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Clinical Profiling and Outcome Analysis of Hospitalized Burn Patients: A Cross-Sectional Study

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Burns; Predictors; Clinical outcome

1. Abstract

1.1. Background: Burns are highly devastating type of injury that can have long-lasting effects on both physical and psychological well-being. This study aimed to evaluate the clinical profile and predictors influencing outcome of hospitalized burn patients.

1.2. Methods: A cross-sectional study was conducted over a period of six months (March to August 2016) at Burns Care Centre. A total of 200 hospitalized patients with acute burn injury fulfilled inclusion criteria. Variables of interest were recorded over a semi structured proforma. Chi-square test and Logistic regression analysis was performed where applicable.

1.3. Results: The mean age of patients was 18.4 years with a male predominance (61.7%). Flame burn constituted most prevalent burn etiology (61%) significantly found in among the age group of 18-26 years ($p<0.001$) and male patient ($p=0.03$) There is statistically significant difference between survivors and non-survivors group based on age ($p<0.001$), residence ($p<0.001$), etiology (flame: $p<0.001$; scald: $p=0.001$), inhalation injury ($p<0.001$), depth of burn ($p<0.001$), total body surface area (%TBSA) burnt ($p<0.001$), time lapse to hospital ($p=0.003$), and length of hospital stay (LOS) ($p<0.001$). Overall mortality was 31%. Multivariate logistic regression analysis showed that mortality was significantly associated with inhalation injury ($p=0.001$), burn depth ($p<0.001$), %TBSA ($p<0.001$), and time lapse to hospital ($p=0.02$). Whereas age ($p=0.04$) and electric burn ($p=0.03$) are main predictors of prolonged LOS.

1.4. Conclusion: Children and male individuals are at high risk to sustain burn injuries. Predictors associated with poor survival include inhalation injury, burn depth, %TBSA affected, and time lapse.

2. Introduction

Burns can be identified as one of the most devastating type of injury that have distressing acute and long-term consequences of functional ability and psychological outcomes [1]. The prevalence of burn injuries in developing countries is higher than developed ones. The highest annual incidence for burn was reported in southeast Asia (243/100,000) followed by East Mediterranean region (187/100,000) and the lowest incidence was recorded from America (19/100,000) [2]. In Pakistan, the exact burn related incidence have not been reported so far, but one of the WHO report accounted annually 1388/100,000 burn related incidence from Pakistan, while global incidence were 110/100,000 annually [2].

Clinical practice has shown the impact of various risk factors on patient's outcome. Several documented predictors of death were age, gender, burn etiology, total body surface area (%TBSA) burnt, full thickness burn injury, inhalation injury, mechanical ventilation, and acute renal failure [3-6].Epidemiological studies play a significant role in identification of risk factors and group of population at high-risk to burn related incidences. Such studies provide a base for educational based preventive programs for targeted high-risk groups.

The present study was designed to evaluate the clinical profile and predictors influencing the outcome of burn patients hospitalized in the Burn Care Center (BCC), the country's first burn care facility established at Islamabad. Only a few studies have been conducted in our local setting to establish to describe the epidemiology and overall management of burn patients [7-10]. However, no local study has been well documented yet, which evaluates the specific association between various risk factors such as age, gender, burn etiology, site and degree of burn, %TBSA burnt, and time-lapse contributing in their clinical outcome in terms of survival and mortality, and length of hospital stay (LOS).

3. Methods

3.1. Study Design and Setting

This was a cross sectional study completed in a period of six months from March to August 2016. The study was conducted at Burn Care Center (BCC) (registration # PF.01-03/16-R-QUI-(BCC)-Admin). It is a 20-bed facility setup with 12-bed intensive care unit and two wards with 8-bed facility and had a plastic surgery unit. We designed a single center study because BCC Islamabad being a referral and only public health sector facility, receives many patients from adjacent areas such as Punjab, Khyber Pakhtunkhwa, Northern areas and Kashmir. Islamabad, the capital and 9th largest city of Pakistan, located adjacent to Rawalpindi jointly known as twin cities, a metropolitan area is the country 3rd largest region with a population exceeding four million. Second, BCC is the sole facility and additionally it provides free of cost treatment to the patients. It would appear a last choice of resort. Therefore, it receives a massive crowd from across the country.

