

Role of topical insulin in electric burns management

Neljo Thomas, Ravi Kumar Chittoria*, Saurabh Gupta, Chirra Likhitha Reddy, Padmalakshmi Bharathi Mohan, Shijina K, Imran Pathan, Nishad K, Daisy Loyola.

Department of Plastic Surgery.

***Corresponding Author:** Ravi Kumar Chittoria, Department of Plastic Surgery Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER) Pondicherry India-605006.

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Abstract:

Electric burns are known for non-healing and plastic surgeons face with difficulty in wound management. In chronic wounds there will be a lack of growth factors. Insulin therapy is a method of wound healing by stimulation of growth factors and provide growth factors for wound healing. In this study we have used topical insulin for wound bed preparation of patient's electric burns wound.

Key words: insulin therapy, Electric burns

Introduction

Adult wound healing can be categorized into three stages: inflammatory phase, proliferative phase, and remodelling phase. The three stages have to occur in correct conjunction to result in good wound healing. Wound bed preparation is a novel concept which is used to manage wounds that fail to heal by itself and can be summarized using T.I.M.E with T for tissue: non-viable or deficient. I for infection/inflammation, M for moisture balance. E for epidermis which was changed to E for edge. Recently in literature, we happened to come across use of topical insulin for use in wound bed preparation.

Materials and methods: This study was conducted in the department of Plastic Surgery at tertiary care center after the departmental ethical committee approval was taken. Informed written consent was taken from the patient. The details of the patient in study are as follows: 40 year old female without any known co morbidities with history of accidental electric burns from low voltage source and sustained circumferential 3rd to 4th degree burns over the left little finger with loss of vascularity of the distal area and 2nd degree burns over the medial aspect of the ring finger in the proximal phalanx (figure 1).



Figure 1: Wound at the time of presentation

Patient underwent little finger disarticulation after 1 week when the line of demarcation was developed and edges were loosely approximated to facilitate healing (figure 2).



Figure 2: Disarticulation of little finger at MCPJ

Following the procedure patient was dressed regularly. She developed a raw area of 3.5cm² over the medial aspect of the ring finger which failed to show any evidence of healing. Wound bed preparation was done for the patient with topical insulin therapy as her ulcer did not show any evidence of healing. 0.2ml of regular insulin was injected onto the border and 0.15ml was sprayed on the floor onto 3.5cm² of the wound when the regular dressing was performed (figure 3).



Figure 3: topical insulin therapy for wound bed preparation

This was repeated once every 3-5 days when the dressing was changed. The wound was reassessed after 2 weeks for evidence of wound healing.

Results: The wound bed showed good granulation tissue after 2 weeks (figure 4)



Figure 4: healed wound bed

Discussion

Burn injury is a major cause of trauma to the human body, causing death as well as disability, with a long healing period. The mortality rate of burn injury has decreased with new treatment modalities, but secondary infections and prolonged healing periods still affect the mortality rates. For this purpose, different kinds of dressings and pharmacotherapies have been developed, but most are costly, and the mechanisms underlying these therapies have not been fully documented. Many therapeutic methods are available to effect the wound healing such as the topical application of insulin, growth factors, negative pressure assisted wound closure, oxidized regenerated cellulose/collagen, hyaluronic acid conjugated with glycidyl methacrylate or gelatin dressings.

Role of topical insulin in wound healing has been in literature since 1970s [1]. Studies done in animal models and humans have found that topical Insulin therapy exerts its effects through the IGF 1 receptor. Insulin is known to stimulate keratinocytes and also the rate of endothelial proliferation leading to a faster neovascularization and also formation of granulation tissue [2]. Topical insulin application rapidly induces upregulation of the insulin signalling related proteins on wound areas following injury. IRS-1 binds the PI3-kinase, one of the SH2 proteins, through the multiple tyrosine phosphorylated sites [3, 4].

Insulin triggers the keratinocyte migration depending on the dose and time in the chronic wounds. Insulin demonstrates its effect through an

insulin receptor dependent but EGF/EGF-R non-dependent way. The fact that it increases the keratinocyte migration on the PI3K-Akt-Rac1 pathway and cause stimulation of the keratinocytes by enabling the production of $\alpha 3$ and LN332 molecules has been proven by the in vitro studies [6,7,8,9]. Insulin is a hormone that also affects collagen production. Insulin selectively and strongly stimulates the collagen production in dermal fibroblasts [10, 11]. The cost of insulin ranges from 130-500 INR per vial. There was no systemic side effects for the insulin being given topically.

Limitations: The study was done on a single patient and needs large population based study to apply in practice

Declarations

Acknowledgment

Authors' contributions

All authors made contributions to the article

Availability of data and materials

Not applicable.

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None.

Conflicts of interest

None.

Consent for publication

Not applicable.

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