MORTALITY ANALYSIS OF BURNS IN A DEVELOPING COUNTRY: THE CAMEROONIAN EXPERIENCE

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Abstract

Background: Burns are the leading causes of disability-adjusted life-years (DALYs) lost in low- and middleincome countries. The survival outcome in the Douala General Hospital was lower than the survival outcome predictions in high income countries.

Methods: It was a retrospective observational study carried out from the 1st of January 2008 to the 31st of December 2015 in the Burn Unit of the Douala General Hospital. An adapted questionnaire was used to collect demographic data, burn agents, burn depth; diagnostic delay, burn surface area, mortality and its causes. Data was transferred to Microsoft Excel 2015 and Statistical Package for Social Sciences (SPSS) version 20.0 for data analysis.

Results: During this 8 year period, 453 patients were studied and most (n=339, 74.8%) patients were admitted. Mortality was high (n=104, 23.0%). Amongst those who died, the burn agents responsible were, flames (n=69, 66.3%), electricity (n=15, 14.4%), water (n=12, 11.5%), contact (n=5, 4.8%), Oil (n=2, 1.9%) and chemicals (n=1, 1.1%). The causes of death were shock (n=36, 34.0%), sepsis (n=25, 24.0%), acute respiratory distress (n=25, 24.0%), acute renal failure (n=6, 6%), severe anaemia (n=4, 4.0%) and unrecorded causes (n= 8, 8%).

Conclusion: A quarter of all patients died mostly from flame, electricity and water burns. Increase in burn depth and burn surface area worsened the prognosis. Shock (the commonest cause of death), sepsis, acute respiratory distress, acute renal failure and wound infection were significantly associated to mortality.

Keywords: Burns, Causes, Agents, Mortality.

Background

Burns are a serious public health problem accounting for 265 000 annual death from fires alone worldwide [1]. Burns are among the leading causes of disability-adjusted life-years (DALYs) lost in low- and middle-income countries. In 2004, about 11 million people worldwide suffered from burns, severe enough to require medical attention [2]. Burn injuries are a major cause of prolonged hospital stays, disfigurement, disability, and death in Africa [3] The survival outcome in our setting (Douala General Hospital) was lower than the survival outcome predictions in high income or developed countries [4].

Methods

Study design and setting

This study was a retrospective observational study with review of medical records over a period of 8 years, from January 1st 2008 to December 31st 2015. The Douala General Hospital is a tertiary hospital in the Cameroon health system and has the only burn unit in the public sector.

Data collection & statistical analysis

The variables of each patient were extracted from the hospitalisation files and filled in the questionnaire.

The variables of each patient were extracted and filled in the questionnaire. This information was transferred from the data collection sheet into Microsoft Office Excel Worksheet 2015 and then coded into the Statistical Package for the Social Sciences (SPSS) version 20.0. The Pearson Chi-square was used to determine associations between categorical variables and mortality with the level of significance set at 0.05 (p-value). Mortality rate was calculated thus,

$$\text{Mortality rate} = \frac{\text{Number of patients who died}}{\text{Total number of patients}} \times 100$$

Results

During this 8 year period, 453 patients were studied and the mean age was 25.2 ± 17.77 years with a male predominance (n=288, 63.6%). The mortality rate was 23.0% (104 patients) from different aetiologies. In this study, sex and age didn't seem to influence mortality. (See Table 1 and 2)

Table 1: Sex distribution of patients who died.

Table 2: Age distribution of patients who died.

Sex	Death (%)	p-value	Age group	Death (%)	p-value
Male	67 (23.3)	0.467 11	0-10	23 (19.2)	0.541
			11-20	13 (19.1)	
Female	37 (22.4)		21-30	21 (24.4)	
Total	104 (23.0)		31-40	23 (23.5)	
			41-50	12 (28.6)	
			51-60	7 (28.0)	
			61-70	2 (25.0)	
			71-80	2 (40.0)	
			>81	1 (100.0)	
			Total (%)	104 (23.0)	

Amongst those who died, the burns were caused by different agents mostly from flames (n=69, 66.3%) and others illustrated below:

Figure 1: Distribution of patients who died according to burn agent.