3.2. Patient Selection

The subjects were selected from inpatient department on the basis of following inclusion criteria; patient of all age groups, gender (male & female), patients who sustained burn injuries admitted for acute burn treatment, burn due to any cause (flame, electrical, scald, chemical, contact etc), inhalation injury, and of any thickness of burn depth (superficial, mixed partial thickness and deep dermal, and full thickness), %TBSA burnt > 10 except in electrical burn and chemical burn. Patients were excluded who stayed less than 1 day or patients who had taken leave against medical advice (LAMA), patients admitted for post burn treatment such as (reconstruction treatment and other complications), patient having premorbid conditions such as end stage renal diseases, chronic debilitating sickness, mental disorder or who do not give informed consent.

3.3. Data Collection

Data were collected by using a pilot tested semi-structured proforma which was designed after extensive literature review. The proforma included detail information regarding patient's demographics (age, gender, residence, marital status, educational status, and occupational status of patient), clinical parameters of burn injuries, and outcome of interest. Variables of interest were etiology of burn, inhalation injury, depth and extent (%TBSA) of burn, site of anatomical location affected, co-morbidities, previous history of hospital admission/referral cases, circumstances (medico-legal cases), location of incidence, time lapse between injury and presentation to hospital while outcome variables were survival/discharged and mortality, and LOS (≤14 days or >14 days).

Concerning inhalation injury, patients presented with a history of smoked exposure in confined space and diagnosed with physical clinical findings. Clinical features such as signed eyebrow, signed nasal hairs, nasal vibrissae burnt, stridor, hoarseness, soot in the nostrils, tachypnea, laryngeal edema, wheezing, and facial burns suggest probable inhalation injury. The burn depth was assessed clinically. The %TBSA burn was performed according to Lund–Browder chart. The data were collected prospectively at the time of admission and study subjects were followed for ultimate outcome (discharge vs mortality).

3.4. Statistical Analysis

Data were analyzed by Microsoft excel and IBM SPSS Statistic Version 20. Continuous variables were analyzed by descriptive statistics. Chi square test was applied to check association of burn etiology with age and gender. This test was also applied to compare association of various variables with outcome between survivors and non-survivors group. Logistic regression analysis was performed to identify predictors of mortality and prolonged LOS (>14 days). The p-value of 0.05 or less was considered statistically significant.

3.5. Ethical Approval

Ethical approval of proposal was obtained from ethical committee of BCC (Approval letter # PF.01-03/16-R-QUI-(BCC)-Admin). Informed consent was obtained from all study participants.

4. Results

Over a six-month period from March to August 2016, 300 patients were admitted to our BCC. Of these, 200 patients met our inclusion criteria (Figure 1).

The mean age of the patients was 18.4. (+14.5) years. The most vulnerable groups for burn injury were pediatric patients with age of ≤5 years (n=62; 31%) and adult patients with an age range of 18-26 years (n=36; 23.5%). Gender distribution pattern showed that males were predominant which accounted for 123 (61.7%) of patients. Flame burn constituted most prevalent burn etiology accounting for 122 (61%) patients. The second frequent cause was scald burn comprising 50 (25%) cases. The severities of burn injury depth were also assessed. Majority of study population had deep burn, with 99 (49.5%) cases being mixed partial thickness deep dermal and full thickness burn. Majority of patients sustained ≤35%TBSA accounted 119 (59.2%) of all cases. The concomitant inhalation injury was found in 40 patients (20%). Regarding circumstantial background of burn incident, majority of burn cases

were accidental (95%) in nature. The majority of the accidents were domestic injuries that occurred at home (73.5%). Eleven patients (5.5%) had concomitant diseases like depression (3 patients), epilepsy (2 patients), cardiovascular, down syndrome, diabetes mellitus, hypertension, hepatitis and nephritic disorder (one patient each case). The time lapse from burn injury hospital presentation varied. Majority of participants had visited to emergency department and took less than 12-hour time interval since burn incidence and hospital admission. The mean LOS was 13.5±15.2 days. Majority of patients (n=140; 70%) spent at least ≤14 days at hospital. Among 200 study subjects, most of admissions (67%) were primarily presented whereas about 66 (33%) patients had previous hospital admission history which were initially managed and referred by some other settings. The demographic information and clinical characteristics of the study participants is presented in Table 1.

