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Progressive Necrosis and Fatal Outcome after High-Voltage Electrical Injury: A Case Report

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Abstract | **Case Report**

Background: High-voltage electrical injury can produce occult muscle and vascular damage disproportionate to the cutaneous burn, with delayed tissue loss and life-threatening systemic complications. ***Case presentation:*** An adult patient sustained an occupational high-voltage electrical injury involving the trunk and both upper extremities. Severe rhabdomyolysis and clinical concern for compartment syndrome prompted emergency bilateral upper-limb fasciotomies. Exploration revealed edematous muscle compartments with areas of nonviable muscle. Despite intensive care and repeated surgery, ascending ischemic necrosis necessitated upper-limb amputation the following day and shoulder disarticulation approximately one week later. The course was further complicated by documented systemic infection and massive stress-ulcer-related upper gastrointestinal hemorrhage with hemorrhagic shock. The patient died after refractory cardiorespiratory arrest. ***Discussion:*** This case illustrates that timely decompression cannot reverse established myonecrosis or diffuse vascular injury. Published associations between early fasciotomy and subsequent amputation largely reflect injury severity and must not be interpreted as evidence that fasciotomy causes limb loss. ***Conclusion:*** Serial multidisciplinary assessment of muscle viability and systemic deterioration is essential; amputation decisions must be individualized rather than based on a fixed timeline.

Keywords: high-voltage electrical injury; rhabdomyolysis; fasciotomy; progressive necrosis; amputation; case report.

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INTRODUCTION

High-voltage electrical burns constitute a distinct clinical entity from conventional thermal burns because of their specific mechanisms of injury, which result in deep, extensive, and progressive tissue damage associated with particularly high morbidity and mortality. Although their overall incidence remains low, these injuries are a major cause of limb loss and multiorgan failure, particularly following occupational accidents.

The pathophysiology of high-voltage electrical burns involves several interrelated mechanisms. Passage of electrical current through tissues dissipates energy as heat in proportion to tissue resistance, accounting for the predominance of muscular, vascular, and neural injury. This initial insult causes deep myonecrosis, often underestimated on clinical examination, together with diffuse endothelial injury, microvascular thrombosis, and progressive impairment of tissue perfusion. Massive interstitial edema further increases intracompartmental pressure and predisposes to delayed compartment syndrome.

Furthermore, extensive muscle destruction causes severe rhabdomyolysis, resulting in major metabolic disturbances and systemic toxicity that may lead to acute kidney injury, an exaggerated systemic inflammatory response, and multiorgan failure. Thus, the course of electrical burns is not confined to the initial local injury but represents a dynamic process characterized by secondary necrotic progression that may occur despite early, aggressive management.

In this setting, early fasciotomy is traditionally advocated to prevent or treat compartment syndrome and restore perfusion to potentially viable tissues. However, several reports suggest that this procedure may be more an indirect marker of the severity of electrical injury than a guarantee of limb salvage. When myonecrosis and vascular injury are irreversible from the outset, surgical decompression cannot halt the ischemic cascade or ascending necrotic progression.

The choice between limb salvage and early amputation therefore remains controversial in severe electrical burns. Prolonged conservative management may expose patients to increased systemic morbidity,

whereas early amputation, although highly disabling, might in selected circumstances reduce the inflammatory burden and life-threatening complications. Through this case of an occupational high-voltage electrical burn complicated by severe rhabdomyolysis and a fatal outcome despite intensive medical and surgical management, we critically examine the limitations of limb salvage and the importance of early assessment of irreversible tissue injury.

Case Presentation

An adult patient with no significant medical history was admitted to the Department of Plastic and Reconstructive Surgery at Mohammed VI University Hospital following an occupational high-voltage electrical injury. Admission occurred a few hours after the electrical accident.

Initial examination revealed extensive deep electrical burns involving the trunk and both upper limbs, with predominant bilateral upper-extremity involvement. The cutaneous lesions were heterogeneous and accompanied by marked swelling and a flexed posture of the upper limbs, raising concern for impending compartment syndrome. Initial laboratory investigations demonstrated severe rhabdomyolysis, indicating deep muscle injury with systemic consequences.

