics**

Of 334 patients with head trauma, 81.4% (272 cases) were male, with a sex ratio of 4.4. The mean age of the patients was 19 ± 17.5 years, with extremes ranging from 1 month to 82 years. Chart 1 below details the distribution of patients by age.

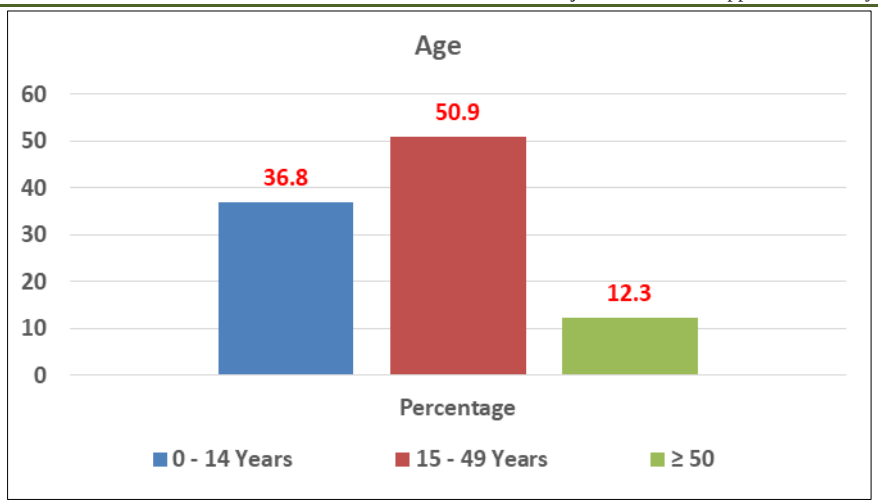


Figure 1: Representation of head trauma victims by age

The 15-49 age group was the most represented in the sample with a proportion of 51%.

Seventy-six point seven percent of patients were transferred from the emergency department of the Gabriel Touré University Hospital, or 170 cases referred from local public health centers, with 15.9%. Figure 2 shows the distribution of patients by health facility of origin.

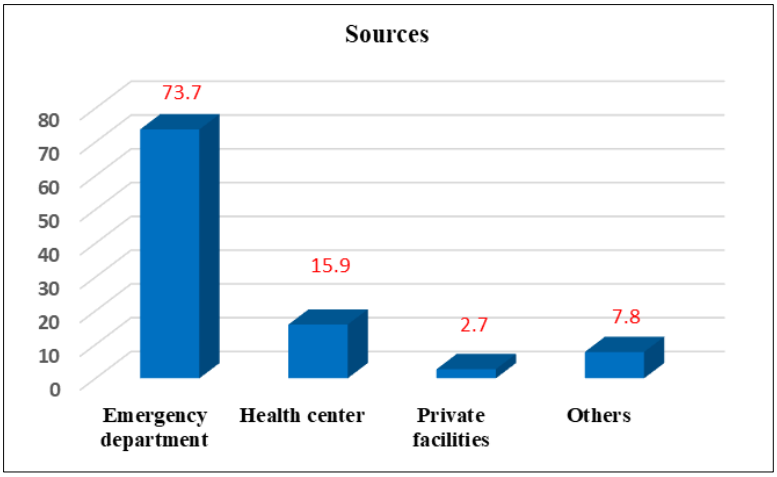


Chart 2: Representation of head trauma patients according to the structure of origin

The majority of patients came from the emergency department with a rate of 73.7%. A total of 44.3% of patients were illiterate. Details of the patients' educational level are given in Table I below.

Table I: Distribution of cranioencephalic traumas by profession

Educational level	Effective	Frequency (%)
State employee	10	3.0
Employed in the private sector	7	2.1
Independent	146	43.7
Student	35	10.5
Housewife	20	6.0
Unemployed	2	0.6
Not available	35	10.5
Not applicable	79	23.7
Total	334	100

Not available= adult records where the profession is not indicated; Not applicable = Records of children not of school age.

Among the 334 participants, the proportion of self-employed workers was the highest, at 44%.