Some of these burn agents were significantly associated with mortality as shown below:

Table 3: Burn agents and mortality.

Burn Agent	Survival (%)	Death (%)	Total (%)	p-value
Water	99 (89.2)	12 (10.8)	111 (24.5)	0.001
Oil	25 (92.6)	2 (7.4)	27 (6.0)	0.031
Flame	100 (59.2)	69 (40.8)	169 (37.3)	0.001
Chemical	6 (85.7)	1 (14.3)	7 (1.5)	0.496
Electrical	104 (87.4)	15 (12.6)	119 (26.3)	0.001
Contact	15 (75.0)	5 (25.0)	20 (4.4)	0.033
Total	349 (77.0)	104 (23.0)	453 (100.0)	-

In our study, vis-à-vis the clinical presentation, burn depth influenced mortality as all the forms were statistically associated to mortality ($p=0.001$). Nonetheless, it was demonstrated that those with first degree ($R=-0.310$) had less propensity to die than patients with second ($R=+0.268$) and third degree burns ($R=+0.364$).

(See Table 4)

The total body surface area burnt was also statistically associated to mortality. (See Table 5)

Table 4: Distribution of patients who died according to Table 5: Mortality according to burn surface area. burn depth.

Burn depth	Death (%)	p-value	R
First degree	8 (6.7)	0.001	- 0.310
Second degree	69 (31.0)	0.001	+0.268
Third degree	27 (47.6)	0.001	+0.364
Total	104 (23.0)	-	-

% Burns surface area	Death (%)	p-value
0-9	2 (1.0)	<0.001
10-19	4 (5.5)	
20-39	24 (29.6)	
40-59	25 (56.8)	
≥60	49 (94.2)	
Total	104 (23.0)	

Table 6: Mortality according to time of arrival after injury.

Time	Survival (%)	Death (%)	Total (%)	p-value
0-1hr	150 (82.0)	33 (18.0)	183 (40.4)	0.005
2-8hrs	92 (76.0)	29 (24.0)	121 (26.7)	0.040
9-24hrs	31 (57.4)	23 (42.6)	54 (11.9)	0.758
25-48hrs	27 (79.4)	7 (20.6)	34 (7.5)	0.001
>48hrs	49 (80.3)	12 (19.7)	61 (13.5)	0.733
Total	349 (77.0)	104 (23.0)	453 (100.0)	0.005

The time of arrival after injury was statistically significant with respect to mortality for those who came to the burn unit between 25 to 48 hours after injury.

Many patients (n=384, 84.8%) experienced complications during this 8 year time frame. The table below shows which of the complications were statistically significant with mortality.

Table 7: Mortality with respect to complications faced.

Complications	Survival (%)	Death (%)	Total (%)	p-value
Shock	12 (12.4%)	85 (87.6)	97 (21.4)	0.001
Sepsis	34 (54.8)	28 (45.2)	62 (13.7)	0.001
Acute respiratory distress	6 (10.5)	51 (89.5)	57 (12.6)	0.001
Anaemia	34 (64.2)	19 (35.8)	53 (11.7)	0.017
Acute renal failure	1 (6.7)	14 (93.3)	15 (3.3)	0.001
Wound infection	12 (12.4)	85 (87.6)	97 (21.4)	0.001
Gangrene	46 (85.2)	8 (14.8)	54 (11.9)	0.086

The causes of death were shock (n=36, 34.0%) followed by sepsis (n=25, 24.0%), acute respiratory distress (n=25, 24.0%) and others

Figure 2: Distribution of burn mortality causes.

Discussion

The mortality rate of this study was 23.0%. This was similar to other studies in Cameroon, Nigeria and Morocco [5-9]. This mortality rate was lower than other studies in Cameroon, Nigeria, Ghana and Iran [10-13]. On the other hand, mortality rate of this study was higher than that of other studies in Nigeria, Singapore and China [14-16].

