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Role of Hybrid Reconstruction Ladder in Electric Burns

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ABSTRACT

Electrical injuries occur when high energy current travels through the body due to contact with an electrical source. Injuries can occur due to various methods; the flow of current through body, arc flash, clothing catches fire to name a few. In the former two, the body converts electricity into heat, which results in thermal burns. It is important to note that the external appearance of an electrical burn does not accurately predict the extent of the injury, as internal tissues and organs may be impacted severely than it appears from outside.[1]

Keywords: Hybrid Reconstruction; Electric Burns.

INTRODUCTION

Electricity is an indispensable part of modern life. However, use of multipurpose electricity in daily life increases the risks of accidents, injury or death. Electrical burns if severe and associated with high voltage (>1000 V) can cause significant morbidity and mortality. Of all the burns treated in a medical setting, 4% to 5% are electrical.[2] In the United States, accidental high voltage electrical injuries account for approximately 400 deaths per year and the total number of electrical deaths is approximately 1,000 per annum, thus making it a devastating, but preventable hazard. Electrical injuries in adults are most commonly occupational, with males more frequently affected than females. In children, household electrical injuries are more common. To minimize the functional effects, reconstruction with skin flaps or grafts should be performed as soon as possible.[3] Recent advances include reconstructive techniques merged with regenerative medicine modalities to improve outcomes in these cases. These treatments combine traditional reconstruction measures with regenerative medicine applications and has been termed 'hybrid reconstructions'.[4] The hybrid reconstruction model (fig. 1) aims at maximizing the function and to minimize the disability and morbidity associated with traditional reconstruction.

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Materials and Methods

This study was conducted in the department of plastic surgery in a tertiary care center after obtaining the departmental ethical committee approval. Informed written consent was taken from the patient. The study is a prospective observational type done on a 60-year-old male with known co-morbidities including hypertension & coronary artery disease with ejection fraction of 25%. Patient presented with raw area (fig. 1) over

Fig. 1: Hybrid Reconstructive Ladder
Source Article: Plastic Surgery Challenges in War Wounded II: Regenerative Medicine[5]

left lower limb & perineum of one month

Methods and Materials

This study was conducted in tertiary care centre in department of plastic surgery after getting the department ethical committee approval. Informed consent was obtained for examination and clinical photography.

A 13 year old girl with 5% electric burns on forehead and bilateral lower limbs (Fig. 1) was admitted and underwent hybrid reconstruction ladder therapy. She underwent multiple sessions of hydrojet therapy, prolotherapy, activated platelet rich plasma, heterografting with collagen, collagen oinment local application, non adhesive dressing, negative pressure wound therapy, Vitamin D3, sucralfate local application, secondary dressing & splinting, and finally Er: YAG laser (Fig. 3-12) to healed areas to remove scars during her course in hospital.

Results

After the hybrid reconstruction ladder therapy, wound healing improved and there was good wound bed preparation for heterografting without any local adverse effects.

Fig. 2: Facial burns at the time of admission

Fig. 3: Burn wounds in the foot at the time of admission

Fig. 5: Application of hydrojet debridement

Fig. 6: Application of prolotherapy

Fig. 7: Application of Vitamin D3, sucralfate therapy

Fig. 8: Application of non adhesive dressing

Fig. 9: Application of heterografting (collagen)

Fig. 10: Application of negative pressure wound therapy

Fig. 11: Application of secondary dressing on the face

Fig. 12: Application of Er:YAG laser on healed areas

Fig. 13: Wound at discharge

Patient was discharged after wound healing and scar reduction. (Fig. 13)

Discussion

In recent years, surgical teams have incorporated a "hybrid reconstructive ladder/elevator" paradigm, in which regenerative medicine therapies are used in conjunction with traditional approaches of reconstruction. This novel treatment paradigm is originally a modification of the conventional reconstructive ladder and has led to improvement in definitive closure of wounds with extensive soft tissue loss.[6] Literature on the topic suggests that technique escalation in accordance with the ladder should be undertaken based on wound etiology, presentation, extent and nature of tissue loss, available resources, and surgeon expertise.[7] It involves starting at the bottom of the ladder and escalating up if one therapy fails to improve the wound. A study conducted in Turkey in 2015 involved 117 patients with HVEI (high voltage electrical injury) who were treated with a flap cover and HVEI defects should include urgent first aid followed by serial debridement and reconstruction with a reliable flap.[3] Hydrojet therapy, prolotherapy, activated platelet rich plasma, heterografting with collagen, collagen oinment local application, non adhesive dressing, negative pressure wound therapy, Vitamin D3, sucralfate local application, secondary dressing & splinting, and Er: YAG laser were the components of hybrid reconstruction ladder used in our patient. Except for the high cost and requirement of extensive infrastructure, hybrid reconstruction ladder is a promising advancement in the field of reconstruction.

Conclusion

Hybrid reconstruction ladder is an important alternative in the treatment of electrical burns patients. At each step of the reconstruction ladder, results were better,

and these modalities may allow for the expansion of indications for each step. The performance of simultaneous hybrid procedures is associated with potential advantages such as reduction in the length of hospital stay and associated morbidity, hospital acquired infections. It also helps in better wound healing, early and definitive recovery. In our study the hybrid reconstruction ladder approach to treatment of electric burns was found to improve wound healing and reduce overall morbidity, hospital stay and better scar outcome.

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