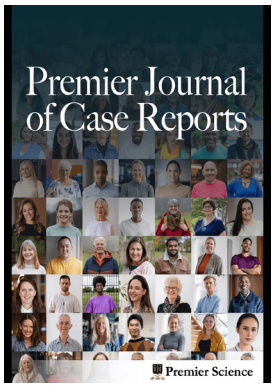

A Case Report of EDC to Middle Finger Rupture Following Electric Shock, An Unusual Mechanism

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Additional material is published online only. To view please visit the journal online.

Cite this as: Sagar HG, Koshy K, Bethapudi S and Chalmers R. A Case Report of EDC to Middle Finger Rupture Following Electric Shock, An Unusual Mechanism. Premier Journal of Case Reports 2025;1:100001

DOI: https://doi.org/10.70389/PJCR.100001

Received: 1 December 2024
Revised: 24 January 2025
Accepted: 25 January 2025
Published: 4 February 2025

Ethical approval: N/a
Consent: N/a
Funding: No industry funding
Conflicts of interest: N/a
Author contribution: Harry G. Sagar, Kiron Koshy, Sarath Bethapudi and Richard Chalmers – Conceptualization, Writing – original draft, review and editing
Guarantor: Harry G. Sagar
Provenance and peer-review: Unsolicited and externally peer-reviewed
Data availability statement: N/a

ABSTRACT

INTRODUCTION

We report a case of a 36-year-old man who sustained a complete rupture of his extensor digitorum communis tendon to his right middle finger from an electrical injury. This is a common injury that is usually caused by trauma or overuse.

PRESENTATION

He attended a delayed presentation. He had an ultrasound to confirm the diagnosis and then underwent primary repair. He is currently following our standard rehabilitation program for a repaired extensor tendon injury of the hand.

DISCUSSION

This is the first report of an extensor tendon rupture to a finger following an electrical injury. We note that other tendon injuries, such as Achilles tendon rupture, have been reported previously.

CONCLUSION

This case underscores the importance of considering a tendon rupture in a patient presenting following an electrical injury. It highlights the need for a swift diagnosis and repair, underscoring the crucial role of medical professionals in such cases.

Keywords: Extensor digitorum communis rupture, Electric shock injury, Tendon repair, Extensor tendon injury, Involuntary contraction

Introduction

Injuries to the extensor tendons of the fingers are a common presentation to plastic trauma clinics, more common than flexor tendon injuries.[1] They are usually caused by trauma or overuse, with injuries to extensor zone five most commonly occurring from a fight bite.[2] We present a very unusual case whereby the mechanism of injury is an electric shock. This case report has been prepared in accordance with the SCARE 2023 criteria,[3] as depicted in Appendix 1.

Case Presentation

A 36-year-old Caucasian male presented to our plastic surgery trauma clinic complaining of pain and swelling to the dorsum of his right hand and an inability to fully extend his right middle finger at the metacarpophalangeal joint (MCPJ). He is normally fit, has no medical issues, and takes no medications. He is a non-smoker and works as an electrician. He reported no significant family history.

He reported that his symptoms had started 11 days prior when he received an electric shock while plugging his car into a public fast charger. He suffered an involuntary convulsion and struck his hand with the charger. He arrived at the local emergency department (ED) immediately after the incident, with primary concerns of swelling and pain in his right hand. It was recorded that he had no open wounds at this time, but there was a small, healing wound at the base of his right middle finger on the dorsal aspect from a previous innocuous injury. He underwent an X-ray of his hand, which showed no fractures, and was discharged with advice to rest and apply ice to the hand.

On examination in the plastic surgery trauma clinic, he had a palpable, firm lump to the dorsum of his right hand over the neck of the middle finger metacarpal, which was tender to palpate. His middle finger had an extensor lag of ~30 degrees at the MCPJ, but there was no obstruction to passive extension. He had a mildly reduced range of flexion globally in the right hand with a normal cascade. The wound described in the ED notes was approximately 5 mm long with a transverse axis across the finger's dorsum and it was healing well. He described occasional pains spreading up into his forearm. He had no other injuries to his hands (Figure 1).

Investigations

Given the unusual presentation, an outpatient ultrasound was booked to clarify whether he had ruptured his Extensor Digitorum Communis (EDC) to his middle finger. This showed a complete rupture of EDC to the middle at zone 5 (Figure 2).

Differentials

Differentials included potential damage to the posterior interosseous nerve from the electrical injury. However, this would cause extensor lag to all the fingers, not just one.

Another differential was damage to the lumbrical of this finger, resulting in an intrinsic minus deformity. This was ruled out during surgical exploration.

