Section: Surgery

Electric Burn Injury: Experience of 218 Cases from a Tertiary Care Center of Western Rajasthan.

Ajay Malviya[1], M L Lohiya[2], Chaila Ram Gehlot[3], Prakash Vishnoi[3], Dharma Ram Poonia[4], Dinesh Dutt Sharma[4], Rajneesh Galwa[5]

[1]Senior professor and Head of Department, Department of General Surgery, Dr SN Medical College, Jodhpur
[2]Associate professor, Department of General Surgery, Government medical college, Pali.
[3]Final year resident, Department of General Surgery, Dr SN Medical College, Jodhpur.
[4]Assistant professor, Department of General Surgery, Dr SN Medical College, Jodhpur.
[5]Assistant professor, Department of Plastic Surgery, Dr SN Medical College, Jodhpur.

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ABSTRACT

Background: The aim of the study is to know the pattern and profile of injury in relation to setting of electric burn and effect of voltage of their presentation. **Methods:** A total of 1328 patients were admitted to the burn unit during study duration amongst them 218 were meeting our selection criteria and taken for final analysis. We restrict ourselves to the duration of the patients till admission and didn't analyze follow up visits. Our protocol is the discharge the patients once, one is able to take self-care and not having open infected wound. **Results:** Majority of patients were of young age and the mean age was 27.8. 96.7% of our patients were male. More than 60% of admitted patients were inflicted with high voltage electric burn. Majority of patients affected on during work. 88 % of the patients were from rural background, and 96.7% of the patients were male, while only 3.3 % were female. Upper limb was most frequently affected site of injury (66%) of the cases. **Conclusion:** Workers exposed to electric current and electrical equipment should be fully trained/certified and properly dressed. The education/certification will lessen the burden of having electrical burns, which affects the person, the family as well as the workplace.

Keywords: Electric Burn, Injury, Wound.

INTRODUCTION

We have witnessed many innovations, which happens to be boon to the mankind, but this have, some unwanted curse associated with it. The electricity is essential for daily living in current scenario both outdoor and indoor. Their routine use is liable to cause some accidents as well. Burns by electrical injury is a relatively uncommon, but most lethal form of injury with high morbidity and mortality associated with it. The person can affect both in household or work place and rarely by lightning and voltaic arc.[1] Electrical burn can be classified based on their energy as low-voltage current (less than 1000 V), high-voltage current (more than 1000 V). According to literature about 1000-1500 individuals affected every year globally with mortality rate of 20-30% and 74% of survivors with permanent disability.[1,6]

Name & Address of Corresponding Author
Dr. M L Lohiya
Associate professor,
Department of General Surgery,
Government medical college,
Pali, Rajasthan.

The clinical spectrum can vary from trivial injury requiring only outdoor care to severe life threatening injuries, which needs great care. 1. Sizable number of cases with electric burn suffers form immediate death with current-induced ventricular fibrillation or asystole or from respiratory arrest secondary to paralysis of the central respiratory control system or due to paralysis of the respiratory muscles.[5,10] Our institute is single referral tertiary care institution where we run a dedicated burn unit. We decided to evaluate our database retrospectively to analyze the clinico-demographic profile of the electric burn cases and their management. The aim of the study is to know the pattern and profile of injury in relation to setting of electric burn and effect of voltage of their presentation.

MATERIALS AND METHODS

The study was carried out at Mahatma Gandhi Hospital, Jodhpur form January 2012 to December 2016. A total of 1328 patients were admitted to the burn unit during study duration amongst them 218 were meeting our selection criteria and taken for final analysis. We analyzed the records of the patients admitted for electric burn in our institute during the study duration. We included the subjected that Bed Head tickets were completely filled including daily notes and operative details. The information pertaining their demographic details, clinical findings and management were recorded in excel sheet. We restrict ourselves to the duration of the patients till admission and didn't analyze follow up visits. Our protocol is the discharge the patients once, one is able to take self-care and not having open infected wound. The local ethical committee of this hospital approved the study protocol. In addition to the demographic and clinical profile of the cases, we analyzed the patients in relation to the setting of electric burn (Household/work related) and severity of burn (HV/LV) and the p value of <0.05 was taken as significant. The data was entered in MS EXCEL spreadsheet and analysis was done using Statistical Package for Social Sciences (SPSS) version 21.0. Categorical variables were presented in number and percentage (%) and continuous variables were presented as mean ± SD and median. Normality of data was tested by Kolmogorov-Smirnov test. If the normality was rejected then non-parametric test was used. Quantitative variables were compared using Kruskal Wallis test between the three groups and qualitative variables were analyzed using Chi-Square test /Fisher's exact test. A p value of <0.05 was considered statistically significant.

