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Epidemiological and clinical aspects of severe burns in patients admitted to intensive care at the Burn Centre in Abidjan, Côte d'Ivoire

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Abstract

Severe skin burns constitute a significant public health problem worldwide. The objective of this study was to describe the epidemiological and clinical profile of severe skin burns in order to implement effective preventive measures. This was a prospective cross-sectional study with descriptive and analytical aims, conducted over a one-year period at the Burn Centre in Abidjan. The study included 230 patients admitted to the intensive care unit for severe burns, aged under 5 years and older. The total burned body surface area was estimated using Wallace's rule of nines. The Baux index assessed the severity of the burn. The population was evenly distributed by sex, with a predominance of children aged 0 to 4 years (37.39%). 49% of our patients had an unfavourable socioeconomic status. Thermal burns were the most common cause (94.78%). Children under 5 years of age were primarily burned by hot liquids, with flame burns (72.92%) and the patients over 5 years of age were more affected by flame burns (72.92%). The burns were primarily of mixed depth (superficial and deep second-degree burns) (57%). The average burn extent was 32.03%. The median burned body surface area was 20.38% in children and 34.5% in older patients. Patient mortality was high (41.3%).

Keywords: Severe Burns; Resuscitation; Epidemiology; Burned Body Surface Area; Cote d'Ivoire**.**

1. Introduction

Burns constitute a global public health problem that, according to the WHO, causes approximately 180,000 deaths annually. They are caused by exposure to excessive heat, chemical substances, electricity, radiations, or to the friction. The severity of burns varies: they can be superficial, affecting only the outer layer of skin, or deep, damaging underlying tissues. They occur mainly at home or in the workplace [1].

In sub-Saharan Africa, burn injuries disproportionately affect children and socioeconomically vulnerable populations, contributing significantly to hospitalizations, disabilities, and the long-term socioeconomic burden. Burns often occur accidentally (domestic accidents, workplace accidents, road traffic accidents, everyday accidents) or are sometimes intentional (violence, assault, etc.). Burns represent a significant problem in African countries [2].

In Côte d'Ivoire, at the Burn Centre in Abidjan, burns constitute a frequent traumatic injury. The high incidence and mortality rates remain a concern despite modern therapeutic approaches. Given this situation, a better understanding of local epidemiological characteristics is essential to guide public health policies, optimize the organization of care, and reduce burn-related morbidity and mortality. However, a precise understanding of burn epidemiology in sub-Saharan Africa remains limited, and Côte d'Ivoire is no exception to this problem. The objective of this study was to describe the epidemiological and clinical profile of severe cutaneous burns in order to implement effective preventive measures.

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2. Methodology

2.1. Study Population

The study included 230 severely burned patients hospitalized in the intensive care unit at Abidjan Burn Centre. The patients, ranging in age from 6 months to 86 years (116 men and 114 women), were recruited using consecutive sampling. They came from Abidjan and other cities in Côte d'Ivoire.

2.2. Study Type, Period, and Place

This was a prospective cross-sectional study with descriptive and analytical aims, encompassing all patient records of those seen in dermatology for severe skin burns at Abidjan Burn Centre (CGB). This centre is part of the Emergency Medical Assistance Service (SAMU), located within the grounds of the Cocody University Hospital Centre in Abidjan, Côte d'Ivoire. The study period extended from January 1, 2022 to December 31, 2024. The diagnosis of severe skin burns was established based on the evidence.

2.3. Methods

Data were collected using a pre-established questionnaire. The data included demographics (age, sex, occupation, socioeconomic status, place of residence) and clinical data (type of burn, causative agent, depth of the burn, extent of the burn). Data sources used were patient records and hospitalization registers.

To be included, burn patients had to be admitted to the intensive care unit (ICU) with a total body surface area (TBSA) burn greater than 10% of their total body surface area (TBSA) for children; a TBSA burn greater than or equal to 20% of their total body surface area (TBSA) for adults; and a TBSA burn greater than 10% with deep burns (deep second-degree or third-degree). They had to be admitted to the ICU for electrical burns regardless of the percentage of the burn. They had to have been previously informed of the purpose of the study and had given their informed consent to participate.

Patient care data were collected upon admission (body surface area burned, degree of burn, severity score, etc.). Body surface area burned (BSA) was estimated as a percentage of total body surface area using Wallace's rule of nines. Burn depth was assessed clinically according to standard criteria (superficial, intermediate, or deep burns). The Baux index (age + BSA) was calculated only for adult patients over 18 years of age.

2.4. Ethical Considerations

The study protocol was approved by the management of the Abidjan Burn Centre and the management of the Cocody University Hospital Centre. All participants were informed about the purpose of the study and gave their informed consent to participate. Minor patients received parental authorization.

2.5. Statistical Analysis

The collected data were entered into a database, and statistical analysis was performed using Epi Info version 6.0 software. The statistical tests used were the Kruskal-Wallis and Mann-Whitney-Wilcoxon tests. The results were considered statistically significant for a p-value < 0.05.

