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SERVICES FOR SCIENCE AND EDUCATION

Anaesthetic Management of Severe Head Injuries at Chu-Kara

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ABSTRACT

The aim of the study was to take stock of the management of severe head trauma (SCT) at the CHU-Kara. This was a retrospective descriptive and analytical study carried out in the surgical intensive care unit of CHU-Kara from 1 January 2021 to 31 December 2023. 185 patients were studied. The sex ratio was 4.6. The average age was 34.68±18.78 years. Farmers were most affected (28.97%), followed by pupils and students (22.76%). The majority of patients (63.78%) came from the outskirts of Kara. Road accidents were the main cause (86.49%). Two-wheelers were involved in 96.87% of cases. 64.52% of patients had not worn a helmet. All patients had received non-medical transport. On admission, 86.65% had a Glasgow score ≤ 8. Fever and hyperthermia were present in 42.16% of cases; 32.05% had presented with hypoxaemia. Lesions associated with TCG were found in 28.11% of cases with limb involvement. Anaemia was found in 36.75% of cases. CT lesions were dominated by cerebral contusions in 27.56% of cases. 45.95% of patients were treated within one hour. 98.37% of patients were treated medically. Complications occurred in 5.41% of cases and mortality was 69.73%. MCTs had a high mortality rate. The introduction of emergency medicine would considerably reduce this mortality rate.

Keywords: head trauma, surgical resuscitation, CHU-Kara, Togo.

INTRODUCTION

Severe cranial trauma (SCT) is mechanical damage to the skull and/or brain with a Glasgow score of eight or less [1].

In the United States, an estimated 1.5 million patients a year are admitted to emergency departments with head injuries. MVAs and falls continue to dominate the causes of head injuries. The incidence of head injuries is falling steadily in developed countries as a result of road safety efforts [2].

In Europe, they are responsible for 35-42% of deaths in the 15-25 age group [2]. In Spain in 2023, a retrospective observational study including 69 patients admitted to the intensive care unit of the Rio Hortega University Hospital with the diagnosis of moderate and severe head trauma between 1 January 2021 and 31 January 2022 concluded that head trauma is more common in men, with a frequency of 78.3% and a high mortality rate of 18.8%, of which road accidents were the main cause [3].

In Niger in 2022, a prospective descriptive study carried out over a period of 6 months recorded 118 cases of CT, 20.34% of which were MCTs. The main aetiology was MVA (73.73%). Mortality was 8.47% [4].

In Togo a retrospective descriptive and analytical cross-sectional study in December 2019 was carried out in the neurosurgery department of the Sylvanus Olympio University Hospital in Lomé over the period from 1 January 2015 to 31 December 2017. With 19.37% of TCG and an overall mortality of 7.3% [5]. In 2023, a retrospective descriptive study carried out from January 2020 to December 2022 in the surgical intensive care unit at the CHU-Kara on polytrauma recorded 183 cases of CT [6].

At the CHU-Kara in the north of Togo, no study had been carried out on MCT ; hence the need for this study, the aim of which was to take stock of the management of MCT in the surgical intensive care unit at the CHU-Kara with the objectives of determining the prevalence of severe head trauma ; determining the epidemiological aspects ; describing the different neurological lesions ; describing the management in the surgical intensive care unit ; and analysing the evolution.

MATERIALS AND METHODS

Our study took place in the surgical intensive care unit of the Centre Hospitalier Universitaire de Kara (CHU-Kara) located in the Kara region, in the north of the country, which is the referral centre for a third of Togo's population (approximately 2.5 million inhabitants). The surgical resuscitation department employed a resuscitation anaesthetist, four anaesthetic nurses, eight nurses and four ward nurses. It had twelve beds.

Material resources included cardiovascular care equipment and medicines; airway release equipment, ventilation or oxygenation equipment and respirators. Oxygen shells and oxygen extractors were the main sources of oxygen supply.

This was a retrospective and prospective descriptive and analytical study on patient records and patients hospitalised for TCG, from 1st January 2021 to 31st December 2023 (36 months); study carried out from 1st July 2023 to 31st March 2024 (09 months).

The study population met the following inclusion criteria:

- patients admitted to intensive care for MCT, regardless of age or mechanism, with or without other associated lesions;
- Mild and/or moderate TC patients with subsequent worsening of neurological condition.

Patients whose records were not completed were excluded from the study. Retrospective data were collected from 1 January 2021 to 30 June 2023 (30 months), supplemented by a prospective section from 1 July 2023 to 31 December 2023 (6 months). The data was collected using the survey form. Records, patient registers, operating theatre registers, anaesthesia sheets, care sheets, patient registers in the emergency department. Prospective data were collected by questioning the intensive care unit supervisor and those accompanying the patients.

The data collected was:

- epidemiological aspects (age, sex, origin, period of admission, time to admission, time to care, circumstances of the trauma)

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- diagnostic aspects (clinical and paraclinical)
- Therapeutic aspects (medical and surgical treatment)
- developmental aspects (complications, death and length of hospital stay).

Data processing was carried out manually. Data processing was carried out using the French version of epi-info7.2.6. The significance threshold was 0.05; univariate and multivariate logistic regression was then performed to identify factors associated with TCG. The confidence interval was 95%. A top-down step-by-step procedure was used to select the final model. This involved including all the variables selected in the initial model and then progressively removing the least significant variables. At each step, we checked that there was no major confounding between the variable removed and those remaining in the model by checking changes in their Odds ratios (tolerated variation: 20%). The document was entered using Microsoft Word Office 2013. The statistical tests used were the Chi-square test and Fisher's Exact test for categorical variables.

