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Contribution of CT-Scan in the Management of Traumatic Brain Injuries at the Sino-Guinean Friendship Hospital (HASIGUI)

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Abstract

Introduction: Traumatic brain injury (TBI) is a potentially life-threatening emergency, even in the absence of obvious clinical signs. Rapid assessment of the nature and extent of lesions is essential, and computed tomography (CT) remains the cornerstone imaging modality. This study aimed to assess the contribution of CT in the diagnostic evaluation of TBI at the Sino-Guinean Friendship Hospital (HASIGUI). **Methods:** This was an 18-month retrospective descriptive study conducted from January 1, 2022, to June 30, 2023. All patients managed for TBI who underwent a brain CT scan were included. **Results:** The hospital prevalence of TBI was 3.7%, with 63.5% meeting the inclusion criteria. The mean patient age was 36.9 years, and males were predominantly affected (sex ratio = 3.6). Motorbike riders and taxi-motor drivers constituted the most represented occupational category (31.8%), and most patients originated from Conakry (59.9%). Road traffic accidents were the leading cause of TBI (78.3%). The most common indications for CT were headache (94.6%) and impaired consciousness (75.2%). Frequent findings included: simple skull vault fractures (69.7%) and depressed skull fractures (24.2%), extradural hematomas (48.7%) and subdural hematomas (35.9%), oedemato-hemorrhagic contusions (51.9%) and intraparenchymal hematomas (25%). CT findings confirmed clinical hypotheses in 83% of cases, while 17% required diagnostic reassessment. **Conclusion:** Brain CT remains the first-line emergency imaging modality for TBI due to its availability, speed, and decisive role in guiding patient management.

Keywords

Computed Tomography, Cranioencephalic Trauma, Epidural/Subdural

Hematoma, Skull Fractures

1. Introduction

Cranioencephalic trauma (CET) refers to an injury to the skull and/or brain resulting from a direct or indirect mechanical force exerted by an external agent [1]. It is a potentially severe condition, even in the absence of obvious clinical or radiological lesions, and therefore requires rapid assessment to determine the nature and extent of the injuries [2].

The radiological diagnosis of CET relies primarily on non-contrast computed tomography (CT), which is the first-line imaging modality to be performed in emergency settings. CT helps determine the presence, location, and severity of cerebral or cerebro-meningeal lesions [3].

In the United States, Faul M. *et al.* (2010) reported that CET accounted for 7.44% of emergency department visits [4]. In Europe, Maas A.I.R. *et al.* (2017) reported that more than 2.5 million cases of traumatic brain injury occur each year [5].

In Mali, Cissé K. *et al.* (2013) reported that among 566 CT scans performed, CET accounted for 22.35% [6]. In Senegal, Meriem K. *et al.* (2021) found that among 134 CT examinations, 54 revealed abnormalities, representing a prevalence of 40.3% [7].

In Guinea, few studies have been conducted on the topic. However, in 2014, Doumbouya M. reported in his doctoral thesis that the frequency of CT performed for CET was 26.27% [8].

Despite the widespread use of CT scanning in the management of CET, mortality remains high, even in developed countries, where it is the leading cause of death among young adults [9].

The frequency of CET, their high mortality, the scarcity of epidemiological data, and the importance of CT in managing head trauma motivated this study, which aims to highlight the contribution of computed tomography in the diagnosis of cranioencephalic trauma at the Sino-Guinean Friendship Hospital (HASIGUI).

2. Materials and Methods

This study was conducted at the Sino-Guinean Friendship Hospital (HASIGUI), involving the departments of medical imaging, emergency medicine, and neurosurgery, which constitute the main units responsible for the management of traumatic brain injuries within the institution. All data were collected from consultation registries and the medical records of patients who sustained a traumatic brain injury during the study period. A standardized data collection form was developed to ensure uniformity and completeness of the information gathered.

We carried out a retrospective descriptive study over an 18-month period, from January 1, 2022, to June 30, 2023. The target population consisted of all patients admitted with traumatic brain injury across the departments involved. The study population specifically included patients who underwent a cranial computed tomography (CT) scan.

Cerebral CT scanning was used as the reference examination to correlate the initial clinical findings with the lesions identified on imaging.

Eligible cases were all complete medical records of patients managed for traumatic brain injury with an interpretable cranial CT scan. Records lacking CT images or the corresponding radiological report were excluded. Recruitment was exhaustive, incorporating all cases that met the predefined inclusion criteria.

The variables studied were both qualitative and quantitative. Epidemiological parameters included the frequency of traumatic brain injuries that underwent CT imaging, age categorized into five groups (0 - 20 years, 21 - 40 years, 41 - 60 years, 61 - 80 years, and ≥81 years), sex, and socioeconomic status, which was divided into seven groups: students, professionals/executives, traders/business owners, farmers/artisans, workers/housewives, motorcycle taxi drivers, and unemployed individuals.

