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ORIGINAL ARTICLE

Mortality among burn patients: experience of the burn unit of Batna university hospital

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ABSTRACT

Introduction. Burns are a common and potentially serious condition whose vital prognosis depends on several factors. Mortality remains high, particularly in severe forms. The aim of this study was to describe the severity factors and mortality observed among burn patients hospitalized in our department. **Materials and Methods.** This prospective, descriptive, and analytical study was conducted in the Burn Unit of Batna University Hospital in 2023. It included patients hospitalized for burns meeting specific criteria related to extent and location. The variables studied encompassed demographic characteristics, causal agent, burn severity, and outcomes (infection and mortality). Assessment relied on standardized tools: the Wallace Rule of Nines, the Lund-Browder chart, and the Baux and UBS scores. Statistical analysis was performed using SPSS (χ^2 test, $p \leq 0.05$), in accordance with ethical standards, including informed consent and patient confidentiality. **Results.** A total of 233 patients were included. Children aged 1–5 years were the most represented age group. Several severity factors were identified, notably a total burned body surface area (TBSA) exceeding 30%, burn depth, and age extremes (under 5 or over 65 years). The overall mortality rate was 15.9%. Mortality reached 83.3% in flame burns and 64.5% in burns involving more than 50% TBSA. It was also higher in patients with deep burns, and reached 83.3% for a Baux score above 100 and for a UBS score ≥ 150. Furthermore, mortality occurred in 29.4% of infected cases. **Conclusion** The main factors associated with burn severity and mortality are age, flame burns, burn extent, depth, and infection. This study confirms the importance of early and appropriate management in improving both the vital and functional prognosis of burn patients.

Keywords: Burns, Severity factors, Mortality, Prognosis, Infection.

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1. INTRODUCTION

Burn injury is a circumstantial traumatic condition, most often accidental and frequent [1,2]. It represents a major public health problem, particularly in developing countries [3]. Despite progress, mortality remains a major concern [1,2,4] due to several factors: frequent involvement of vital anatomical areas, immunosuppression induced by severe injuries, the scarcity of specialized facilities, and the lack of appropriate care pathways, particularly in the pre-hospital setting [3]. Burns are also among the costliest injuries because of prolonged hospitalization, the need for rehabilitation, and the high cost of care and sequelae [5].

Our objective was to describe severity factors and mortality observed in our series of 233 patients admitted in 2023.

2. MATERIALS AND METHODS

This was a prospective descriptive and analytical study conducted in the Burn Unit of Batna University Hospital, including all patients hospitalized for burns in 2023. The studied parameters were age, sex, type of causal agent, extent and depth of burns, and outcome (occurrence of infection and mortality).

Our study included all burn victims regardless of age with a total body surface area (TBSA) burned greater than 15% in adults and greater than 10% in children, as well as burns located in high-risk anatomical areas. Patients, both adults and children, presenting burns that did not meet hospitalization criteria were excluded from the study, particularly when the burned body surface area was small (<10%, or <5% in infants) and/or in the absence of burns involving high-risk anatomical sites.

Infection was defined based on clinical criteria (local signs of wound infection) and/or bacteriological findings. The TBSA was assessed using the Wallace Rule of Nines in adults and the Lund-Browder chart in children. Burns were classified as second-degree, third-degree, and mixed forms according to clinical assessment (first-degree burns were excluded). The Baux score is calculated as age plus TBSA (with +15 added in the presence of comorbidity), and the UBS index is calculated as total TBSA + (3 × third-degree TBSA).

Data entry and analysis were performed using IBM SPSS software version 26. The final document was formatted using Word 2016. Results were expressed as numbers and percentages. Categorical variables were compared using the χ^2 test, with a significance threshold set at $p \leq 0.05$. Informed consent for treatment was obtained from the patients, their families, or legal representatives. Anonymity and confidentiality were respected.

3. RESULTS

Epidemiological and clinical profile of deceased burn patients

The mortality rate was 15.9%. Death occurred mainly between day 5 and day 10 (48.6%), followed by the 0–5-day period (13.5%). The causes of death were dominated by septic shock, accounting for 54% of deaths. Flame was responsible for 83.8% of deaths, compared with 13.5% for scalds and 2.7% for electrical burns. Among deceased patients, 54.1% had a TBSA > 50%. 40.6% of deceased patients had a BAUX score > 100, and 51.4% had a UBS score > 100. Infection was present in 81% of deceased patients (Table 1).

