

A Case of Falling Into an Acid Tank From Height After High-Voltage Electrocution

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ABSTRACT

In this case report, we present the management of a dramatic and rare combination of injuries: high-voltage electrical injury, chemical burn, and open tibial and calcaneal fractures resulting from a fall from height. The patient underwent early fasciotomies. After treatments administered by a multidisciplinary team consisting of plastic surgeons, general surgeons, orthopedic specialists, anesthesiologists, and physiotherapists, the patient was discharged without extremity loss after a 135-day hospital stay. This case report discusses the importance of early fasciotomy and debridement in management of extensive burns and fall-related injuries, the potential for extended hospitalization for reconstruction, and the necessity of a multidisciplinary approach.

KEY WORDS: *Burn, Composite burn, Flap, Multi-trauma, Reconstruction*

INTRODUCTION

Burn injuries that differ from thermal burns and progress with more severe necrosis include high-voltage electrical injuries and chemical burns. Most burns result from thermal injuries, whereas electrical and chemical burns occur less frequently. In addition to complications such as cardiac arrhythmias and rhabdomyolysis, soft tissue trauma in these patients can lead to significant damage.¹ The management of these injuries often requires surgical

treatments such as early escharotomy or fasciotomy, debridement, skin grafting, local and free flap surgeries, and amputations.

In this case report, we present the management of a dramatic and rare combination of injuries: high-voltage electrical injury, chemical burn, and open tibial and calcaneal fractures resulting from a fall from height. The patient underwent early fasciotomies. After treatments administered by a multidisciplinary team consisting of plastic surgeons, general surgeons, orthopedic specialists, anesthesiologists, and physiotherapists, the patient was discharged without extremity loss after a 135-day hospital stay. This case report discusses the importance of early fasciotomy and debridement in managing extensive burns and fall-related injuries, the potential for extended hospitalization for reconstruction, and the necessity of a multidisciplinary approach.

CASE REPORT

A 34-year-old male patient fell into a tank containing an alkaline chemical after being electrocuted while working on top of it. Approximately 6 hours after the trauma, the patient was admitted to our burn intensive care unit. He had second- and third-degree burns covering 30% of his total body surface area, including his back, both gluteal regions, and lower extremities (Figure 1). Both lower extremities were significantly swollen with limited mobility. In addition, open tibial and calcaneal fractures were observed in both lower extremities as a result of the fall (Figure 2).

After admission, the patient underwent early fasciotomies (Figure 3). Daily dressings were performed with antiseptic solutions and creams. Wound sites secondary to burns were cleaned through serial debridement (Figure 4). Open tibial and calcaneal fractures in the right lower extremity were treated by the orthopedic team. Once the patient's clinical condition stabilized, the exposed tibia, calcaneus, and Achilles tendon in the right lower extremity were

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reconstructed by using free chimeric latissimus dorsi and serratus anterior flaps. The open tibial defect in the other lower extremity was reconstructed with a free latissimus dorsi muscle flap (Figure 5). Superficial burn areas on the

posterior torso were covered with meshed split-thickness skin grafts following debridement. During the hospital stay, minor revisions were performed. The patient, whose wounds were repaired without the need for amputation,

FIGURE 1. Deep Burn Areas Observed on Both Lower Extremities and Back at Patient's Admission to Our Clinic



FIGURE 2. Direct Radiographs Revealed Fractures of the Tibia and Calcaneus in Patient



FIGURE 3. Early Fasciotomies Were Performed on the Patient's Wound Sites



External fixators were applied by the orthopedic team.

was transferred to the rehabilitation unit to continue intensive rehabilitation and physiotherapy (Figure 6).

DISCUSSION

Electrical and chemical burns are less common than thermal burns but cause more devastating tissue damage. According to the American Burn Association's data from 2004 to 2015, these injuries accounted for only 3.4% of hospital admissions.² This case report presented a rare combination of injuries caused by electrocution and a fall into a tank containing an alkaline chemical.

Myonecrosis and compartment syndrome can develop within 48 hours of the injury. In chemical burns, brushing

off the chemical agent and extensive irrigation are crucial steps after exposure.¹ Unlike thermal burns, chemical burns continue to cause damage until the offending agent is removed. Irrigation therapy should continue until the skin surface pH normalizes, which can take more than 2 hours in alkaline burns.²

Electrical exposure can cause injuries not only to the skin and musculoskeletal system but also to other organ systems. If cardiac injury is suspected, 24-hour cardiac rhythm monitoring should be performed. Because the patient's evaluated electrocardiogram showed no dysrhythmia, 24-hour monitoring was not conducted. Muscle damage-related myoglobinuria may lead to renal injuries.

