RESEARCH ARTICLE

Clinical profile, management, and outcome of electric burn injuries at a tertiary care hospital

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Abstract

Objective: To determine the clinical profile, management and outcomes of electric burn injury cases in a tertiary care setting.

Method: The prospective, cross-sectional study was conducted at the Jinnah Burns and Reconstructive Surgery Centre, Lahore, Pakistan, from August 2021 to July 2022, and comprised patients admitted with electric burns. Data collected included demographic variables, total burn surface area, associated injuries, entry and exit points, areas/regions involved, number of blood transfusions, number and type of amputations, total stay in hospital, surgical procedures, and clinical outcomes. The patients were followed up for six months after discharge from hospital. Data was analysed using SPSS 21.

Results: Of the 883 patients, 91(10.3%) had electric burns; 70(76.9%) males and 21(23.1%) females. There were 44(48.3%) patients aged 21-40 years and 37(40.6%) were aged >40 years. Total body surface area was >20% in 62(68.2%) patients. Amputation was required in 25(27.5%) cases. The duration of hospital stay was up to 15 days in 50(54.9%) cases. The survival rate was high 88(96.7%).

Conclusion: Severe injuries, like high-voltage electrical burns, need interdisciplinary treatment available only in tertiary care settings.

Key Words: Electric burn injuries, Electrical injury, Electric burn, Amputation, Electrical flash burn, Burn mortality, Burn epidemiology, Burn reconstruction.

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Introduction

A rising number of people are suffering from electrical injuries, which are characterised by a unique pathophysiology and a high rate of morbidity and mortality. Injury from electric strikes, both of high and low voltage, fall in this category.[1, 2] Tissues may be burned by high temperatures, electricity, chemicals, light, radiation, or even by just coming into contact with anything hot.[3] One of the most significant threats to public health in low-income regions is burns, which persist in grades.[4] As a significant public health concern across the world, burns are among the most upsetting injuries to suffer. Electrical burns are a subset of thermal injuries that may cause serious functional and cosmetic complications.[5]

Although the exact rate of burn injuries worldwide is unknown, the World Health Organisation (WHO) estimates that burns and fires cause at least 265,000 fatalities annually. However, mortality ratio of electrical burns varied from 2.35% to 26.7%.[6]

The electrical burn prevalence and epidemiology have been reported differently in literature.[7,8] For example, between 2008 and 2012, 94 patients with electrical burns were treated at the Samsun Training and Research Hospital in Turkiye.[9] Of them, 47 had high-voltage injuries and 42 experienced low-voltage burns. There were 85 cases of children presenting with electrical burn injuries to a single burn treatment centre in Pakistan; among them, 71.76% had high-voltage burns, leading to 35 significant amputations. Construction workers accounted for 52% of the 202 patients treated in Iran's Motahari Hospital between March 2011 and June 2012.[10] Worker injuries were most often caused by coming into contact with overhead electricity wires, and the results revealed that construction workers were at a higher risk for developing serious problems and requiring invasive operations.[10] In a local study comprising 85 children, 89.41% were males with a mean age of 10.47±4.09 years. High-voltage burns were the commonest type (71.76%). There were 41.2% patients who had major limb amputations. High-voltage injuries constituted the commonest form of these injuries.[11] Farooq et al. found that flame injuries were the commonest (43.96%) with mean age of victims being 22.81 years. Most of the electrical injuries were sustained at home (40.63%).[12]

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Cheema et al. evaluated 61 cases, and 33% of them were in the fifth decade of life. High-voltage electric burn injury was seen in 69% of the cases.[13]

The current study was planned to evaluate the clinical profile, management and outcomes of electric burn injury cases in a tertiary care setting.

Patients and Methods

The prospective, cross-sectional study was conducted at the Jinnah Burns and Reconstructive Surgery Centre, Lahore, Pakistan, from August 2021 to July 2022, and comprised patients admitted with electric burns. After approval from the institutional ethics committee, the sample size was calculated using win-pepi ver:11.[5] to estimate a proportion with 95% confidence level and an acceptable difference of 0.09, assuming electric burn mortality proportion of 0.261 from Ding et al study.[6] The sample was raised using non probability, consecutive sampling technique. Those included were admitted patients aged 12-65 years of either gender from different cities of the Punjab province of Pakistan. Transferred patients and poly-trauma cases were excluded. After taking informed consent from the patients data was collected using a semi-structured proforma regarding demographics, percentage of total body surface area (TBSA%), mode and mechanism of burn, associated injuries, time of presentation since burn, entry and exit points, areas/regions involved, number of blood transfusions, number and type of amputations, length of hospital stay (LOS), including time spent in intensive care unit (ICU) and the burns ward, surgical procedures for reconstruction undertaken, and outcomes.

Data was analysed using SPSS 21 and Graph Pad Prism.[7] Data was presented as frequencies and percentages. Cross-tabulation was done for variables of interest; time of presentation of injury and morbidity. $P<0.05$ was taken as statistically significant.