The ethical aspects of the study were respected by authorisation from the director and the head of the CHU's medical advisory committee. The anonymity of patients and records was respected.

RESULTS

Social and Epidemiological Aspects

Patient Population:

Five thousand and sixty-nine (5069) patients were hospitalised in the department during this period, with 185 files retained for the study (3.65%). The average annual number of patients was 61.66. The monthly average was 5.14, with extremes of 1 and 13. There were peaks in July (12.97), December (12.43) and February (9.72).

Age of Patients:

Figure 1 shows the age ranges, with 44.86% between 16 and 40.

Table 1: Age distribution of patients.

	Workforce	Percentage
≤ 15 years	32	17,30
[16 - 40]	83	44,86
[40 - 65]	57	30,81
> 65 years	13	7,03
TOTAL	185	100,0

The mean age was 34.68±18.78 years, with extremes of 2 and 80 years.

Gender of Patients:

82% of the patients were male, with a sex ratio of 4.60.

Patient Origin:

Table 2 shows the distribution of patients according to origin, with 36.22% in the town of Kara and 63.78% outside Kara.

Table2: Breakdown of patients by origin.

	Workforce	percentage
Kara	67	36,22
Dapaong	29	15,67
Bassar+ Kouka	21	11,35
Sokodé	20	10,81
Défalé + Kanté	14	7,56
Binah + Kétao	13	7,02
Sotouboua +Blita	11	5,94
Bafilo	9	4,86
Mango	1	0,54
Total	185	100,0

Breakdown of Patients by Occupation:
Table 3 shows that the occupation of patients is dominated by farmers (28.97%).

Table 3: Breakdown of patients by occupation.

	Workforce	Percentage
Farmer/breeder	42	28,97
Pupil/student	33	22,76
Civil servant	22	14,49
workers	14	9,64
housewife	12	8,28
Motorbike taxi driver	11	7,59
Retailers	6	4,14
Security agent	4	2,76
Courier	1	0,69
cook	1	0,69
TOTAL	145	100,00

A Etiological Aspects
Circumstances of Occurrence:
Road accidents accounted for 86.49% and falls 5.94%.

The Mechanism of Road Accidents:
Two-wheelers against two-wheelers accounted for 58.75%; two-wheelers against pedestrians 22.50%; two-wheelers against lorries 8.13%; two-wheelers against cars 7.50%. Two-wheelers were involved in 96.87% of MVAs.

Wearing Headphones:
14.94% of patients had worn a helmet, 64.52% had not and 20.65% had not specified.

Means of Patient Transport:
All patients had received non-medical transport, consisting of fire brigade vehicles (60.54%), taxis or private vehicles (29.72%) and motorbikes (9.73%).

Diagnostic Aspects
Clinical Aspects:

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Admission Deadline:
47.09% were admitted before 6 a.m.; 13.37% between 6 and 12 hours; 5.81% between 12 and 18 hours; 32.56% after 24 hours. The admission time was only recorded for 172 patients, with an average of 16h30min and extremes of 40 minutes and 4 days.

Temperature During Hospitalization:
Fever/hyperthermia 42.16% of cases; 35.65% normal and the rest unspecified. The mean temperature was 38.10°c ±1.54, with extremes of 35°c and 41.5°c.

Neurological Condition:
Glasgow Score
88.65% of patients had a Glasgow score between 3-8, 10.27% between 9-12 and 1.08% between 13-15.

Neurological Signs
12.97% of patients had bilateral mydriasis; 8.11% had convulsed; 5.94% had bilateral miosis. 85 patients had a scalp wound.

Cardiocirculatory Signs:
Tachycardia in 45.95% of cases; bradycardia in 1.62%; hypertension in 15.13% and hypotension in 2.70%. External haemorrhage was found in 22 patients (11.89%).

Respiratory Signs:
Tachypnoea in 34.05% of cases, bradypnoea in 6.48% and hypoxaemia in 30.27%.

Associated Lesions:
52 patients had lesions associated with MCT (28.11%) and 133 patients had isolated MCT (20.54% limbs, cervical spine 4.32%, thorax 2.16% and 1.08% abdomen).

Paraclinical Aspects:
Biological Tests:
115 (62.15%) patients had achieved haemoglobin levels with 36.75% anaemia.
126 patients (68.11%) had achieved glycaemia with 8.10% hypoglycaemia.

Radiological Examinations:
Cerebral CT Scan
Seventy-two (72) patients (38.92%) had undergone cerebral computed tomography (CT), revealing 20.54% cerebral contusion, 9.72% subdural haematoma, 4.86% meningeal haemorrhage, 2.16% embarrhment and 1.62% extradural haematoma.

Therapeutic Aspects
Processing Time:
41.08% were treated in less than an hour, 45.94% in more than an hour and 12.97% were unspecified. The average response time was 54 ±17.7 minutes, with extremes of 20 minutes and 2 hours.

Medical Treatment:
Table 4 presents the patients according to the medical treatment received.

Table 4: Distribution of patients according to medical treatment received.

