




Case report

Treating injuries on the shoulder and leg caused by electrical shock using a combination of wound care techniques: A case report

Kamal Rahimi^{a,1}, Najmaddin Amini^b, Behnam Babamiri^{c,2} , Navid Faraji^{d,1},
Milad Ahangarzadeh^{e,3}, Mohammad Reza Faramarzi^{e,*,3}

^a Department of Medicine, Faculty of Medicine, Urmia University of Medical Sciences, Urmia, Iran

^b Department of Medicine, School of Medicine, Islamic Azad University, Tabriz, Iran

^c Critical Care and Emergency Nursing Department, Nursing and Midwifery School, Zanjan University of Medical Sciences, Zanjan, Iran

^d Department of Medical-Surgical Nursing, School of Nursing and Midwifery, Urmia University of Medical Sciences, Urmia, Iran

^e Department of Nursing, School of Nursing and Midwifery, Maragheh University of Medical Sciences, Maragheh, Iran

ARTICLE INFO

Keywords:

Trauma
Infection
Wound
Electrical
Case report
Rehabilitation
Wound management

ABSTRACT

Introduction and importance: Electrical injuries involve complex tissue damage and varied wound patterns, requiring a deep understanding of their pathophysiology for effective management. They often affect critical areas like the shoulder and leg, complicating treatment and necessitating specialized care plans for optimal healing.

Case presentation: We report a 42-year-old male with severe lacerations and tissue damage from a high-voltage power line accident. Immediate intervention included surgical debridement, antimicrobial therapy, and advanced wound care.

Clinical discussion: A multidisciplinary team developed a tailored rehabilitation strategy, emphasizing collaborative care's role in successful recovery. The effective closure of wounds and functional restoration highlights the need for specialized approaches in managing electrical injuries.

Conclusion: This case underscores the complexities of treating electrical injuries and the importance of a coordinated, multidisciplinary approach for optimal healing and patient outcomes.

1. Introduction

Electricity-induced injuries often result in severe and intricate wounds, posing significant challenges in wound management [1]. These injuries are characterized by their capacity to cause extensive tissue damage and complex wound patterns, necessitating a nuanced understanding of their pathophysiology for effective treatment [2]. The diverse array of tissue damage—including thermal burns, deep lacerations, and underlying tissue trauma—demands a meticulous and tailored approach [3]. Particularly, injuries affecting critical anatomical areas such as the shoulder and leg further complicate treatment, requiring specialized care and detailed therapeutic plans to achieve favorable healing outcomes [4,5]. For instance, the case of a 42-year-old male who suffered extensive injuries to his left shoulder and leg after accidental

contact with a high-voltage power line exemplifies the complexities of managing electrical injuries. This case not only highlights the immediate challenges posed by such injuries but also underscores the necessity for a comprehensive management strategy that integrates surgical intervention, advanced wound care modalities, and collaborative rehabilitation efforts [6]. By exploring this specific case, we aim to shed light on the intricate healing processes characteristic of electrical injuries and the critical importance of a multidisciplinary approach in achieving optimal patient outcomes. The work has been reported in line with the SCARE 2023 Criteria [7].

* Corresponding author.

E-mail addresses: Faramarzimohammedreza@gmail.com, Navidfaraaji1993@gmail.com (M.R. Faramarzi).

¹ Address: Nursing and Midwifery Faculty, Campus Nazlu, 11 KM Road Seru, Urmia, West Azerbaijan, Iran. Postal Code: 575611-5111.

² Address: Zanjan, Professor Dr. Yousef Sobuti Boulevard, Zanjan University of Medical Sciences - Postal Code: 4513956184.

³ Address: Nursing and Midwifery Faculty, Maragheh, West Azerbaijan, Iran. Postal Code: 55158-78151.

2. Case presentation

2.1. Patient presentation and initial assessment

A 42-year-old male was brought to the emergency department following an electrical accident at a construction site, reporting accidental contact with a high-voltage power line. This resulted in extensive injuries to his left shoulder and leg (Fig. 1). Upon arrival, he presented with lacerations, tissue damage, and signs indicative of electrical burns. Initial assessment revealed complex wounds involving multiple tissue layers, necessitating immediate medical attention. Physical examination demonstrated extensive tissue necrosis, with deep and irregular wounds exhibiting signs of thermal and electrical injury.

