

Original Article

High-Risk Factors causing Mortality in Pediatric Burn Patients, admitted in Burns Centre of Karachi

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Abstract

Objective: To evaluate the High-Risk Factors Causing Mortality in Pediatric Burn Patients, Admitted In Burns Centre of Karachi.

Material and Methods: This is a cross-sectional, descriptive study performed in the Pediatric Burns unit at Ruth Pfau Civil Hospital, Karachi, retrospectively from January 2019 till August 2019 by convenient non-probability sampling technique. ERB was taken from SMBBMCL & SGLGH Karachi, with approval from Burn Center Karachi. Clinical records of 227 pediatric patients after getting written informed consent were analyzed. Statistical analyses were carried out by using version 20.00.

Results: Mean age 4.8 ± 3.3 years, total body surface area (11-50%) were involved mostly 202 (89%) in our population in burn injuries. The reason for burn injury due to scald (61.23%) and Flame/Fire (33.92%) was mostly affected with the multiple region burns (involving more than three regions) were the most common category constituting 156 (68.7%) of the pediatric burn patients, so considered as a major cause of mortality was due to multiple burns with > 50% involvement of total body surface area (TBSA). The nutritional status of the patients was also a major predictor of the pediatric patient's mortality rate. It was related to the IV access to the pediatric patient.

Conclusion: It was observed in this retrospective study that scald or hot liquids were mostly affected with the multiple region burns and considered the most common category constituting the pediatric burn patients, so considered as a major cause of mortality with > 50% involvement of TBSA of burns.

Keywords: Burn, Burn injuries, Mortality.

Introduction

According to World Health Organization (WHO)¹, a burn injury can be comprehensively defined as: "An injury caused by heat (flames, hot objects, or gases), chemicals, electricity and lightning, friction, or radiation". According to a recent report, 7.1 million burn injuries occur per year.² These injuries cost the lives of more than 300,000 people per year.³ 2.5% per 100,000 of these deaths are pediatric burn-related deaths.⁴ Among all accidental trauma fatalities, burn injuries ranks the top third in all age groups and the top second in patients of age below 4 years.⁵ Unfortunately, Children are more vulnerable to these burn injuries than any other age group, because of their skin sensitivity, small body size, and inability to evaluate and recognize lethal situations.⁶ These traumatic burn injuries are the cause of permanent or temporary cosmetic and physical aberration (i.e. wound contractures), persistent pain, emotional and psychological suffering-not only for patients but also for his/her caregivers,⁷ multiple expensive treatments, and surgeries with limited treatment benefits. However, the recent development in early management, treatment strategies, and surgeries, and well-equipped and well-trained medical staff have alleviated the death tolls among these pediatric burn patients. Even though with such advancement there are still some major predictors that increase the risk of morbidities within pediatric burn patients. Some of the most important categories for assessment of severity in burns is, the involvement of the following factors which can lead to increased deaths in pediatric burn patients like total body surface area (TBSA) >50%,⁸ age of patient⁸, presence of inhalation injury⁸, place of wound⁹, septicemia (multi-drug resistant bacteria) after burn¹⁰, a late arrival in the hospital, health status of the patient during admission (i.e. lower hematocrit, lower base deficit, higher serum osmolarity, platelet count < 20,000, intravenous access, need for inotropic support), first aid interventions at the incident site, absence of well-equipped burn units, qualified medical staff, premature surgical excision and skin grafting, the inadequacy of public awareness, prevention and management of burn injuries and absence of ambulances for transport. In developing countries, like Pakistan mortality and morbidity in burn patients is high due to infections or multi-drug resistant bacteria, total body surface area (TBSA) >50%, patient age, place of wound, presence of inhalation injury. The Pakistani nation needs to work for burn victims for prevention, as burns incidence increases in the winter

season.¹¹ Childhood burn can lead to the development of devastating physical morbidity, psychological or severe emotional and socioeconomic or economic burdens.¹² The scarce literature availability and scarce reporting on associated risk factors in burn patients. So, risk factors for mortality are not well known and strategies should be made for their prevention, like prompt referral of the burn patients to specialized burn centers or tertiary care hospitals. Therefore, this research has been conducted this study to evaluate the high-risk factors causing mortality in pediatric burn patients, admitted to the burns center of Karachi, that lead to mortality and morbidity of the pediatric burn victims.

Objective: This retrospective study aimed to evaluate the high-risk factors causing mortality in pediatric burn patients, admitted to the burns center of Karachi.

Materials and Methods

Study design: Cross-sectional, descriptive case series.

Setting: Burn unit Ruth Pfau Civil Hospital Karachi (CHK).