3. Results

3.1. Sociodemographic Profile of Patients

3.1.1. Distribution of the Population by Age and Sex

The results showed that children aged 0 to 4 years constituted the most represented age group (Figure 1), accounting for 37.39% of cases. Adults aged 25 to 44 years represented the second largest category (27.83%). Patients aged 15 to 24 years and those aged 45 to 64 years represented 16.09% and 9.56% of cases, respectively. Children aged 5 to 14 years constituted 7.83% of patients, while individuals aged 65 years and over were underrepresented (1.30%). The sex ratio (M/F) was 0.98, indicating a slight male predominance (114 women versus 116 men), without significant difference ($p = 0.610$)

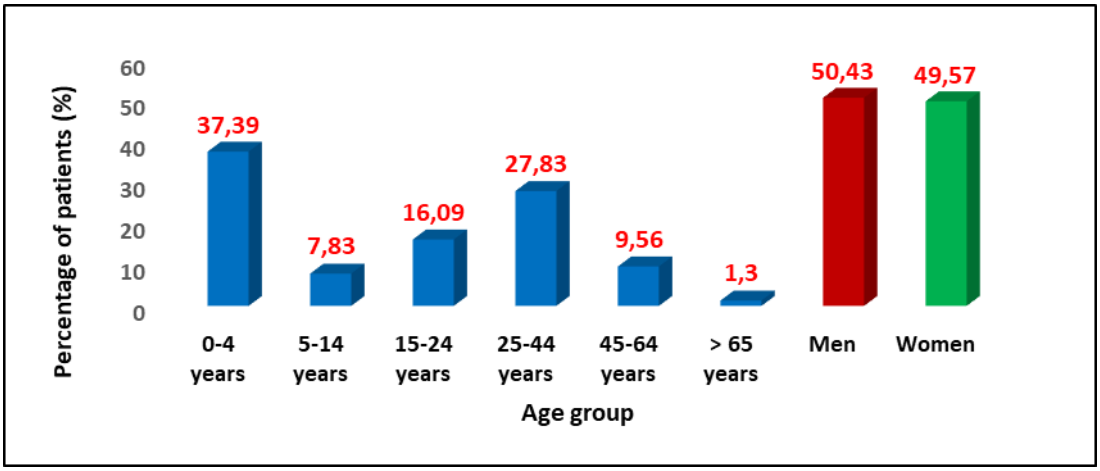

Figure 1 Distribution of burn patients according to age and sex

3.1.2. Distribution of the population according to socioeconomic status

In our series, we observed that 49% of patients (Figure 2) had a low socioeconomic status, while 13.5% had a medium socioeconomic status. Socioeconomic status is not specified in the remaining cases.

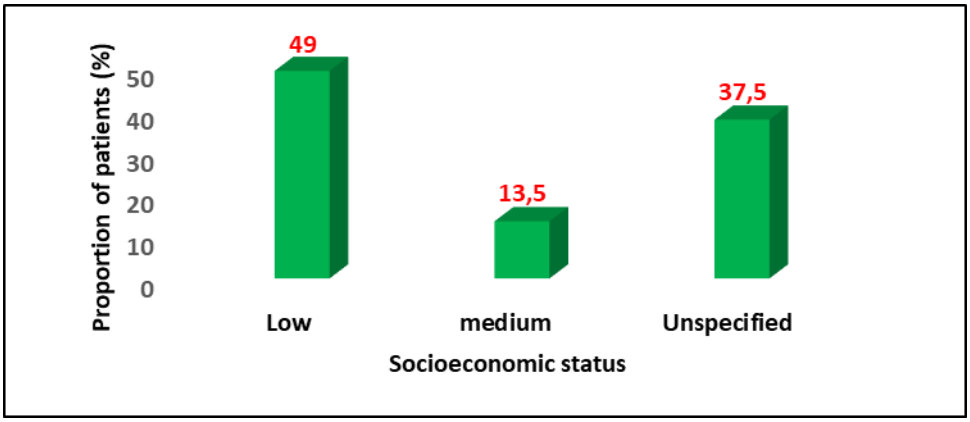

Figure 2 Distribution of burn patients according to socioeconomic level

3.1.3. Population Distribution by Occupation

The population distribution by occupation is shown in Figure 3. It shows that patients and their relatives working in the informal sector represented the largest proportion of our study population, at 54.35%, in contrast to salaried employees, who were very poorly represented at 4.78%. Those not engaged in any professional activity represented 40.87%. Statistical analysis of the distribution by occupation showed a highly significant difference between occupational categories ($p = 2.08 \times 10^{-20}$). This distribution suggests a strong association between severe burns and precarious socioeconomic conditions.