2.2. Risk and multidisciplinary management

The extent of tissue damage posed a significant risk of infection and impaired wound healing, prompting the medical team to initiate comprehensive wound management. The patient was admitted for further evaluation and treatment, with imaging studies confirming the depth of tissue involvement. A multidisciplinary team, including wound care specialists, plastic surgeons, and physical therapists, collaborated to develop a tailored treatment plan.

2.3. Treatment and outcomes

The treatment plan included surgical debridement to remove necrotic tissue, antimicrobial therapy to prevent infection, and advanced wound care techniques. The patient underwent multiple surgical procedures to facilitate wound closure and received specialized care, including advanced dressings and negative pressure wound therapy. Physical therapy was initiated early to maintain range of motion and optimize functional outcomes.

Throughout the treatment, the patient was closely monitored for infection and wound healing progress. He demonstrated significant improvement, with complete wound closure achieved within 12 weeks and approximately 90 % of his pre-injury range of motion regained in the shoulder and leg by six months post-treatment (Fig. 2). This case underscores the importance of a tailored and multidisciplinary approach in managing the complexities of electrical trauma.

3. Discussion

Wound healing is a fascinating and intricate process that involves several key stages working together, including stopping bleeding, inflammation, tissue growth, and remodeling. Each of these stages is essential for repairing the skin and the tissues beneath it [8,9]. Various factors can impact how well and how quickly a wound heals, such as the



Fig. 2. Treating injuries by combination therapy.

amount of oxygen and nutrients available, as well as the presence of any infections [10]. Additionally, personal factors like a patient's age, existing health conditions, and overall wellness can greatly affect the healing process. With a deeper understanding of the biological mechanisms behind wound healing, healthcare professionals have developed new and innovative treatments to support recovery. By creating the best possible healing environment and tackling any underlying challenges, providers can enhance healing outcomes and help patients return to their normal lives more swiftly, regardless of the type of wound they have [11,12].

The successful management of extensive wounds resulting from electrical trauma underscores the significance of a comprehensive and multidisciplinary approach in addressing the multifaceted challenges associated with such injuries. Electrical injuries are known to cause extensive tissue damage, making the management of these wounds particularly complex [13,14].

The treatment plan employed in this case involved a multidisciplinary collaboration, integrating surgical debridement, advanced wound care modalities, antimicrobial therapy, and physical rehabilitation [15,16]. Surgical debridement played a pivotal role in removing necrotic tissue and creating a conducive environment for granulation tissue formation and subsequent wound closure [17,18]. Studies have shown that timely surgical intervention significantly reduces the risk of infection and promotes faster healing rates [19–21].

Concurrent application of specialized wound care products and negative pressure wound therapy has been shown to promote tissue regeneration, minimize infection risk, and foster optimal healing environments [22,23]. Negative pressure wound therapy, in particular, enhances blood flow to the wound area, which is crucial for healing extensive electrical injuries [24].

Furthermore, the early initiation of physical therapy aimed to prevent contractures, maintain range of motion, and optimize functional outcomes. Evidence suggests that early rehabilitation interventions significantly improve functional recovery and reduce long-term disability in patients with severe injuries [25,26]. The collaborative efforts of the medical team, comprising wound care specialists, plastic surgeons, and physical therapists, facilitated a comprehensive approach to address the complex wounds resulting from electrical trauma,



Fig. 1. Severe injuries on the shoulder and leg caused by electrical shock.

underscoring the pivotal role of a multidisciplinary approach in achieving successful wound closure and functional recovery [27].

The successful management of the extensive left shoulder and leg wounds caused by electricity emphasizes the critical importance of prompt intervention, diligent wound care, and the integration of advanced therapeutic modalities in addressing the diverse challenges posed by such injuries.

4. Conclusion

The effective management and healing of extensive left shoulder and leg wounds from electrical trauma emphasize the importance of a comprehensive, multidisciplinary approach. Key interventions included surgical debridement, advanced wound care, antimicrobial therapy, and physical rehabilitation, all of which contributed to favorable outcomes.

This case illustrates the efficacy of a holistic approach and highlights the need for timely intervention and ongoing education for healthcare professionals in managing electrical injuries. Future research should focus on standardized treatment protocols and innovative wound care technologies to enhance healing. The insights from this case can guide clinical practice and inform multidisciplinary teams in developing effective treatment strategies for similar cases.