Management

Surgery was performed for weeks post-injury at a regional plastic surgery centre by a consultant plastic surgeon sub-specializing in hand surgery. Intraoperatively, it was confirmed that the EDC to the right middle finger was 100% divided, and the two tendon ends had undergone minimal excursion following minimal debridement of the scar tissue; a primary repair was performed. This consisted of 5-0 Nylon epitendinous and 4-0 Prolene core suture using the 4-strand Adelaide technique. Postoperatively, he was placed into a volar-blocking splint to rest the finger and returned one week post-op to have this changed to a thermoplastic splint. He was advised to start active mobilization per our local hand therapy guidelines. He was then followed up monthly, in the face-to-face clinic,

Fig 1 | X-ray-Flexion deformity of middle finger, with loss of extension

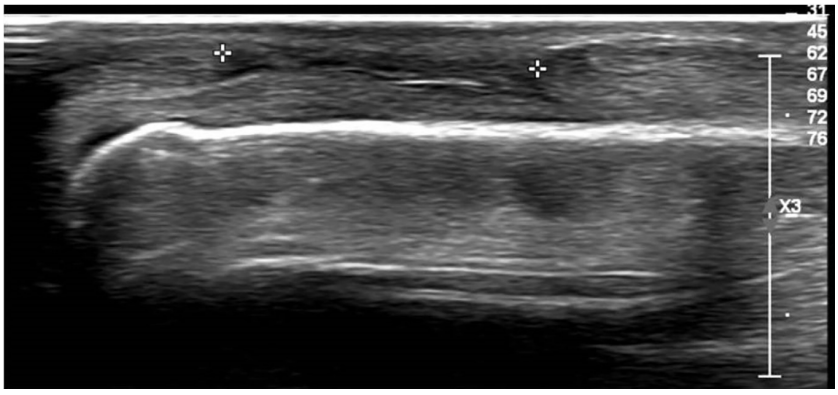

Fig 2 | Ultrasound image - long axis sonogram image of middle finger demonstrating full-thickness extensor tendon rupture of the right middle finger following electrocution. Extensor zone injury with maximal separation of torn tendon fibers by up to approximately 1.5 cm during passive flexion of the finger

Fig 3 | Intra-operative photograph showing the cut tendon ends

by the hand therapy team for 3 months before being discharged with patient-initiated follow-up. No wound healing issues or other complications were reported. By the point of discharge, he had a full active range of movement in his fingers (Figure 3).

Discussion

While electric shock injuries are reasonably common, with 10,000 cases presenting to ED annually,[4] musculoskeletal injuries following electric shock are rare. The most common injury described is a posterior fracture dislocation of the shoulder.[5] Achilles tendon rupture secondary to electrocution has also been described.[6,7] However, we believe that the first occurrence of a rupture of an extensor tendon of a finger was due to an electrical injury.

Electricity can result in several types of injury depending upon the resistance of the tissues involved; these can be thermal, mechanical due to trauma or tetany, and interference with currents within the body, for example, in the heart. The extent of injury from an electrical shock depends upon the voltage and current of the source, the resistance of the tissues, the type of current (AC [alternating current] vs DC [direct current]), contact time, and the electrical flow.[8] Voltage can be classified as High, typically (>1000 V), or low (<1000 V). High-voltage injuries usually cause extensive thermal damage to the skin and soft tissue as they take the shortest route through the body. At the same time, lower voltages tend to preferentially travel through lower resistance tissues such as nerves or muscles, where they cause involuntary contraction.[9]

In this case, given that the source of electricity was an automotive fast charger, which typically ranges from 400–)500 V, we believe the electric current passed up the arm and caused forceful voluntary contraction of the extensor compartment of the forearm, with the middle finger held in a position unable to fully extend, resulting in the EDC to middle finger rupture. It seems improbable that a pre-existing injury predisposed the tendon to rupture. The patient reports that the wound to the finger was a scratch sustained at work with no associated pain or weakness/limitation in his movements.

The delayed presentation and delay in getting an ultrasound diagnosis pushed the patient outside the ideal 2-week window to perform primary tendon repair.[2] As such, we had discussed with the patient pre-operatively the possibility of reconstructing the tendon using either a tendon graft taken from Palmaris Longus or a tendon transfer from Extensor Indices. There was adequate tendon length for performing a primary repair upon surgical exploration. The tendon was thick enough at this level to manage a four-strand core repair, and the Adelaide technique was chosen.

A penetrating mechanism generally causes traumatic extensor tendon injuries. However, this case highlights that electrical injuries can also cause rupture of tendons; therefore, if clinical examination points towards tendon injury, this should be investigated and treated as such. Ultrasound can be a useful, non-invasive diagnostic tool where the history or examination is atypical, as in this case. We believe this is relevant for readers in emergency medicine, hand surgery, and radiology.

Acknowledgements

The patient gives their consent for the use of their images in this case report.