Though, many patients had more than one anatomical region affected by burn. It had been observed that major anatomical part of the body affected from burn injuries was upper extremity followed by anterior trunk (Figure 2).

Analyzing the association between demographic data and burn etiology distribution significantly differed between age groups. Flame burn was significantly higher among the age group of 18-26 years (n=45; p<0.001) whereas the most vulnerable age group observed for scald burn was ≤ 5 years which accounts 40 (64.5%) of the total cases. A significant number of young populations of age group 6-17 years (p<0.001) had electric burn. Regarding gender distribution, flame injuries were significantly more prevalent among male patients as compared to female patients (p=0.03) (Table 2).

A comparison of patient characteristics among non-survivors and survivors is provided in Table 3. Of the 200 cases, 138 patients discharged in satisfactory condition with follow up advice. About 62 (31%) patients died during their hospital stay. The outcome of the patient was found to be dependent on age of the patient (p = 0.002). Significantly higher number of patients aged ≤5 years had survived and discharged (85.5%). However, statistically insignificant difference was observed in gender (p = 0.1). Patients residing in rural areas had significantly higher mortality 69.4% (p<0.001). Regarding etiology, flame and scald burn significantly affect the outcome of both groups. Patients sustained inhalation injuries were significantly higher in non-survivor group 82% (p<0.001). In relation to depth and extent of burn, majority of non-survivor patients had partial thickness deep dermal and full thickness burns and sustained >35% TBSA. These findings were statistically significant (p<0.001). The time lapse to hospital presentation was also statistically different between two groups (p=0.003). Survivors (72.2%) mostly seek care within 12 hours of burn incidence. Similarly, non-survivor group had significantly shorter LOS compared to survivor group (p<0.001).

Logistic regression analysis for exposure to mortality and prolonged LOS is presented in Table 4. In multivariate logistic regression analysis, 34 times greater risk of mortality was found in patients who had deep (mixed partial thickness deep dermal and full thickness) burns (p <0.001). Patients with TBSA burnt greater than 35% had 15.5 times greater risk of mortality (p <0.001). Time lapse to presentation also showed significant association with mortality through univariate and multivariate logistic regression analysis. Patients presented later than 12 hours had 6 times more risk of mortality with p value of 0.025 in multivariate logistic regression model.

In multivariate logistic regression analysis, the most influencing predictor of prolonged LOS were; age group 27-35 years (OR =4, CI=1-16.5; p=0.04) and electric burn (OR =3.7, 95% CI= 1-13.2; p= 0.03).