Author contribution

Kamal Rahimii, Navid Faraji, and Behnam Babamiri: Study concept, data collection, writing the paper and making the revision of the manuscript following the reviewer's instructions. Milad Ahangarzadeh, Najmaddin Amin, and Mohammad Reza Faramarzi: Study concept, reviewing and validating the manuscript's credibility.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Ethical approval

Ethical clearance was not necessary by Research Committee of Urmia University of Medical Sciences as the format of this paper is a case report.

Guarantor

Navid Faraji.

Research registration number

Not applicable.

Funding

This CASE REPORT did not receive any specific grant from funding agencies in the public, commercial or not-for-profit sectors.

Conflict of interest statement

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

- [1] C.W. Chen, Y.K. Lin, Y.S. Yeh, C.W. Chen, T.Y. Lin, S.H. Chang, Low-voltage electricity-associated burn damage of lung parenchyma: case report and literature review, *J. Emerg. Med.* 60 (2) (Feb 1 2021) e33–e37.
- [2] T. Kanchan, V.P. Meshram, R.S. Shekhawat, K. Krishan, Electricity induced burns and lung injury: a rare autopsy observation, *J. Burn Care Res.* 42 (5) (Sep 1 2021) 1050–1052.
- [3] B.D. Arnoldo, G.F. Purdue, The diagnosis and management of electrical injuries, *Hand Clin.* 25 (4) (Nov 1 2009) 469–479.
- [4] W. Lederer, F.J. Wiedermann, E. Cerchiari, M.A. Baubin, Electricity-associated injuries II: outdoor management of lightning-induced casualties, *Resuscitation* 43 (2) (Jan 1 2000) 89–93.
- [5] M. Kidd, C.S. Hultman, J. Van Aalst, C. Calvert, M.D. Peck, B.A. Cairns, The contemporary management of electrical injuries: resuscitation, reconstruction, rehabilitation, *Ann. Plast. Surg.* 58 (3) (Mar 1 2007) 273–278.
- [6] N. Parizad, K. Hajimohammadi, R. Goli, Surgical debridement, maggot therapy, negative pressure wound therapy, and silver foam dressing revive hope for patients with diabetic foot ulcer: a case report, *Int. J. Surg. Case Rep.* 82 (May 1 2021) 105931.
- [7] C. Sohrabi, G. Mathew, N. Maria, A. Kerwan, T. Franchi, R.A. Agha, The SCARE 2023 guideline: updating consensus surgical CASE RReport (SCARE) guidelines, *Int. J. Surg. Lond. Engl.* 109 (5) (2023) 1136.
- [8] F. Zare, N. Shabbazi, N. Faraji, R. Goli, B. Mostafaei, S. Anari, A cruel invasion of Ewing's sarcoma of the skull: a rare case report, *Int. J. Surg. Case Rep.* 108 (Jul 1 2023) 108380.
- [9] K. Rahimi, R. Goli, N. Faraji, B. Pourheidari, S. Nabavi, M. Pourheidari, B. Babamiri, The effects of coadministration of curcumin and vitamin E on the reproductive system of diabetic male rats; an experimental study, *Toxicol. Rep.* 11 (Dec 1 2023) 241–248.
- [10] K. Hajimohammadi, N. Parizad, M. Bagheri, N. Faraji, R. Goli, Maggot therapy, alginate dressing, and surgical sharp debridement: unique path to save unresponsive diabetic foot ulcer, *Int. J. Surg. Case Rep.* 111 (Oct 1 2023) 108907.
- [11] B.C. Anzali, R. Goli, N. Faraji, A. Torabzadeh, Z. Najafzadeh, S. Nikpey, Invasion of undifferentiated pleomorphic sarcoma (UPS) in breast tissue; a case report study, *Int. J. Surg. Case Rep.* 107 (Jun 1 2023) 108307.
- [12] N. Faraji, N. Parizad, R. Goli, F. Nikkhah, M. Golhkar, Fighting diabetic foot ulcer by combination therapy, including larva therapy, Medi honey ointment, and silver alginate dressings: a case report, *Int. J. Surg. Case Rep.* 113 (Dec 1 2023) 109055.
- [13] R. Goli, N. Faraji, H. Maroofi, A. Hassanpour, Effect of spiritual care on the quality of life in patients who underwent intracranial hemorrhage surgery: a randomized controlled trial, *Int. J. Surg.* 110 (1) (Jan 1 2024) 167–175.
