

CLINICAL PROFILE AND OUTCOME OF ELECTRIC INJURY IN NORTH INDIAN POPULATIONS

Plastic Surgery

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ABSTRACT

Introduction: Electrical burn injuries are generally more severe than thermal injuries. High voltage electricity is a very big disaster in which many people have lost their lives, most of the cases happen due to accidents in which most of the adults are men. Electrical injuries occur when the human body comes into direct contact with an electrical source. injury occurs due to either the flow of current through the body, arc flash, or clothing that catches fire. body or by Electrical injuries are very aggressive pathological lesions with heavy functional and aesthetic consequences. Moreover, electrical burns can occur at multiple sites and cause deep wounds. The Pathophysiology of electrical burn depends on the voltage, current flow, and tissue resistance. **Aims & Objective :** 1. To evaluate the electric burn patient demographic profiles. 2. To look at management strategy and various reconstruction options. 3. To determine the prognosis of electric burn patients in the presence of complications, and how its turn-in affects morbidity and mortality. **Material & Methods :** In This study, the author reviews 200 patients with high-voltage electric burns in tertiary care centres in north India between the period of April 2022 to April 2024. Only high-voltage electric burn patients were included. Patient data were included in detail with references to their age, sex, mode of injury, surface area, part of body affected, hospital stay, occupation, reconstruction of affected area & outcome. **Results & Discussion:-** The study of 200 patients show that electric burn injuries cause significant morbidity and mortality. Majority of patients were male (68%), females (23%) and childrens (9%). The 65% are of most active group of society 15-40 yrs age. The upper limb (49%) was the most affected part of body and (37%) amputation were most common surgery perform. fasciotomy was performed in 42% patients, (25%) got lower limb injuries out of which 13% underwent flap cover and skin grafting & 12% of patients underwent amputation 17.5% of patients got contact over the scalp and reconstructed with flap cover. (7.5%) patients got torso injury out of which 4.9% underwent skin grafting and flap cover. 1% of patients involved another area like perineal, buttocks, and neck. The Overall mortality rate was 23%, for males (n=32), females (n=9), and children (n=5), majority of patients died due to septicemia, and most patients died within 2 weeks of injury. other cause of death are renal failure, cardiac failure and hypovolemic shock. Most common organism isolated was pseudomonas. The Overall complication rate was 20%, 5% of patients required revision amputation, 15% of patients had infected wounds that were managed with daily dressing and antibiotics, 8% of patients had flap margin necrosis which requires flap advancement and 5% of patients had complete flap loss which requires revision surgery. **Conclusion :** Electric burn is a serious kind of injury, leading to permanent disabilities making people physically dependent on others, increase poverty. The Upper limb was the most affected part of the body and amputation was the most common surgery performed. Early and adequately done fasciotomy has a significant role in electric burn injuries to lower the incidence and level of amputation in extremities with good rehabilitation by the best, economical, well-balanced prosthetics. Local flaps are most commonly performed for post-burn defects. Proper education, communication, and rehabilitation may reduce the social burden caused by occupational hazards. To prevent this life-threatening event, measures should be taken by healthcare officials, electric department officers, and social networks to help educate the people about the application of safety equipment, proper communication between electrical department workers, and improvement of medical facilities regarding burn cases or early refer of complicated burn to higher center, through every available means of communication.

KEYWORDS

Electric Burn, Scalp Defects, Amputation, Occupational Hazards.

INTRODUCTION

Electricity was a wonderful invention for man, which changed man's life but sometimes this invention becomes so harmful for man that it ends man's life.

Electrical burn injuries are generally more severe than thermal injuries. High voltage electricity is a very big disaster in which many people have lost their lives, most of the cases happen due to accidents in which most of the adults are men.

Electrical injuries occur when the human body comes into direct contact with an electrical source. Injury occurs due to either the flow of current through the body, arc flash, or clothing that catches fire. Electrical injuries are very aggressive pathological lesions with heavy functional and aesthetic consequences [1],[2]. The primary cause of their gravity is the progressive tissue necrosis that occurs with the continuous extension of wound necrosis, even leading to the loss of the entire injured extremity. Electrical burns often extend into the subcutaneous tissue and cause necrosis of the muscle, tendon, and bone. Moreover, electrical burns can occur at multiple sites and cause deep wounds [3], [4]. The Pathophysiology of electrical burn depends on the voltage, current flow, and tissue resistance [5], [6]. The effect of current is determined by factors like type of current AC/DC, amount of current, pathway of current, duration and area of contact. The damage

caused by electrical burn is due to two mechanisms, the local generation of heat and the direct action of the passage of the current itself through the tissue. The heating causes coagulative necrosis of the cells and the current causes cell membrane disruption that leads to tissue loss and death

Aims & Objective :

1. To evaluate the electric burn patient demographic profiles.
2. To look at management strategy and various reconstruction options.
3. To determine the prognosis of electric burn patients in the presence of complications, and how it turns in effects to morbidity and mortality.

