

Analyzing Mortality in Burned Patients with Lethal Area 50.

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Abstract

Background; Clinical outcome is the most measurable of the critical care activity. Although every burn center has its own particular limitations, it is clear that exists a minimum standard of survival after burn injury which is LA50 (Lethal Area 50).

The aim of this study is to present demographic and epidemiologic features of severe burns in Albania in the period 2009-2019 and to analyze burn mortality as an important outcome measure analyzing LA 50.

Material and Methods; The study is retrospective clinical and analytical. Since our burn center is the only one in the country it encompasses all the cases with moderate burns from the capital and severe burns. The data used are obtained by the analysis of the medical records' of 1684 patients hospitalized in Burns Service ICU near University Hospital Center in Tirana, Albania during 2009-2019.

Results; While comparing the decade (2009-2019) with the previous one (1998-2008) there is a progressive decrease of mortality (6.89% versus 10.5%) of our burn patient population although mean BSA (%) burned increased to 25.6±19.1 % (versus 22.8±14.7%). LA 50 for all patients was 80.04%, for children was 77.7%, for adults was 87% and for elderly was 52.28%. The mortality rate of all ICU burns as an average for 2009-2019 was 0.35 cases per 100000 population/year.

Conclusions; The long-term studies and the comparison of our results with the ones of other burn centers have allowed us to determine the actual level of care and as well as to build up contemporary protocols in order to improve the treatment with the objection decreasing the mortality. Improvements in overall mortality expressed by LA 50 noticed it as an important outcome measure.

Keywords: Burns, Mortality, Lethal Area 50

Introduction

Clinical outcome is the most measurable of the critical care activity. It can be measured from different perspectives: patients, ICU staff, health managers and the population as a whole.

The aims of healthcare staff and society should be to improve patients' outcomes such as survival, functional outcome and quality of life. The outcome of the burn injury depends on the nature of the injury, the nature of the patient and the treatment available. Epidemiological studies on burns provide vital information for the development of effective burn prevention strategies [1-2].

The aim of this study is to present demographic and epidemiologic features of severe burns in Albania in the period 2009-2019 and to analyze burn mortality as an important outcome measure analyzing LA 50 (Lethal Area 50).

Material and Method

The data used are obtained by the analysis of the medical records' of 1684 patients hospitalized in Burns Service ICU near University Hospital Center in Tirana, Albania

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during 2009-2019. The study is retrospective clinical and analytical. Since our burn center is the only one in the country it encompasses all the cases with moderate burns from the capital and severe burns. All cases are from all over the country and need a specialized medical treatment. From this point of view, the data is characterized nationally wide and it represents the medical strategies with institutional character.

The patients' diagnoses were given according to ICD-9 codes while the admission criteria in ICU were based on American Burn Association [3]. The parameters of the patients included are as follows:

- Age, Group-Age [Children (0-14 years); Adults (15-60 years); Elderly (>60 years)]
- Gender (Male, Female)
- Etiology of burns (Scalds; Flame; Electrical; Chemical; Others)
- Body Surface Area (BSA) (%) burned: (0-10%; 11-20%; 21-40%; 41-60%; 61-80%; 81-100%)
- Degree (Partial-thickness; Full-thickness)
- o Length of Hospital Stay - LOS
- o Mortality in percentage and for 100,000 persons/year
- o LA 50 (body surface area that kills 50% of the people)

Statistical analysis

SPSS 23 software was used for the conduction of the statistical analysis. Incidence density rates are calculated as the number of burn admissions in any age category in one year multiplied by 100000 and divided by the total persons at risk (the population at specific year taken from Institute of Statistic in Albania). Descriptive Statistics were conducted to summarize data for the central tendency (Mean) and variability (Standard Deviation). We have used Inferential Statistics through probability theory to draw conclusions. Concretely Simple Linear Regression for estimating Lethal Area 50 (LA 50). We use Line graphs for presentation of our data. Statistical significance was defined as $p < 0.05$.