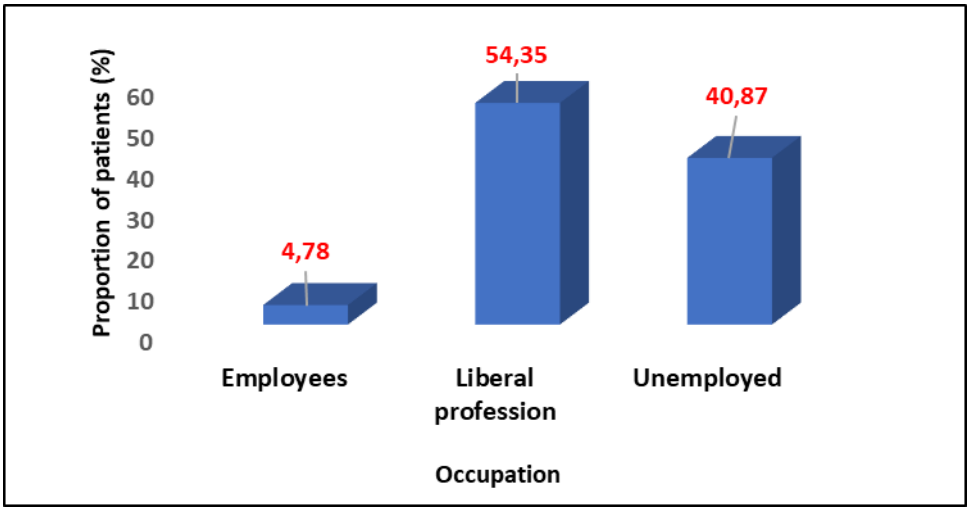

Figure 3 Distribution of burn patients according to occupation

3.1.4. Distribution of burns according to the education level

The distribution of burn victims according to their education level is shown in Figure 4. The majority of burn patients had a primary school education (38.26%). 29.13% had no education. Furthermore, 25.65% of burn victims had a secondary school education and 6.96% had completed a higher education.

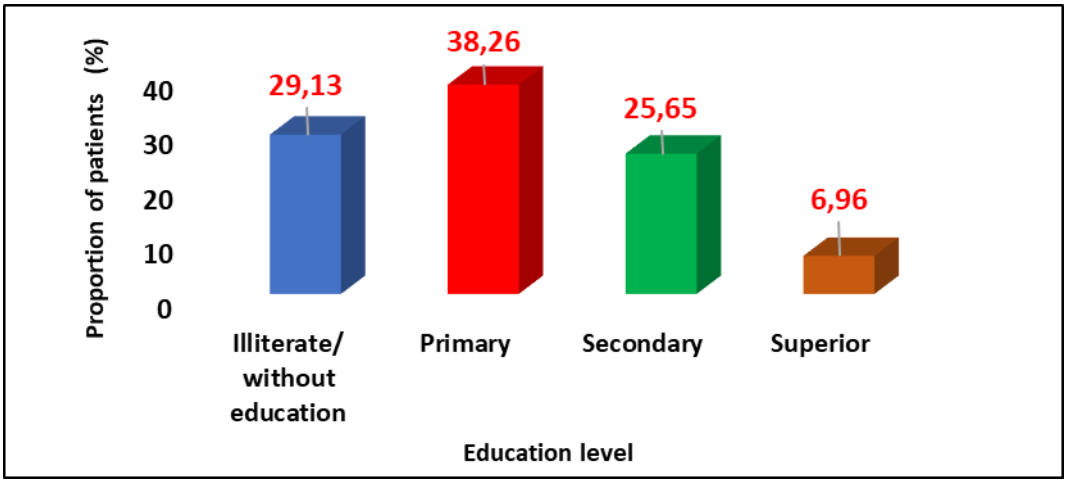

Figure 4 Distribution of the population according to education level

3.1.5. Population Distribution by Area of Residence

The distribution of burn victims according to their place of residence is shown in Figure 5. 58.27% of patients resided in the densely populated districts of Abidjan (Abobo, Adjamé, Yopougon), compared to approximately to 21.74% in other districts of Abidjan and 20% in cities in the interior. A statistically significant difference was observed between the different localities ($p < 0.05$). The district of Abobo accounted for the largest proportion of admissions, followed by Yopougon and Adjamé.