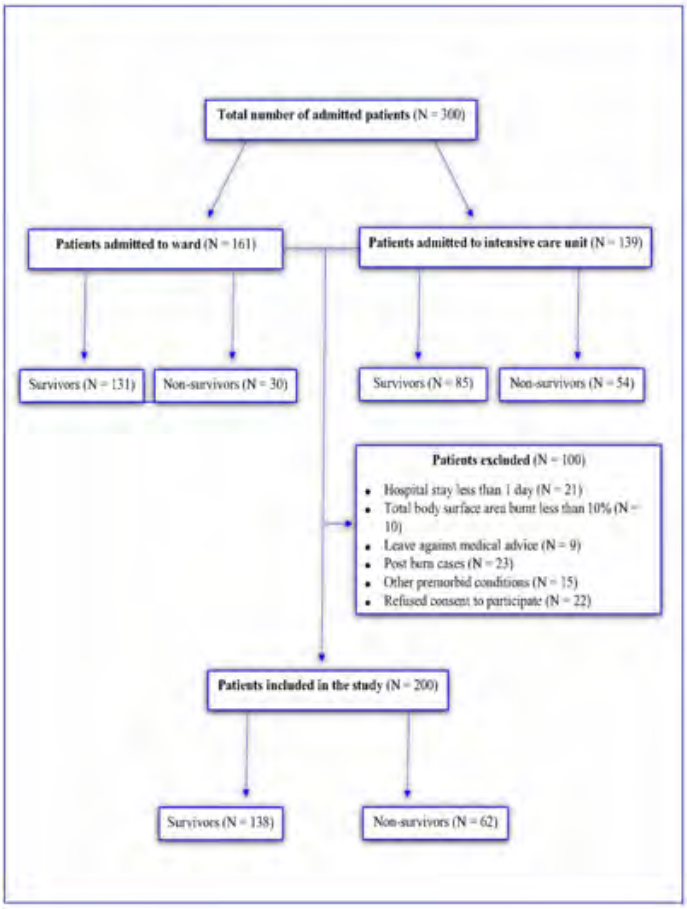

Figure 1: Study flow diagram of participant

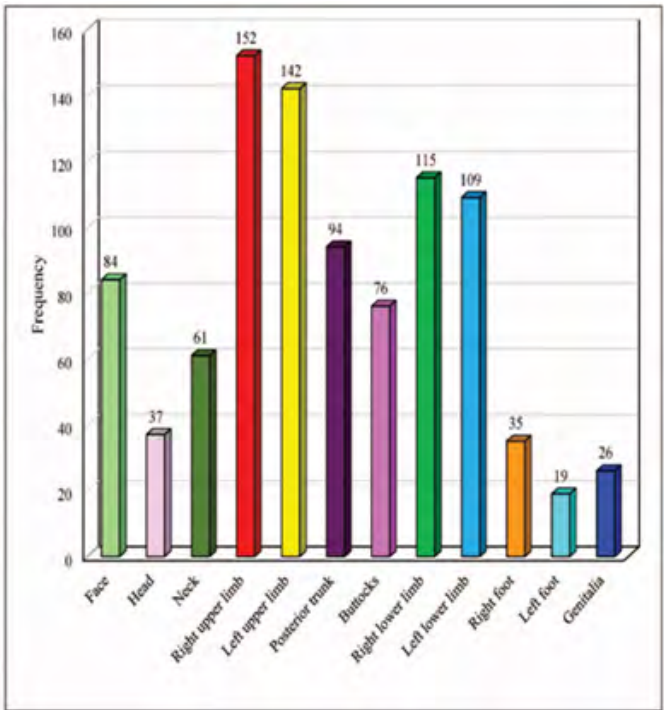

Figure 2: Anatomical location of burn injury

Table 1: Socio-demographic and clinical characteristics of participants

Variable	N (%)
Age (years)	
≤5	62 (31)
17-Jun	36 (18)
18-26	47 (23.5)
27-35	27 (13.5)
≥36	28 (14)
Gender	
Male	123 (61.5)
Female	77 (38.5)
Marital status	
Married	62 (31)
Single	138 (69)
Residence	
Urban	101 (50.5)
Rural	99 (49.5)
Occupation	
Employed	61 (30.5)
Unemployed	139 (69.5)
Educational status	
Preschool /Nursery	60 (30)
Primary School or illiterate	63 (31.5)
Secondary School	41 (20.5)
Intermediate	29 (14.5)
Graduate or above	7 (3.5)
Burn injury types	
Flame	122 (61)

Scald	50 (25)
Electric	17 (8.5)
Contact	5 (2.5)
Drug reaction	4 (2)
Chemical	2 (1)
Depth of burn injuries	
Superficial+ partial thickness	60 (30)
Deep [a]	99 (49.5)
Mixed	41 (20.5)
%TBSA	
≤ 35	119 (59.2)
>35	82 (40.8)
Inhalation injury	
Present	40 (20)
Circumstances of burn incidence	
Accidental	190 (95)
Suicidal	4 (2)
Drug reaction	4 (2)
Homicidal	2 (1)
Place of injury	
Home	147 (73.5)
Kitchen	110 (55)
Living room	19 (9.5)
Roof	12 (6)
Others (Washroom, Courtyard)	5 (2.5)
Outside	53 (26.5)
Workplace	38 (19)
Others (Commercial area, Playing area, Neighborhood)	13 (6.5)
Time Lapse to hospital presentation (hours)	
<12	180 (90)
>12	20 (10)
LOS (days)	
≤14	140 (70)
>14	60 (30)