	Workforce	Percentage
Conditioning	184	99,46
Ventilation	182	98,38
Vascular filling	182	98,38
Analgesic	180	97,29
Sedation	176	95,13
Antibiotic	150	81,08
Anti-edematous	133	71,89
Enteral feeding	79	42,70
Transfusion	27	14,59
Vasoactive drugs	12	6,48

Surgical Treatment:
Three (03) patients had undergone surgical treatment under general anaesthesia.

Evolution
Length of Stay in The Intensive Care Unit:
The mean length of stay in intensive care was 7.75 days, with a standard deviation of 9.34 and extremes of 1 and 46 days.

Complications During Hospitalization:
There were 5.41% complications, dominated by bedsores (2.16%), urinary tract infection (2.16%) and pneumopathy (1.08%).

Patient Progress:
69.73% died and 30.27% were transferred to neurosurgery.

Causes of Death: Factors Predictive of Mortality:
Table 5 shows the univariate analysis of factors predictive of mortality.

Table 5: Univariate analysis of factors predictive of mortality.

	Survivors (%)	Deceased (%)	p-value
Age	28,73	71,27	0,201
Gender	28,73	71,27	0,313
Source	28,73	71,27	0,000046
Admission deadline	27,98	72,02	0,8
PEC timeframe	27,22	72,78	0,024
Fever/Hyperthermia	24,36	75,64	0,019
Glasgow score	30	70	0,057
Myosis	16,67	83,33	0,01
Convulsive seizures	20	80	0,232
Hypoxemia	23,21	76,79	0,103
Anemia	23,88	76,12	0,48

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After a uni-factorial study, we included in a logistic regression model all the variables retained by the univariate analysis for which p-value < 0.05 (Table 5).

Three (3) independent predictors of mortality were identified. These factors were: origin, fever/hyperthermia and time to ECP (table 6).

Table 6: Multivariate analysis of factors predicting mortality in severe head injuries.

	Odds-Ratio	IC (95%)	P value
Source	4,23	1,75	0,0013
Fever/hyperthermia	0,43	0,19	0,041
PEC timeframe	0,90	0,37	0,046

Progression of Patients Treated According to Factors Predictive of Death:
Table 7 shows the correlation between place of origin and death.

Table7: Correlation between place of origin and death.

	Kara n (%)	Outside Kara n (%)	Total n (%)
Survivors	31(46,27)	21(18,42)	52(28,73)
Deaths	36(53,73)	93(81,58)	129(71,27)
Total	67(100)	114(100)	181(100)

Chi-square=14.651 p=0.000046. There was a statistically significant correlation between origin and death.

Table 8: Correlation between delay in care and death.

	< 1 hour n (%)	>1 hour n (%)	Total n (%)
Survivors	26(34,67)	17(20,48)	43(27,22)
Deaths	49(65,33)	66(79,52)	115(72,78)
Total	75(100)	83(100)	158(100)

Chi-square= 3.317 p=0.024. There was a statistically significant association between delay in ECP and death.

Table 9: Correlation between temperature during hospitalisation and death.

	Hypothermia n (%)	Normal n (%)	Fever/Hyperthermia n (%)	Total n (%)
Survivors	0(0,00)	29(46,03)	19(24,36)	48(33,8)
Deaths	1(100)	34(53,97)	59(75,64)	94(66,2)
Total	1(100)	63(100)	78(100)	142(100)

Chi-square=7.82 p=0.019. There was a statistically significant correlation between temperature during hospitalisation and death.

Table 10: Correlation between length of hospitalisation and death.

	1 day n (%)	2-7 days n (%)	>7 days n (%)	TOTAL n (%)
Survivors	1(2,00)	16(22,54)	35(58,33)	52(28,73)
Deaths	49(98,0)	55(77,46)	25(41,67)	129(71,27)
Total	50(100)	71(100)	60(100)	181(100)

Chi-square=44; p=0.00. There was a statistically significant correlation between time in intensive care and death.

DISCUSSION

Methodology

Retrospective and prospective data collection on anaesthesiological management of severe head injury patients in the surgical intensive care unit from January 2021 to December 2023 at

the University Hospital Centre (CHU) of Kara resulted in the collection of 185 patients. The main limitations were related to the type of study, the retrospective nature, incomplete records and the absence of staff responsible for archiving the records apart from the ward supervisor. The medical staff alone were inadequate to complete and update the medical records.

Epidemiological and Socio-Demographic Aspects

Frequency:

The low frequency is thought to be linked to the multi-purpose nature of the surgical intensive care unit and the post-operative awakening of surgical patients, as it is the only intensive care unit reserved for all surgical procedures.

This low frequency was linked to the limited number of beds available during the study period, and some patients were referred to other centres.

Our result was identical to that obtained under the same conditions by Mouzou et al. [6] in 2023 on polytrauma in the same department with a frequency of 3.62% of encephalic head injuries. Our frequency is higher than that of Maxim Challiot et al. [7] in 2019 at the CHU of Guadeloupe (France) with a frequency of 1.6%, because there were three reception centres for head injuries in Guadeloupe.

In our context, the CHU-Kara was the only centre for the treatment of AHTs in the north of Togo.

Doléagbenou et al [5] in 2019 at the Sylvanus Olympio University Hospital in Lomé had 395 cranioencephalic trauma (CTE) patients over a period of 36 months, 19.37% of whom were MCTs with an overall frequency of 7.41%. This high frequency was selective (neurosurgery department).