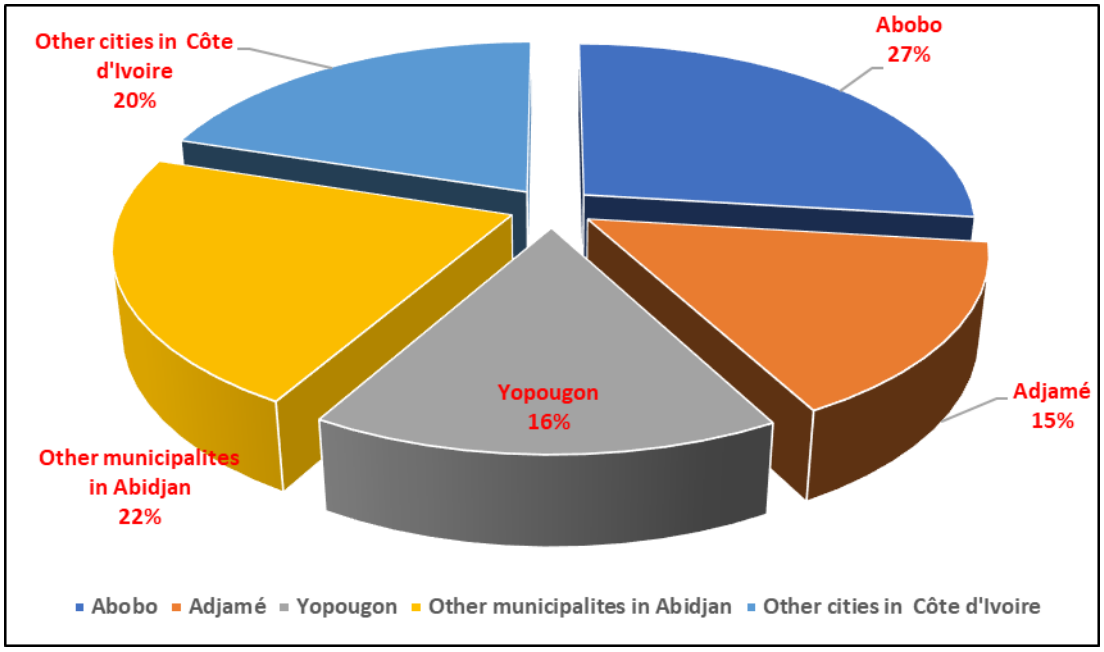

Figure 5 Distribution of severe burn victims according to residential area

3.2. Clinical Profile of Patients

3.2.1. Causes of Burns

The figure 6 presents the main causes of burns. It highlights the most frequent burning agents and their distribution according to age. In children under 5 years of age, burns were exclusively thermal, primarily caused by hot liquids (water, oil, sauce). Hot liquids were the predominant cause of burns, reflecting high domestic exposure to sources such as boiling water, hot food, or scalding beverages. In contrast, in patients aged 5 years and older, the distribution of burning agents is more diverse. There is an increase in burns of electrical, chemical, and flame origin.

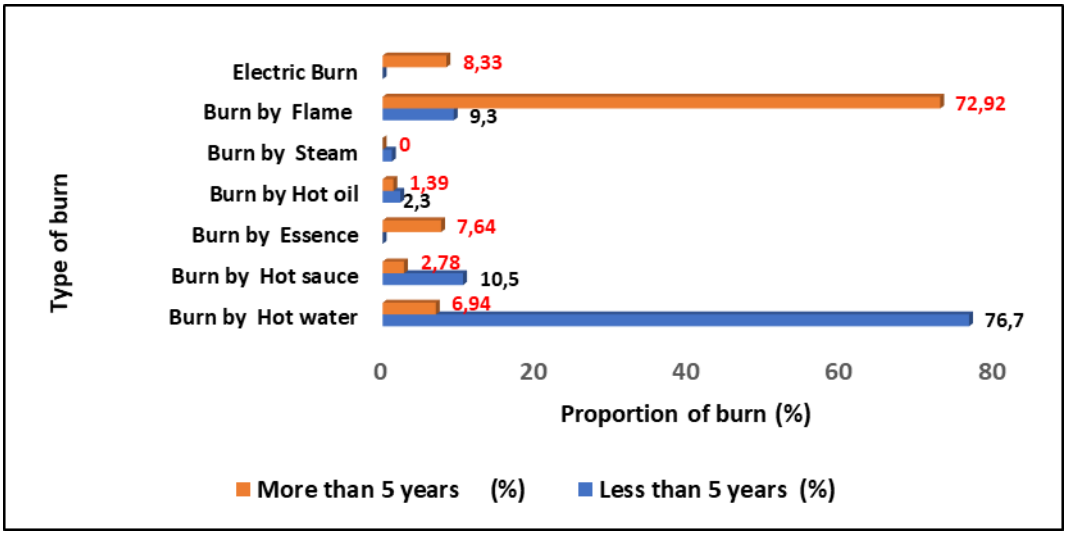

Figure 6 Distribution of the study population according to age groups and causes of burns

3.2.2. Burned Body Surface Area

The burned body surface area according to the different burning agents is shown in Figure 7. The distribution of burned body surface area according to the causative agents highlights significant trends in the severity of burns based on their origin. Burns caused by fire appear to be the most extensive, reflecting often prolonged exposure or rapid spread of the thermal agent across the body. Conversely, burns from hot liquids, although frequent, generally affect a more limited surface area. As for chemical and electrical burns, although less prevalent, they present variable surface areas. Chemical

agents can cause deep lesions even on small areas, while electrical burns, although sometimes small in surface area, can lead to serious internal damage.