Deep [a] Mixed partial thickness deep dermal+full thickness; TBSA: total body surface area burned; LOS: Length of stay

Table 2: Age-gender wise distribution of burn etiology

Burn etiology	Age (years)					P-value⊥	Gender		P-value⊥
	≤5	17-Jun	18-26	27-35	≥36		Male	Female	
	N (%)	N (%)	N (%)	N (%)	N (%)		N (%)	N (%)	
Flame	14 (22.6)	19 (52.8)	43 (91.5)	25 (92.6)	21 (75)	<0.001	69 (55.6)	55 (44.4)	0.03
Scald	40 (64.5)	6 (16.7)	1 (2.1)	0 (0)	3 (10.5)	<0.001	31 (25.2)	19 (24.7)	0.9
Electric	3 (4.8)	10 (27.8)	0 (0)	2 (7.4)	2 (7.1)	<0.001	14 (82.4)	3 (17.6)	0.06
Others	5 (8.1)	2 (5.2)	3 (6.4)	0 (0)	1 (3.6)	0.6	8 (61.5)	3 (27.3)	0.4

⊥ Pearson Chi square test applied, Others include contact burn, drug reaction and chemical burn

Table 3: Patient demographic and clinical parameters comparison among non-survivors and survivors

Variable	Outcome		p-value⊥
	Non-survivors	Survivors	
	N (%)	N (%)	
Age (years)			
≤5	9 (14.5)	53 (85.5)	
17-Jun	9 (25)	27 (75)	
18-26	19 (40.4)	28 (59.6)	0.002
27-35	10 (37)	17 (63)	
≥36	15 (53.6)	13 (46.4)	
Gender			
Male	33 (53.2)	90 (65.2)	0.1
Female	29 (46.8)	48 (34.8)	
Residence			
Urban	19 (30.6)	82 (59.4)	<0.001
Rural	43 (69.4)	56 (40.6)	
Etiology			
Flame	51 (41.8)	71 (58.2)	<0.001
Scald	6 (12)	44 (88)	0.001
Electric	3 (17.6)	14 (82.4)	0.2
Others	2 (18.2)	9 (81.8)	0.3
Inhalation injury			
Present	33 (82.5)	7 (17.5)	<0.001
Depth of burn			
Superficial partial thickness	3 (4.8)	57 (41.3)	
Deep thickness [a]	42 (67.7)	57 (41.3)	<0.001
Mixed	17 (27.4)	24 (17.4)	
%TBSA			
≤35	13 (21)	105 (76.1)	<0.001
>35	49 (71)	33 (23.9)	
Time lapse to presentation (hours)			
<12	50 (27.8)	130 (72.2)	0.003
>12	12 (60)	8 (40)	
LOS (days)			
≤14	58 (41.4)	82 (58.6)	<0.001
>14	4 (6.7)	56 (93.3)	

⊥ Pearson Chi square test applied, TBSA: total body surface area burned; a Deep thickness included partial thickness deep dermal and full thickness burns; LOS: length of hospital stay

Table 4: Logistic regression analysis for predictor variables associated with mortality and prolonged LOS (>14 days)

Variable	Mortality				LOS (>14 days)			
	Univariate		Multivariate		Univariate		Multivariate	
	OR (95%CI)	p-value	OR (95%CI)	p-value	OR (95%CI)	p-value	OR (95%CI)	p-value
Age (Years)								
≤5	Reference		Reference		Reference		Reference	
17-Jun	2 (0.7-5.5)	0.2	2.5 (0.5-12.7)	0.2	4.2 (1.1-15.7)	0.03	3.5 (0.8-15)	0.08
18-26	4 (1.6-10)	0.003	4.4 (0.8-28.7)	0.09	5.3 (1.3-21)	0.01	3.2 (0.7-14)	0.11
27-35	3.5 (1.2-10)	0.02	2 (0.3-12.1)	0.4	4 (1-15)	0.04	4 (1-16.5)	0.05