Results

A total of 3355 patients had a burn-related primary admission in the Service of Burns and Plastic Surgery of the UHC in Tirana, Albania from 2009 to 2019, from which 1684 were admissions in the Intensive Care Unit.

From all the patients admitted 1033 or 61.3% were male and 651 or 38.7% were female with 1.58:1 as a ratio. The total number of cases increases across the age range from 1 month to 93 years old with burn incidence appearing

to peak at 24.9 years (mean age is 24.9 ± 25.5 years). A large percentage of children burns (50.7%) are observed followed by 36.05 % in adults and 13.18 % in aged. The mean age of children was 3.2 ± 2.7 years, median 2, of adults was 38.7 ± 12.3 years, median 40 and for aged was 70.4 ± 8.37 years, median 68 (Table 1). The most frequent subgroup-ages were as follows: 28.2% (475) were children 2-4.9 years, 12.9% (218) were children 0-1.9 years and 9.4% (158) were adults 40-49.9 years while the less frequent were elderly older than 80 years 2.4% (41).

The BSA (%) burned for all patients was 25.6 ± 19.1 %. Presence of Full-thickness burns was present in 17% (287 patients) of all patients, increasing in an age-related fashion reaching 41.6% in the group-age +80 years. Scalds were the predominant cause of burns in children (82% of them) admitted to the burn ICU particularly in the subgroup age 2-4.9 years.

In other groups, flame was the predominant cause (66% of adults and 74% of elderly patients) with the peak in subgroup age 40-69.9 years. Mean LOS was 11.2 ± 15.58 days.

Table 1-Demographic, clinical and burn injury characteristics 2009-2019 (n=1684)

	% of cases	No of cases
Age, mean (SD)	24.9 (19,1)	
Gender		
• Female	38.7	651
• Male	61.3	1033
Group ages		
• Children (0-14y)	50.77	855
• Adults (15-60 y)	36.05	607
• Elderly ≥ 60 y	13.18	222
Etiology of burns		
• Scalds	49.6	835
• Flame	39.5	666
• Electrical	5.1	86
• Chemical	5	85
• Others	0.7	12
BSA % burned, mean (SD)	25.6 (19.1)	
Full-thickness burn	17	287
Inhalation injury	15.4	260
LOS, mean (SD)	11.2	15.58
Mortality	6.89	116
• Mortality Children (0-14y)	0.53	9
• Mortality Adults (15-60y)	2.85	48
• Mortality Elderly ≥ 60	3.51	59

Overall mortality of our patients was 6.89% (116 deaths in 1684 patients) with an increasing trend from 0.53% in the children's group (0-14 years), 2.85 % in the adult's group and 3.51 % in the elderly's group (Fig. 1).