Given the clinical and laboratory evidence of acute muscle compromise, emergency bilateral upper-extremity fasciotomies were performed immediately upon admission. Intraoperative exploration revealed edematous muscle compartments with areas of nonviable muscle, suggesting deep injury extending beyond compression alone.

Despite intensive multidisciplinary medical and surgical management, including critical care, close monitoring, and repeated surgical procedures, the patient developed progressive ascending ischemic necrosis. Secondary upper-limb amputation was indicated the following day because of rapid lesion progression and the absence of clinical improvement.

Nevertheless, the local course remained unfavorable, with continued necrotic progression despite amputation, necessitating shoulder disarticulation approximately one week later in the setting of persistent rhabdomyolysis and progressive deterioration of the patient's general condition.

The systemic course was complicated by a documented systemic infection and massive gastrointestinal bleeding leading to hemorrhagic shock. Esophagogastroduodenoscopy identified a bleeding stress ulcer. Despite maximal resuscitative measures, the patient died in the intensive care unit following cardiac arrest refractory to resuscitation.



Figure 1: Initial presentation Extensive deep electrical burns of the trunk and both upper limbs at admission, with heterogeneous skin lesions suggestive of deep muscle injury



Figure 2: Early fasciotomy Emergency decompression incisions exposing edematous and partially nonviable muscle compartments



Figure 3: Secondary amputation Upper-limb amputation specimen demonstrating extensive, irreversible ischemic necrosis



Figure 4: Shoulder disarticulation Shoulder disarticulation performed following failure of limb salvage and ascending necrotic progression

DISCUSSION

High-voltage electrical burns are characterized by the depth and progressive nature of tissue injury, reflecting specific pathophysiological mechanisms dominated by myonecrosis, microvascular damage, and progressive secondary ischemia. The frequent discrepancy between apparently limited cutaneous lesions and severe muscular and vascular destruction explains the occurrence of delayed complications, sometimes despite early management consistent with current recommendations.

In our case, the unfavorable course, characterized by ascending necrotic progression despite immediate fasciotomy, should not be interpreted simply as failure of the therapeutic strategy, but rather as the consequence of irreversible tissue injury probably established within the first hours after electrocution. Published evidence indicates that electrical current causes diffuse endothelial injury and progressive microvascular thrombosis, leading to sustained impairment of tissue perfusion. This secondary ischemic process, often clinically silent initially, is a major determinant of necrotic progression regardless of decompressive treatment.

The indication for fasciotomy should be based on suspected or established compartment syndrome and the clinical assessment of threatened tissue perfusion, not on voltage exposure alone. In a National Burn Repository analysis of 1,469 adults with electrical injuries, Pannucci *et al.,* found amputation during the initial admission in 49.0% of patients who underwent early fasciotomy versus 4.6% of those who did not [6]. These figures describe nonrandomized groups with different baseline injury severity; they cannot establish a harmful effect of decompression. Serial clinical examination, laboratory trends and, where feasible, direct reassessment of muscle viability remain crucial after the initial operation.

Interpretation of the observational literature is limited by confounding by indication: patients selected for urgent fasciotomy commonly have more severe deep-tissue injury at baseline. The evolving zone of injury may include direct muscle destruction, vascular endothelial injury, microvascular thrombosis and secondary

ischemia. Thus, decompression may relieve elevated compartment pressure while failing to restore viability to muscle already irreversibly injured. A published case report and review likewise emphasizes selective early fasciotomy in the setting of compartment syndrome rather than assuming that decompression alone ensures limb salvage [10].

The timing of amputation requires a careful balance between preservation of potentially viable tissue and control of an extensive necrotic burden. Early primary amputation may be appropriate for a demonstrably nonviable limb, but available case reports and retrospective studies do not establish that earlier amputation independently improves survival. Decisions should integrate repeated operative findings, perfusion and muscle viability, metabolic deterioration, infection and the overall physiologic condition of the patient. A recent high-voltage injury case report describes progressive deep-tissue necrosis and amputation despite aggressive multidisciplinary management, supporting the need for ongoing reassessment rather than reliance on a single early examination [11].