For studies which had a higher mortality rate than that of this study; according to Amengle *et. al*, the mortality was 41.2% this was because, these was it was due to the high incidence of severe burns in these children [10]. Kalayi in Zaria, Nigeria had a mortality rate of 35% was because 52% of admissions were children below the age of five years with severe burns [11]. Nguema *et.al*, in Gabon had a death rate of 54.8%. This was because this study was conducted in an intensive care unit [12]. Soltani *et.al*, in Tehran, Iran had a mortality rate of 59.48%. This was because patients with below 40% of burned surface constituted 52.5% of injuries so more cases of severe burns [13].

For studies which had a lower mortality rate than that of this study; Dongo *et.al*, conducted a study in Irrua, Nigeria in 2007 revealing a 9.72% mortality [14]. Song & Chua in Singapore had a mortality rate of 4.61%. This was because patients with burn size of 10% TBSA and less made up the majority of admissions at 70.7% while patients with burn size 30% TBSA and more made up 8.2% [15]. Jie & Baoren in China had an overall mortality rate of 0.86%. The high survival rate, may relate primarily to the low percentages of older patients and of patients with severe burns [16].

Mortality in males 64.4% was higher than that in females 35.6%. This is similar to a study conducted by Olaitan & Jiburum in Nigeria [6]. In our study, it was found that sex and mortality were not statistically significant ($p = 0.467$). The highest mortality rate was the 0 - 10 and the 31 – 40 years age group (22.1%) followed by the 21 – 30 years age group (20.1%) and

the lowest being those aged above 80 years; this is similar to results obtained Olaitan and Jiburum, where age and mortality were not statistically significant with $p = 0.541$.

From this study, the percentage survival drops as the burn surface area increases. This is because the more the surface area burned, the more fluids lost, more liability to infection and multiple organ shut down. This was statistically significant in this study with $p < 0.001$.

In this study, shock (34%) was the most common cause of death, sepsis (24%), acute respiratory distress (24%), severe anaemia (4%), acute renal failure (6%) and in 8% no specific cause of death was indicated. This is unlike the study conducted by Olaitan & Jiburum in Nigeria where acute renal failure (24 cases, 42.1%) was the commonest cause of death, septicaemia (18 cases, 31.6%), acute respiratory syndrome (5 cases, 8.7%), shock (4 cases, 7.0%), and upper gastrointestinal bleeding due to peptic ulcer and severe anaemia (1 case each, 1.8%) and in four cases (7.0%) no specific cause of death was indicated [6]. Martina & Wardhana in Indonesia, found out that death was caused by septicaemia (42.1%), multiple organ failure (31.6%), systemic inflammatory response syndrome (17.6%), and acute respiratory distress syndrome (8.7%) [17].

In this study mortality with respect to complications was statistically significant with shock, sepsis, acute respiratory distress, acute renal failure and wound infection all with $p < 0.001$.

Most patients (31.7%) who died came in within 0 to 1 hour. This is because severe burns are generally rapidly rushed to the hospital, in this case, the Douala Burn Centre. This is could be due to delayed referral from primary hospital care,

ignorance and poverty. In this study, mortality was statistically significant with those who came 25-48 hours after burn ($p < 0.001$) this is probably because many patients were referred still unstable.

Conclusion

A quarter of all patients died mostly from flame, electricity and water burns. Increase in burn depth and burnt surface area worsened the prognosis. Shock (the commonest cause of death), sepsis, acute respiratory distress, acute renal failure and wound infection were significantly associated to mortality.

Abbreviation

ARD: Acute Respiratory Distress

Competing interest

The authors declare that they have no competing interests in this section.

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Authors' contribution

NAF collected data from files of patients. NAF wrote the manuscript. CMA, FP and NNM supervised this work. First corrections were done by CMA. All authors approved final manuscript and are responsible for it.

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