RESULTS

The demographic and clinical details are depicted in [Table 1]. During the study duration total of 1328 patients were presented to burn unit, amongst them 218 patients (16.4%) were admitted to burn unit with history of electric burn. Majority of patients were of young age and the mean age was 27.8. 96.7% of our patients were male. More than 60% of admitted patients were inflicted with high voltage electric burn. Majority of patients affected on during work. 88 % of the patients were from rural background, and 96.7% of the patients were male, while only 3.3 % were female. Upper limb was most frequently affected site of injury (66%) of the cases. The distribution of involved site is shown in Table 1. The Chest, Abdomen and Perineum were significantly more affected in High voltage cases, while rest of the site including face/scalp, extremities and back were equally affected in either case. Patients having suffered the associated injury were significantly more in high voltage group (p 0.049). The complication and reconstruction methods details are mentioned in [Table 2]. The need of Debridement and amputation was significantly higher in the patients affected with high voltage electric burn. The need more frequent complex flap reconstruction and more need of skin grafting.

Table 1: Demographic profile of the cases

Variable		**High Voltage**	**Low Voltage**	**P value**
Total cases admitted to burn unit	1328			NA
Cases of Electric burn	218 (16.4%)	131 (64.3%)	87 (35.7%)	NA
Mean Age	27.18±8.91	27.8	25.7	> 0.05
Male: Female	210:08 (96.7: 3.3%)	128:5	90:3	> 0.05
Urban: Rural	26/192 (12.0/ 88.0%)	19: 112	7: 80	> 0.05
Patients having associated injuries	52 (21.3%)	39 (29.7%)	13 (14.9%)	0.049
Abdominal trauma	14 (5.7%)	9 (6.8%)	5 (5.7%)	0.425
Chest trauma	04 (1.6%)	3 (2.2%)	1 (1.1%)	0.213
Bone Injury	19 (7.7%)	16 (12.2%)	3 (3.4%)	0.041
Head Injury	15 (6.1%)	11 (8.3%)	4 (4.5)	0.052
Home/Work place	54/190 (22.1: 77.9%)	7/129	47/35	0.003
Burn involved sites				
Face/Scalp/Neck	87	57 (43.5%)	30 (34.5%)	0.863
Upper Limb	145	87 (66.4%)	58 (66.7%)	0.091
Chest	25	19 (14.5%)	6 (6.8%)	0.01
Abdomen	37	27 (20.6%)	10 (11.4%)	0.02
Back	31	24 (18.3%)	7 (8.0%)	0.966
Perineum and genitalia	9	7 (5.3%)	2 (2.2%)	0.02
Lower Limb	102	64 (48.9%)	38 (43.6%)	0.589

Table 2: Distribution of cases according to complications, early consequences and reconstruction methods.

	Total	**High Voltage**	**Low Voltage**	**P Value**
Complications and early consequences				
Brought dead	09	08 (6.1%)	01 (1.1%)	0.053
Blood transfusion	27	09 (6.9%)	18 (20.7%)	0.0008
ECG & Electrolyte changes	19	16 (12.2%)	03 (3.4%)	0.051
Fasciotomy	62	44 (33.6%)	18 (20.7%)	0.068
Debridement	177	124 (94.6%)	53 (60.9%)	0.004
UL amputation	51	39 (29.7%)	12 (13.8%)	0.001
Lower limb amputation	42	33 (25.1%)	09 (10.3%)	0.041
Digital amputations	44	31 (23.6%)	13 (14.9%)	0.062
Reconstruction methods				
Grafting	89	63 (48.1%)	26 (29.9%)	0.004
Flap	18	17 (12.9%)	1 (1.1%)	0.0004

