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Hospital Mortality in Orthopedic Traumatology at the Department of Orthopedic Surgery, Treichville University Teaching Hospital, Abidjan (Côte d'Ivoire): Clinical Determinants and Structural Constraints

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Abstract

Background: Hospital mortality remains a key indicator of trauma care quality. This study aimed to describe the epidemiological profile and determinants of mortality among trauma patients managed in a Department of Orthopaedic and Trauma Surgery from Sub-Saharan Africa. **Methods:** A five-year retrospective and analytical study (January 2020 - December 2024) including the population of all patients hospitalized in the orthopedic and traumatology department. All records of patients who died secondarily in the department were included. Demographic, clinical, therapeutic, and outcome variables were analyzed. **Results:** Out of 3569 admissions, 115 deaths were recorded, yielding an overall hospital mortality rate of 3.2%. Males accounted for 62.6% of deaths (sex ratio 1.67). The mean age was 52.4 ± 18.6 years; age ≥ 60 years was a significant predictor of death ($p = 0.03$). Hemorrhagic shock (24 cases) and sepsis (38 cases) were the leading causes. Most deaths occurred during the preoperative phase (70.4%). Mortality was associated with injury severity, lack of health insurance, high treatment costs, and limited availability of intensive care beds. **Conclusion:** Trauma-related hospital mortality at Treichville reflects the combined impact of clinical severity and systemic constraints. Strengthening intensive care capacity, ensuring blood product availability, and implementing universal health coverage are essential strategies to improve trauma outcomes in Côte d'Ivoire.

Keywords

Trauma, Hospital Mortality, Risk Factors

1. Introduction

Hospital mortality is a key indicator of the quality of patient care. It reflects both the initial severity of the lesions, the performance of therapeutic acts, as well as the structural limitations of the health system [1]. In low- and middle-income countries, particularly in sub-Saharan Africa, hospital mortality remains high. The lack of structured pre-hospital systems, the delay in care, and the shortcomings of the technical platforms are pointed out as causes [2] [3].

Studies conducted in Ghana, Nigeria, or South Africa report hospital mortality rates ranging from 6% to 15%, a significant part of which is considered avoidable [4] [5]. In Côte d'Ivoire, data on hospital mortality, especially in orthopaedic trauma services, are poorly documented [6]. Yet, these data are an essential indicator for improving care. At the Treichville University Hospital, a national reference structure, understanding the determinants of mortality is essential to reduce this mortality.

Thus, the present study aims to analyze the causes of death of patients hospitalized in traumatology at the University Hospital of Treichville between 2020 and 2024, in order to identify the main factors.

2. Patients and Methods

It was a retrospective, descriptive, and analytical study. The study period extended from January 1, 2020 to December 31, 2024. The study population consisted of all patients hospitalized in the orthopedic and traumatology department. All records of patients who died secondarily in the department were included. Patients who died in the surgical emergency room or who died after their discharge from hospitalization were not retained.

The data were extracted from medical records, hospital records, and death registries. The variables studied concerned sociodemographic characteristics, clinical data, medical causes of death, the period of death, as well as the duration of hospitalization.

They were entered and analyzed using Microsoft Excel 2019 software. A descriptive analysis was used to calculate the frequencies, proportions, and averages. Comparative analyses explored associations between certain variables (type of diagnosis and cause of death, evolutionary phase and injury mechanism) using statistical tests following the Pearson Chi2 or the exact Fisher test. Risk factors related to age (over or under 60 years), sex (male or female), diagnosis (cause of death), occupational sector (informal sector), and the time of death (pre-operative or post-operative period) were investigated by logistic regression. The threshold of significance was set at $p < 0.05$.

3. Results

Of a total of 3569 admissions recorded between 2020 and 2024, 115 deaths were recorded, representing an overall hospital mortality of 3.2%. The annual evolution of admissions, deaths, and the mortality rate is presented in **Table 1**.

Table 1. Annual distribution of admissions, deaths, and hospital mortality rates.

year	Admissions	Deaths	Mortality rate (%)
2020	743	18	2.4
2021	702	26	3.7
2022	755	29	3.8
2023	735	29	3.9
2024	634	13	2.1
Total	3569	115	3.2

The average age of deceased patients was 52.4 ± 18.6 years, with extremes from 19 to 93 years. There was a male predominance (sex ratio = 1.67). The distributions of occupations and sectors of activity are presented in Table 2 and Table 3, respectively.

Table 2. Distribution of occupations of deceased patients.

Occupations	Effective (n)	Percentage (%)
Household	25	21.6
merchant	11	9.5
driver	11	9.5
merchant	9	7.8
Retired	8	6.9
Artisan/Planter	6	5.2
Student	5	4.3
Civil servant	4	3.4
Worker/Technician	4	3.4
Unemployed	3	2.6
Farmer	3	2.6
Private sector employee	2	1.7
Military/Gendarme	2	1.7
Teacher	2	1.7
Other	20	17.4
Total	**115**	**100.0**

Table 3. Distribution of activity sectors of deceased patients.