Data collection followed a systematic procedure based on the manual extraction of information from medical records and its transcription onto the standardized data form. Data entry and analysis were performed using Epi Info version 7.2. Tables and figures were generated using Microsoft Word, Excel, and PowerPoint from the Office 2019 suite.

Regarding ethical considerations, all data were used exclusively for scientific purposes. Patient anonymity and confidentiality were strictly maintained throughout all phases of the study.

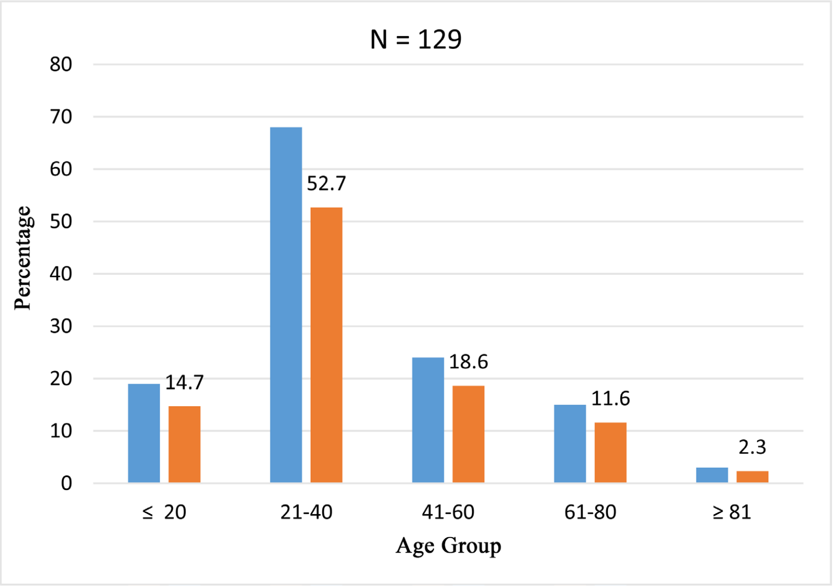
3. Results

During our study, we identified 203 cases of traumatic brain injury (TBI) among 5544 patients, corresponding to a hospital frequency of 3.7%. Among the 203 TBI cases, 129 (63.5%) met our inclusion criteria. The remaining 36.5% were not included, mainly due to the absence of computed tomography (CT) imaging, related to the cost of the examination and its limited accessibility for the studied population.

The 21 - 40-year age group was the most represented (52.7%), with a mean age of 36.9 ± 18.81 years and extremes ranging from 3 to 83 years (**Figure 1**). The sex ratio was 3.6, with a clear male predominance (78.3% male vs. 21.7% female) (**Figure 2**). The most affected occupational categories were motorcycle taxi drivers (31.8%), followed by students (22.5%), and most patients originated from Conakry (59.9%) (**Table 1**).

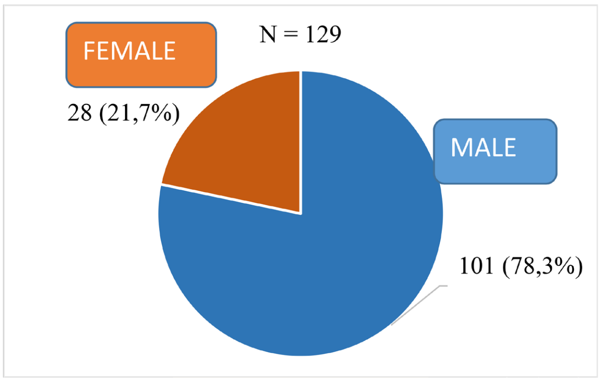
Road traffic accidents (RTAs) were the leading cause of TBI (78.3%), followed by domestic accidents (9.3%) (**Table 2**). The main indications for CT scanning were headaches (94.6%) and altered consciousness (75.2%) (**Table 3**).

Bone fractures were observed in 33 patients (25.6%), most frequently located at the cranial vault (24 cases; 72.7%). Simple vault fractures (69.7%), followed by depressed fractures (24.2%), were the most common patterns (**Table 4**).



Average age = 36.9 ± 18.81 years. Extremes = 3 and 83 years.

Figure 1. Distribution of patients according to age group.



Sex-ratio (M/F) = 3.6.

Figure 2. Distribution of patients according to sex.

Table 1. Distribution of patients according to socio-professional categories.