≥36	6.8 (2.4-19)	<0.001	4.8 (1-25.5)	0.06	3 (0.6-13)	0.15	2.5 (0.5-12)	0.23
Gender								
Male	Reference				Reference		-	-
Female	1.6 (1-3)	0.1	2 (0.8-5.3)	0.1	1 (0.5-2)	1	-	-
Etiology								
Flame	4.4 (2.1-9)	<0.001	0.7 (0.2-3)	0.6	0.6 (0.3-1.2)	0.14	1.3 (0.5-3.2)	0.6
Scald	0.2 (0.1-0.6)	0.002	1.4 (0.2-7.6)	0.9	1.3 (0.6-2.5)	0.47	-	-
Electric	0.4 (0.1-2)	0.22	-	-	3.8 (1.4-10.5)	0.01	3.7 (1-13.2)	0.03
Others	0.5 (0.1-2.3)	0.35	-	-	0.5 (0.1-2.4)	0.38	-	-
Inhalation injury [a]								
Present	21.2 (8.6-53)	<0.001	11.7 (3.1-44)	0.001	0.3 (0.1-0.7)	0.01	0.3 (0.1-1.1)	0.09
Depth of burn								
Superficial partial thickness	Reference		Reference		Reference		-	-
Deep thickness [b]	14 (4.1-48)	<0.001	21.5 (4.2-110)	<0.001	0.89 (0.4-1.8)	0.75	-	-
Mixed	13.5 (4-50.2)	<0.001	5.1 (0.8-30.5)	0.07	0.89 (0.4-2.1)	0.79	-	-
%TBSA								
≤35	Reference		Reference		2.4 (1.3-4.7)	0.008	1.8 (1-3.7)	0.1
>35	12 (6-25)	<0.001	12 (4.4-32)	<0.001	Reference		Reference	
Time lapse to presentation (hours)								
<12	Reference		Reference		Reference		Reference	
>12	4 (1.5-10.1)	0.005	6.2 (1.4-27.4)	0.01	0.5 (0.1-2)	0.13	0.5 (0.1-1.8)	0.3

OR: odd ratio; CI: confidence interval; TBSA: total body surface area burned; a Inhalation injury: no inhalation injury considered as reference; Deep thickness included partial thickness deep dermal and full thickness burns; LOS: length of hospital stay

5. Discussion

The present study assessed clinical profile of acute burn patients at the indoor department and evaluates predictors affecting their clinical outcome. Predictors include age, gender, burn etiology, depth of burn, %TBSA burnt, and time lapse. A clinical outcome includes patients discharged in satisfactory condition with follow-up advice or hospital mortality and LOS.

In our series, the age groups most frequently sustained burns were < 5 (31%) years and those between 18-26 (26.5%) years. These results are consistent with the findings of published literature [11, 12, 2, 13]. Children (< 5 years) are considered to be particularly vulnerable population for acquiring burn related incidences due to their curious nature, playfulness, low socioeconomic conditions of parents, poor supervision practices, and inadequate understanding of potential agents causing burns (e.g., fire, hot liquid, electricity etc.). The young population represents are the productive population of the country, and are at high risk for burn injuries, either at workplace or home.

Regarding gender distribution, male population preponderates was observed in this study and these findings are in agreement with previous literature reported from Pakistan, Malaysia, and Iran [14, 3, 15, 16]. The male population more susceptible to burns and exposed to perilous environment at home and workplace. They might be at high risk for burns due to inadequate work experience, unawareness of work-related safety measures, lack of coordination, motor-vehicle accidents, lack of training, and being involved in more dangerous job (such as coalmine, electrical companies, exposure to inflammable objects etc.), or domestic incidences. However, other studies reported from India and Singapore have found high proportion of female patients sustained burn injuries due to their exposure to domestic burn incidences such as cooking, heating water, and hazardous devices and equipment (such as stoves, gas cylinders etc.) [17, 18].