Patients & Methods :

In This study, we review 200 patients with high voltage electric burns in a tertiary care center in north India (SMS Medical College & Hospital, Jaipur) between the period of April 2022 to April 2024. Patient data were included in detail with references to their Age, Sex, Mode of injury, Surface area, part of body affected, hospital stay, occupation, reconstruction of affected area & outcome.

RESULTS:

In the present study of 200 cases of electric burn patients, the following

data has been analyzed-

Males are most commonly affected by 68% (n=136), females comprise 28% (n=56), and children were 9% (n=18). The Most common age group was the younger population (20-30 years) comprising 46%,

The upper extremities are most commonly involved in electrical injuries because they are typically the contact points to the voltage source, that comprising (49%) of total cases. Lower limbs were involved in 25%, head & neck involvement was 17.5%, followed by Trunk which was involved in 7.5% patients and the least involvement was Perineal & buttocks 1%.

Males were mostly affected by Electric burn due to engagement with electric **appliances** & involvement in high-risk occupations, The Majority of patients were electricians by occupation which were involved in 52% of total cases while 35% of patients were farmers by occupation which were involved in electric injury either by accidental contact or by falling of high-tension wire while working in fields. 11% of patients were labourers by occupation, who were injured while working on rooftops.

Electric injury is directly proportional to body surface area and depth of penetration, Electric contact burns lead to deeper penetration of tissue as compared to electric flash burn, Table 1. sh

1. Distribution by Body Surface Area:

% BSA	Male	Female	Children's
0-10	13	-	3
11-20	25	12	7
21-30	52	18	3
31-40	13	7	5
41-50	11	9	-
51-60	8	6	-
>60 %	4	4	-

In the Initial primary survey, Patients were examined for the development of compartment syndrome, especially in limbs and often required immediate fasciotomy, but sometimes late presentation of patients where tissue necrosis already occurs, present with dry, charred limbs may require amputation despite fasciotomy. Most commonly, 16% of patients had below-elbow amputation in the upper limb while 17% of patients had below-knee amputation.

Management of electric burn based on clinical profile & area involved in the injury of patients, patients present early need simple fasciotomy for compartment syndrome, the limb was regularly checked for vascular status, and if vascularity is enough, may need either healing by secondary intention Or required skin grafts. 27% of patients need fasciotomy out of which 15% are managed with grafting of wounds 12% patients further require amputation.

Table.2 Showing Flap Options For Burn Reconstruction.

Local flap	No. of patients	Regional flap	No. of patients	Free Flap	No. of patients
Transposition	17	Groin	16	Free ALT	3
Lateral trunk	4	Abdominal	9	Free LD	1
Cross finger	9	Cervical	2	Free RAFF	2
Delto-pectoral	2	Pedicled LD	1	-	-
Reverse Sural	4	Pedicled ALT	2	-	-
Others	14	others	2	-	-
Total	50	Total	32	Total	6

The overall mortality rate was 23%, for males (n=32), females (n=9), and children (n=5), majority of patients died due to septicemia, and most patients died within 2 weeks of injury. other causes of death are renal failure, cardiac failure, and hypovolemic shock. The most common organism isolated was pseudomonas.

The Overall complication rate was 20%, 5% of patients required revision amputation, 15% of patients had infected wounds that were managed with daily dressing and antibiotics, 8% of patients had flap margin necrosis which requires flap advancement and 5% of patients had complete flap loss which requires revision surgery. 2 of 6 free flaps was necrosed on day 3 and was reconstructed with local flap and VAC-dressing.

Case 1-

20 yr/male presented with electric contact burn with TBSA ~35% right upper limb auto-amputated at mid-arm level with left temporal, back, abdomen, and thighs involved. After proper resuscitation, right shoulder disarticulation with skin grafting was done, the patient's condition was improved & the overall area was reduced and for temporal exposed bone local flap was done. (fig.1)



Fig.1 – Showing clinical pictures A, B, C; Electric burn with temporal defect & right arm amputation, D, E, F; Showing Right shoulder disarticulation with post Skin graft Area & temporal defect, G; Intra-op local transposition Flap elevation, H; immediate post-op, I; post-op picture.

Case 2.

9yr/M with accidental contact electric burn while catching kite over the roof, TBSA ~10%, left temporo-occipital region & right cheek involvement with left partial loss of upper helical rim of ear, the patient was stable and planned for posteriorly based local transposition flap with skin grafting. (fig.2).