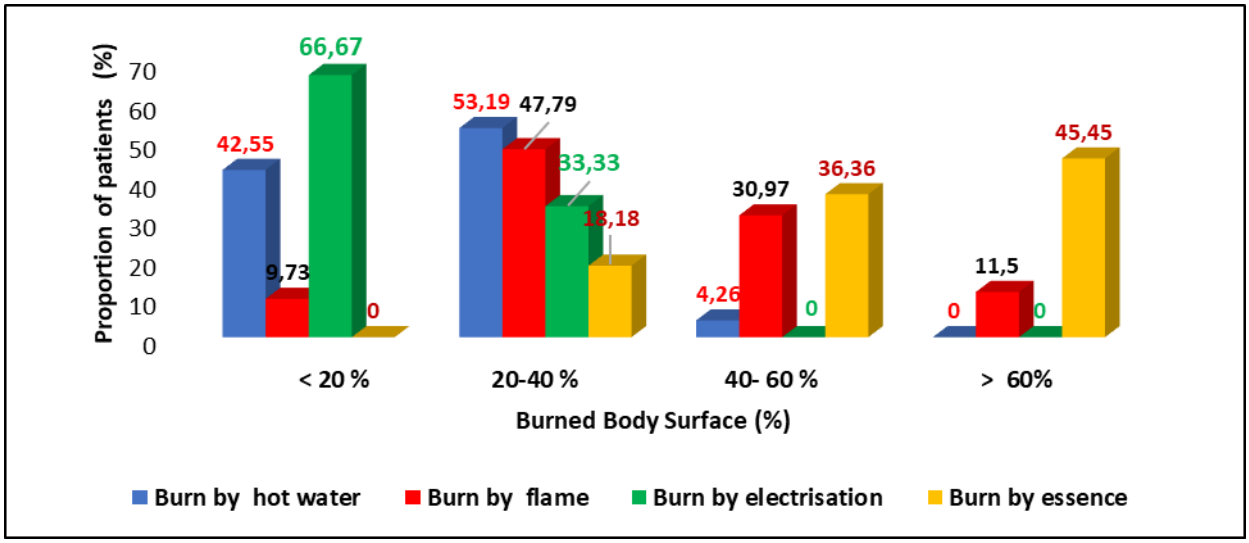

Figure 7 Distribution of Burned Body Surface area in relation to burning agents

3.2.3. Burn Depth

The figure 8 shows the distribution of burn depths according to the causative agent. The distribution of burn depths according to the causative agent highlights a marked correlation between the nature of the burning agent and the severity of the observed skin lesions. Burns caused by fire are predominantly deep, with a predominance of deep second-degree and third-degree burns. This profile is explained by the high thermal intensity and often prolonged exposure time during domestic or occupational fires. These injuries generally require specialized care and are associated with an increased risk of functional and aesthetic sequelae. Burns from hot liquids, on the other hand, are mainly superficial or superficial second-degree, indicating a more limited depth of damage. This type of burn is common in children and the elderly, due to the increased vulnerability of these populations in domestic settings. Chemical burns vary considerably in depth, depending on the nature of the chemical, its concentration, and the duration of contact. Some chemical substances can rapidly cause deep lesions, even on small areas. Finally, electrical burns, although sometimes barely visible on the surface, often result in deep burns due to the internal resistance of tissues and the path of the current through the body. They require rigorous clinical and paraclinical evaluation.

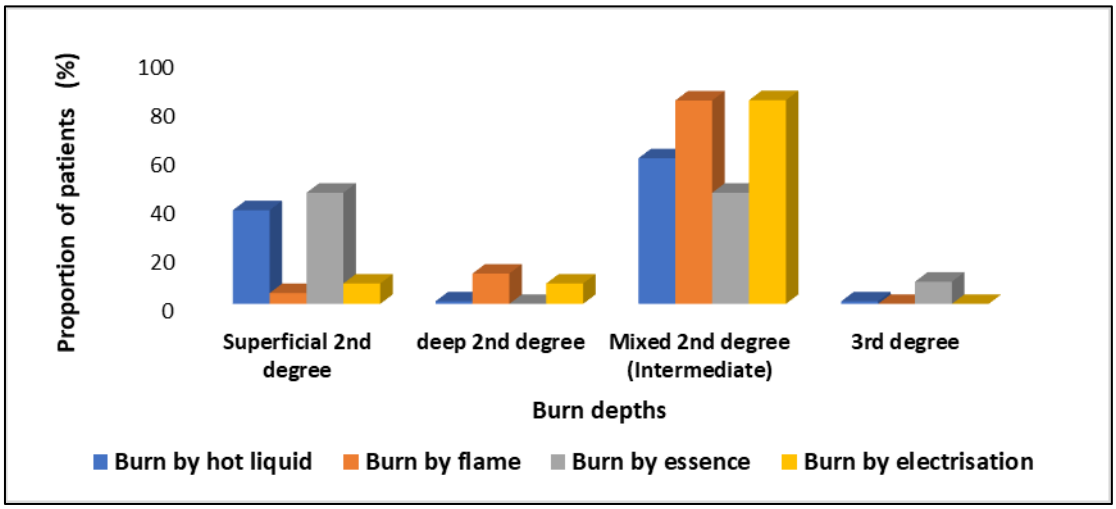

Figure 8 Distribution of burn depths according to the causative agent

3.2.4. Distribution of the population according to the Burned Body Surface Area

The figure 9 shows the distribution of patients according to their burned body surface area (BSA). The most represented group was that of patients with a BSA between 20% and 40%, accounting for 47.83% of the study population. Burns with less than 20% BSA were present in 25.65% of patients. More extensive burns, with a BSA between 40% and 60%, represented 18.69% of cases, while very severe burns (BSA ≥ 60%) were observed in 7.83% of patients. Regarding the extent of the burns, the median burned body surface area (BSA) (Figure 10) was significantly higher in patients over 5 years of age (34.5%) than in those under 5 years of age (20.38%).

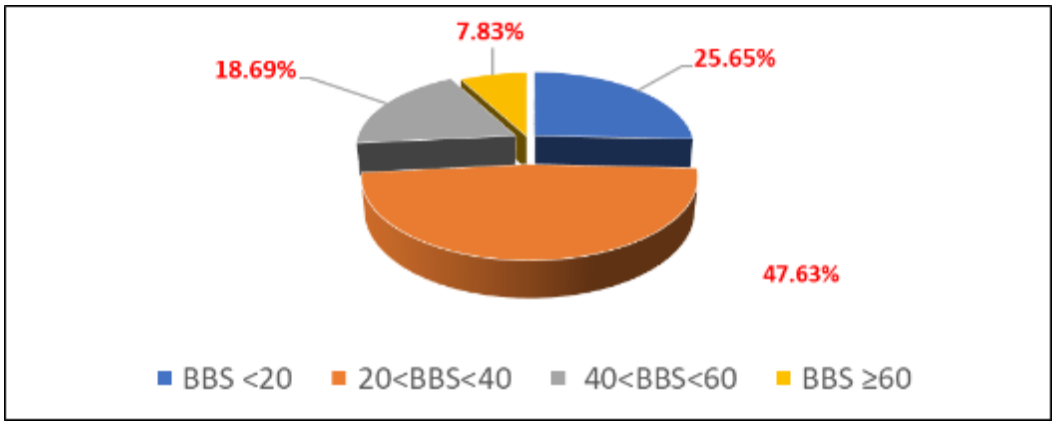

Figure 9 Distribution of the population according to body surface area burned (BSA)