DISCUSSION

Of the different types of burns, electrical burns are one of the most distressing. There is limited literature particularly from India, which describe electric burn. To best of our knowledge the current study is largest to describe the clinical profile of electric burn from India. The electric burn is most lethal variety of injury hence contributes to significant morbidity and mortality. It's dual damaging effect of local heat and passage of current energy from the body, makes the consequence more dreaded. During study duration a total of 1328 patients registered with burn unit and amongst them 218 patients were affected by electric burn (16.4%). The incidence rate of electric burn is higher than other reported series (6.6-8.8%). Dega, JCDR, Jayesh et al. The plausible explanation for this may be selection bias, as we record date from Indoor register and did overlook the patients attending the outdoor. The high incidence of electrical burns may be the consequence of the low social and economic level of the population, improperly insulated wires, poorly placed and managed electrical switches, illegal electrical connections, and repair work on the electricity grid done by non-professionals.

As most of existing literature the major population affected was young and the mean age was 27.8 years. 96.7% of our patients were male. Maghsoudi6 from Iran reported 4% incidence of electric injuries with mean age of 27.5 years (range, 3-71 years). Haddad43 performed a four-year retrospective study (Jan 2004- Dec 2007) of 12 patients with electric burn. The reported mean age was 22.7 years (range, 11-36 years).

More than 60% of admitted patients were inflicted with high voltage electric burn. This is well higher the other reported series, but we have majority of study population came from rural background and domestic electricity is still under development. People have direct lines form high voltage unprotected lines, hence more likely to be affected by high voltage current. The Frequency of high and low voltage electric burns differ based on setup. In developing countries frequency of high voltage injuries are common as one study form it is reported as high as 56%, while in developed world it is lesser (United states 37%). Worldwide 43% of the electric injuries were from low voltage and 57% from high voltage. (25) In our study 96.7% of the patients were male, while only 3.3 % were female. Similar observation were made by Handschin et al[35] with more than 90% of the patients were male.

Electric burn can affect almost any part of body and it is well demonstrated in Table 1 of current study. In present study upper limb was most frequently affected site of injury (66%) of the cases. The Chest, Abdomen and Perineum were significantly more affected in High voltage cases, while rest of the site including face/scalp, extremities and back were equally affected in either case. The results well aligns with reports from sokhal et al, Haddad et al. About 21% of the subjected suffered from associated injury including 7.7% as bony injury, 6.1% as Head injury and 5.7% were sustaining abdominal trauma. This figure was significantly higher for high voltage injury (p 0.049). Our results are similar to sokhal et al. As sizable number of cases sustain associated injuries and contribute to major morbidity and mortality, primary care provider should be well aware and compatible to manage such injuries. The rate of amputation and debridement's were significantly higher in patients with high voltage injury, and results well aligns with a perspective small study form Rajasthan the rater of amputation was 30% for high voltage and 16.7% for low voltage group. The high voltage injury causes more devastating and deeper damage needs more debridement and amputations.

The present study is one of the larger study analyzing the impact of electric burn and implications of voltage, but it has certain limitation including its retrospective nature, not describing long-term sequelae and functional outcome of the patients.

CONCLUSION

The increase in electrical burns may be linked to the country's rapid pace of industrialization especially when proper education and training with regards to safety and proper handling of electricity is overlooked. With this, the workforce may be severely affected since majority of the victims are males of working age. Not only that, care for burns is a long and costly journey and most of these patients are the sole provider for their family.

Prevention must be prioritized and preventive activities should be aimed to reduce the incidence of burns to address the burden of burn management in developing countries. Prevention is not easy. There are different risk factors and epidemiological patterns in different communities, thus government programs must be utilized to educate people on safety and proper handling of electricity. Education, enforcement and training should be stressed as the primary weapons to combat this problem. The enforcement of existing safety regulations should be reiterated, and the employers should do stricter adherence to these regulations. Workers exposed to electric current and electrical equipment should be fully trained/certified and properly dressed. The education/certification will lessen the burden of having electrical burns, which affects the person, the family as well as the workplace. It decreases productivity and also adds cost of having to train another work to replace their jobs.

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