

## Management of Extensive Forearm Injury – A Case Report

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### ABSTRACT

Upper limb injuries are a common occurrence in countries like India. Here, we report the case of a 52-year-old gentleman with severe flexor tendons and neurovascular injury which was managed on an emergency basis. Clinical examination revealed multiple flexor tendons and ulnar nerve and artery injuries. Intraoperatively, the tendons were repaired with the flexor carpi radialis requiring tendon transfer. Ulnar artery cut ends were anastomosed and the ulnar nerve was repaired. The patient was taught some passive exercises and given physiotherapy. On follow-up, the patient showed satisfactory recovery, highlighting the importance of early exploration and repair.

**Key words:** Early repair, Forearm flexor injury, Ulnar artery injury, Ulnar nerve injury

Hand wounds represent 10–15% of admissions in the emergency departments [1]. Complex lesions require urgent treatment after a good clinical and radiological examination. The objective of this assessment is to adopt correct guidelines for preventing functional and esthetic sequelae. Surgical repair of transected neurovascular structures and sectioned flexor tendons has been improved in the past 40 years, thanks to a better knowledge of anatomy, physiology, the development of new suture techniques, and a specific rehabilitation program. However, even despite such advanced surgical techniques and appropriate rehabilitation programs, flexor tendon injuries may be associated with adhesion formation and loss of hand function [2,3]. Results of flexor tendon cut after repair depend on many factors such as concomitant nerve injury, technique and type of repair, surgeon's experience, nature of the lesion, and post-operative rehabilitation [4]. Here, we report the case of a 52-year-old gentleman with severe flexor tendons and neurovascular injury which was managed on an emergency basis.

### CASE REPORT

A 52-year-old gentleman was referred from a district hospital as a case of the right forearm flexor injury following a glass cut injury while repairing windows. The patient reached within 6 h of injury after receiving first aid at the district hospital. The patient gave a history of profuse bleeding. There was no history of any other


associated injuries. The patient had no known comorbidities, allergies, or addictions.

The general survey was normal. Examination of the right upper limb revealed two lacerations on the ulnar aspect of the flexor surface, approximately 5 cm and 12 cm proximal to the wrist joint skin crease which had been stitched by the district hospital (Fig. 1). The patient could not flex the ring and little fingers at the metacarpophalangeal and interphalangeal joints, suggesting possible injuries to the flexor digitorum profundus (FDP) and the flexor digitorum superficialis (FDS). The patient was unable to abduct or adduct the fingers. Adduction of the thumb was also lost. Furthermore, the patient was unable to flex the wrist, suggesting injuries to either flexor carpi ulnaris (FCU) or flexor carpi radialis (FCR) or both. There was a loss of sensation on the volar aspect of the little finger, ulnar aspect of the ring finger, and the hypothenar eminence, suggesting ulnar nerve injury. No pulsations of the ulnar artery could be appreciated, while the radial pulse could be felt.

The patient underwent routine biochemical and COVID investigations. Hemoglobin was 9.5 gm% with normal total and differential leukocyte counts. Platelets were 250,000/mm<sup>3</sup>. Random blood glucose level was 136 mg/dl. Renal and liver function tests were normal. Serum electrolytes were normal. HIV and hepatitis B and C were done through rapid spot test and were negative. A chest X-ray was essentially normal. No imaging studies were thought to be required and hence were not done. The patient was put up for emergency surgical exploration under the brachial block, on suspicion of major neurovascular and muscular injuries.

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Intraoperatively, the clinical findings were confirmed. The ulnar nerve and artery were completely transected. The median nerve was intact. The FCU was found to be transected completely at the musculotendinous junction. The FDS was partially lacerated with a hematoma formation. The ring and little finger tendons of the FDS were completely transected. The tendon of the FCR was also transected with a loss of more than 2 cm of the tendon. A thorough lavage with normal saline was given and any hematomas that were found were evacuated. The first repair undertaken was that of the FDP tendons with a Kessler 6 strand core suture with Prolene 4-0 and peripheral running suture using Prolene 6-0 (Fig. 2). Only running peripheral sutures, with Prolene 5-0, to the FDS were given as it was only partially lacerated. The ulnar nerve was then repaired after freshening the cut ends. Primary epineurial nerve repair was done with 7-0 Prolene interrupted sutures under loupe guidance. The anastomosis was tension free.

The focus was then given to the ulnar artery. The proximal end was blocked by a thrombus, but pulsations were present. After a little exploration and dissection, the distal end of the artery was discerned. After flushing both ends with heparin, anastomosis was carried out using interrupted 7-0 Prolene sutures under loupe guidance, and vessel continuity was checked. The FCU was repaired using Bunnell's technique of musculotendinous repair to increase the strength. This was also done using Prolene 4-0 sutures. Repair of the FCR was a dilemma as the defect was quite large, approximately 4 cm. We had to then harvest a tendon graft from the palmaris longus tendon of the left upper limb under local anesthesia (Fig. 3). This was used to bridge the defect between the proximal and distal ends of the FCR using the Pulvertaft weave (Fig. 4). After a final thorough lavage and checking for hemostasis, the skin wounds were closed with loose Ethilon 3-0 sutures. Drains were not required. The limb was placed in a cast with wrist and fingers flexed at an angle of 45°.