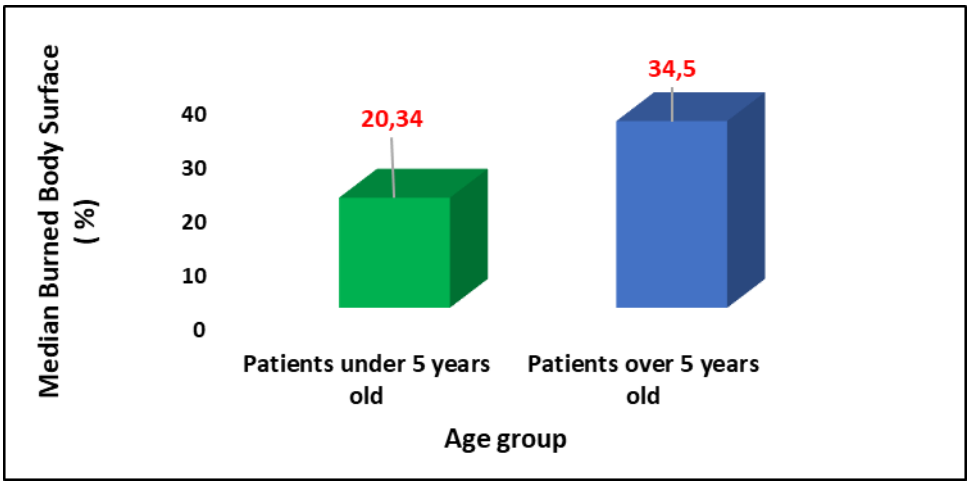

Figure 10 Distribution of median burned body surface area according to the age

3.2.5. Distribution of the population according to burn depth

The figure 11 shows the distribution of patients according to burn depth. Superficial and deep second-degree burns were the most frequent, representing 57.0% of cases. Superficial second-degree burns accounted for 38.4% of patients. In contrast, isolated deep second-degree burns were infrequent (3.5%), and third-degree burns remained rare (1.2%).

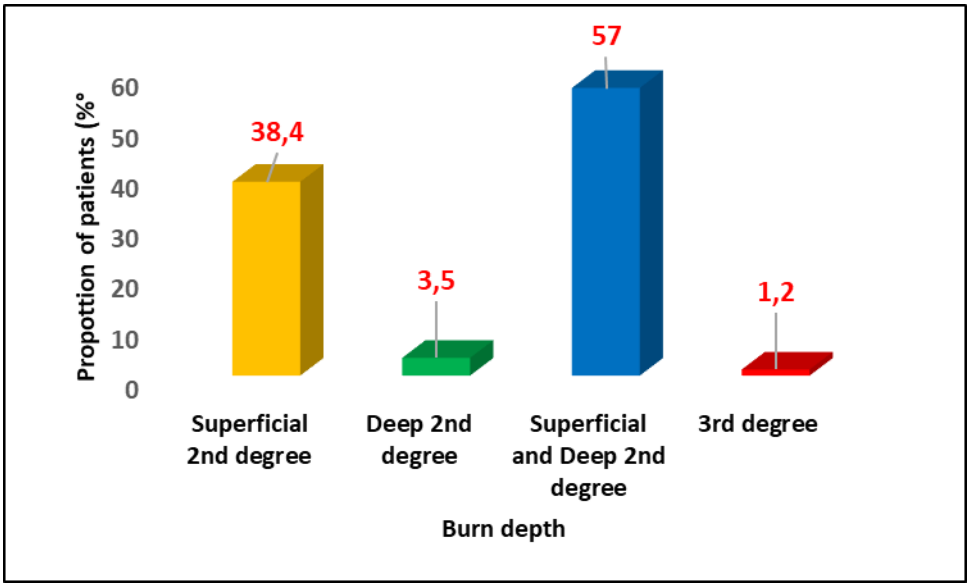

Figure 11 Distribution of the population according to burn depth

3.2.6. Distribution of the population according to the Baux Index

The figure 12 illustrates the distribution of the Baux Index among burn patients. It highlights a direct correlation between burn severity (in terms of affected body surface area and patient age) and clinical outcomes, particularly morbidity and mortality rates. The data show that patients with a high Baux Index (greater than 100) are predominantly associated with a fatal outcome. Indeed, the higher the index, the more critical the prognosis, especially in elderly individuals and those with extensive body surface burns.