Despite their low overall frequency, MCTs are a major concern for emergency departments and surgical intensive care units because of the seriousness of the lesions they cause to the brain, according to Bighouab [8] in Morocco. According to Tsiaremby MG [1], 50% of trauma victims die before reaching hospital. On average, there were 62 MCTs per year in our context, so in reality there are around 124 MCTs per year. This is a real public health problem. It is therefore vital to continually raise awareness among road users of the need to comply with the highway code, wear a helmet and have a driving licence, in order to reduce the incidence of trauma and head injuries.

Monthly Breakdown of Patients:

The average monthly TCG was 5.14, with extremes of 1 and 11 TCG. The months of February, July and December had a higher frequency, with 9.97%, 12.97% and 12.43% respectively. February corresponded to the funeral period in the Kozah prefecture, when the population was more mobilised. The high frequency in July was linked to the period of major holidays and traditional festivities (Evala) in the Kara region, and mobilised all regions of the country and beyond. This increased road traffic and incivility during this period. December, meanwhile, corresponded to the end-of-year festive period. Our result was similar to that of Towoezim et al. [9] at CHU-Kara in 2023 who reported the same characteristics in January, February and July with 13.8%, 11.2% and 9.8% of cases respectively.

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For Agaly et al. [10] in 2023 in Mali, the months of July, August and September were the most represented, with 23.1%, 20.2% and 19.8% respectively, and corresponded to the holidays, while TCEs were frequent among pupils and students.

It is important to raise public awareness, especially among young people, about good citizenship, not drinking and driving, especially during the festive season, and respecting the highway code to reduce the frequency of injuries.

Age of Patients:
The average age was 34.68 ± 18.78 years, with extremes of 2 and 80 years. All ages were involved, with 17.30% under 16 and 7.03% over 65 (Table 1). The most common age group was 16 to 40, followed by 41 to 65, with frequencies of 44.86% and 30.81% respectively. This result explains the young age of the population and the most active age group. This young age is characteristic of the population in developing countries.

In Africa, similar results were presented by Mahaman et al [11] in 2022 with a mean age of 28.8 years; Monkessa et al. [12] in 2023 with a mean age of 39 years; Randriamantena et al. [13] in Madagascar in 2022. In developing countries, young people and teenagers were most affected by the increase in the number of cars on the road, the poor state of road infrastructure and the lack of civic-mindedness among road users.

Artola MV et al [3] in 2022 at Rio Horterga in Valladolid, Spain, with an average age of 58 and the most represented age group being 40 and 70. This study shows the demographic characteristics of developed countries, with an ageing population.

In our context, 7.03% were over the age of 65 because of the relatively short life expectancy. The population in our context was younger and constituted the valid arms for development. The high incidence of the disease among young people is a real public health problem.

Sex of Patients:
The predominance of males (82%) in our context was linked to men engaging in risky activities (driving) and the tendency of males to be violent, especially young males.

Most studies have shown a predominance of males, notably Zohrevandi et al. [14] in 2023 in Iran with 81.31%; in February 2024 in Switzerland by Magyar et al. [15] with 79.8%; Gomis et al. [16] in 2024 in Ziguinchor in Senegal with 69%; Agaly et al. [10] in 2023 in Mali with a sex ratio of 6.3. All these authors reported a male predominance, due to the frequency of high-risk activities in men and the greater number of men travelling with vehicles, especially two-wheelers, which are one of the main factors in road accidents.

Patient Occupation and Origin:
A large proportion of patients came from other towns and/or prefectures outside Kara, 63.7% (Dapaong15.67%; Guérinkouka+Bassar11.35%; Sokodé10.81%; Défalé+Kanté 7.56%, Binah+kétao7.02%; Sotouboua 5.94%; Bafilo 4.86%) due to the fact that Kara was the only referral centre for TCG treatment; 36.3% came from Kara (see tables 2 and 3). The movement of people from rural to urban areas for socioeconomic exchanges, with the increase in the

number of cars and the lack of civic-mindedness among road users, were factors that favoured the occurrence of MVAs.

Diango et al. [17] in Mali found that 57.2% of patients came from Bamako and 44% from outside Bamako. Bamako being the capital with a high population rate. Farmers/breeders were more represented with 28.97%, followed by pupils/students 22.76%, civil servants 14.49% and motorbike taxi drivers 7.59%. These results were linked to the fact that the victims came from outside Kara, where agriculture was the main occupation. These users were using two-wheeled vehicles with little knowledge of the highway code and the poor state of the road infrastructure, which contributed to the accidents.

Our results were similar to the study by Doléagbenou et al [5] in 2019 in Lomé, with 57.46% of patients being self-employed, pupils/students 11.43%, motorbike taxi drivers 7.64% and civil servants 7.3%. This result is thought to be linked to the failure of people in Lomé and the surrounding area to obey the highway code.

Sidibé A [18] In 2023, 31.4% of students were owners of two-wheeled motorised vehicles.