Results

Of the 883 patients, 91(10.3%) had electric burns; 70(76.9%) males and 21(23.1%) females. There were 44(48.3%) patients aged 21-40 years and 37(40.6%) were aged >40 years. There were 62(68.2%) married patients, and 69(75.8%) were labourers by profession (Table 1). The highest number of patients were from Okara, Kasur and Pakpattan (Figure).

Table-1: Socio-demographic characteristics.

Variables (n = 91)	Frequency	Percentage
Age		
Up to 20 years	10	10.9
21-40 years	44	48.3
>40 years	37	40.6
Gender		
Male	70	76.9
Female	21	23.1
Marital status		
Married	62	68.2
Unmarried	29	31.8
Occupation		
Labourer	69	75.8
Non-Labourer	22	24.2

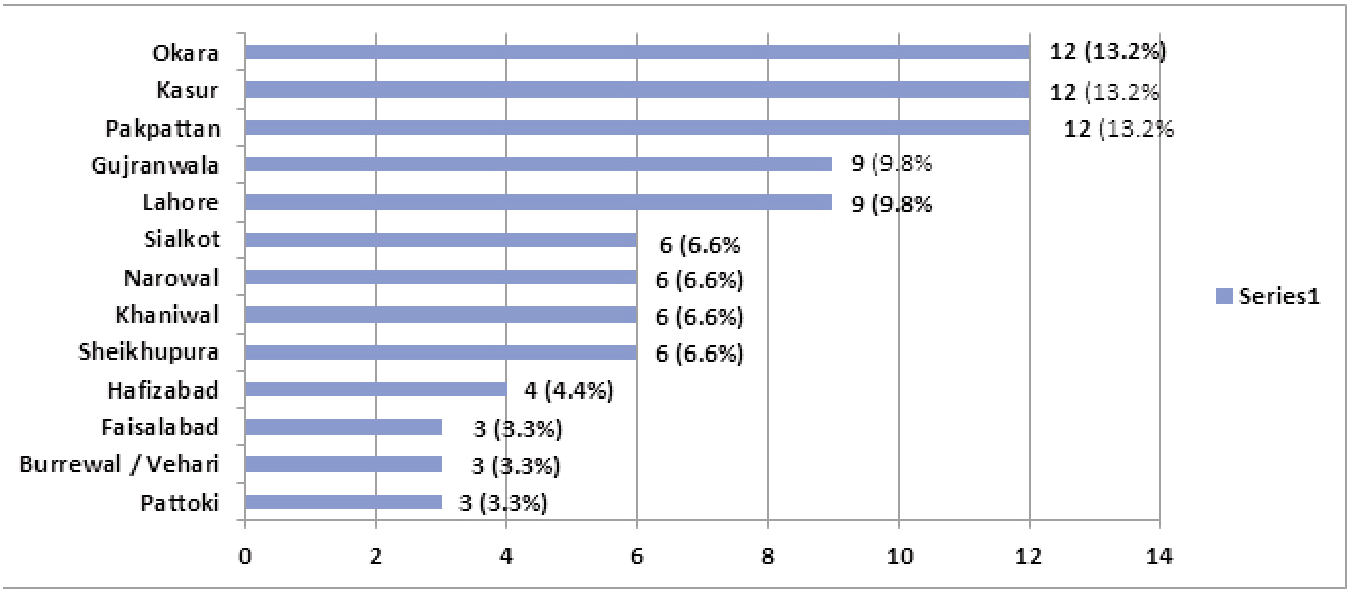

Figure: Distribution of electric burn injuries cross various cities of the Punjab province.

Table-2: Clinical characteristics.

Variables	Frequency	Percentage
Time of presentation since burn		
1 day	49	53.8
> 1 day	42	46.2
Associated injury (Head injury or fracture)		
Yes	7	7.7
No	80	87.9
Burn area		
20%	62	57.9
20-50%	17	68.2
> 50%	12	18.6
Electric current Entry points		
Scalp	10	13.2
Both hands	28	30.7
Right hand	14	15.4
Left hand	12	13.2
Right shoulder	16	17.6
Left shoulder	29	31.8
Exit wound sites		
Right foot	36	39.6
Left foot	14	15.4
Right thigh	12	13.2
Left thigh	52	57.1
Reconstruction		
Flap/Skin grafting	49	53.8
Type of amputation n=25		
Disarticulation	8	29.6
Above or below the elbow	10	37.0
Above or below knee	4	14.8
Trans metatarsal	5	18.6
Site of amputations n=25		
Right/left upper extremity	15	55.6
Right/left lower extremity	12	44.4
Number of amputations (n=17)		
Single	11	57.9
Dual	7	36.8
Triple	1	5.3

Table-3: Outcome variables.

Variables (n = 91)	Duration of Injury		Total	P value
	≤ 1 day	> 1 day		
Amputations				
Yes	5	12	17	P=.025
	29.4%	70.6%	100.0%	
No	44	30	74	
	59.5%	40.5%	100.0%	
Mortality				
Yes	1	2	3	P=.469
	33.3%	66.7%	100.0%	
No	48	40	88	
	54.5%	45.5%	100.0%	

TBSA was >20% in 62(68.2%) patients. Amputation was required in 25(27.5%) cases. Of the total, 72(79.1%) patients had accidental burns, while 19(20.9%) were injured at the workplace.