Duration: This study was carried out from January 2019 till August 2019.

Sample size: A total of 227 (135 males and 92 females) pediatric patients were included in this study by using open epic software.¹³

Sampling technique: Convenient non-probability sampling technique.

Inclusion criteria: The burn patients were admitted to the Burns unit, CHK. The inclusion criteria included children from birth until 12 years of age of either gender, children only from Karachi.

Exclusion criteria: Burn patients with co-morbidities like Epilepsy, Asthma, Allergies, Thalassemia, Kidney problems were excluded.

Data Collection Procedure: Admitted burns patients of either gender (male & females) with age (<12 years) were included in the study after taking written consent. Detailed history regarding any allergies and co-morbidities were taken from the patient or patient family members and recorded in pre-designed Performa. This includes variables like age, gender, injury cause, type of injury, site of injury, Total body surface (TBSA), nutritional status (total protein), history of illness, chronic diseases, or congenital diseases, and other measures. The baseline investigations and general physical examination were done. The albumin levels were measured at 3-7 days period after admission in the burns ward, with a TBSA of 5-20% to identify the severity of wounds.

The primary management is to assess the A.B.C.s and resuscitation in the burn patients to prevent life-threatening conditions. The physical exam findings in burn patients are to record the extent of the burns, which is expressed as a percentage of total body surface area burned (% TBSA), and the depth of the burns, expressed as superficial (or first-degree), partial-thickness (or second-degree) or full-thickness (or third-degree). Children with burns of more than 20% - 25% of their body surface should be managed with aggressive IV fluid resuscitation to prevent "burn shock." Fluid resuscitation is done by the Parkland Formula. This formula estimates the amount of fluid (crystalloid: 2-4 ml/kg body weight) given in the first 24 hours in extensive burn wounds and management depends on the severity of the burn, as a superficial type of burns (superficial burns) would be managed with cleaning with soap and water, followed by dressings and pain medication, while the major type of burns (Partial or Full-thickness burns) requires prolonged treatment and hospital stay, such as skin grafting.¹⁴

Data analysis procedure: Version 20.00 of the Social Science Statistical Package (SPSS) was used for the statistical analysis. The data of categorical variables were presented as counts and percentages. Descriptive frequencies were used for analyzing all categorical data (i.e. gender mortality).

Results

Two hundred twenty-seven (227) Pediatric admitted patients were included in this study. One hundred thirty-five (60%) participants were male while 92 (40%) were female. Mean age 4.8 ± 3.3 years with the percent of mortality being highest in the age group ranging from 1-5 years. Burn injuries on multiple sites was seen in 156 (68.7%), injury to arms and hands in 15 (6.6%), head, face, and neck in 11 (4.8%), legs and feet burn injuries in 19 (8.4%) while only 3 (5.3%) sustained burn injuries on trunk and Buttocks and genitalia were 6 (2.6%). The total body surface area (11-50%) was involved mostly 202 (89%) in our population. The reason for burn injury was due to scalding or hot liquids [139 (61.23%)] and Flame/Fire [77 (33.92 %)] were mostly affected. (Table 1) A significant relationship was analyzed between the nutritional status of patients as assessed by albumin levels and mortality ($p=0.004$) with regarding the length of time to IV access 7.5% (17) patients were resuscitated with IV fluids within the first hour of burn, 21.1% (48) within 1-4 hours, and 71.4% (162)

presented after 4 hours of injury. (Table 2) The multiple region burns (involving more than three regions) were the most common category constituting 156 (68.7%) of the pediatric burn patients. The mortality rate reported in the multiple region burn category was highest, constituting 87.5% (56) of total deaths reported. Amongst the single region burnt, the trunk was the most common region that got affected in pediatric burn patients. It constituted 8.8% (20) of the patients. Buttocks and genitalia were the least common category, constituting 2.6% (6) of all patients. However, it can be depicted from the table that there is no specific site of injury with the highest mortality rate but rather multiple burns with > 50% TBSA involvement have the highest mortality rate. Therefore, it can be inferred that burn with high involvement of TBSA is the major cause of mortality among burns patients. (Table 3).

Table 1: Distribution of demographic variables.

Characteristics	n (%)
Age (years) mean \pm SD	4.8 \pm 3.3
Gender	
Male	135 (60%)
Female	92 (40%)
Major Area Involved	
Head neck and face	11 (4.8%)
Trunk	20 (8.8%)
Arms and hands	15 (6.6%)
Legs and feet	19 (8.4%)
Buttocks and genitalia	6 (2.6%)
Multiple sites	156 (68.7%)
Total Body Surface Area Involved	
Up to 10%	22 (9.7%)
More than 11-50%	202 (89%)
More than 50%-100%	3 (1.3%)
Reason for Burn Injury	
Flame/Fire	77 (33.92 %)
Chemical	4 (1.76%)
Electric	7 (3.08%)
Scald (hot liquids)	139 (61.23%)

Table 2: Comparison Showing Length of Time to I V access and the Percentage of Mortality.