Table 1: Characteristics of deceased burn patients

Variable	Percentage
Mortality rate	15.9 %
Time to death	
0-5 days	13.5 %
5-10 days	48.6 %
11-30 days	24.4 %
>30 days	13.5 %
Causes of death	
Severe hydro-electrolyte disorders	10.9 %
Multiple organ failure	35.1 %
Septic shock	54 %
Causal agent	
Flame	83.8 %
Hot liquids	13.5 %
Electrical burns	2.7 %
TBSA	
<20 %	8.1 %
21-50 %	37.8 %
>50 %	54.1 %
BAUX score	
0-75	35.1 %
76-100	24.3%
>100	40.6%
UBS score	
0-49	16.2 %
50-99	32.4 %
100-149	24.3 %
≥150	27.1 %
Infection	
Yes	81 %
No	19 %

Analytical study of mortality

Mortality according to age and to sex

A mortality rate of 100% was observed in patients older than 65 years. Only 3.9% of children under 5 years died, with a statistically significant association (p < 0.001). Mortality was significantly higher in female patients (23.2%) compared with male patients (11.9%). This relationship was statistically significant (p = 0.025) (table 2).

Table 2: Relationship between mortality and demographic characteristics (age and sex).

Variable	Outcome		Total	*p*
	Deceased	Survivors		
Age				
0-5	**3 (3.9 %)**	73 (96.1 %)	76 (100 %)	< 0.001
6-15	3 (11.5 %)	23 (88.5 %)	26 (100 %)	
16-45	19 (18.8 %)	82 (81.1 %)	101 (100 %)	
46-65	7 (28 %)	18 (72 %)	25 (100 %)	
>65	**5 (100 %)**	0	5 (100 %)	
Sex				
Male	18 (11.9 %)	133 (88.1 %)	151 (100 %)	0.025
Female	**19 (23.2 %)**	63 (76.8 %)	82 (100 %)	

Mortality according to TBSA

Mortality reached 64.5% for TBSA > 50% and 32% for TBSA between 30% and 50%. This relationship was statistically significant (p < 0.001) (Table 3).

Table 3: Relationship between mortality and TBSA.

TBSA	Outcome		Total	*P*
	Deceased	Survivors		
<20%	3 (2.3 %)	127 (97.7 %)	130 (100 %)	< 0.001
20 - 30%	6 (12.8 %)	41 (87.2 %)	47 (100 %)	
30 - 50%	8 (32 %)	17 (68 %)	25 (100 %)	
> 50%	20 (64.5 %)	11 (35.5 %)	31 (100 %)	

Mortality according to burn depth

Mixed (mosaic) burns had the highest mortality rate (35.8%). This relationship was statistically significant (p < 0.001) (Table 4).

Table 4. Relationship between mortality and burn depth.

Burn depth	Outcome		Total	*P*
	Deceased	Survivors		
Second-degree burn	9 (5.9 %)	143 (94.1 %)	152 (100 %)	< 0.001
Third-degree burn	4 (28.6 %)	10 (71.4 %)	14 (100 %)	
Mixed burns (second- and third-degree)	24 (35.8 %)	43 (64.2 %)	67 (100 %)	

Mortality according to BAUX score

Mortality increased with the BAUX score, from 2.1% for a score ≤ 50 to 83.3% for a score > 100. This relationship was statistically significant ($p < 0.001$) (Table 5).

Table 5. Relationship between mortality and BAUX score.

BAUX score	Outcome		Total	*p*
	Deceased	Survivors		
0-50	3 (2.1 %)	139 (97.9 %)	142 (100 %)	
51-75	10 (20.8 %)	38 (79.2 %)	48 (100 %)	< 0.001
76-100	9 (36 %)	16 (64 %)	25 (100 %)	
> 100	15 (83.3 %)	3 (16.7 %)	18 (100 %)	

Mortality according to UBS score

Mortality increased from 35.3% for a UBS score between 50 and 99 to 83.3% for a score ≥ 150. This relationship was statistically significant ($p < 0.001$) (Table 6).

Table 6. Relationship between mortality and UBS score.

UBS score	Outcome		Total	*p*
	Deceased	Survivors		
0 - 49	6 (3.5 %)	166 (96.5 %)	172 (100 %)	
50 - 99	12 (35.3 %)	22 (64.7 %)	34 (100 %)	< 0.001
100 - 149	9 (60 %)	6 (40 %)	15 (100 %)	
≥ 150	10 (83.3 %)	2 (16.7 %)	12 (100 %)	

4. DISCUSSION

Despite the inclusion of 233 patients, the sample size remains relatively limited for certain analyses, particularly for subgroup analyses. Some potentially influential variables were not taken into account, such as comorbidities and the delay in initial management. In addition, the number of patients older than 65 years was small, and the related results should therefore be interpreted with caution. The study was limited to the in-hospital period and did not allow the assessment of long-term mortality.

