

Reconstruction of Post Electric Burn Defect of Upper Limb

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Abstract: *Background and objectives:* Upper limb burns are classified as severe burns which require treatment in specialized burn centres. Early flap cover is essential for good functional and aesthetic outcome. Various local, loco regional, distant pedicled and free flap options are available for cover. *Materials and method:* 37 patients between the ages of 19-56years, (Male 23 and Female 14) admitted in Burn ward between January 2021-December 2021 with upper limb electric burns were operated for various flap cover options after adequate resuscitation and debridement of wounds. 20 patients underwent a free flap cover rest 17 had local flap cover. *Results:* 3 out of 20 free flaps had marginal changes which were debrided and healed well by secondary intention. Local flaps (17) did not show any complications. *Conclusions:* Early local and free flap coverage helps preserve the salvagable hand structures and provides a platform for later tendon and nerve repairs for complete functional restoration.

Keywords: Electric burn reconstruction, Microsurgery, Upper limb defects

1. Introduction

Reconstruction of hand and upper limb burn defects is essential as it affects the patients recovery and integration into normal life. 3-4% of admissions in the burn institute constitute electric burns.

Out of which 70x80% cases show extremities involvement. Inappropriate treatment of even a small defect over the upper limb may lead to severe functional loss for the patient. The treatment starts in the acute phase itself as proper dressing, splinting and early physiotherapy all constitute in a better outcome. It is essential to restore the aesthetics of the hand as it cannot be hidden in clothes. It has been pointed out by surgeons in the 1940's that failure to mobilise fingers in the acute phase leads to severe loss of hand function.

In case of electric current burn injuries, the damage to the local tissues is also often just the tip of iceberg. Multiple debridements are required to prepare the wound for early flap cover. At the point of contact coagulative necrosis at skin is noted but there always immense damage noted to the underlying tendon, nerve, muscle, vessels and even bone.

With increasing versatility of microsurgery, free flaps for coverage of forearm defects post high voltage electric burn defects have become popular too.

Aims and objectives

The various flap cover options have been explored in the study for defects of various sizes, location and constituting simple to composite defects.

2. Materials and methods

This is a prospective study of 37 patients admitted in the Burn ward of SMS Medical College, Jaipur with an electric contact burn between January to December 2021.

All patients were assessed for the site of defect, the flap used, the number of components reconstructed and complications of the flaps encountered. All debridement and flaps were performed by a single surgeon.

Low voltage electric burns were excluded from the study.

3. Results

In our study there were a total of 37 patients, 23 male and 14 female between the age group of 19-56years. The mean age was 32years.

Out of 34 patient's 5 underwent local flaps, 1 underwent locoregional flap cover, 11 underwent distant pedicled flap covers and 20 underwent free microsurgical flap covers.

Complications were seen in 3 of the 20 free flaps performed where distal marginal changes developed and 4 had undergone re exploration within 24hrs of the surgery. They were managed with debridement and daily dressings and healed well with secondary intention. The local flaps healed well. The pedicled distant flaps were detached from their donor site and inset done after a period of 3 weeks in all cases without any delay procedure.

Table 1: Site of the defect

Type of flap		Number of cases
Local	Crossfinger flap	2
	First dorsal metacarpal artery flap	2
	Posterior interosseous artery flap	1
LOCOREGIONAL	Reverse RAFF	1
DISTANT		
Pedicled	Abdomen Flap	5
	Groin flap	4
Free	Hypogastric flap	2
	Anterolateral Thigh flap	12
	Latissimusdorsi	6
	Profunda artery perforator	2

Table 2: Different components used in the flap for reconstruction

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Different components used in the flap	Number
Muscle	6
Nerve Graft	1
Tensor Fascia Lata	2
Flow through	2
Sensate	1

Table 3: Complications

Complications			
Early	Re-exploration	4	Flap survived
Late	Marginal necrosis	3	Debridement and dressings done

4. Discussion

High voltage electric burn injuries are now encountered more often due to illegal attempting of tapping electric lines in the mushrooming dwellings around cities. The victims are also often lineman, construction workers and due to fallen faulty live wires in agricultural fields.

Electric burn injuries in 80% cases involves extremities and upper limbs functionality play a pivotal role in restoring patient back this life and daily activity. In cases of electric burn defects the tissue loss is composite involving skin, subcutaneous tissue, muscle, nerve, tendon and even bone in some cases. The priority of the surgeon should be to salvage as many vital structures as possible by means of proper resuscitation, adequate antibiotic coverage and early meticulous debridement.

Debridement plays a very important role for preserving structures of the hand and forearm. The age long thought process which made the surgical community believe that there is progressive necrosis of tissue seen in electric burn wounds has been proved wrong in studies. In the early 1970s, three groups investigated the concept of progressive vascular injury using serial arteriograms. Injuries seen initially on arteriograms do not progress on serial studies of the same patients. Clinical studies by Luce and Gottlieb could not corroborate findings of progressive tissue necrosis. The loss of further neighbouring tissue later could be due to inadequate debridement, incomplete fasciotomies, missed underlying deep group of muscle necrosis or devascularisation of particular tissue due to previous debridement. Thus debridement should be undertaken as soon as patient is vitally stable and well resuscitated and done by the senior surgeon.



Flow through flap in ALT flap through radial artery.



Profunda artery perforator free flap

With the wound well prepared after debridement a well vascularised flap cover is required. Local flap options like cross finger flaps, groin, abdomen, hypogastric flaps call for immobilisation of joints which lengthen the process of recovery due to stiffness of joints. 13 patients underwent such flaps and were detached after a period of 3 weeks on a day care basis. Flaps survived well and later required defatting in some cases (4) for aesthetic reasons.

Use of free flaps is a very useful option in such cases as it compensates for the paucity of tissue in the local vicinity. These flaps can provide a Pandora of components along with adequate muscle and fasciocutaneous cover for the wound. Flaps can be made sensate with the use of nerve from the donor flap. In 2 cases flexor tendons were reconstructed with TFL graft and in 1 case median nerve repair was done with sural nerve graft. In one case free functional muscle transfer was done for flexion of the wrist. This saves the patient from the ordeal of undergoing another surgery at a later time for rehabilitation and saves time.

The use of flow through flaps was also helpful in maintaining the vascularity in cases where distal end of vessel was available and was done in 2 cases with anterolateral thigh free flap.

5. Conclusion

The choice of flap in case of a post electric burn defect depends on the site of the defect and the tissue lost after debridement. Our aim should be to provide a flap cover with maximum possible components so as to reduce rehabilitation time in patients. Also the aesthetic part should be taken care of by providing healthy tissue in necessary quantity.

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