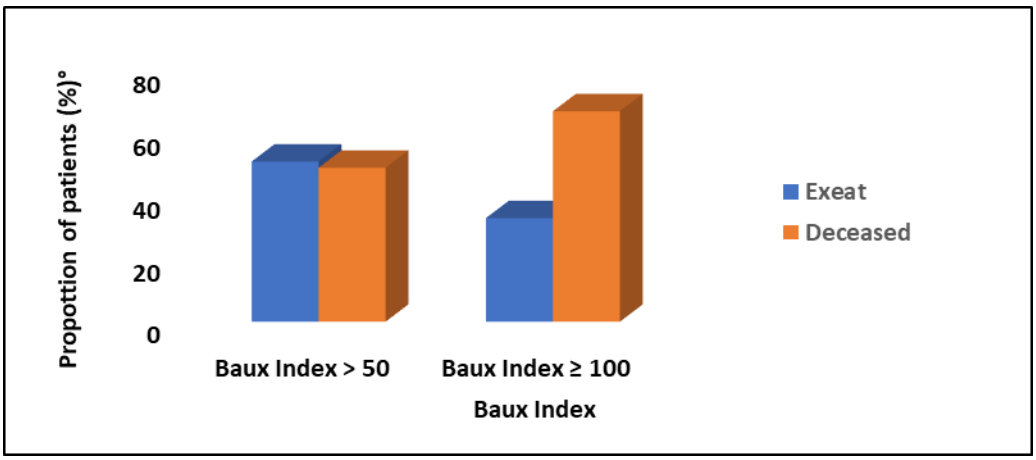

Figure 12 Evaluation of death and survival rates according the Baux Index

3.2.7. Length of Hospital Stay and Patient Outcomes

The figure 13 shows the length of hospital stay for burn patients according to age group. The average length of stay in our study was 19 days, with a range of 3 to 80 days. The average length of stay was shorter for children aged 0-4 years. The figure 14 shows the patient outcomes after treatment. Among the 230 patients hospitalized in intensive care for burns, 57.83% (133) were declared discharged after healing and 41.30% (95 patients) died during treatment (figure 14).

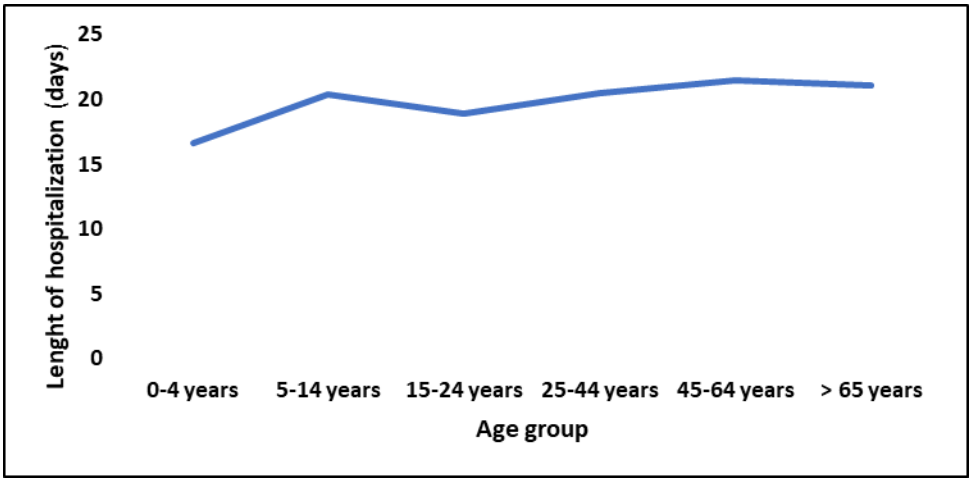

Figure 13 Length of hospital stay for patients according to age group

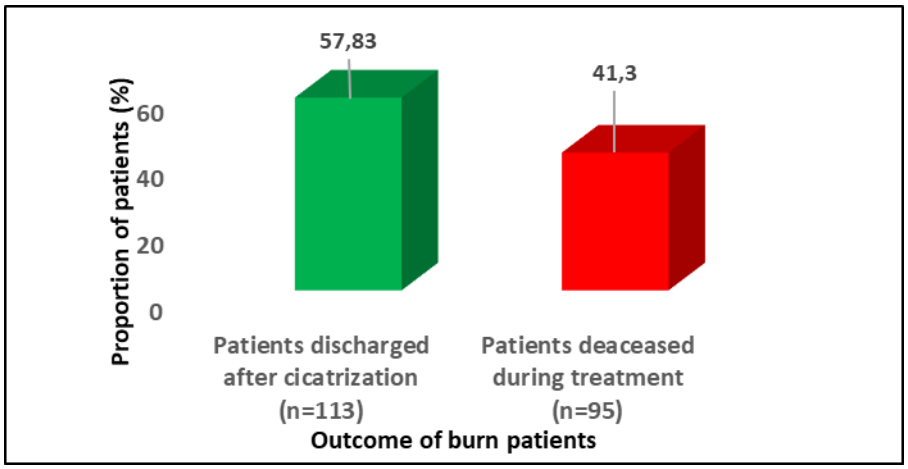

Figure 14 Outcome of burn patients after treatment

4. Discussion

Our study, involving 230 severely burned patients hospitalized in the intensive care unit at the Abidjan Burn Centre, aimed to describe the epidemiological profile of patients admitted for severe burns at this centre. The study results revealed clear trends and significant disparities according to sex, age, place of residence, and the type of burn.