FIGURE 4. Wound Sites Were Monitored With Daily Dressings, and Serial Debridement Procedures Were Performed



FIGURE 5. Open Tibial Defect in the Other Lower Extremity Was Reconstructed With a Free Latissimus Dorsi Muscle Flap

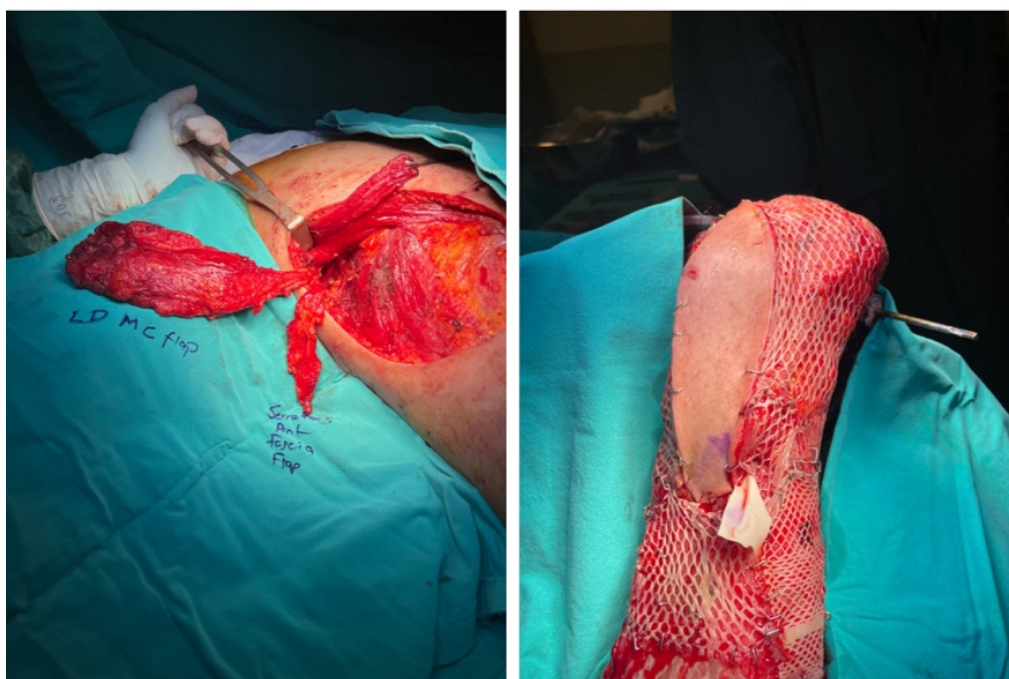


FIGURE 6. Wound Repair and Patient Rehabilitation

After the patient's wound sites were repaired, the patient was referred to a physiotherapy center. After effective rehabilitation, the patient began walking with the aid of a walker.

In addition, ophthalmologic evaluation and follow-up of patients are required.³

The burn eschar in flame burns and the heat-induced swelling of muscles caused by current passing through the bone in electrical burns play constricting roles on the fascia, leading to compartment syndrome. Signs such as pain during passive extension, disproportionate pain on examination, paresthesia, and pulselessness should raise suspicion of compartment syndrome. A compartment

pressure measurement exceeding 30 mm Hg is associated with compartment syndrome.²

The early diagnosis and management of compartment syndrome are critical. Fasciotomy, when performed early, significantly reduces the need for amputation.¹ However, performing fasciotomies also increases the number of subsequent surgical interventions by exposing viable tissues. Free flaps are commonly used in reconstructive procedures and are particularly suitable for the repair of large and

complex defects.^{4,5} However, severe soft tissue injuries caused by electrical and chemical burns can complicate the identification of recipient vessels, making reconstruction more challenging. Therefore, imaging methods such as Doppler ultrasonography and angiographic tomography are essential for identifying potential recipient vessels.

In both lower extremities of our patient, wounds with exposed vital structures were reconstructed by using free latissimus dorsi skin and muscle flap. Antiplatelet and anticoagulant therapies were administered perioperatively and postoperatively. These therapies are considered an effective strategy to reduce the risk of thrombosis in burn areas with observed hypercoagulability.⁶ After skin grafting and flap reconstruction in burn patients, complications such as flap and graft losses may occur from factors such as patient positioning, vascularization of the wound bed, and burn-induced vasculopathies in recipient vessels.

In our patient, no flap loss was observed. However, additional operations were required for minor revisions due to re-grafting and wound dehiscence. Physiotherapy interventions are also an essential component of burn management. A multidisciplinary approach from the early stages of treatment is crucial to preventing unnecessary delays in initiation of rehabilitation interventions. Ensuring that the patient receives appropriate physical therapy in both the early and long-term phases contributes to better rehabilitation outcomes.⁷

CONCLUSIONS

This case report highlighted a rare combination of electrical and chemical burns. Our case emphasizes the importance of early fasciotomy, controlled debridement, a multidisciplinary approach, and appropriate use of reconstructive steps in the management of complex and extensive lower extremity wounds without the need for amputation.

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