Role of Various Regenerative Methods in the Management of Electrical Burns: Our Experience

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Abstract

Although the incidence of electrical burns is rather low, they are considered one of the most devastating injuries, due to their high morbidity and mortality.[1] Moreover, high costs are related to the long term hospitalization, the need for multiple surgical procedures and the functional sequels that might result from the original injury.[2] The mechanism of injury is a result of the combination of thermal and non-thermal processes. An electric current can reach deep tissues, causing deep and extensive injuries. Depending on voltage magnitude, injury may be sustained in nerve, bone and tendon tissue, as well as in skin.[3]

Keywords: Electrical burn, High-voltage, Low-voltage, Non adhesive collagen dressing, Regenerative techniques

INTRODUCTION

Electrical burn injuries are the most disastrous when compared to other forms of burns involving the same surface area. The mechanism of injury is complex, being a result of the combination of thermal and non-thermal processes. An electric current can reach deep tissues, causing deep and extensive injuries. The burden of electrical burn injuries is different among developed and developing countries. According to multiple reports, it is more prevalent in developing countries.[1,2] Statistics show that prevalence is higher among men, and it most commonly affects the young population and the working classes the main human resources of countries.[2,3,6] Preventive measures, namely education on electric current danger and hazards, as well as safety measures in workplaces are probably the most effective methods to reduce the incidence of electrical injury.[7,8] We share our experience in the management of electrical burns by using various regenerative techniques in this article.

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MATERIALS AND METHODS

This study was conducted in the Department of Plastic Surgery at tertiary care center. Informed written consent was taken from the patient. The details of the patient: 13 yr old female presented with alleged history of thermal burns over forehead and bilateral lower limbs on 14.5.21 at 4.30 pm at her residence from low voltage electric tower and sustained injury over forehead involving both eyes,

scalp, left big toe, right little toe. On examination she was found to have forehead and both upper eyelids superficial second degree burns with loss of epithelium, frontal scalp-1st degree burns about 4*4 cm ,1*1 cm deep burns with necrosed skin,no exsposed bone or soft tissue and left big toe 1*1 cm deep burns over tip, right little toe 2*2 cm superficial second degree burns over the little toe tip. At presentation BJWATS score was of 29, 24, 17, so was admitted in ward and treated with continuous ECG monitoring, antibiotics, analgesics, antacids and regular wound dressing with Autologous Platelet Rich Plasma (APRP) (figure 2), hydrojet debridement (figure 3) and Prolotherapy (figure 4). Once the wound bed was healthy, heterografting (figure 6) with negative pressure wound therapy (NPWT) (figure 7) was applied to scalp, both feet and non-adhesive dressing with collagen ointment (figure 5) was done. Patient underwent regular dressing and later er yag laser (figure 8) was given to healed areas.

Fig. 1: Face burns at the time of presentation

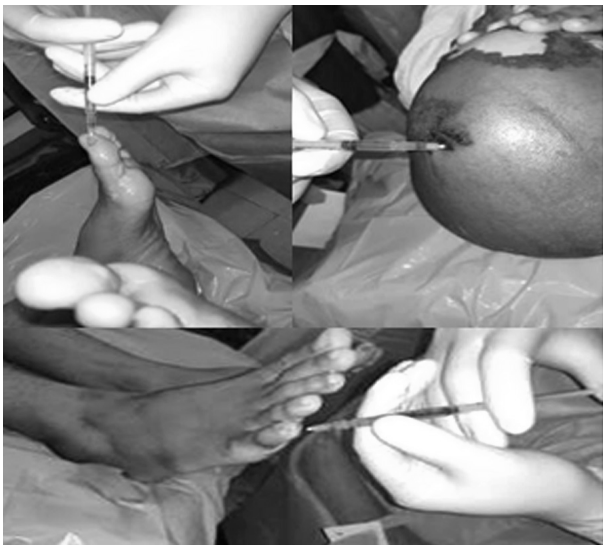

Fig. 2: APRP therapy

Fig. 1: Foot at the time of presentation

Fig. 3: Hydrojet debridement

Fig. 4: Prolotherapy

Fig. 4: Prolotherapy

Fig. 5: Non adhesive dressing

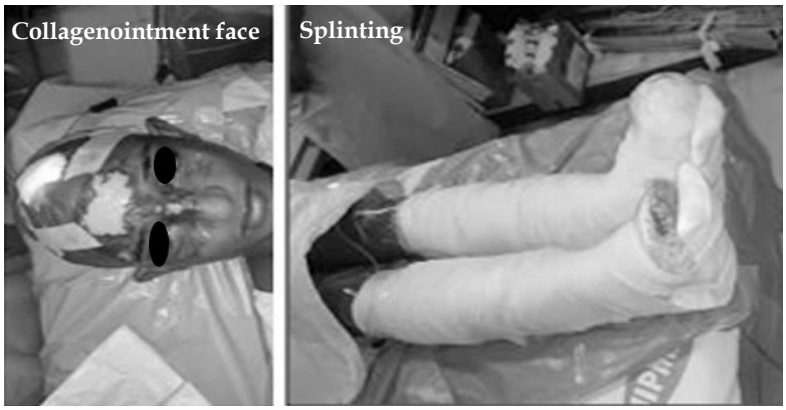

Fig. 6: Heterografting

Fig. 7: Negative pressure wound therapy application

Fig. 8: Er YAG laser to healed areas

Fig. 9: At discharge

RESULTS

After the use of various regenerative methods, the wound healing was successful (fig. 9) Patient was ambulating well.

DISCUSSION

Neoangiogenesis, stimulation of the local immune response, and the presence of growth factors such as epidermal growth factor (eGF), transforming growth factor (TGF), and basic fibroblast growth factor all play a role in wound healing (bFGF). Role of prolotherapy in TGF-β expression which by high-glucose helps in angiogenesis, fibroblast proliferation, collagen synthesis, matrix deposition, and remodeling, and wound reepithelialization. Multiple agents are being used in prolotherapy like irritants (phenol), chemoattractants (sodium morrhuate), osmotic agents (dextrose). Although the exact mechanism of prolotherapy is not clear, it is believed that the injection of hypertonic dextrose causes cell dehydration and osmotic rupture at the injection site that leads to local tissue injury. That will subsequently induce granulocyte and macrophage migration to the site, with release of the growth factors and collagen deposition. In vitro studies have shown that even concentrations as low as 5% dextrose have resulted in the production of several growth factors critical for tissue repair.[14]

Platelet rich plasma (PRP) is a new adjunct that is increasingly being used to treat soft tissue defects in order to speed up healing of chronic nonhealing wounds. Platelet rich plasma is made by combining centrifuged blood with thrombin and calcium chloride to form a viscous coagulum gel that is rich in growth factors released by activated platelets. After preparation, platelet rich plasma is stable for around 8 hours. TGF-b and PDGF are the most essential growth factors in PRP. They have an impact on every stage of wound healing because they stimulate cell proliferation and differentiation. PRP also enhances tissue incorporation of biological mesh.

Early burn wound excision and wound closure with immediate autologous skin or skin substitutes, has lowered the mortality rate of severe burns and improved survival chances by minimising infections and metabolic problems.[13] Split thickness skin grafting restores epidermal function, avoids further hypothermia, protein and fluid losses, and infection risk, and integrates itself into the healing process, remains the primary permanent source of burn wound closure.

CONCLUSION

We have used different regenerative methods to augment the wound healing process and have found it to be useful. In this study, management of electrical burns by collagen dressing, NPWT and heterografting was done.

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