- [14] N. Aghakhani, N. Faraji, N. Parizad, R. Goli, V. Alinejad, J. Kazemzadeh, Guided imagery: an effective and practical complementary medicine method to alleviate pain severity and pain-related anxiety during dressing change in burn victims, *J. Burn Care Res.* 43 (3) (May 1 2022) 756.
- [15] B. Babamiri, S. Yavari, S. Nikpey, N. Faraji, R. Goli, K. Rahimi, Undifferentiated soft-tissue sarcoma (STS) in a 34-year-old woman: a case report, *Int. J. Surg. Case Rep.* 105 (Apr 1 2023) 108104.
- [16] N. Parizad, N. Faraji, R. Goli, H. Salmanzadeh, B. Mostafaei, M.H. Bisafar, Extensive excisional surgery; the last hope for a patient with human papillomavirus-associated severe head and neck squamous cell carcinoma: a case report, *Int. J. Surg. Case Rep.* 94 (May 1 2022) 107049.
- [17] R. Goli, N. Faraji, S. Shakorzadeh, M. Abbasi, R. Abbaszadeh, B. Mostafaei, Treating extravasation injury by honey antibacterial wound dressing in a neonate: a case report, *Int. J. Surg. Case Rep.* 95 (Jun 1 2022) 107279.
- [18] K. Rahimi, L. Hosseinpour, S.M. Balaneji, R. Goli, N. Faraji, B. Babamiri, Large wound surgery of diabetic foot ulcer with Split-thickness skin graft (STSG), and maggot debridement therapy (MDT): a case report, *Int. J. Surg. Case Rep.* 104 (Mar 1 2023) 107947.
- [19] B. Babamiri, F. Nikkhah, N. Faraji, R. Goli, N.V. Moghaddam, K. Rahimi, Diabetic foot ulcer: successful healing with combination therapy, including surgical debridement, maggot therapy, and negative pressure wound therapy, *Int. J. Surg. Case Rep.* 110 (Sep 1 2023) 108695.
- [20] N. Faraji, R. Pourbahram, R. Goli, B. Parvaresh, H. Alidoust, M.E. Dastgerdi, A simple sore can lead to limb amputation; metastatic squamous cell carcinoma of the sole in a 22-year-old man, *Int. J. Surg. Case Rep.* 124 (Nov 1 2024) 110378.
- [21] N. Bagheri, F. Marivani, N. Faraji, R. Goli, R. Chooapani, N. Mirzaei, Surgical management of a massive omphalocele in a newborn: a case report study, *Int. J. Surg. Case Rep.* 126 (Jan 1 2025) 110680.
- [22] N. Faraji, R. Goli, S. Shaddeli, A. Rahmati, M. Amirshayeri, S.Y. Yengejeh, Surgical management on a rare type of vertical liner fracture of tibia: a case report study, *Int. J. Surg. Case Rep.* 110 (Sep 1 2023) 108692.
- [23] S. Anari, R. Goli, N. Faraji, K. Rahimi, B. Babamiri, F. Zare, Surgical excision for gigantic bilateral pulmonary hydatid cyst in a 14-year-old adolescent: a case report study, *Int. J. Surg. Case Rep.* 109 (Aug 1 2023) 108548.
- [24] S. Esmaeili, N. Faraji, S. Bahrami, S. Shaddeli, A. Ahmadi, B. Mostafaei, Deep excision surgery of face due to cruel invasion of basal cell carcinoma: a case report study, *Int. J. Surg. Case Rep.* 109 (Aug 1 2023) 108551.
- [25] B. Babamiri, M.R. Faramarzi, S.K. Taraj, N. Faraji, R. Goli, F. Mohammadi, Healing of a diabetic foot wound through surgical debridement using med-honey, maggot

- therapy, and human amniotic membrane: a case study, *Int. J. Surg. Case Rep.* 122 (Sep 1 2024) 110041.
- [26] M.R. Faramarzi, G.A. Farid, B. Babamiri, H. Lotfy, R. Goli, N. Faraji, M. Ahangarzadeh, Management of an infected wound complicated by osteomyelitis secondary to neuropathy caused by previous leprosy; successful treatment with gauze ribbon, multivitamins, and maggot therapy, *Clin. Infect. Pract.* 23 (Jul 1 2024) 100370.
- [27] N. Parizad, K. Hajimohammadi, R. Goli, Y. Mohammadpour, N. Faraji, K. Makhdomi, Surgical debridement and maggot debridement therapy (MDT) bring the light of hope to patients with diabetic foot ulcers (DFUs): a case report, *Int. J. Surg. Case Rep.* 99 (Oct 1 2022) 107723.