Fig.2 – showing clinical pictures A, B & C left temporooccipital defect with right cheek involvement, D; intra-op Local transposition Flap raising, E, F; post-op flap.

Case 3.

26 yr/M with accidental contact of cooler wire, presented with right dorsum hand wound with fracture metacarpals, initially managed with serial debridement under local anesthesia followed by groin flap cover with k wire fixation for fracture metacarpals. (fig.3).

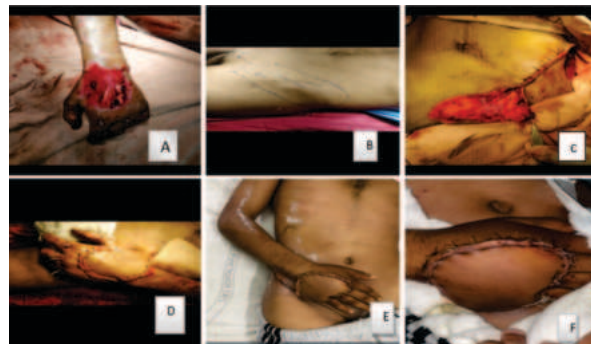


Fig.3 Showing clinical picture A; Post electric burn defect right dorsum hand, B, C, D, E, F show the progression of treatment, including flap coverage and wire fixation for fracture metacarpals.

dorsum of hands, B; Marking for groin flap ,C; Immediate post-op, D & E; Post-op day 5th flap healthy.

DISCUSSION:

In our study of 200 patients with electric burn injuries, The Majority of patients were male(68%), female (23%) and children (9%). 65% are of the most active group of society 15-40 yrs age.

The Upper limb (49%) was the most affected part of the body and (37%) amputation was the most common surgery performed. fasciotomy was performed in 42% of patients, (25%) who had lower limb injury out of which 13% underwent flap cover and skin grafting & 12% of patients underwent amputation 17.5% of patient got contact over the scalp and reconstruction with flap cover .(7.5%)of patients got torso injury out of which 4.9% undergo skin grafting and flap cover .1% patients involved another area like perineal , buttocks and neck .

Brandão C, Vaz M, Brito IM, Ferreira B, Meireles R, Ramos S, Cabral L. et. Al suggested that males are more commonly involve in electric burn injury (7) .

Nwadinigwe C, Olewe OS.et.al suggest upper limb amputation is more common in electric burn.[8]

BEGUM Na, AHMED Tb, ZAHANGIR AMc, KALAM Mad et.al suggested that electric injury is a male dominant and right upper limb is most commonly involved..[9]

The Majority of patients require local flaps for defect , while few patients require regional & free flaps for the complex distant region where no local tissue is available.

Gupta.M et.al suggested that local FDMA local flaps are a good option for thumb defect.[10]

Periakaruppan Jeyakumar, Alia T. Hussain, M and Ashik R. Ahamed et. Al suggested that Local scalp flaps with skin grafts remain the mainstay of reconstruction in most instances. [11]

Overall mortality is 23% , majority of patients died due to the development of septicemia, other causes of death are renal failure, cardiac failure, and hypovolemic shock. The Most common organism isolated was pseudomonas.

Samia Tasleem, Ahmed Ibrahim Siddiqui, Muhammad Abdul Wasay Zuberi.et.al suggested that the most common cause of death is septic shock.[12]

Overall 69% of patients required amputation in various regions of the body out of which 15% required revision amputation. 9% of patients required skin grafting and flap coverage with amputation which leads to disability.

The overall 20% Complications occurred, include, an infection which may treated with appropriate antibiotics and daily dressing, flap margin necrosis, required flap advancement, and complete flap necrosis which requires redo surgery.

CONCLUSION

Electric burn is a serious kind of injury, leading to permanent disabilities making people physically dependent on others, increase poverty. The Upper limb was the most affected part of the body and amputation was the most common surgery performed. Early and adequately done fasciotomy has a significant role in electric burn injuries to lower the incidence and level of amputation in extremities with good rehabilitation by the best, economical, well-balanced prosthetics. Local flaps are most commonly performed for post-burn defects. Proper education, communication, and rehabilitation may reduce the social burden caused by occupational hazards. To prevent this life-threatening event, measures should be taken by healthcare officials, electric department officers, and social networks to help educate the people about the application of safety equipment, proper communication between electrical department workers, and improvement of medical facilities regarding burn cases or early refer of complicated burn to higher center, through every available means of communication.

Declarations

Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Compliance with Ethical Standards: Approval from the Institutional Ethics Committee of SMS Medical College, Jaipur was taken for the conduct of this study

Conflict Of Interest: The authors would like to declare there is no funding from the institution or commercial company about this study

Consent: Well-informed consent from patients taken.

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