Sector of activity	Effective (n)	Percentage (%)
Informal sector	91	78.4
Formal sector	25	21.6
Total	**115**	**100.0**

The average time to death was 6.4 ± 3.2 days after admission. The diagnoses found in deceased patients are detailed in Table 4. The main medical causes of death observed during the study period are shown in Table 5. The majority of deaths occurred in the preoperative phase (70.4%), followed by postoperative (19.1%) and intraoperative (10.5%) periods. This distribution is shown objectively in Table 6.

Table 4. Distribution of the main diagnoses among deceased patients.

Main Diagnosis	Effective (n)	Percentage (%)
Gangrene	30	26.1
Polytrauma	19	16.5
Severe head injury	9	7.8
Polyfractured (multiple limbs)	8	7.0
Bone cancers/malignant tumors	7	6.1
Complex pelvic fracture	7	6.1
Chronic osteoarticular infections (osteitis, pseudarthrosis, arthritis, osteomyelitis)	7	6.1
Septic pseudarthrosis of the leg/femur	4	3.5
Vertebral tuberculosis	3	2.6
Fracture/vertebral dislocation	2	1.7
Fracture of the distal femur	2	1.7
Fracture of the femoral neck	2	1.7
Extensive pressure injuries	2	1.7
Bilateral open tibia fracture	1	0.9
Open fracture of the femur	1	0.9
Crush syndrome	1	0.9
Total	**115**	**100.0**

Table 5. Distribution of the medical causes of death.

Medical Cause of Death	Effective (n)	Percentage (%)
Septic shock/infections	38	33.0
Hemorrhagic shock/anemia	24	20.9
Severe head trauma	21	18.3
Pulmonary embolism	9	7.8
Tumor metastasis	7	6.1
Perioperative cardiopulmonary arrest	4	3.5
Trauma of the high cervical spine	3	2.6
Bone sealing syndrome	1	0.9
Total	**115**	**100.0**

The results of bivariate and multivariate statistical analyses are summarized in Table 7 and Table 8.

Table 6. Distribution of deaths according to the stage of disease progression.

Period of Death	Effective (n)	Percentage (%)
Preoperative	81	70.4
Intraoperative	9	7.8
Postoperative	25	21.8
Total	**115**	**100.0**

Table 7. Bivariate analysis of factors associated with hospital mortality.

Variables studied	observed association	test used	p-value
Age 60 years old/<60 years old because septic	Increased risk of sepsis among those 60 years old	χ^2	0.03
Sex causes hemorrhage	No significant association	χ^2	0.28
The informal sector causes septic	Significant association	χ^2	0.01
Infectious diagnosis causes septic	High correlation	χ^2	0.004
Polytraumatism causes hemorrhage	Significant correlation	χ^2	0.002
Preoperative period septic shock	Significant association	χ^2	0.001
Early death (<3 days) head injury	Significant association	χ^2	0.01
Duration of hospitalization > 7 days pulmonary embolism	Non-significant trend	Fisher	0.07

Table 8. Multivariate logistic regression analysis of factors associated with hospital mortality.

Independent factor	Adjusted OR	IC 95%	p
Age 60 years	1.9	[1.1- 3.3]	0.02
Informal sector	2.4	[1.3 - 4.6]	0.01
Hemorrhagic shock/anemia	3.1	[1.5 - 6.8]	0.004
Severe head trauma	2.6	[1.1 - 5.5]	0.02
Preoperative period	2.0	[1.0 - 3.9]	0.045

4. Discussion

Over a five-year period, 115 deaths were recorded out of 3569 admissions, representing an overall hospital mortality rate of 3.2%. This relatively moderate rate is within the range of international standards (1% to 4%) [7]. It reflects the overall performance of the service, but should be interpreted with some caution. Indeed, the traumatology and orthopaedics department of the University Hospital of Fukushima admits patients through two separate circuits. The first is outpatient con-

sultations where patients benefit from prior medical preparation. The second is surgical emergencies, where patients are often admitted in a critical context. The number of deaths related to traumatic pathologies was observed in surgical emergencies. This reality is described by Zoumenou *et al.* [8] in Benin. This reduces the prevalence of deaths related to traumatological pathologies.

The average age of deceased patients was 52.4 ± 18.6 years. It corresponds to the active age group most exposed to severe trauma. This average is close to that observed in the study by Loukou *et al.* [6] in Bouaké, which reported a mean age of 58.5 years. In Côte d'Ivoire, nearly 70% of the population is under 35 years old. This demographic structure explains the high proportion of young adults among victims [9]. Men accounted for 62.6% of deaths (sex ratio = 1.67). It confirms the male predominance already reported in African literature [10]-[12]. This excess male mortality is explained by the greater exposure of men to risky activities (driving, transport, construction sites, etc.) as well as their overrepresentation in professions with high mobility. However, age 60 years stood out as a major risk factor ($p = 0.03$) for the occurrence of deaths. This result confirms the vulnerability of elderly patients in severe trauma contexts. Older patients often had cardiovascular or metabolic comorbidities [13]-[15].