Analysis of the patient sex distribution showed a male-to-female ratio of 0.98, with no significant difference between men and women. This result is consistent with observations reported in the literature, such as that of Hounkpè et al., which showed a male predominance [3]. Regarding age groups, there was a predominance of children aged 0-4 years (37.39%). This distribution aligns with data from several African studies that identify this age group as the most vulnerable to burns [4][5][6]. This vulnerability is explained in particular by the dependence of young children on parental supervision, their increasing mobility and their frequent exposure to domestic accidents, especially to hot liquids and heat sources in the family environment.

Our results also show that the majority of patients come from the informal sector or are unemployed, while salaried workers are very poorly represented. This distribution reflects the well-documented association between burns and socioeconomic vulnerability described by several authors [5][7]. Similarly, several studies conducted in sub-Saharan Africa highlight that burns occur more frequently in contexts characterized by precarious living conditions and limited access to domestic safety infrastructure [8].

In our study, the mechanisms of burns differ significantly according to the patients' age. In children under 5 years of age, burns from hot liquids are by far the most common, particularly hot water (76.74%) and hot sauces (10.47%). In contrast, in patients over 5 years of age, flame burns are the leading cause (72.92%), followed by electrical burns

(8.33%) and hydrocarbon burns. Several studies have shown that burns from hot liquids, primarily water or hot food, are the dominant mechanism in young children and generally occur in the home environment [9]. These accidents are related to their increasing mobility, meal preparation, the presence of containers of hot water on the floor, or the handling of pots in a confined domestic space [9].

In older patients, our results showed a clear predominance of flame burns, as was the case in a study conducted in Nigeria by Dongo et al. [10], who showed that flame burns were the leading cause in adolescents and adults. They are often linked to domestic accidents, fires, flammable fuels, or accidents involving gasoline. Similar results were also described in a study conducted in Kenya by Wong et al. [9], where flame burns were predominant in older subjects, while burns from hot liquids were dominant in young children.

Furthermore, the presence of electrical burns observed in our patient population over five years of age is consistent with data from the literature. Electrical burns are more frequent in older children, adolescents, and adults, often related to occupational activities, domestic accidents, or exposure to unsafe electrical installations [10].

The majority of patients presented with a burned body surface area (BSA) between 20% and 40% (47.83%), followed by burns less than 20% (25.65%). Extensive burns remained less frequent, with 18.69% of patients presenting with a BSA between 40% and 60% and 7.83% with a BSA ≥ 60%. Moreover, the median BSA was significantly higher in patients over five years of age than in those under five years of age (34.5% vs. 20.38%).

This distribution is comparable to that described in several African studies on severe burns. In a study conducted in Nigeria, Dongo et al. reported that the majority of hospitalized patients had a total body surface area (TBSA) between 20% and 40%, while very extensive burns (>60%) remained less frequent [10]. Similarly, an analysis of paediatric burns in sub-Saharan Africa showed that the most frequently observed burned body surface areas in hospitalized patients were generally between 15% and 40% of the total body surface area [8].

According to several studies, the difference observed in our study between children under five years of age and older patients, with a higher median burn severity score (BSS) in the latter, was due to the fact that burns from flames or flammable fuels, more frequent in adolescents and adults, tended to cause more extensive burns than burns from hot liquids, which are predominant in young children [9]. Thus, our results confirm that the extent of burns varies according to age and the mechanism of injury and highlight the importance of prevention strategies targeted according to age and circumstances of exposure.

Regarding burn depth, second-degree burns combining superficial and deep forms represented the vast majority of cases (80.6%), while superficial second-degree burns and isolated deep second-degree burns represented 9.7% and 9.0%, respectively. Third-degree burns were rare (0.7%). This predominance of second-degree burns is consistent with data reported in the literature on the epidemiology of burns [7].

Indeed, several studies have shown that second-degree burns are the most frequently observed type of burn in patients hospitalized for burns. In a review of paediatric burns in sub-Saharan Africa, the majority of burns observed in specialized care units were partial burns, i.e., second-degree burns, often related to domestic scalding [8].

Similar results were reported in a hospital study conducted in Nigeria by Dongo et al., where second-degree burns also accounted for the majority of hospitalized cases. The authors explain this predominance by the frequency of burns from hot liquids and flames, which most often result in intermediate-depth lesions rather than deep burns from the outset [10].

The median observed value (74.25) of the Baux Index reflects significant burn severity in this population (patients aged 18 years and older) and suggests a considerable risk to life. Several studies have confirmed the predictive value of this index. In an analysis of more than 17,000 burn patients, David N. Herndon and David G. Greenhalgh showed that the Baux Index remains strongly correlated with mortality. The authors emphasize that mortality increases progressively with rising Baux Index scores, confirming its usefulness for the initial assessment of severity [11, 12].

The median length of hospital stay in our study was 19 days. The relationship between burn severity and length of hospital stay is well documented in the literature. The study by Craig et al. showed that an increase in the burned surface area was associated with longer hospital stays [13]. The length of hospital stay for burn patients was closely related to the extent and depth of the burns. More extensive or deeper burns required prolonged care, resulting in longer hospital stays [8, 10, 11]. Thus, the longer length of hospital stay observed in our study appears to reflect the severity of the burns.

Conclusion

The study showed that severe burns primarily affected children and young adults. The percentage of body surface area burned was 20.38% in children and 34.5% in older patients. Their occurrence is linked to low socioeconomic status, and patient mortality is high. To reduce the incidence of burns, appropriate measures such as public awareness campaigns should be implemented.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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