Risk Factors and Mechanisms of Occurrence:

Road traffic accidents (RTAs) accounted for 86.49% of all accidents, followed by falls (5.9%) and intentional bodily harm (ABH) (2.7%). Motorcyclists were involved in MVAs in 96.87% of cases. The majority of road users in our context were motorcyclists. These results are identical to those reported in the literature by Elombila et al. [2] in 2022 at Brazzaville University Hospital with 78% of MVAs; Souaré et al. [19] in 2021 in Guinea Conakry at the Donka national hospital with 68.5% of MVAs and 73.2% of motorcyclists; Hode et al., [20] in 2018 in Cotonou, Benin, with 87% of MVAs and 53.6% of motorcyclists; Mahamat et al. [21] in 2022 at the national hospital in Niamey, Niger, with 73.73% of strokes. The young adult population was the most economically active, with men in high-risk occupations, taxi and motorcycle-taxi drivers and people in occupations requiring frequent travel more exposed to road accidents. According to Gomis, the refusal of some motorbike drivers to wear helmets, non-compliance with the highway code and persistent lack of civic-mindedness due to the absence of penalties for offenders contributed to users' exposure. [16]. There is a need to raise public awareness, especially among young people, of the consequences of road accidents.

Transport of Trauma Patients to The University Hospital:

All the trauma victims had received non-medical transport combining fire brigade vehicles, taxis and personal vehicles, including motorbikes. None of the trauma patients had received medical transport.

In France, trauma patients were referred and transported by the emergency medical service (SAMU) and the mobile emergency and resuscitation service (SMUR) according to Geeraerts et al. [22].

Togo had no pre-hospital facilities. Most of the injured were transported by the fire brigade in 60.54% of cases, by private car in 29.72% of cases and by motorcyclists in 9.73% of cases. None of the patients had been picked up and/or transported medically from the site of the trauma by

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anyone other than the fire brigade, thereby exposing the patient to the risk of secondary injuries. This practice was linked to a lack of pre-hospital care in our context.

Tsiaremby et al [1] in 2022 in Antsiranana, Madagascar, found that 75% of trauma patients had received non-medical transport and 25% medical transport. Despite the existence of medical ambulances, pre-hospital emergency care did not cover all the injured. This may be due to the inadequacy of the pre-hospital structure.

Wearing a Helmet:
There were 22 (14.19%) trauma victims using two-wheeled vehicles who had worn their helmets. This low frequency in our context can be explained by a lack of civic-mindedness and ignorance on the part of the population, especially young people, of the risks to which they are exposing themselves by refusing to use their helmets, despite the fact that the Ministry of Safety has made it compulsory for two-wheeled users to wear helmets. The lack of public awareness of the need to wear helmets will only increase the frequency of MCTs and the seriousness of head injuries.

Clinical Aspects
Admission Deadline:
The average admission time for the 172 patients was 16 hours 30 minutes, with extremes of 40 minutes and 4 days. 47.09% of patients were admitted in less than 6 hours. This long admission time was due to the fact that most of the accident sites (63.7%) were far from the CHU-Kara, and to the absence of pre-hospital medicine.

Our result was superior to that of Akodjénou et al. [23] in 2019 at the departmental CHU of Ouémé-Plateau in Benin with an average admission time of 9h15min with extremes of 20 minutes and 6 days. More than 78% of patients were admitted within the first 6 hours following the trauma. Dembélé et al. [24] in 2022 at the Gabriel Touré University Hospital in Mali found that 87.3% of patients had an admission time of less than 12 hours, with the average admission time being 8 hours 24 minutes. The difference in delay between our context (Kara) and the last two authors is due to the fact that the majority of accidents occurred close to healthcare facilities: 70% in Cotonou and 87.3% in Bamako.

Glasgow Score:
All patients were assessed by Glasgow score. 88.64% of patients had a score between 8 and 3 ; 10.27% between 12 and 9 and 1.08% between 15 and 13. Patients with a score between 15 and 9 had deteriorated into severe coma during hospitalisation, hence their inclusion in the study. This result explains the progressive nature of CTE during hospitalisation in our study. The Kara University Hospital was the only centre for the treatment of CTE in the north of Togo, and our study focused solely on CTE.

In our context the result was superior to that of Dembélé et al [24] in 2022 with 71 patients suffering from TCG with a frequency of 43.2% of TCE.

Examination of Pupils:
There were 24 patients (12.97%) with bilateral mydriasis on admission; they had a Glasgow score between 8 and 3 and a death rate of 83.33% (20 patients). Bilateral miosis was present

in 5.94% (11 patients), of whom 9 patients had a Glasgow score between 8 and 3 and 2 patients between 12 and 9, with a mortality rate of 100% (11 patients). The appearance of the pupils had an impact on mortality, with a significant statistical test p=0.01 for miosis.

Convulsive Seizures:
Fifteen (15) patients (8.11%) had presented with convulsive seizures on admission, with a mortality of 80% (12) with no significant correlation with death. However, convulsive seizures are indicative of the high degree of cerebral distress and do not in themselves explain the high mortality. Sidibé A [18] found 13.61% and Tsifiregna et al. [25] in 2020 at 14.63%. This low frequency in our study can be explained by the fact that the studies by Sidibé et al [18] took into account all TCEs, whereas ours was based solely on TCGs.

Heart Rate and Systolic Blood Pressure:
Tachycardia was found in 45.95% of cases to be related to post-traumatic stress due to adrenergic secretion and traumatic lesions.

Five (5) patients (2.70%) had hypotension with 4 deaths. 28 patients (15.13%) had hypertension with 70.37% (19) dying and 29.93% (8 survivors) with no statistical correlation with death p=0.9. Arterial hypotension in MCTs was fatal and required immediate management. Our values were lower than those of Diango et al. [17] in 2019 with 7.1% hypotension and 18.2% hypertension and Konate et al. [26] 8% hypotension and 24.7% hypertension.

