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Sai Surya Dinesh Pydi
Junior Resident, Department of Orthopaedics, Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh, India

Deepak Kumar
Department of Orthopaedic Surgery, Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh, India

Utkarsh Kumar Reddy Gopavaram
Department of Orthopaedic Surgery, Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh, India

Kartik Sharma
Department of Orthopaedic Surgery, Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh, India

Ajay Jose
Department of Orthopaedic Surgery, Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh, India

Corresponding Author:
Sai Surya Dinesh Pydi
Junior Resident, Department of Orthopaedics, Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh, India

Isolated Scapular Fracture Following High-Voltage Electrical Injury Without External Trauma: A Case Report

Sai Surya Dinesh Pydi, Deepak Kumar, Utkarsh Kumar Reddy Gopavaram, Kartik Sharma and Ajay Jose

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Abstract
Introduction: Electrical injuries commonly present to emergency departments with burns, arrhythmias, or neurological complications, while skeletal injury due to tetanic muscle contraction is often overlooked.
Case Presentation: A 43-year-old electrician presented 30 minutes after accidental contact with an 11 kV live wire. He was conscious, haemodynamically stable, and had no burns. Persistent shoulder pain and restricted motion prompted imaging, which revealed a displaced scapular-body fracture involving the lateral border. Early surgical fixation was performed within eight hours using a single-incision, minimally invasive Brodsky approach. Reduction was aided by shoulder abduction and external rotation, allowing fragment manipulation and fixation with two pre-contoured 3.5 mm locking plates. The patient recovered uneventfully and achieved full, pain-free motion with a Constant–Murley score of 95 at one year.
Conclusion: High-voltage electrocution can produce isolated scapular fractures through violent muscle contractions even without external burns or impact. Early recognition, imaging, and multidisciplinary management ensure complete recovery and prevent long-term disability.

Keywords: Electrical injury, Scapular fracture, Emergency department, Muscle contraction, Minimally invasive fixation

Introduction
Electrical injuries form a unique subset of trauma. Initial evaluation often focuses on burns, cardiac rhythm abnormalities, and neurological sequelae, while musculoskeletal injury may remain under-recognised [1, 2]. High-voltage current can induce simultaneous contraction of large agonist–antagonist muscle groups, generating forces capable of fracturing bone without external trauma [3].
Among skeletal injuries, scapular fractures caused solely by internal muscle forces are extremely rare and easily missed. Early identification is vital to prevent functional loss [4]. Recent studies support minimally invasive fixation for displaced scapular fractures, reducing soft-tissue disruption and improving recovery [5]. This case describes an isolated scapular fracture due to electrical tetany, promptly recognised in the emergency department and treated with early minimally invasive fixation.

Case Presentation
A 43-year-old electrician sustained an 11 kV electric shock while working. He experienced severe right-shoulder pain and inability to elevate the arm, without fall or loss of consciousness.
Emergency Evaluation: Thirty minutes post-injury, the patient presented alert (GCS 15/15), haemodynamically stable (BP 130/80 mmHg, HR 84/min, SpO_2 98%), and without burns. ECG showed normal sinus rhythm. Laboratory tests including troponin-T, CK-MB, CK, and renal parameters were normal. Local examination revealed tenderness and swelling over the right scapula with restricted motion; neurovascular function was intact.
Imaging: Radiographs demonstrated a comminuted scapular-body fracture. CT with 3-D

reconstruction confirmed displacement along the lateral border (Figure 1).

Surgical Management: Given > 1 cm displacement and the patient's occupational demand, fixation was indicated. Under general anaesthesia in lateral decubitus, a single posterior incision was made along the lateral border following the minimally invasive Brodsky approach [6]. The infraspinatus–teres minor interval was gently developed, preserving the circumflex-scapular vessels. Reduction was aided by shoulder abduction (relaxing deltoid) and external rotation (relaxing teres minor). The fragments were manipulated using bone-holding forceps and fixed with two 3.5 mm pre-contoured locking plates placed along the lateral border and scapular spine, ensuring stable fixation with minimal soft-tissue disruption.

Outcome: The arm was immobilised for two weeks. Passive exercises began on day 3, active-assisted motion by week 3, and strengthening by week 6. At one year, radiographs confirmed union (Figure 2), and the patient had full, pain-free motion and a Constant–Murley score of 95 (Figure 3).

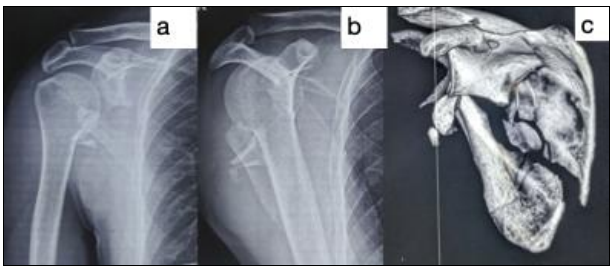

Fig 1: Plain radiograph showing displaced scapular-body fracture; 3-D CT confirms lateral-border displacement.