In socio-economic terms, the majority of patients who died came from the informal sector. These are patients essentially without health insurance and without structured social support. The lack of universal health coverage during the study period makes it particularly difficult to deal with emergencies. In the majority of cases, families bore the costs alone. This fact delayed access to examinations, care, as well as surgical interventions. The informal sector was significantly correlated with the occurrence of death ($p = 0.01$). This result reflects the influence of socio-economic status on the prognosis. This economic precariousness as a risk factor for death has been reported by some authors [16] [17].

In addition, the average time to death shows that most deaths occurred within the first week of hospitalization. The deaths occurred mainly in the pre-operative phase (70.4%). They were due to the severity of the initial lesions. Indeed, a large number of patients presented with polytrauma and/or head injuries. The Treichville University Teaching Hospital did not have a neurosurgery service. This service was based at the Cocody University Teaching Hospital (during most of the study). This service was not far from our service, facilitating the evacuation of patients in case of necessity. Thus, the delay in management by the neurosurgical team was lengthened. This existing organizational constraint, present in many African countries, was also reported by Vaca *et al.* and Malomo *et al.* [18] [19]. It was a source of delay in care and death. Moreover, these severe cases required admission to the intensive care unit. The intensive care unit was very often saturated due to a lack of beds. Management was therefore not optimal. These findings were made by Gwaram *et al.* [20] and Storm *et al.* [21] in their respective studies in Nigeria and South Africa. Finally, the initial refusal of the surgical procedure for cultural or financial reasons delayed management. The acceptance of mutilat-

ing interventions, particularly amputations, often remains difficult in Africa [22] [23]. The polytrauma cases generated anemia and hemorrhagic shocks.

Acute anemia and hemorrhagic shock were significantly responsible for the deaths. The unavailability of blood products represented a major obstacle to their effective management. Indeed, transfusion coverage remains very insufficient in most of the Ivorian public hospitals [24]. The chronic deficit in volunteer donors is a recurring constraint. Kouao *et al.* [25] showed the factors of the donor deficit in Bouake (Côte d'Ivoire). Like Côte d'Ivoire, Storn *et al.* posed this issue in South Africa. Multiple trauma and hemorrhagic shock were significantly associated with high mortality ($p = 0.002$). While hemorrhagic complications dominated the initial picture, postoperative infections and sepsis also accounted for a significant share of deaths.

Infectious pathologies, in particular septic shock, were strongly associated with mortality ($p = 0.004$). These conditions are often the result of a multifactorial delay in management. This includes late acceptance of the surgical procedure, unavailability of the operating equipment or the block, and the high cost of antibiotics. The resulting septic shock was not always managed in intensive care due to a lack of available beds. Kouassi *et al.* [26] mentioned this bed shortage in a resuscitation unit in the capital during an armed conflict. The cost of microbiological examinations (blood cultures, antibiograms) and last-generation treatments remains prohibitive for the majority of patients. Hyland *et al.* [27] showed that the cost of examinations was a hindrance to their realization in low-income countries.

In view of the results obtained, it appears essential to strengthen the chain of care for the traumatized person, in accordance with the recommendations of the World Health Organization (WHO) [28]. At the organisational level, the creation of intensive care units dedicated to polytraumatized patients and better multidisciplinary coordination are strategic priorities. These recommendations were highlighted by Mock *et al.* [29] in their work on the quality of care in traumatology.

Logistically, improving the availability of antibiotics and their accessibility remains imperative to reduce mortality [30] [31]. Several African authors, including Kambé *et al.* [32], highlighted the structural weakness of the Ivorian transfusion system and the need to strengthen national policies for voluntary and regular blood donation.

Finally, the effective implementation of universal health coverage integrating the care of road accident victims appears essential. It will reduce inequalities in access to emergency surgical care and improve the overall prognosis of patients [33].

This is a retrospective study. This approach exposes data collection and completeness biases. However, this study highlights the major determinants of mortality in traumatology at the Treichville Teaching Hospital. These findings have made it possible to make suggestions to improve patient care.

5. Conclusion

This study highlights a hospital mortality rate of 3.2%. It is mainly related to ad-

vanced age, the severity of the lesions, as well as the socio-economic precariousness of the patients. Hemorrhagic shock or anemia and infections remain the dominant immediate causes. These results highlight the need to strengthen transfusion coverage and access to intensive care. Improving multidisciplinary coordination and expanding universal health coverage are priorities. Will taking these recommendations into account reduce the mortality rate? Apart from clinical determinants, are there other (biological and radiological) determinants related to hospital mortality in orthopaedic and traumatological surgery services? Multicenter prospective studies will assess the impact of these reforms on survival and address these concerns.

Ethics

This study was conducted according to the statement of Helsinki.

Conflicts of Interest

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

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