In this patient, muscle nonviability was already evident at the initial bilateral fasciotomies. Rapid ascending necrosis led to amputation on the following day, followed by shoulder disarticulation approximately one week later. The persistence of tissue destruction despite successive operations is consistent with severe deep injury; however, the available clinical record does not establish the relative contributions of primary electrical injury, secondary vascular compromise or infection. The fatal course was additionally complicated by systemic infection and endoscopically documented stress-ulcer bleeding with hemorrhagic shock. It is therefore not possible to attribute death to any single complication or to conclude that a different amputation date would have prevented it.

The principal lesson is not that fasciotomy should be avoided or that early amputation is universally preferable. Rather, high-voltage electrical injury requires repeated, multidisciplinary reassessment of threatened limbs and systemic complications. Importante limitation of this report are the absence in the available manuscript of the exact exposure voltage, total body surface area, serial creatine kinase and renal-function measurements, perfusion studies, microbiological details, operative viability criteria and a complete day-by-day timeline. These missing data limit causal interpretation and should be retrieved from the medical record, if available, before submission.

Conclusion

High-voltage occupational electrical injury can produce progressive deep-muscle and vascular damage that is not reliably predicted by initial cutaneous findings. This case documents severe rhabdomyolysis, repeated limb-loss procedures and fatal systemic complications despite prompt surgical intervention.

Fasciotomy is indicated when compartment syndrome is suspected or established, but it cannot reverse irreversible myonecrosis. The need for amputation should be determined by serial assessments of tissue viability and systemic status, rather than a predetermined timetable.

The clinical priority is early multidisciplinary management, repeated evaluation of the evolving injury and timely source control when tissue is clearly nonviable. A single case cannot establish that earlier amputation would have changed the outcome.

References

1. Arnoldo BD, Klein MB, Gibran NS. Practice guidelines for the management of electrical injuries. J Burn Care Res. 2006;27(4):439–447.
2. Mann R, Gibran N, Engrav L, Heimbach D. Is immediate decompression of high-voltage electrical injuries to the upper extremity always necessary? J Trauma. 1996;40(4):584–589.
3. Handschin AE, Jung FJ, Guggenheim M, *et al.,* Surgical treatment of high-voltage electrical injuries. Burns. 2007;33(7):827–834.
4. Hsueh YY, Chen CL, Pan SC. Analysis of factors influencing limb amputation in high-voltage electrically injured patients. Burns. 2011;37(4):673–679.
5. Shih JG, Shahrokhi S, Jeschke MG. Review of adult electrical burn injury outcomes worldwide. J Burn Care Res. 2017;38(1):e293–e298.
6. Pannucci CJ, Osborne NH, Jaber RM, Cederna PS, Wahl WL. Early fasciotomy in electrically injured patients as a marker for injury severity and deep venous thrombosis risk: an analysis of the National Burn Repository. J Burn Care Res. 2010;31(6):882–887. doi:10.1097/BCR.0b013e3181f93597.
7. Arnoldo BD, Purdue GF, Kowalske K, *et al.,* Electrical injuries: a 20-year review. J Burn Care Res. 2004;25(6):479–484.
8. Palmieri TL, Greenhalgh DG. Stress-related mucosal bleeding in burn patients. Burns. 2002;28(7):635–640.
9. Chandraprakasam T, Kumar RA. Acute compartment
10. Case report of a high voltage electrical injury and review of the indications for early fasciotomy in limb salvage of an electrically injured limb. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC5627555/ (bibliographic metadata to be verified before submission).
11. High-voltage electrical injury resulting in visceral ischemia and loss of abdominal wall musculature: A case report. Burns Open. 2026;15:100465. doi:10.1016/j.burnso.2026.100465.