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Case Report

Management of Electrical Burn Injury of the Hand Using Collagen-Based Nanocrystalline Silver Cream: A Case Report

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ABSTRACT:

Advances in the understanding of wound healing have encouraged the use of newer topical agents for managing both acute and chronic wounds. Silver-based preparations have traditionally formed an important component of burn care due to their antimicrobial properties. Nanocrystalline silver represents a refinement of conventional silver formulations by offering sustained antimicrobial activity along with modulation of the inflammatory response. Electrical burns affecting the hand present particular challenges because tissue injury is often unpredictable and infection risk is high. We report the conservative management of an elderly patient with an electrical burn injury to the hand using nanocrystalline silver cream, which resulted in satisfactory wound healing without the need for surgical intervention.

Keywords: *Electrical burn; Hand burn; Nanocrystalline silver; Burn wound management; Conservative treatment*

INTRODUCTION

Electrical burns of the hand represent a unique clinical challenge due to their unpredictable depth of tissue injury, high risk of infection, and potential for long-term functional impairment [2]. Effective wound management requires sustained antimicrobial control while preserving a biological environment conducive to healing [1]. Although silver-based topical agents have long been used in burn care, conventional formulations have limitations related to cytotoxicity and short duration of action [2,3]. Nanocrystalline silver, particularly when combined with collagen, offers prolonged antimicrobial activity with additional support for tissue regeneration [1,4,5]. This case report highlights the successful conservative management of an electrical burn injury of the hand using collagen-based nanocrystalline silver cream.

MATERIALS AND METHODS

This study was conducted in the Department of Plastic Surgery at a tertiary care center after obtaining approval from the departmental ethical committee. Written informed consent was obtained from the patient for treatment and publication.

A 70-year-old male presented with an electrical burn injury involving the right hand. Clinical examination revealed raw areas with adherent slough over the palmar aspect of the hand, including the base of the thumb and distal digits. The surrounding skin showed hyperpigmentation and induration consistent with electrical injury.

After initial wound cleansing with normal saline, a conservative treatment approach was adopted. Collagen-based nanocrystalline silver cream was applied as a thin, uniform layer over all raw areas and covered with a non-adherent sterile dressing. Dressings were changed at regular intervals under aseptic conditions (Figure 2).

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Figure 1(a,b): Pre-operative image of the right-hand showing patient with electrical burn injury managed with k wire fixation to prevent contracture (K-wires in situ).

Figure 2: Application of collagen-based nanocrystalline silver cream over the post-burn wound.

RESULTS

The wound demonstrated gradual and consistent improvement following treatment with nanocrystalline silver cream. Slough reduced progressively, followed by the appearance of healthy granulation tissue and subsequent epithelialization within 3 days (Figure 3). Similar improvements in wound bed quality with nanocrystalline silver have been reported in clinical studies [4,5].

Figure 3a,b: Early granulation tissue formation following nanocrystalline Ag cream application.

Complete wound healing was achieved without the requirement for surgical procedures such as skin grafting or flap coverage. No local or systemic complications were observed during treatment, consistent with the favorable safety profile of nanocrystalline silver [3,6].

Discussion

Electrical burn injuries differ from thermal burns because tissue damage often extends beyond visible skin involvement. Electrical current follows paths of least resistance, resulting in microvascular thrombosis, progressive ischemia, and delayed tissue necrosis, which may cause wound deterioration despite an initially stable appearance [7]. These features are particularly important in hand injuries, where complex anatomy and high functional demands increase the risk of infection, contracture, and long-term disability [2,7].

Although surgical excision and skin grafting are standard treatments once tissue viability is established, early surgery may not always be ideal, especially in elderly patients or when the extent of injury is uncertain [6,7]. Surgical management is associated with donor-site morbidity, scarring, and prolonged rehabilitation, which can adversely affect hand function [6]. Consequently, conservative wound management strategies are increasingly considered in selected cases [4,5].

Silver-containing topical agents have long been used in burn care due to their broad antimicrobial activity [2]. However, conventional formulations such as silver nitrate and silver sulfadiazine have limitations, including frequent dressing changes and cytotoxicity to keratinocytes and fibroblasts, which may delay epithelialization [2,3]. Nanocrystalline silver overcomes many of these limitations by providing sustained release of silver ions with reduced overall toxicity [1,2]. Its antimicrobial effects are mediated through disruption of bacterial cell membranes, interference with cellular metabolism and DNA replication, and inhibition of biofilm formation [9,10].

In addition to antimicrobial activity, nanocrystalline silver exhibits anti-inflammatory effects by modulating cytokine expression and suppressing nuclear factor-κB–mediated pathways, which are beneficial in electrical burn injuries characterized by prolonged inflammation [1,3,7]. When combined with collagen, which serves as a biological scaffold promoting granulation tissue formation and epithelialization, a synergistic wound-healing effect is achieved [4,5].

In the present case, collagen-based nanocrystalline silver cream resulted in early granulation tissue formation and complete epithelialization without the need for surgical intervention. Similar favorable outcomes and a good safety profile have been reported in previous studies of nanocrystalline silver dressings [3–6]. Although limited by its single-case design, this report supports the use of collagen-based nanocrystalline silver cream as an effective conservative option for selected electrical burn injuries of the hand.

Conclusion

Collagen-based nanocrystalline silver cream is a safe and effective option for the conservative management of selected electrical burn injuries of the hand. Its sustained antimicrobial and anti-inflammatory properties, combined with support of the wound healing environment, promote satisfactory healing while reducing infection risk and surgical morbidity.

Competing Interest:

None

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None

Consent for Publication: Informed consent was obtained from the patient.

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