Hypoxaemia (see table 5):
A total of 30.27% (56) of patients had a peripheral oxygen saturation of less than or equal to 90% on admission. Hypoxaemia was a factor in the respiratory distress present in our context, together with cerebral damage which would have led to damage to the respiratory centres. Our result is similar to that of Diop et al [27] in 2020 who found 31.9% of patients with hypoxemia. Our result is inferior to that of Konate et al. [26] who found 66.7% of patients with hypoxaemia on admission. Any hypoxaemia creates cerebral ischaemia and worsens the neurological prognosis by aggravating cerebral oedema followed by intracranial hyperpressure. Hypoxaemia is always very harmful to the brain.

Associated Injuries:
Injuries associated with MCT were 28.11% (52). These associated injuries were dominated by trauma to the limbs (20.54%) with a mortality rate of 68.42%, followed by cervical spine injuries (4.32%) with a mortality rate of 62.50% and thoracic injuries (2.16%) with a mortality rate of 50%. This result can be explained by the fact that the limbs are more exposed in MVAs, since most of them involve two-wheelers. Konate et al [26] reported bone injuries as the most frequent associated injury in 20.6% of cases with a mortality rate of 38.7%. Elombila et al [2] in Brazzaville found that associated trauma was dominated by trauma to the limbs (21.7%) and thorax (20%). MCTs were more often isolated in our context. In all cases there was a notion of polytrauma in 28.11% of cases.

Paraclinical Examinations
Anaemia:
Thirty-six-point seventy-five percent (36.75%) of patients had anaemia. This anaemia was linked to the presence of external haemorrhage in 11.89% of traumas patients or to pre-existing

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anaemia prior to the trauma. Konate et al. [26] and Diango et al [17] found 9.1 and 16.7% anaemia respectively. Anaemia increases the risk of secondary cerebral attacks, and therefore of a worsening neurological prognosis.

Hyperglycaemia:
In our study, 8.1% (15) of patients had hyperglycaemia on admission, with a mortality rate of 86.67% and a non-significant statistical test (p=0.09). Hyperglycaemia is thought to be linked to traumatic stress. Numerous observational studies have clearly shown that hyperglycaemia in TCE is associated with an increased risk of mortality and morbidity, particularly in terms of medium- and long-term neurological outcome. Hyperglycaemia >2 g/L was identified as an independent factor in excess mortality, the occurrence of infections and increased length of stay according to Geeraerts [22].

This result was lower than that of Konate et al [26] in 2013 and Diallo et al [28] in 2011 in Bamako, who found respectively 12% and 16% of patients with hyperglycaemia on admission. The immediate management of any severe head injury remains a priority in order to prevent secondary brain damage.

Cerebral Computer Tomography (CT):
CT scans were operational and available in Kara from 2021, although the cost was somewhat high. This essential diagnostic tool was used privately. A few rare patients in 2021 were able to undergo this examination outside Kara. Seventy-two (72) patients (38.91%) underwent cerebral CT, the most frequent lesion being cerebral contusion (20.54%), followed by subdural haematoma (9.72%), meningeal haemorrhage (4.86%) and extradural haematoma (1.62%).

Sani et al [29] in 2016 at Zinder National Hospital in Niger had found 65.4% of cerebral CT performed. Cerebral contusion, cerebral oedema, embarrassement and extradural haematoma were the lesions found respectively 28.85%, 18.95%, 11.11% and 10.46%.

For Elombila et al. [2] a cerebral CT scan was performed in all TCG patients. Cerebral CT revealed cerebral contusions in 40% of cases.

This difference in the performance of CT scans was linked to the unavailability of the scanner in Kara, which was also carried out privately at a high cost to patients.

Therapeutic Aspects
Payment Deadline:
The average time to care was 54±17.7 minutes, with extremes of 20 minutes and 120 minutes. The mean time to care corresponded to the time spent between the emergency department and the start of care in the surgical intensive care unit. This evaluation involved 161 patients. 52.8% of patients had a waiting time of more than 1 hour and 47.2% less than 1 hour. This long delay was linked to the time spent by the interns writing up the medical records. There were no senior staff on duty in the emergency department. In 2011 Tomta et al. [30] at the Sylvanus Olympio University Hospital in Lomé found an average waiting time of 3h27minutes. This delay, which was longer than ours, was linked to the understaffing of nursing staff and the plethora of patients admitted to the emergency department in Lomé, resulting in delays in diagnosis and management. In our context, the emergency department did not have adequate technical

facilities for the management of TCG. Only the surgical intensive care unit had a technical platform and a team trained in the management of MCTs, but with a very small number of staff (just one intensive care physician for the department). This delay would be shorter if there were a senior doctor in the emergency department and if there were a medical writing sheet adapted to emergencies. Emergency department organisation was under the control of the resident and paramedics. Management in the emergency department posed a real problem in our context. The literature recognises that the immediate post-trauma period is the period most at risk of secondary ischaemic aggravation, and that these episodes of ischaemia largely determine prognosis. Appropriate management of these head injuries should not be delayed according to Graham [31].