Length of time groups (Hours)	Successful resuscitation (%)	Death (%)
<1 hours	5.73%	1.76%
1-4 hours	14.54%	6.61%
>4 hours	51.54%	19.82%

Table 3: Percentage of Deaths associated with location of burn injuries.

Location of burn injuries	Frequency of Deaths	
	admissions n (%) total =227	n (%) total =64
Head and Neck	11 (4.8%)	1(1.5%)
Trunk	20(8.8%)	3(4.6%)
Upper Extremities	15(6.6%)	2(3.1%)
Lower Extremities	19(8.4%)	2(3.1%)
Buttocks and Genitalia	6(2.6%)	0(0%)
Multiple	156(68.7%)	56(87.5%)

Discussion

Burn injuries are coupled with intense physical disfigurements, physiological complications, and deep psychological traumas. By the virtue of some major medical advancements in the past 20 years, the mortality rate in burn cases has reduced a lot. Improvement of critical care and nutrition of burn patients, therapeutic development (fluid resuscitation, early surgical excision), availability of multi-disciplinary burn centers, and pharmacologic and non-pharmacologic management¹⁵ of burn victims have attributed to a decrease in the death toll of patients. Despite all these medical up-gradation, death still occurs in pediatric burn patients. Hence, the purpose of this research was to evaluate high-risk factors causing mortality in pediatric burn patients, admitted to the burns center of Karachi. In this retrospective study, we examined burn type, age group, gender, TBSA, nutritional status of the patient, and the site of injury.

In our study, two hundred twenty-seven pediatric admitted patients in the Burn Unit of Ruth Pfau Civil Hospital Karachi., out of this One hundred thirty-five (60%) were male while 92 (40%) were female with mean age 4.8 ± 3.3 years and highest mortality in age group 1-5 years. These results are similar to the results of the study done by Li, H. et al & Mohammed et al.^{16,17} In our study results, body area injured on multiple regions (involving more than three regions) were the most common category constituting 156 (68.7%) of the pediatric burn patients. In contrast to our study results, a retrospective observational study was conducted in Korea showed upper limbs (43.7%) followed by the lower limbs (16.8%).¹⁷ Scald burns injuries are known to be the most frequent type [139 (61.23%)] of burns among children, typically by pulling down a container filled with hot water on the stove (Table 1), like our study results Korean study

also showed similar results.¹⁸ The total body surface area (11-50%) was involved mostly 202 (89%) in our population, in contrast to our study results showed that burns of less than 20% TBSA represent the large majority of Burns cases.¹⁶ The nutritional status of the patients was also a major predictor of the pediatric patient's mortality rate. It was related to the IV access to the pediatric patient. Burns victims who got resuscitation liquids during the first hour of injury were more likely to survive. (Table 2) The period of intravenous access was another important determinant of mortality. The burns duration of the IV line was extended up to 06 months. Burn injuries cause hypovolemia, and if not treated this can lead to hypovolemic shock.¹⁹ Moreover, it is common among critically ill burn patients to suffer from hypoalbuminemia. The major loss of extracellular fluid from the body increases vascular permeability and results in loss of plasma proteins (i.e. albumin) - this is the hyper-metabolic and hyper-catabolic response of the body to the burn injuries.²⁰ Our study also highlights, that, the mortality rate was highest in the multiple regions burn 87.5% (56) of total deaths reported. Amongst the single region burnt, the trunk was the most common region that got affected in pediatric burn patients. It constituted 8.8% (20) of the patients. Buttocks and genitalia were the least common category, constituting 2.6% (6) of all patients. However, it can be depicted from the table that there is no specific site of injury with the highest mortality rate but rather multiple burns with > 50% TBSA involvement have the highest mortality rate. Therefore, it can be inferred that burn with high involvement of TBSA is the major cause of mortality among burns patients. (Table 3). Similar to our results, observed in India.²¹ As this descriptive study and the limitation of this study was a small sample size and conducted in a single centre. So it is recommended that studies should extend to multicenter with a large sample size should be conducted to confirm or compare the results of this study.

Conclusion

In this retrospective study that scald or hot liquids, duration to IV access, or nutritional status of the patients, the multiple region burns with > 50% involvement of TBSA were considered as a major cause of mortality in the pediatric burn patients.

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