In our series, the age groups most frequently sustained burns were < 5 (31%) years and those between 18-26 (26.5%) years. These results are consistent with the findings of published literature [11, 12, 2, 13]. Children are considered to be particularly vulnerable population for acquiring burn related incidences due to their curious nature, playfulness, low socioeconomic conditions of parents, poor supervision practices, and inadequate understanding of potential agents causing burns (e.g., fire, hot liquid, electricity etc.). Likewise, young adults are more susceptible to burns and exposed to perilous environment at home and workplace. This could be partly described by the fact that young male adults are the productive population of our country. They are at high risk for burns due to inadequate work experience, unawareness of work-related safety measures, lack of coordination, motor-vehicle accidents, lack of training, and being involved in more dangerous job (such

as coalmine, electrical companies, exposure to inflammable objects etc.). Similarly, female young adults are exposed to domestic burn incidences such as cooking, heating water, and hazardous devices and equipment (such as stoves, gas cylinders etc.)

Regarding gender distribution, male population preponderates was observed in this study and these findings are in agreement with previous literature reported from Pakistan, Malaysia, and Iran [14, 3, 15, 16]. However, other studies reported from India and Singapore have found high proportion of female patients sustained burn injuries [17, 18].

The overall mortality observed in our study was 31% which is closer to that described in local and international literature [19, 4, 2]. Iqbal et al, from BCC PIMS, reported a 14% mortality rate among the hospitalised patients in Islamabad, Pakistan {Iqbal, 2013 #146}. Al Ibran et al., reported a 31.2% mortality rate in Karachi, Pakistan {Al Ibran, 2013 #13} {Al Ibran, 2013 #13}. A systematic review reported more than a 20% mortality rate from the 12 countries of Eastern Mediterranean region {Othman, 2010 #150}. In contrast to our finding, a multi-institutional study conducted in United States reported least proportion of burn mortality [20]. The present study found higher hospital mortality and might be attributed to various factors. First, BCC being a referral public health sector facility receives massive number of patients territory-wide. Second, due to limited bed availability for patients with least serious injuries who might fit the admission criteria could not be entertained and those presented with minor injuries not meeting criteria of admission are managed in outpatient department of our center. Forth, large figure of admissions with high extent of burnt (%TBSA>35; n=82) and deep injuries (n=99), late presentation from referral centers, high proportion of referral cases with severe burn injuries (66), inadequate care during referring, large number of flames burn (n=122) with or without inhalation injuries (inhalation injury; n=40). It is also observed that fifty-eight patients out of sixty-two cases expired in first two weeks of hospital admission. Furthermore, ICU admitted patients (with major trauma) who met our inclusion criteria were also enrolled in present study. This might lead to great discrepancy in burns related mortality as reported from Malaysia, India and Singapore [3, 21, 22]. Moreover, study population of the present study had a majority of patients sustained severe burn injuries.