Medical Treatment:

Almost all patients (98.38%) had received mechanical ventilation. The remainder of patients had moderate CTE with secondary worsening (see table 4). This result was similar to that of Van Haverbeke et al [32] in the French Isles with 96.3% of patients receiving mechanical ventilation. While Akodjénou et al [23] in Benin had 3.3% mechanical ventilation with a single mechanical ventilation device that was not always functional.

Pain management was effective in 95.13% of cases, with non-morphine analgesics associated with morphine in 94.05% of cases.

Anticonvulsant prophylaxis was carried out with phenobarbital in 95.13% of cases compared with 45.65% for Akodjénou et al [23]. Sedation was achieved with diazepam in 3.78% of cases, while the fentanyl-midazolam combination was used by Van Haverbeke [32].

Antibiotic therapy was administered in 81.08% of cases, with secondary adaptation to the antibiogram. In our setting, 71.89% of patients had received anti-oedema medication (mannitol or furosemide).

Adrenaline was used in 6.4% of cases of shock.

Vascular filling was performed in 98.38% of cases and blood transfusion in 14.59%, whereas Tsiaremby et al. [1] achieved 59% vascular filling and 20% blood transfusion; the low rate of vascular filling in Tsiaremby was linked to the shortcomings in the medical treatment of TCG.
In our context, pre-hospital care was limited to collecting the injured and transporting them to hospital by the fire brigade or third parties. The absence of this pre-hospital care would have worsened the vital prognosis of the victims and made it difficult to stabilise their vital functions once they had been admitted to intensive care.

Medical treatment remains a priority in the management of TBI in order to stabilise the vital functions of trauma victims; any failure in this area would worsen the vital prognosis.

Surgical Treatment:

Three (3) patients underwent surgery with a 100% mortality rate. There was no significant statistical relationship between surgical treatment and mortality (p=0.17). This low frequency of surgical management was linked to the unavailability of the neurosurgeon (only 1) with an almost non-existent technical platform and complex cerebral lesions that could not be treated

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surgically. Our results were similar to those of Akodjènou et al. [23] in 2019 in Cotonou with three patients operated while Tsiaremby et al. [1] in Madagascar in 2022 had 13 patients operated on and a mortality of 38% (5 patients).

Evolution

Duration of Hospitalization:

The average length of stay was 7.75±9.34 days, with extremes of 1 and 46 days. 28% of patients had a hospital stay of less than 24 hours in the surgical intensive care unit, with a mortality rate of 98% due to serious and complex lesions. 32% of patients had a stay of between 24 hours and 7 days, with a mortality rate of 77.46%, and 40% had a stay of more than a week, with a mortality rate of 41.67%. The longer the patients stayed in intensive care, the greater their chances of recovery (p=0.000 with Chi-square=44 and 95% CI). This result is thought to be linked to the degree of severity of the lesions and their complexity, which left the most serious with less chance of survival, as well as to the delay in management. While Tsiaremby et al [1] reported an average duration of 5.9 days ± 4.1 with extremes of 1 and 21 days linked to the severity of the cerebral lesions leading to early death.

Completions:

Five-point ninety-four percent (5.94%) of patients had complications of urinary tract infection and bedsores, which were the most frequent in 2.16% of cases each, followed by pneumopathy in 1.08% of cases. These infections were thought to be linked to invasive procedures and insufficient asepsis in the administration of care. The mortality rate for patients presenting complications was 36.37%. The progression of these complications in relation to death was not statistically significant. (P=0,47). Dembélé et al [24] found 6% of complications, of which 4.7% were pneumopathies and 1.3% urinary tract infections. It is well known that these factors were detrimental to the evolution of TCG with cerebral disturbances in terms of increased intracranial hypertension according to Konate [26].

Death:

Mortality was 69.73%, with 28.10% of survivors. This high rate of death was linked to the seriousness of the injuries, the lack of pre-hospital care, inadequate technical facilities and a lack of financial resources for patients. The discharge rate from hospital before recovery was 2.16% of trauma patients, linked to the exhaustion of financial resources. Siby et al [33] in 2022 in Mali had 63% of deaths and a favourable outcome of 32.6%. Irie et al [34] in Côte d'Ivoire had a 66% mortality rate. In contrast, Miguel et al [3] in 2022 in Spain had 18.8% mortality. This alarming number of deaths in low-income countries was linked to the lack of technical facilities in hospitals and the absence of pre-hospital structures for treating serious trauma. The introduction of emergency and pre-hospital medicine must be one of the priorities of health policy in our developing country context.

Deaths by Age (see table 5):

The mortality rate for trauma patients over 60 was 75% and 80.70% for those aged 40 to 60, compared with 61% for those under 15, with p=0.201 not significant. Death was not influenced by age. Diaga et al [35] in Mali reported a mortality rate of 89.4% in subjects aged over 60, with a significant statistical test (P=0.01). In our context, other factors, such as the severity of the lesions and the delay in treatment, should be taken into account, as they would be detrimental factors.

Deaths by Gender (see table 5):
Mortality was 70.47% in men and 75% in women, with a non-significant statistical test p=0.313. There was no correlation between death and sex in our study. The study by Diango et al. [17] reported that gender had a statistically significant association with mortality with p=0.042.

Deaths by Origin (tables 5, 6 and 7):
Patients from the outskirts of Kara had a high mortality rate of 81.58% and those from the town of Kara a lower mortality rate of 53.73%, with a significant statistical test p=0.000046. This was probably linked to the delay in the administration of care and the delay in consultation (non-existence of pre-hospital care).