Occupation/Activity	Frequency (n)	Percentage (%)
Unemployed	3	2.3%
Retirees	2	1.6%
Manual laborers/Housewives	19	14.7%
Military personnel	7	5.4%
Students/Pupils	29	22.5%
Drivers/Motorcycle taxi drivers	41	31.8%
Business owners/Business managers	15	11.6%
Executives/professionals	13	10.1%
TOTAL	129	100%

Table 2. Distribution of patients according to the mechanism of occurrence.

Type of Accident	Frequency	Percentage (%)
Road traffic accident (RTA)	101	78.3%
Domestic accident/Fall	12	9.3%
Physical assault	8	6.1%
Workplace accident	6	4.7%
Sports accident	2	1.6%
Total	129	100%

Table 3. Distribution of patients according to the indications for computed tomography.

CT Scan Indications	Frequency	Percentage
Vomiting	33	25.6%
Dizziness	8	6.2
Altered consciousness	97	75.2
Rhinorrhea	8	6.2
Otorrhea	3	2.3%
Otorhagia	16	12.4%
Epistaxis	27	21.0
Headaches	122	94.6
Agitation	36	28.0

Table 4. Distribution according to bone lesions observed on CT scan.

Type of Injury	Frequency	Percentage
Bone defect	2	6.1%
Depressed fracture	8	24.2%
Depressed fracture	2	6.1%
Comminuted fracture	3	9.1%
Multiple fracture	6	18.2%
Simple fracture	23	69.7%

Pericerebral lesions were identified in 39 patients (30.2%). Among these, epidural hematoma (EDH) was the most frequent (19 cases; 48.7%), followed by acute subdural hematoma (ASDH) (14 cases; 35.9%) and subarachnoid hemorrhage (6 cases; 15.4%).

Intracerebral lesions were found in 52 patients (40.3%), mainly edematous–hemorrhagic contusions (27 cases; 51.9%), followed by intraparenchymal hematomas (13 cases; 25%), intraventricular hemorrhage (10 cases; 19.2%), and cerebral edema (2 cases; 3.8%) (Table 5).

Table 5. Distribution according to intracranial lesions observed on CT scan.

Type of Parenchymal Lesion		Frequency	Percentage
Extra-axial	Extradural hematoma	19	48.7%
	Subdural hematoma	14	35.9%
	Meningeal hemorrhage	6	15.4%
Intra-axial	Intraparenchymal hematoma	27	51.9%
	Hemorrhagic contusion	13	25.0%
	Cerebral edema	2	3.8%
	Ventricular hemorrhage	10	19.2%

Associated maxillofacial and cervical injuries were present in 13 (39.4%) and 4 (12.1%) patients, respectively.

Beyond trauma-related findings, CT imaging incidentally revealed other lesions in 10 patients (7.8%), among which 8 (80%) were tumoral, 1 (10%) was infectious, and 1 (10%) was parasitic.

At the end of our study, we found that CT imaging confirmed clinical suspicions in 83% of cases, while in 17% it provided a different orientation for patient management.

4. Discussion

This retrospective study conducted over an eighteen-month period aimed to assess the contribution of computed tomography (CT scan) in the diagnosis of cranioencephalic trauma (TBI) at the Sino-Guinean Friendship Hospital (HASIGUI). Among the 5544 patients admitted during the study period, 203 presented with TBI, and 129 underwent a CT scan and were included in the analysis. The prevalence observed in our series is comparable to that reported by Bréhima S. in Mali in 2022 [10], but lower than that described by Irié BI *et al.* in Côte d'Ivoire in 2017 [11]. Such discrepancies likely reflect regional variations in epidemiological patterns and healthcare access.

The mean age of our patients was similar to that reported by Van Haverbeke *et al.* in France [12], but higher than the mean age reported by Dabo M. in Mali in 2019 [13]. Young adults aged 21 - 40 years were the most affected, consistent with findings from Fatigba OH *et al.* in Benin in 2010 [14], who reported a predominance in the 20 - 40-year age group. This trend may be explained by the high level of activity in this age bracket, which increases exposure to accidents.

A marked male predominance was observed in our study, with a high sex ratio, in agreement with the findings of Hafida B. [15] and Konaté Z. [16]. As frequently reported in the literature, males are more likely to be involved in high-risk activities, particularly occupational ones, which may account for this overrepresentation.

Most of our patients originated from Conakry (59.9%), a finding consistent with the medical thesis of Doumbouya M. in 2014 [8]. This can be attributed to the hospital's central location and the population density of the capital city. From a socioprofessional perspective, drivers—particularly motorcycle-taxi operators—represented the most affected category (31.8%), in agreement with Irié BI *et al.* [11], although other studies such as that of Diarra A. [17] reported a higher proportion among students. The high involvement of motorcycle taxis in road accidents may explain this trend.