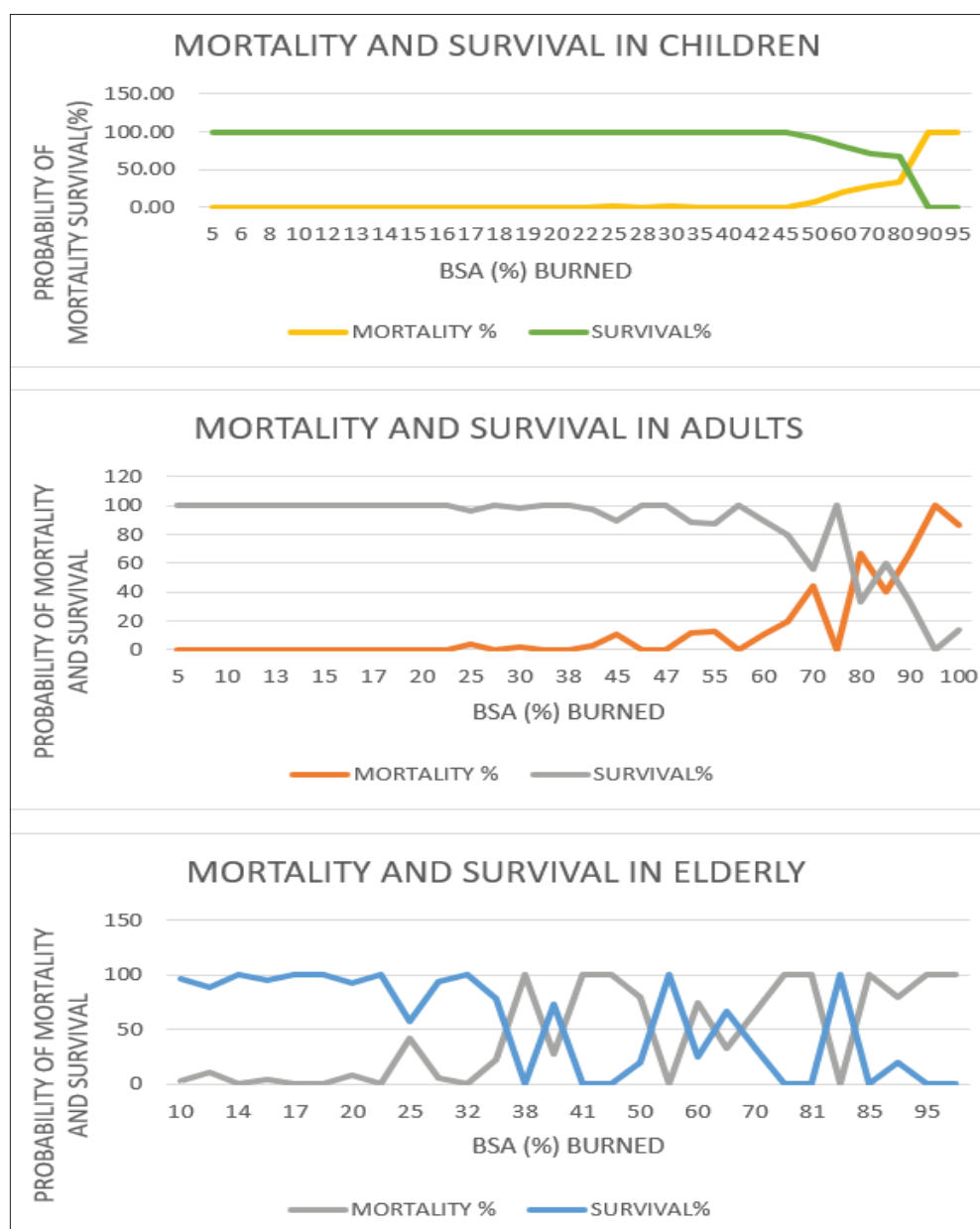


Figure 1-Presentation of Mortality and Survival in different group-ages

Deaths in the period of shock and in the first week are greater in patients with greater burn sizes BSA (80-100%). We performed a simple Linear Regression of BSA (%) as an explanatory variable on the mortality (%) as a response. The regression line for all patients was $M = 0.8162 \cdot \text{BSA} (\%) - 15.3297$, the correlation was $r = 0.7057$, $r^2 = 0.4981$ (Figure 2). We calculated LA 50 for all patients as well as for each group-age based on the Regression equations. LA 50 for all patients was 80.04%, for children was 77.7%, for adults was 87% and for elderly was 52.28%.

The mortality rate of all ICU burns as an average for 2009-2019 was 0.35 cases per 100000 population/year.

Discussion

During the period studied there is a decrease in the children patient's percentage (from 66, 89% in 1998-2008 to 50.7% in 2009- 2019) accompanied with an increase in the percentage of adults (from 27% in 1998-2008 to 36.05 % in 2009-2019) and also there is increasing percentage of burns in elderly population (from 6.2 % in 1998-2008 to 13.18% in 2009- 2019) [2].