Deaths According to Helmet Use:
Patients who had worn the helmet had a mortality of 61.90% and those who had not 68.32%. The statistical test was not significant p=0.28 (see Table 5). A retrospective study by Mouzou et al [36] on the impact of wearing a helmet on head trauma patients at the University Hospital of Lomé found a significant difference for bone and brain lesions on cerebral CT (p=0.0005) and a mortality rate of 37.9% for those who wore a helmet and 42.6% for those who did not, with a significant statistical test (p=0.0042). Wearing a helmet has a significant impact on brain damage during the trauma and therefore on the mortality of head trauma victims.

Death According to The Time Taken for Treatment:
The longer the delay, the higher the mortality rate. The death rate was 79.52% for patients who were treated within 1 hour or more, compared with 65.33% for those treated within 1 hour, with a significant statistical test (p=0.024) (tables 5, 6 and 8). Universal health insurance needs to be promoted to the entire population in order to reduce the delay in treatment.

Deaths According to Temperature During Hospitalization:
Fever and hyperthermia were present in 42.16% of patients, with a mortality rate of 75.64% and a significant statistical test (p=0.019) (see Tables 5, 6 and 9). In our context, the hyperthermia was of central and peripheral origin (infectious complications) increasing cerebral oedema, a factor in intracranial hypertension worsening the vital prognosis. Diallo et al [28] had a frequency of 40.3% with a mortality of 92 %; Konate et al [26] found 54.0% hyperthermia with a mortality rate of 66.7%. MCTs are at risk of hyperthermia, which is a factor in the aggravation of secondary cerebral lesions. Hyperthermia was a poor prognostic factor.

Death According to Glasgow Score:
Mortality was 70% when the Glasgow score was between 8 and 3 and 84.2% between 12 and 9 with a non-significant statistical test p=0.057 (table 5). Altered consciousness did not influence the prognosis of TCE patients in our context. Konate et al [26] reported a mortality rate of 78.5% for patients with a Glasgow score of less than 8 and 33.7% for patients with a Glasgow score of 12-9. The lower the Glasgow score, the greater the vital prognosis. It is essential to protect the head against trauma, especially for two-wheeled users.

Death According to Oxygen Saturation:
Mortality was 76.79% in patients with saturation < 90% and 67.26% in patients with saturation > 90%. Hypoxaemia is one of the secondary systemic brain injuries (SSBAs) that worsen the vital prognosis. The statistical test was non-significant p=0.103 (table 5). Our result is similar

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to that of Diaga et al [35] who reported a mortality rate of 78% in patients with hypoxaemia. Hypoxemia is a factor in secondary cerebral aggression, contrary to our test.

Death According to Associated Lesions:
Mortality was 100% in patients with abdominal involvement, 68.42% in patients with limb involvement and 62.50% in patients with cervical involvement. In our study, injuries associated with TCE constituted polytrauma, which worsened the prognosis of patients. Injuries associated with CTE require early multidisciplinary management.

Death by Brain Injury:
Patients with cerebral contusion on CT had a mortality rate of 54.90%, those with subdural haematoma 69.23% and those with meningeal haemorrhage 66.67%. CT lesions are a key factor in patient prognosis, hence the need for this key examination in hospitals. Our hospital did not have one. CT scans were carried out privately outside the hospital.

Death According to Length of Time in Intensive Care:
The mean length of stay was 7.75±9.34 days. There was a significant correlation between death and length of stay in the surgical intensive care unit (see Tables 5 and 10). It increased progressively below the mean length of stay, and decreased above the mean length of stay. It is important to manage ACSOS effectively and early in the first 7 days in order to reduce secondary damage, which worsens the neurological state and favours death.

Relationship Between Complications and Death:
Here the number of deaths does not appear to be high, so this isolated factor alone cannot be sufficient to explain the death.

Relationship Between Anaemia and Death:
This is not significant, probably because isolated anaemia was not a negative factor (see table 5).

Factors Predictive of Mortality in Severe Traumatic Brain Injury (TBI):
Multivariate analysis of factors predictive of mortality in MCTs revealed three independent predictors of mortality in MCTs in surgical intensive care at CHU-Kara. These were: origin (distance from care centres); hyperthermia and time to in-hospital care (see table 6). The introduction of pre-hospital medicine will solve the problem of remoteness to avoid the occurrence of ACSOS and the promotion of universal health insurance to reduce the delay in intra-hospital care.

CONCLUSION

MCTs were 3.65% frequent at the CHU-Kara.

Road accidents were the main cause of TCGs. Rural populations were the most affected. Farmers and pupils/students were most affected. Young males were the most affected. All ages were affected, making this a public health problem. Patients were transported in non-medical vehicles, mainly by the fire brigade. Very few road users on two-wheeled vehicles had worn helmets.

The main neurological lesions were cerebral contusions, followed by subdural haematomas, embrasure fractures and extradural haematomas.

All the trauma victims had received medical treatment, with neuro-resuscitation being the mainstay.

The course was marked by complications including urinary tract infections and a high mortality rate of 69.73%.

The main factors predictive of mortality were: delay in care, place of origin and hyperthermia. The prognosis for head injuries was linked to the severity of the initial lesions and the development of secondary lesions.

Roads kill. Preventive measures must be adopted and applied. Road users must exercise caution.

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