Time of presentation since burn was <1 day in 49(53.8%) cases, Total LOS was up to 15 days in 50(54.9%) cases, and >15 days in 41(45.1%) cases (Table 2).

The survival rate was high 88(96.7%). Amputations were significantly associated with time of presentation >1 day (Table 3).

Discussion

Electric burns are responsible for high mortality and morbidity rates worldwide and have the potential to cause severe burn injuries. These patients must be initially assessed as trauma patients as well. Due to the difficulty in accurately diagnosing electrical burns at the time of presentation, their severity is often overestimated. It may be challenging to determine the injury's mechanism at the time of presentation.[11]

The mortality rate of burn is 18.27% globally.[12] The mortality rate varies by socioeconomic status, ranging from 3% to 15% in developed nations to 21% to 27% in developing nations.[13] Recent reports indicate that the mortality rate of electric burn injury is 20%.[14] Burn injuries continue to take a heavy toll, especially in susceptible patients and in cases of electrical burns, despite major advancements in burn therapy.[15] Both in developing and industrialised nations, it has been a major cause of illness and death.[16]

The current study showed that most of the cases were aged 21-40 years, and there were more male than female patients. These findings are in agreement with those of a study in Iran.[17]

A recent Indian study revealed that the highest proportion (81%) of the sample had TBSA <20%. IN the current study, the corresponding value was 68.2%.[18] According to studies, males are more likely to sustain an electrical injury at workplace than women.[19,20] This may be because men are more likely to take on dangerous occupations that include frequent contact with electricity. In the current study, 75.8% injuries were reported in those who were labourers by profession.

In the current study, the affected regions comprised 64.9% cases of extremity compared to the scalp, face, abdomen, right knee, left leg and the buttocks. The incidence of electrical burn injuries exhibited 92% of high-voltage, 4% of low voltage shock and 4% of electric flash burns. In Pakistan and Turkey, most of the cases were reported to be of electric high voltage 71.7% and 54.5%, respectively.[6] The mechanism of injury showed that 79.1% had accidental burns, while 20.9% were injured at the workplace. Similar epidemiological and clinical findings have reported that most burns occurred in participants aged 21-50 years and in industrial workers and electricians at work or householders at home. Only one person with high-voltage burns died, with the mortality rate being 0.46%. Amputation rates were 37.33% for high-voltage burns and 22.01% for low-voltage burns.[6]

The maximum number electric high voltage burns were reported in Qasoor, Pakpattan and Okara cities in the current study. Due to scarce burn-management facilities in most of the cities of Pakistan, the patients suffered from several associated injuries, and underwent initial procedures, including debridement, fasciotomy, chest tube insertion, etc., to protect themselves from the consequences of delay in the time of presentation.[21] In the current study, 53.8% patients consulted healthcare centres within hours, while 46.2% reached there in days. Also, 70.6% of patients with amputations had injury time lapse of > 1 day ($p<0.05$). The total LOS was up to 15 days in 54.9% of cases, which was mostly spent in the ward (57.1%) compared to the ICU (42.9%). Similar findings were reported by other studies.[6, 8, 11, 21]

In the current study, amputations in extremities was required in 20.8% cases, which was less compared to an Albanian study in 2018 (40.7%).[20] In literature, amputation rates were 37.33% for high-voltage burns and 22.01% for low-voltage burns, and the tissue damage and the entry wound sites were mostly in the upper extremities than the lower extremities.[22,23] The rate of survival in the current study was significantly higher (96.7%) compared to a local study (70.3%).[24] The mortality rate in the current study was 3.3% compared to 2.8-6% reported earlier.[25]

The current study has limitations, including a small sample size that may have introduced potential bias and limited the generalisability of the findings. Resource constraints may have hindered timely treatment, and the study lacked a long-term follow-up, leaving gaps in understanding the long-term impact on the patients.

Despite the limitations, however, the study provides valuable insights into the incidence, presentation and outcomes of electrical burn injuries in the region.

On the basis of the findings, it is necessary to implement preventative measures to lower the frequency of electrical injuries. These could include public awareness campaigns about the dangers of electrical injuries, as well as general socioeconomic education to lessen the incentives for electric wire theft by prohibiting the trade of stolen electric wire cables. Also, there is a need for a proper tertiary care facility for the management and treatment of life-threatening electrical burn injuries, particularly in low-income and resource-restrained countries.

Conclusion

Severe burn injuries need interdisciplinary treatment that is available only in tertiary care settings. Patients who have suffered high-voltage electrical burns, or who have lost limbs to amputation have a dismal quality of life. Therefore, it is necessary to take action to raise awareness and develop an effective prevention strategy against electrical burns.

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BA: Concept, experimentation, study conduction, analysis, interpretation, discussion and writing.

FAK: Concept, experimentation, study conduction, analysis, interpretation, discussion, writing, critical review, facilitation and material analysis.

UI & SSA: Experimentation, study conduction, analysis, interpretation and discussion.

MYM: Writing, facilitation and material analysis.

YS: Critical review, facilitation and material analysis.