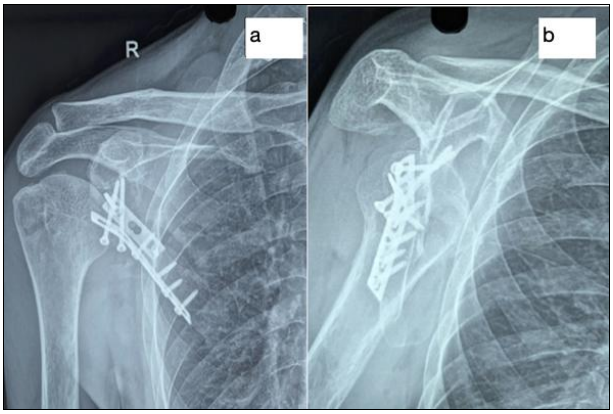

Fig 2: One-year postoperative radiograph showing complete union.

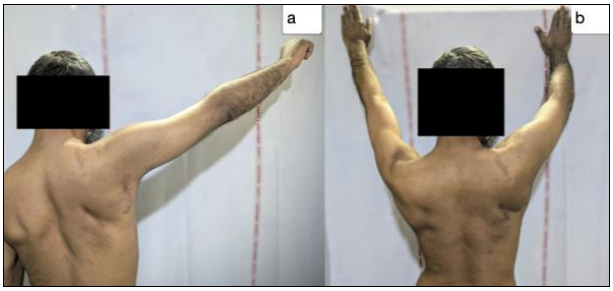

Fig 3: Clinical photographs at one year demonstrating full, pain-free shoulder motion.

Table 1: Review of Literature of Scapular Fractures Associated With Electrical Injury

S No.	Authors (with Ref. No.)	Year	Title	Journal	Type of Study	Management	Key Findings
1.	Pydi SSD, Kumar D, Gopavaram UKR, Sharma K, Jose A [present case]	2025	Isolated Scapular Fracture Following High-Voltage Electrical Injury Without External Trauma	Journal of Orthopaedic Case Reports (Intended Submission)	Case Report	Early minimally invasive Brodsky approach fixation with dual 3.5 mm plates	High-voltage shock causing displaced scapular-body fracture without burns; early fixation achieved excellent functional recovery
2.	Beswick DR, Morse SD, Barnes AU [7]	1982	Bilateral scapular fractures from low-voltage electrical injury	Ann Emerg Med	Case Report	Conservative management with analgesia and sling	Bilateral scapular fractures due to tetanic contraction from low-voltage shock
3.	Rana M, Banerjee R [8]	2006	Scapular fracture after electric shock	Ann R Coll Surg Engl	Case Report	Non-operative treatment	Absence of burns does not exclude fracture; imaging essential
4.	Chen H, Zhang T, Li X, *et al*. [10]	2024	Single-sided scapular fracture resulting from electric shock: a case report	Medicine (Baltimore)	Case Report	Conservative immobilisation	Unilateral fracture from muscle contraction; early CT recommended
5.	Modi BN, Machin JT, Tudor F, Peckham T [9]	2012	Scapular fracture following electronic muscle stimulation	J Surg Case Rep	Case Report	Non-operative management	Muscle stimulation alone can cause scapular fracture
6.	Cole PA, Freeman G, Dubin JR [4]	2013	Scapula fractures	Curr Rev Musculoskelet Med	Review Article	Discusses conservative and surgical options	Explains muscle-force mechanism relevant to electrical injury

Discussion

Electrical injuries can cause skeletal trauma through violent co-contraction of multiple large muscle groups, rather than external impact [3, 7]. In the shoulder girdle, synchronous contraction of opposing force couples serratus anterior versus rhomboids and trapezius, and subscapularis versus infraspinatus and teres minor generates intense torsional and shear stress on the scapular body and lateral border [4]. These internal forces may exceed bone strength and result in fracture even without external trauma or burns.

Most reported cases in the literature [4, 8-10] describe conservative management due to minimal displacement. In contrast, our patient presented with a significantly displaced fracture but no external injury or systemic complications (Table 1). Early (< 8 hours) fixation using the minimally invasive Brodsky modification achieved anatomical reduction with minimal morbidity and excellent functional recovery. Compared with extensile approaches, this method provides sufficient exposure while preserving vascularity and muscle integrity [5, 6].

From an emergency perspective, persistent focal pain following electrocution warrants prompt imaging regardless of the presence or absence of burns. Early orthopaedic collaboration enables definitive management, shortens hospital stay, and improves outcomes.

Conclusion

High-voltage electrical injuries can cause deep musculoskeletal damage solely through muscle contraction. Persistent pain after electrocution should prompt early imaging to rule out skeletal injury. Early diagnosis and minimally invasive fixation of displaced scapular fractures facilitate rapid rehabilitation and complete recovery while minimising morbidity.

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