Regarding the etiology of head trauma, road accidents were found in 67.2% or 225 cases. Blows and injuries represented 10.5% (35 cases). The following graph 4 describes the detailed distribution of TBI according to etiology.

Others: Unintentional blow and injury, falling from a tree

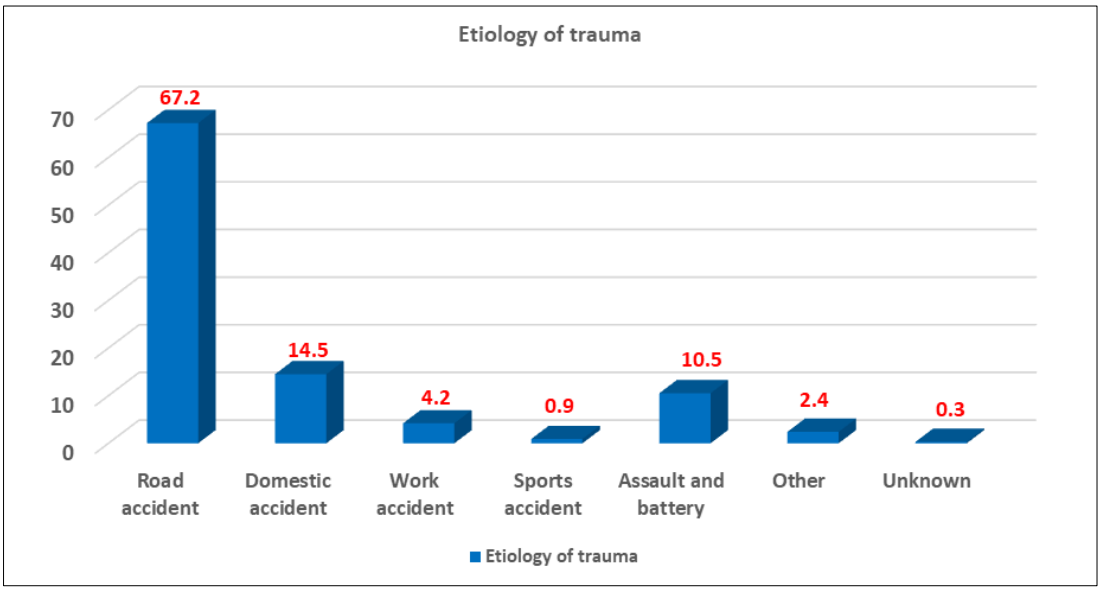
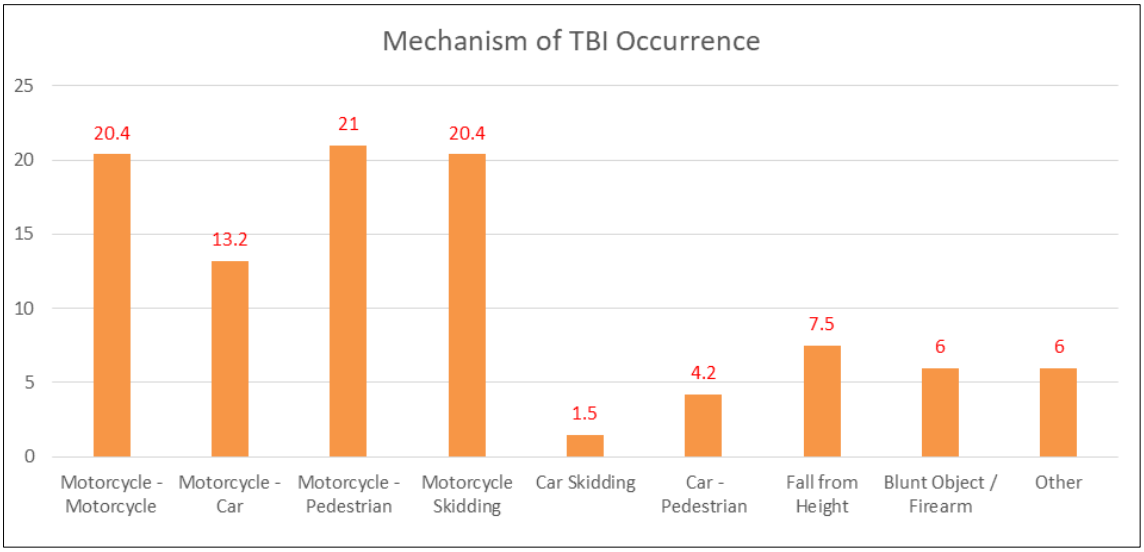