Finally, the present study identified mortality predictors including: inhalation injury, depth of burn, %TBSA, and time lapse. The present study did not describe age and gender as significant predictors. In contrast to our observation, some previous studies report female gender and old age (>50 years) as significant predictors [4, 5]. The associated inhalation injury identified as significant predictor reported with 13.2 higher odds of mortality risk in the present study. This relationship has been described to be significant in many previous studies [6, 5, 23, 3]. The wound depth and extent of TBSA burnt are significant prognostic factors. The significant impact of burn wound depth on mortality that was observed in the present study corroborates what has been previously published in the literature [6, 24]. In the current study, the burn extent over 35% TBSA has significant influence on mortality. Several studies reported from Malaysia [3], Spain [25], Brazil [5], Africa [26], Pakistan [14, 27], and India [21] confirmed our findings that the most influencing factor of mortality was high %TBSA burnt. In this study, the time lapse to hospital presentation has a significant impact on mortality. This could be explained by the fact that majority of patients had previous hospital admission and were referral cases due to serious burn injuries from other health facilities. It receives burn patients from both urban and rural areas of federal capital as well as from other different regions of the country. Delayed presentation of patients from time of injury to hospital had high risk of mortality with compromised clinical and metabolic status. Late presentation following burn incidence may contribute in burn related complications such as wound infection, sepsis, acute renal failure, compartment syndrome, acute respiratory failure, shock, and multi-organ failure. Similar findings were also reported by previous studies [28-30].In regard to LOS, this literature is in line with other previous published reports which revealed that age and electric burn were also considered major predictors of a long LOS [12, 23, 31]. Irrespective of age, patient with a particular burn size admitted and the probability of discharge in earliest few days of stay depends mostly on characteristics of injury rather than individual's age. However, in course of time, age significantly contributes in discharge planning of a patient; this pattern might reflect complications, comorbidities, infections, or taking prolong time to heal wounds, that is more prevalent in adult population [31]. This observation indicated that electric burns are most devastating type of trauma which led to deeper injuries. These patients are more prone to develop necrosis of intact limb and deep tissues, which further need amputation and numerous major surgeries. Keeping this in view, in our setting one of the inclusion criteria of admission was %TBSA burnt <10 for electric burns regardless of injury size. This description explains that long LOS among patients presented with electric burns requires effective medical treatment for long period of time.

This study has some limitations. The time period of study was short, completed in six months duration, covered spring and summer season so the seasonal variations regarding the presentation of burn injuries were not assessed. The second limitation was small sample size which might not represent the true picture of actual population. This was a cross-sectional and single centered study conducted in tertiary care referral hospital; analysis and extrapolation of results of the present study to other population should be made with vigilance. In addition, each country has different demographic, predisposing and epidemiological feature of burn incidence. Further, we do not rule out exact cause of mortality because in our study setting autopsy was not performed. It was assumed that mortality observed in this study might be related to

the following causes; wound infection, sepsis, acute renal failure, compartment syndrome, acute respiratory failure, shock, and multi organ failure. Future research may consider this aspect.

It is incredibly important for each burn care center to be acquainted with specific clinical presentation and management of burn injuries to make appropriate plan for treatment and prevention. Unlike developed countries the number and presentation of burn patients and their management outcome in developing countries is entirely different due to lack of resources, trained medical personnel, and treatment cost. It was assumed that most of burn injuries in our country are caused due to ignorance, illiteracy, and lack of government policy. Consequently, it is very difficult for us to lower the burns related mortality rate as compared to developed countries. Developed countries have made a substantial progress in reducing the burn incidences, through introduction of public education programs, legislation, and safety measures installation in home and workplace. Unlike developed countries, our country has low-resource settings for short-term treatment and long-term management of burns sustained population. More effective and advance care treatment burn centers should be established in different regions of the country. Special attention should be drawn towards the most vulnerable population for such hazards. Training programs should be formulated for proper first aid practice of victim. Tertiary prevention can be achieved by establishment of rehabilitation centers for both physical aspects as well as psychological status of burn's patient. The incidence of thermal and electrical burns can be minimized by awareness campaigns through educational programs. Moreover, fixing of fire extinguishers at workplace and sand containers at home will also minimized the disaster extent of burn incidences. Therefore, this study would assist health care professionals and policy makers to develop a perspective on primary prevention programs, care giver or parent's education programs, and proposed policies that support child supervision, labor protection, and health safety promotion strategies for population at risk. Furthermore, such studies might provide more sophisticated approach for development of algorithms for burn injuries management based on clinically relevant predictor variables of hospital admission in present setting.

6. Conclusions

This study revealed that children remain the more vulnerable group for burn related injuries. Male population is mostly at risk. Flame and scald burn are leading causes of injuries in our population. Predictors related with poor survival outcomes are; inhalation injury, depth of burn, TBSA >35% burnt, and time lapse. Age and electric burn are identified as main risk factors of LOS. Preventive measures should be implemented to decrease mortality associated with burn injuries and improve survival outcomes in high-risk patients.

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