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Appendix

Appendix 1 | Copy of the SCARE checklist followed with page location of each point

SCARE Checklist			
Topic	**Item**	**Checklist Item Description**	**Page Number**
Title	1	The words "case report" and the area of focus should appear in the title (e.g. presentation, diagnosis, surgical technique or device or outcome).	1
Key Words	2	3–6 key words that identify areas covered in this case report (include "case report" as one of the keywords).	1
Abstract	3a	Introduction—What is unique or educational about the case? What does it add to the surgical literature? Why is this important?	1
	3b	The patient's main concerns and important clinical findings.	
	3c	The main diagnoses, therapeutics interventions, and outcomes.	
	3d	Conclusion—what are the "take-away" lessons from this case?	
Introduction	4	A summary of why this case is unique or educational concerning the relevant surgical literature and current standard of care (with references, 1–2 paragraphs). What is the nature of the institution where the patient was managed: academic, community, or private practice?	1
Patient Information	5a	De-identified demographic and other patient-specific information, including age, sex, ethnicity, occupation, and other useful, pertinent information, e.g., BMI and hand dominance.	1
	5b	The presentation includes presenting the complaints and symptoms of the patient as well as the mode of presentation, e.g., brought in by ambulance, walked into the Emergency room, or referred by a family physician.	
	5c	Past medical and surgical history and relevant outcomes from interventions	
	5d	Drug history, family history including any relevant genetic information, and psychosocial history including smoking status and where relevant accommodation type, walking aids, etc.	
Clinical Findings	6	Describe the relevant physical examination and other significant clinical findings (include clinical photographs where relevant and where consent has been given).	1
Timeline	7	Data should be included to allow readers to establish the sequence and order of events in the patient's history and presentation (using a table or figure if this helps). Delays from presentation to intervention should be reported.	1
Diagnostic Assessment	8a	Diagnostic methods (physical exam, laboratory testing, radiological imaging, histopathology etc.).	1
	8b	Diagnostic challenges (access, financial, cultural).	
	8c	Diagnostic reasoning, including other diagnoses considered	
	8d	Prognostic characteristics when applicable (e.g., tumor staging). Include relevant radiological or histopathological images in this section (the latter may sometimes be better placed in section 9).	
Therapeutic Intervention	9a	Pre-intervention considerations, e.g., Patient optimization: measures taken before surgery or other intervention, e.g., treating hypothermia/hypovolaemia/hypotension in a burn patient, ICU care for sepsis, dealing with anticoagulation/other medications, etc	1
	9b	Types of intervention(s) deployed and reasoning behind treatment offered (pharmacologic, surgical, physiotherapy, psychological, preventive) and concurrent treatments (antibiotics, analgesia, anti-emetics, nil by mouth, VTE prophylaxis, etc.). Medical devices should have a manufacturer and model specifically mentioned	
	9c	Peri-intervention considerations - administration of intervention (what, where, when, and how was it done, including for surgery; anesthesia, patient position, use of a tourniquet and other relevant equipment, prep used, sutures, devices; surgical stage (1 or 2 stages, etc.). Pharmacological therapies should include formulation, dosage, strength, route, duration, etc.).	
	9d	Who performed the procedure operator experience (position on the learning curve for the technique if established, specialization, and prior relevant training).	
	9e	Any changes in the interventions with rationale. Include intra-operative photographs and/or video or relevant histopathology in this section. The degree of novelty for a surgical technique/device should be mentioned, e.g., "first-in-human."	
	9f	Post-intervention considerations, e.g., post-operative instructions and place of care.	
Follow-up and Outcomes	10a	Clinician-assessed and patient-reported outcomes (when appropriate) should be stated with the inclusion of the periods assessed. Relevant photographs/radiological images should be provided, e.g., a 12-month follow-up.	1–2
	10b	Important follow-up measures - diagnostic and other test results. Future surveillance requirements - e.g., imaging surveillance of endovascular aneurysm repair (EVAR) or clinical exam/ultrasound of regional lymph nodes for skin cancer.	
	10c	Where relevant - intervention adherence and tolerability (how was this assessed).	
	10d	Complications and adverse or unanticipated events. It is described in detail and ideally categorized by the Clavien-Dindo Classification. How they were prevented, diagnosed, and managed. Blood loss, operative time, wound complications, re-exploration/revision surgery, 30-day post-op, and long-term morbidity/mortality may need to be specified.	
Discussion	11a	Strengths, weaknesses, and limitations in your approach to this case. For new techniques or implants-contraindications and alternatives, potential risks, and possible complications if applied to a larger population. If relevant, has the case been reported to the relevant national agency or pharmaceutical company (e.g., an adverse reaction to a device)?	2
	11b	Discuss the relevant literature, implications for clinical practice guidelines, and any relevant hypothesis generation.	
	11c	The rationale for your conclusions.	
	11d	The primary "take-away" lessons from this case report.	
Patient Perspective	12	When appropriate, the patient should share their perspective on their treatments.	N/A
Informed Consent	13	Did the patient give informed consent for publication? Please provide if requested by the journal/editor. If not given by the patient, explain why, e.g., death of patient and consent provided by next of kin or if the patient/family is untraceable, then document efforts to trace them and who within the hospital is acting as a guarantor of the case report.	2
Additional Information	14	Conflicts of Interest, sources of funding, institutional review board, or ethical committee approval where required.	1

DOI: https://doi.org/10.70389/PJCR.100001 | Premier Journal of Case Reports 2025;1:100001