Figure 3: Distribution of TBIs according to Etiology or mode of occurrence

Road accidents predominated, followed by domestic accidents and intentional assault and battery with 67,2%, 14.5% and 10.5% respectively.

As regards the mode of occurrence of TBIs, The motorcycle-pedestrian mechanism was the most frequent with 21.0%, followed by the motorcycle-motorcycle and motorcycle-skid mechanisms with 20.4% each. The following graph 5 gives the details:



Graph 4: Distribution of cranioencephalic trauma according to the mechanism of occurrence

4. DISCUSSION

4.1 Overall Frequency

We were able to identify 334 cases of cranioencephalic trauma. This would represent approximately 12 cases per 100,000 inhabitants for the district of Bamako in 2023. Our data are consistent with those found in other studies in Mali, notably those of Traoré Y which concerned 242 patients in the neurosurgery department of the CHU-GT [14]. This highlights the frequency of this pathology in our country. The incidence of road accidents is reported to be higher in Southeast Asia (1.5% of the population per year) and in Europe (1.2%) [14]. According to the same author, the

overall incidence of TBI was highest in North America with 1,299 new cases per 100,000 inhabitants (varying from 650 per 100,000 to 1,947 per 100,000 inhabitants per location) [3 and in Europe with 1,012 new cases per 100,000 inhabitants (varying from 911 to 1,113 per 100,000 inhabitants depending on the country) [4]. On the other hand, the incidence was lowest in Africa and was estimated at 801 new cases per 100,000 inhabitants (varying from 732 to 871 per 100,000 inhabitants per zone) [4], and in the Eastern Mediterranean, it would be 897 new cases per 100,000 inhabitants (varying from 771 to 1023 cases per 100,000 inhabitants per zone) [13].

4.2 Sociodemographic Study

– ***Sex***

The male sex predominates in our study. The study carried out by Ouadidié [15], on the epidemiological and therapeutic aspects of cranioencephalic trauma due to a motorcycle accident at the GABRIEL TOURE University Hospital found a male predominance of 82.8%. Assamadi [16]. In Morocco, there is also a male predominance: 101 men for 18 women. The study of Hugues *et al*., in Brazzaville (Congo) [13], on childhood trauma, also had 33 boys for 12 girls. This male predominance could be explained for large children and adults by the fact that the male sex is the most exposed to physical effort. It is he who carries out activities requiring a lot of physical effort, they are the ones who are most transported and therefore the most exposed to accidents. However, these reasons cannot hold for infants and those under 12 years old, even if the male sex actually predominates at this age in our study and also in the one carried out in Congo [13].

– **Age**

The age groups most affected in our study were those aged 15-49, representing 36.8% and 50.9% of cases respectively.ThatThis could be due to the fact that the African population in general, and the Malian population in particular, is young and active. Young people most often ride motorcycles or other two-wheeled vehicles, respect the highway code less or not at all, drive at speed and are ultimately careless about dangers.

– **The Profession**

The high representation of self-employed workers in our study could be explained by the fact that they constitute a significant segment of the population. They are the most mobile and transported. This high mobility in a road traffic plagued by incivility would expose them to road accidents which can result in head trauma.

– **The Residence**

The majority of patients in our study were from urban areas with a rate of 68.3%. This is comparable to the study by Traoré Y which reported 71.6% of his patients in urban areas [17]. This could be explained by the fact that traffic density is higher in the capital compared to rural areas.