Mortality in our series was 15.9%, a rate comparable to that reported by several international studies, such as those by Iqbal T and Theodorou P (10–19%) [6,7], but lower than the rates observed in other studies, such as those by Tchaou BA and Amengle AL (25.9–41.2%) [4,8], and higher than those reported by Rafii MH and Nickel KJ (5.6–9.5%) [9,10]. Deaths occurred between the 5th and 10th day of hospitalization in 48.6% of cases. This is comparable to the results reported by Boukind L et al. in Morocco [11], where 60% of deaths were recorded between the first and the second week, but differs from those of Hoyos Franco MA in Colombia [12], who reported 40% of deaths within the first 24 hours. Ada MO et al. in Senegal [13] observed a mean time to death of 13.2 days.

Age appeared to be a major prognostic determinant in our series: all patients older than 65 years died, whereas mortality remained low in children (3.9%), highlighting a very significant association between age and mortality ($p < 10^{-4}$). These findings are consistent with the literature. Wassermann reported a marked increase in vital risk after 50 years of age [14], and Theodorou et al. identified age as one of the most powerful predictors of post-burn mortality [7]. Similarly, Essayagh M et al. showed the poor prognosis associated with extreme ages, particularly in elderly patients, due to impaired healing mechanisms and reduced immunity [15]. In our series, mortality was slightly higher in women (23.2% versus 11.9%), a trend also observed in several international studies, such as that of Bryski MG et al. (24% versus 15%) [16], and in the 2018 WHO data indicating slightly higher mortality among women worldwide [17].

Flame was by far the most lethal causal agent in our series, being involved in 83.8% of deaths, while burns caused by hot liquids or electricity were associated with much lower mortality. This predominance of flame burns is widely confirmed in the literature: Beyiha

G et al. in Cameroon [18] reported 89% of deaths due to flames, Ibran EA et al. in Pakistan [19] 89.3%, and Hoyos Franco MA in Colombia [12] 66.7%, highlighting the particularly severe and destructive nature of flame burns.

In our series, burn severity was a major determinant of prognosis. The mean TBSA among deceased patients was 54.5%, and mortality increased sharply beyond 50% TBSA (64.5%, $p < 10^{-4}$). These findings are consistent with the literature: Boukind in Morocco [11] reported 65% mortality for TBSA > 40%, Hoyos Franco in Colombia [12] reported a mean TBSA of 70.5% among deceased patients, Ibran in Pakistan [19] reported 79.5% mortality for TBSA ≥ 61%, and Beyiha in Cameroon [18] reported 73.7% mortality for TBSA > 60%. Overall, TBSA is recognized as a key prognostic factor, with critical thresholds generally around 20% in adults and 10% in children [11]. Burns exceeding 40% are particularly associated with a high risk of multiple organ failure [20].

Regarding burn depth, our series shows a significant increase in mortality with lesion severity. Mortality was 5.9% for second-degree burns, 28.6% for third-degree burns, and 35.8% for mixed burns, with a statistically significant association ($p < 10^{-4}$). These results are consistent with the literature. According to Wassermann D, first-degree burns do not affect vital prognosis, whereas deep second-degree and third-degree burns are associated with a high risk of infection and mortality due to the severity of lesions and the prolonged clinical course they entail [14].

In our series, the main causes of death were septic shock (54%), multiple organ failure (35.1%), and severe hydro-electrolyte disorders (10.9%). These findings are globally consistent with the literature. Boukind L in Morocco [11] reported a predominance of infections (60%), followed by respiratory complications (20%) and hemodynamic shock (10%). Hoyos Franco in Colombia [12] reported sepsis in 46.7% of cases and multiple organ failure in 40%. Essayagh M [15] confirmed the major role of septic shock, responsible for 88% of deaths. In the study by Beyiha G in Cameroon [18], causes of death included multiple organ failure (15.6%), septic shock (17.9%), and pulmonary involvement (28.6%). Overall, the literature confirms that septic shock is the leading cause of mortality in burn patients [11,12,15].

5. CONCLUSION

Mortality among burn patients remains high and results from several closely associated factors linked to poor prognosis. Advanced age, particularly over 65 years, is a major determinant of death, as are flame burns. The severity of injuries, especially when TBSA exceeds 30% or in the presence of deep burns, significantly worsens outcomes. Infection, and more specifically septic shock, represents the leading cause of death in burn patients. Improvement in prognosis relies on early and structured management, infection prevention, appropriate resuscitation, and strengthening of resources dedicated to these patients.

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