Road traffic accidents were the leading cause of TBI in our study (78.3%), followed by domestic accidents. This pattern is consistent with results from Konaté Z. [16] and exceeds the frequency reported by Sissako A. [18]. Poor road conditions, vehicle deterioration, lack of compliance with traffic regulations, and excessive speeding are major contributing factors to the predominance of road traffic accidents.

The high prevalence of head injuries among motorcycle taxi drivers (31.8%) reflects their significant exposure to road accidents. This risk is exacerbated by non-compliance with traffic laws, inadequate personal protective equipment, and the poor condition of their vehicles. These drivers constitute a vulnerable occupational group, particularly in resource-limited settings. The findings underscore the importance of local prevention initiatives, including helmet use, road safety training, and infrastructure improvements. Such an approach could reduce the incidence and severity of head injuries and improve overall road safety.

Headache was the most common indication for CT scanning (94.6%), closely aligning with observations made by Diarra A. [17] and Konaté Z. [16]. Disturbances of consciousness represented the second most frequent indication. This distribution differs slightly from studies in which scalp bruises or cranial wounds were more commonly reported.

Bone fractures were identified in 25.6% of patients, a proportion lower than that found by Dabo M. [13] and Cissé K. [6]. Simple vault fractures were the most common, followed by depressed fractures, similar to the pattern described by Sissako A. [18]. However, these rates were higher than those reported by Diarra A. [17].

Peri-cerebral lesions were present in 30.23% of patients. Extradural hematoma was the most frequent (48.7%), followed by subdural hematoma (35.9%) and subarachnoid hemorrhage (15.4%). These results closely resemble those reported by Dabo M. [13], though they differ from the findings of Konaté Z. [16] and Cissé K. [6], who reported subarachnoid hemorrhage as the predominant lesion.

Cerebral lesions were dominated by hemorrhagic-edematous contusions (51.9%), a frequency lower than that reported by Sissako A. [18] and Cissé K. [6]. Intraparenchymal hematoma was identified in 25% of cases, a higher rate than that found by Cissé K. [6]. Ventricular hemorrhage (19.2%) was also more frequent in our series compared to the findings of Cissé K. [6] and Gbane M. [19]. According to Godlewski [20], such lesions are characteristic of high-velocity trauma, during which the brain parenchyma is violently projected against bony prominences.

Associated traumatic injuries were also observed, predominantly maxillofacial lesions (39.4%) and cervical injuries (12.1%). These proportions exceed those reported by Dabo M. [13] and underscore the importance of systematically evaluating the facial bones and cervical spine during CT assessment of TBI.

Incidental findings were identified in 7.8% of patients, including tumoral, infectious, and parasitic lesions. Finally, CT imaging confirmed the clinical hypotheses in 83% of cases, highlighting its essential role in diagnostic decision-making, although 17% of scans revealed unexpected findings.

This result confirms the central role of CT as the gold standard examination in emergency situations, enabling rapid and reliable identification of traumatic injuries. However, in 17% of cases, CT revealed unexpected injuries or injuries not present in the initial clinical suspicion, leading to a change in treatment plan. This finding highlights the limitations of clinical examination alone and underscores the importance of systematically using CT imaging to avoid missed diagnoses, particularly in the context of trauma or nonspecific symptoms. These results are consistent with data from the literature, which also report a crucial contribution of CT in optimizing the management of patients with head trauma.

This study has several limitations. Its retrospective design may have introduced biases related to the completeness and accuracy of medical records. In addition, the single-center nature of the study limits the generalizability of the findings, as the results mainly reflect the experience of one hospital. Furthermore, the exclusion of some patients due to the unavailability or limited financial accessibility of computed tomography may have led to an underestimation of the true frequency of traumatic lesions. Despite these limitations, the present study provides valuable local data on the contribution of CT scanning to the management of traumatic brain injury in Guinea.

5. Conclusions

This study highlights the central role of computed tomography in the diagnostic evaluation of cranioencephalic trauma at the Sino-Guinean Friendship Hospital (HASIGUI). Traumatic brain injury predominantly affected young adult males, particularly motorcycle taxi drivers, with road traffic accidents being the leading etiology. Cranial CT scan proved indispensable for the detection and characterization of bone fractures, peri-cerebral and intra-parenchymal lesions, as well as associated maxillofacial and cervical injuries.

Beyond confirming clinical suspicions in the majority of cases, CT imaging significantly influenced patient management by revealing unsuspected lesions in a substantial proportion of patients. However, the limited accessibility to CT scanning mainly due to financial constraints—resulted in the exclusion of more than one third of clinically suspected cases, underscoring a major challenge in the management of traumatic brain injury in resource-limited settings.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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