– **Means of Transport**

In our series, 59% were transported to the hospital by non-medical means, including private vehicles and taxis. In his study, Traoré Y found that patient transport was provided by ambulances and the civil protection group (firefighters) [17]**.** The development of pre-hospital medicine In developed countries, the problem of transporting patients to the hospital is no longer an issue. The operationalization of pre-hospital medicine is difficult for a country whose policy is oriented towards the prevention and treatment of infectious diseases. Efforts still need to be made to make decision-makers in our country understand the need.

4.3 Clinical Data

– The etiology and mode of occurrence of cranioencephalic trauma

As in our study, road traffic accidents have been reported by several authors in the occurrence of head trauma [13-17]. On the other hand, in other series domestic accidents by falls from heights have been identified as the cause of trauma [2-5]. The high frequency of road traffic accidents in our cohort could be explained by the lack of knowledge and/or non-compliance with the code of conduct, the absence of wearing helmets and the inadequacy of signaling means on the roads.

– **The Mechanism of the Accident**

Motorcycles were involved in the vast majority of road accidents. This finding was noted in our study as well as in that of other authors [3-9]. We could attribute this to the drivers' lack of control over the two-wheeled vehicle. Since obtaining a motorcycle license is not required to ride a two- or three-wheeled vehicle, all kinds of skidding-related incidents are possible. One of the consequences is a road accident.

– **Wearing a Helmet**

The lack of rigor in the application of the texts governing road driving in our country means that riding a motorcycle without a helmet is normal; 98.8% of the patients in our series were not wearing one. The studies of Ouadidié [15], and Traoré Y [17], reported the same result.

– **The State of Consciousness**

As in previous studies, the proportion of severe head trauma patients with a comatose state is low [2-4]. Most patients in our cohort had mild head trauma. This could be interpreted by the fact that the traumas were of low kinetic energy.

– **The Initial Loss of Consciousness**

The initial loss of consciousness found in our study at 79.6% was reported by several authors but with varying frequencies [2]. This initial loss of consciousness is due to a disturbance of the brain during the head trauma. The mechanism of occurrence of the trauma and the element of surprise contribute significantly to this.

– **Associated Lesions**

Unlike previous studies [7, 8], having reported a predominance of maxillofacial lesions in patients with head trauma, in our series the associated lesions had affected the spine. The spine, especially the cervical spine, is highly exposed during head trauma because of its proximity to the head but especially because it supports the head. This gives full meaning to this statement which says that "any head trauma patient is considered to be a cervical spine patient until proven otherwise".

4.4. Paraclinical Data

Brain CT was the examination of choice in our study for lesion diagnosis. It was performed in 97.3% of cases. In 9 patients, it was not performed due to lack of financial means. The availability, accessibility, and speed of its performance make this examination the first-line examination. And the most encountered injuries were scalloped fractures, oedemato-hemorrhagic contusions, extradural hematomas, and subdural hematomas. Because the majority of our patients had mild or moderate trauma.

4.5 Treatment

– **Medical Treatment**

In order to relieve them, analgesic treatment was administered to all our patients as in the Diallo series [18], and that of Traoré Y [17]. In general, paracetamol 1g infusion, intravenous route 100% and the combination Paracetamol l-Nefopam or Paracetamol – Acupan were used for treatment.

– **Surgical Treatment**

Only 28.4% of our patients underwent surgery, and the most common surgical technique performed in our study was osteoarthritis. This could be explained by the fact that the majority of our patients had mild or moderate trauma, i.e., non-surgical injuries.

– **Complications**

At the end of treatment, we recorded only two cases of complications, or 0.59%. These were one case of psychomotor agitation and one patient who presented with respiratory distress. The latter was transferred to intensive care. Despite these complications, the evolution of these two cases was favorable at discharge.

5. CONCLUSION

Traumatic brain injury is a common ailment in our country. The problem of treatment is due in part to the lack of pre-hospital medicine, which makes it difficult to identify and transport patients to appropriate healthcare facilities. This pathology has a significant socioeconomic impact. The involvement of decision-makers could help improve the quality of treatment for this ailment.

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