While comparing the decade (2009-2019) with the previous one (1998-2008) there is a progressive decrease of mortality (6.89% versus 10.5%) of our burn patient population although mean BSA (%) burned increased

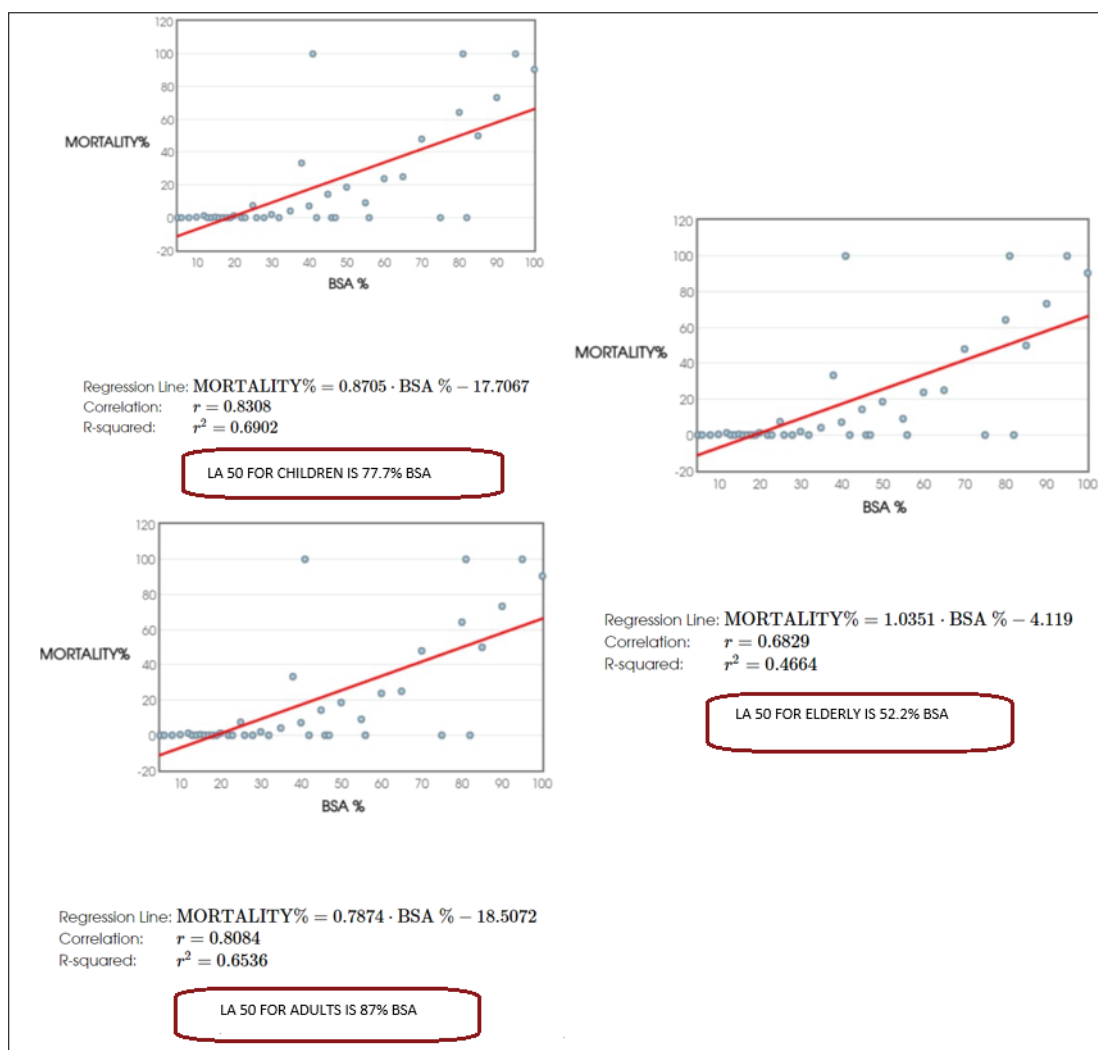


Figure 2-Presentation of LA 50 in children, adults and elderly.

to 25.6 ± 19.1 % (versus $22.8 \pm 14.7\%$). There were improvements in mortality despite more patients were affected by flame burns (39.5% versus 23%), more patients had with inhalation burns (15.5% versus 10.6%) as well as there is evidence of an increase of the number of adults with burns and more than double of the number of elderly with burns with greater burn size and full thickness burns.

