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Reconstruction of post electric burn defects of upper limb with different modification of flaps

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Abstract
Introduction: Post electric burn defects are difficult to manage due to deep injury involving all the structures up to bony level. A good vascularized flap is required to resurface the defect for preventing the complication and for reconstruction.
Aim of study: Resurface the post electric burn defect with different flaps according to need of defect.
Material and method: All patients of electric burn hand and fore arm defect admitted to burn, plastic and reconstructive department of SCB Medical College, Cuttack and Dept. of Burn and Plastic Surgery, AIIMS Bhubaneswar between January 2015 to December 2017 with different flap covers used for reconstruction.
Observation: Out of 30 cases of post electric burn forearm and hand reconstruction, 10 cases undergone groin flap cover, 6 cases undergone abdominal flap cover,5 cases undergone cross finger flap cover 4 cases undergone free anterolateral thigh flap cover, four cases undergone free Latissimus dorsi flap cover. Flaps have resurfaced the defect with minor complication like infection and minor necrosis of flaps which were managed.
Conclusion: Reconstruction of post electric burn defect of distal fore arm and hand represents great challenge due to depth of injury involving full thickness of skin and other structures Choice depends on size of defect, availability of local or regional tissue, patient's acceptance and cooperation, keeping in mind the cost effectiveness of the procedures.

Keywords: post electric burn, upper limb, modification of flaps

Introduction

Electric burn injury is defined as tissue injury following exposure to electrical current or forces Includes: direct contact burn, arc injuries, flash, and flame burns.

Statistics: it contributes to 4% of admissions to burn centers & 5-10% all occupational fatalities.

Classified according to Voltage <High (>1000 V) vs Low (<1000 V) > and type of injury (Arc, Thermoelectrical, Flash/Flame burn). While considering voltage degree of injury increases proportionately with voltage.

Pathophysiology: V=IR where R is Resistance, I is current follows path least resistance (R), resistance of skin (dry skin=100,000, wet=1000 ohms) and Internal organ (bone, tendon, fat) = 500-1000 ohms. Nerves, vessels, muscles are very good conductors of current. Again, resistance is inversely proportional to cross-sectional area of joints, so small joints of body like joints of foot & hand suffers from maximum injury.

Electric burn also classified according to type of current (Alternative current/Direct current), frequency (Hz), magnitude (mA), pathway. Alternative current injuries have more morbidity and mortality than direct current. Hand to hand pathway (across heart) produces more mortality. standard household outlet (0.5mA, 60Hz, AC, 120V) produces startle response, cutaneous burns.>10mA alternative current produces tetany, "locked-on" phenomenon. >100mA alternative current produces loss of consciousness, asystole, and severe tissue injury. Long-term sequalae of electric burn include: Infection, scarring, contracture, neurologic deficits **(**for weeks/months post-injury), cataracts (ophthalmologic exam in all cases high voltage injury), extremity complications such as neuromas, phantom limb pain. Post electric burn upper limb defects are difficult to manage due to deep injury exposing: tendons, neurovascular bundles, bones. Therefore, a good vascularized flap is required to resurface the defect for preventing the complication and with aim of future reconstruction.

Aim of the study

Resurface the post electric burn hand and forearm defects with different flaps according to need of defect.

Materials and methods

All patients of electric burn hand and fore arm defect admitted to burn, plastic and reconstructive department of SCB Medical College Cuttack and AIIMS Bhubaneswar between January 2015 to December 2017 with different flap covers used for reconstruction. Patients were informed about their problem, various reconstructive majors available with the aim of future reconstruction and informed consent taken for different flap cover.

Results

Segregation of patients according to voltage of injury

suffered

Table 1

Low voltage (<1000)	High voltage (> 1000)
15	25

Table 2

Isolated defects of upper extremity	Defects of upper extremity associated with other defects
10	30

Table 3: Types of flap used and number of patients

Types of flap	Number of patients
Groin flap	10
Abdominal flap	06
Cross finger flap	05
Free anterolateral thigh flap	05
Reverse radial forearm flap	05
First dorsal meta carpal artery based flap	05
Free latissimus dorsi flap	04

Discussion

We categorized our patient into different according to severity of injury they suffered (high voltage/ low voltage) and as isolated injury of upper extremity or injury of upper extremity associated with other defects.

Out of 40 patients of post electric burn forearm and hand defects we got 15 patients suffering from low voltage electric burn injury, 25 patients of high voltage electric burn injury. Isolated defects of upper extremity include 10 patients and defects of upper extremity associated with other defects include 30 patients.

Out of 40 patients of post electric burn forearm and hand defects groin flap given in 10 cases, abdominal flap in 6 cases, cross finger flap 5 cases, free anterolateral thigh flap 5 cases, reverse radial forearm flap 5 cases, first dorsal metacarpal artery based flap 5 cases, free latissimus dorsi flap 4 cases.

In two cases of groin flap cover we found proper maintenance of hand position by patient after flap cover difficult in initial period leading to partial detachment of flap, which was reinserted.

In one case of electric burn injury of hand, forearm (left) with loss of index finger, patient was advised below elbow amputation, but now the patient had functioning limb following free latissimus dorsi flap cover and flexor tendon reconstruction.

Observations

Preoperative photograph | Photo after groin flap insetting | Photo after groin flap reinsetting

Fig 1: Groin flap cover for wrist and palm defects

Preoperative photo | Photo after abdominal flap cover | Photo after division of abdominal flap

Fig 2: Abdominal flap cover for wrist defect

Pre-operative photograph | Photograph during free LD flap anastomosis | Photograph after settlement of free LD flap & skin graft over it.

Fig 3: Free lattisimus dorsi flap for post electric burn forearm reconstruction

Pre-operative photograph | Photograph after 2nd post-operative day | Photograph after 3 month post-operative

Fig 4: Free alt flap for post electric burn hand reconstruction

Pre-operative photograph | Photograph after planning | Photo after one month of FDM flap cover

Fig 5: First dorsal meta carpal artery based flap for defect on thumb

Post electric burn contracture index finger | Photo after release and flap cover | Photo after release and flap cover

Fig 6: Cross finger flap

Pre-operative photo | Post-operative photo

Fig 7: Reverse radial forearm flap for wrist defect

Conclusion

Reconstruction of post electric burn defect of distal fore arm and hand represents great challenge due to depth of injury involving full thickness of skin and other structures Choice depends on size of defect, availability of local or regional tissue, patient's acceptance and cooperation, keeping in mind the cost effectiveness of the procedures.

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