The patient was advised limb elevation and passive flexion of fingers in the post-operative period. He was also given physiotherapy. The patient was discharged on the 3<sup>rd</sup> post-operative day with proper antibiotic coverage. The patient was reviewed after 1 week. He showed satisfactory recovery of the flexor muscle function and partial recovery of sensations on the ulnar aspect of the hand. This is presumed to progress with time. Allen's test showed satisfactory blood flow in the ulnar artery.

## DISCUSSION

The wounds of the hand constitute a real surgical emergency. They are commonly seen in the young working class related to work injuries and domestic accidents. The dexterity and complexity of this organ make any surgical repair more difficult and sequelae are often obvious. All vascular, nervous, tendinous, and osseous structures can be injured depending on the wounding strength and agent [5]. Most wounds of flexor tendons are located near the injured area. Obtaining the best outcomes need primary surgical repair in an emergency with the restoration of length, strength, and gliding excursion of tendon followed by post-operative rehabilitation.

The palmar area is divided into five zones (V) that extend from the proximal border of the transverse carpal ligament to the musculotendinous junction in the proximal part of the forearm. Repair of tendon laceration in this area is made easy by a modified dual Kessler. Modified Kessler technique reinforced with continuous running sutures provides enough strength at flexor tendon repair site to permit early gentle passive and active motion of the fingers [4]. The use of absorbable sutures limits foreign



Figure 1: Appearance of injury on examination

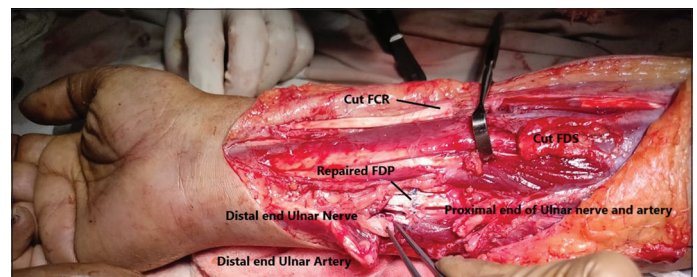


Figure 2: Intraoperative picture of various injuries

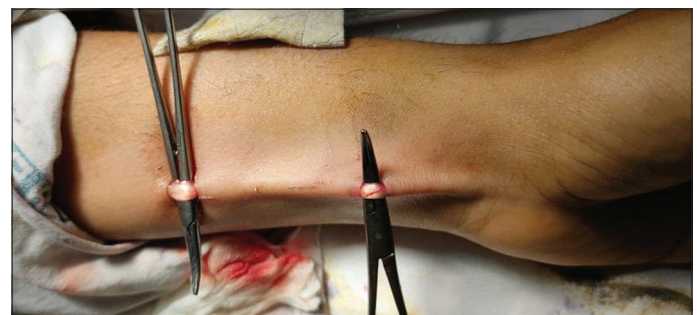


Figure 3: Harvesting palmaris longus tendon

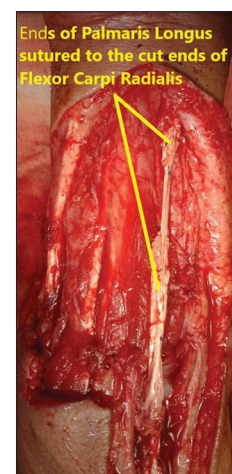


Figure 4: Repair of flexor carpi radialis

body implantation such as excessive fibrosis and granuloma, but maintaining adequate tensile strength is unpredictable due to their absorption into the body [6].

Injury of one of the major arteries (radial and ulnar) of the forearm occasionally may lead to ischemia of the hand or fingers. In cases of ischemia, immediate repair should be performed to avoid necrosis. However, in most cases, the hand and fingers have no signs of ischemia. [7]. A prospective study of prognostic factors for median and ulnar nerve injuries in the forearm was conducted by Hundepool *et al.* found that the injury of the arteries had a negative prognosis for motor recovery [8]. Moreover, Gelberman *et al.* found that patients with combined arterial and nerve injuries had the most significant symptoms of cold intolerance and pain [9]. One of the problems of these lesions regards the timing of repairing all of the involved structures. As nerves and tendons can be repaired electively, arteries should be managed as an emergency, either by suture or ligation [7].

Every peripheral nerve injury in which there is complete nerve damage that will require axonal regeneration and reinnervation is a form of chronic nerve injury. This is because the rate of regeneration in humans is approximately 1 mm/day, and the distance to target end organs from the area of nerve injury is quite lengthy. This renders the distal nerve zone as well as the muscle end organ or the sensory receptor to be chronically denervated [10]. A large body of animal literature, as well as circumstantial patient literature with regard to timing of nerve repair and outcomes, underscores the fact that outcomes are greatly improved when nerve repair is undertaken earlier [11]. There has been a gradual and appropriate shift in the timing of nerve exploration and possible reconstruction, with an emphasis on intervening earlier, particularly in patients with clinically complete and severe peripheral nerve injuries. The dogma of waiting for many months or up to 6–8 months is no longer tenable [10].

## CONCLUSION

Early repair of neurovascular and muscular injuries leads to better functional outcomes no matter how severe the injury may be.

This case stands as an example that there can be no substitute for decisive action, good surgical technique, and good post-operative care. Thus, neurovascular and musculotendinous injuries require a holistic approach including the surgeon, anesthetist, nurses, physiotherapists, and other paramedical staff.

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