The mortality rate of our study is comparable with rates of other countries like in Belgium (7.1%), Turkey (6.3%), France (9%) and Hong Kong (8.7%) [4, 5, 6, 7]. Different studies show better outcomes in Sweden (3%), Netherlands (4.1%), Spain (3.4%) and Portugal (3.7%) [8, 9, 10, 11].

As our center is the only burn unit in our country, we can draw national conclusions. The death rate from fire and burns for the period 2009-2019 was 0.3 patients per 100000 population/year which lies very close to the death rate from all burns (0.35 patients per 100000 population/year). Our hypothesized explanation relies on the fact that flame was an important etiologic factor of burn deaths (66% of adults and 74% of elderly patients) and at the same time it is related with burn deaths. There were 8.2 ± 0.68 , median 10,

deaths from flame in our patient's versus 10.2 ± 0.78 , median 10, deaths from all burns as an average.

Although every burn center has its own particular limitations, it is clear that exists a minimum standard of survival after burn injury which is LA50. In the 1940s, LA50 in the United States was 40% [12]. With the development of broad-spectrum antibiotics and specialized burn units, also with standardization of a multidisciplinary approach instituted at tertiary health care centers, LA50 increased to approximately 60% in the 1970s [13]. Currently, most burn centers in the United States report LA50 over 90% [13]. Europe experienced a similar improvement in LA50 over time. Wasserman showed an overall mortality of 11.8% and LA50 of 60% in 1985 in France [14].

In 1999, Barrett et al. demonstrated an overall mortality of 3.5% and LA50 of 90% in Spain [10].

Our LA50 for all patients is improved in the last period 2009-2019 which speaks for a better work of the staff in the service of burns.

If we compare the LA50 for all patients, there is a difference of 80.4% versus 50-60% in previous decade. In

the previous study (1998-2008) LA₅₀ for children was 60% BSA less than for adults 65% BSA and for elderly 45% BSA.

In this study LA 50 for all patients was 80.04%, for children was 77.7%, for adults was 87% and for elderly was 52.28% with promising values.

Conclusions

There is a decline in severe burn admissions in the Service of Burns UHC” Mother Teresa” in Tirana of children and adults but there is an increase of admissions in elderly group. The subgroup with the highest admission frequency were children of 2-4.9 years with scalds as the main causative agent (in 87.3% of cases). Etiology of burns has changed towards an increase of flame burns especially in adults and the elderly population. Future preventive measures should focus on this group. Overall registered mortality was 6.8% and survival following severe burns has improved.

Our medical staff, despite the clinical work in the health system, should help form the awareness of the public through different mediums for the damages that can be caused by thermal agents, pointing out the risky group-ages. In the multi-disciplinary treatment of the severe burn patient a major importance has the commitment of the medical staff, which with its devotion will manage to handle even difficult situations caused by fire catastrophes

The long-term studies and the comparison of our results with the ones of other burn centers has allowed us to determine the actual level of care and as well as to build up contemporary protocols in order to improve the treatment with the objection decreasing the mortality. LA50 for all patients was 80%. for children was 77.7%, for adults was 87% and for elderly was 52.28% with promising values. Improvements in overall mortality expressed by LA 50 noticed it as an important outcome measure.

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Conflict of Interest Statement

There is no conflict of interest

Authorship Contribution

The first author has done the conception or design of the work and data collection and analysis.

The second author has done the data analysis and interpretation as well as drafting the article and critical revision of the article.

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