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**Case Report**

# Traumatic injury of the ulnar artery and ulnar nerve: clinical case report

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## ABSTRACT

Traumatic injuries to upper extremities cause vascular and nerve injuries, which is why they constitute a cause for attention in the emergency service of medical units. These injuries can cause sequelae that can affect people's quality of life and their daily activities if they are not managed appropriately, so it is necessary to have knowledge of the anatomy to provide individualized therapeutic management. Therefore, we present the case of a female patient who suffers a traumatic injury to the forearm, which causes ulnar arterial and nerve injury. Exposing the management provided in our institution and its results.

**Keywords:** Arterial and ulnar injury, Neurorrhaphy, Vascular anastomosis

## INTRODUCTION

Penetrating trauma to the upper extremity usually causes vascular injuries, which in most cases also affect nerves and tendons. About 40% of all peripheral vascular injuries occur in the upper extremities and 67% result from penetrating trauma. Injury to the brachial artery accounts for about 40% to 55% of all upper extremity injuries, the axillary artery accounts for 6% to 23%, and the radial and ulnar arteries accounts for 4% to 36%.[1] Peripheral nerve injury secondary to trauma has a prevalence of 1.3-2.8%. Being more frequent in the male gender with 68% compared to the female gender, which is 32%. Overall, the average age was 27 years (±18.5).[2] Among the etiologies, 30% of peripheral nerve injuries derive from lacerations caused by sharp objects and long bone fractures. 73.5% of nerve injuries are located in the upper extremities, being the ulnar nerve.[3-4]

### *Anatomical review*

The extrinsic flexor muscles are located on the anterior surface of the forearm and are arranged in three layers. The superficial layer comprises four muscles: pronator teres, flexor carpi radialis, flexor carpi ulnar, and palmaris longus. The palmaris longus muscle may be absent in up to 10% to 12% of individuals. These muscles originate from the medial humeral epicondyle on the proximal forearm and function to flex the wrist and pronate the forearm.[5] The middle layer is formed by the flexor digitorum superficialis, which allows independent flexion of the finger joints. In the deep layer there are three muscles: the flexor pollicis brevis, which flexes the proximal interphalangeal joint to the thumb; the extrinsic flexor pollicis longus, which flexes the proximal interphalangeal joints of the fingers; and a distal

quadrangular muscle that extends between the radius and ulnar.[5]

The irrigation of the upper limb comes from the brachial artery, which bifurcates at the elbow into the radial and ulnar arteries. The ulnar artery bifurcates into an anterior and a posterior branch. Perfusion of the hand is established from the superficial and deep palmar arches, which receive contributions from the radial and ulnar arteries.[6] The ulnar artery is a major source of blood flow to the upper extremity and is usually the dominant arterial supply to the hand.[7] Sharp injuries cause complete transection of the ends of the vessels. Cut injuries can usually be repaired after carefully trimming the ends of the split vessel. Most upper limb vascular injuries are treated by primary correction by performing autologous artery interposition and suturing the forearm vessels with 8-0 nylon.[7] The ulnar nerve originates in the axilla as a continuation of the median cord in the brachial plexus, and originally arises from the C8 and T1 nerve roots in the spinal cord.

Distally, the ulnar nerve runs up the arm in the medial neurovascular bundle, through the posterior compartment of the upper arm, posterior to the brachial artery. At the elbow joint, the ulnar nerve passes through the condylar groove of the cubital tunnel on the medial and posterior aspects of the medial condyle. Within the forearm, the ulnar nerve travels posteriorly to the flexor carpi ulnar is muscle, which it also innervates. 8 when it reaches the wrist, it produces the dorsal cutaneous branch, which provides sensation to the ulnar dorsal aspect of the wrist. The ulnar nerve enters Guyon's canal once it reaches the hand. Distal to Guyon's canal, the ulnar nerve branches into a superficial sensory branch and the deep motor branch. The first provides sensation to the fourth and fifth fingers, while the second innervates the hypothenar muscles of the hand, the interosseous muscles, as well as the third and fourth lumbrical muscles.[8]

Ulnar nerve injuries have a detrimental impact on the patient's daily activities and professional life. Many patients with serious injuries are forced to change professions, while some must deal with permanent disabilities.[8-9] Therefore, it is important to carry out adequate treatment of nerve injuries, a correct diagnosis must be made, which is why to carry out an approach in a prompt and timely manner.[10] For the initial approach, plain radiographs are used to identify fracture sites, bone calluses, or tumors as the cause of the compression.[11] Ultrasound allows direct visualization of the affected nerve with evaluation of the exact site, extent, and type of injury. Providing unmatched information on the anatomical details of the nerve. Showing the pathological segment of the nerve with loss of normal honeycomb structure, decreased echogenicity, discontinuity, focal enlargement, or neuroma formation.[11] MRI increases soft tissue detail and helps characterize the injury. Denervated muscles begin to appear hyperintense on T2-weighted images 48 h after nerve injury. However, it cannot clearly differentiate between nerve rupture and contusion injuries.[11] By performing the appropriate classification of the lesion, it leads to a surgical approach in a timely manner at the time of surgery.[10] Early neurorrhaphy as a surgical management of acute nerve injuries provides the best result.[9]

Three techniques are described for direct nerve repair: epineural repair, perineural repair, and group fascicular repair.[2] Before beginning, we must identify the structures that make up the peripheral nerve. The connective tissue is individualized in the form of three sheaths that organize the internal structure of the nerve trunk. Epineurium: tissue that surrounds the nerve, which forms a sheath that separates it from the other structures and this extensive structure contains blood vessels. This structure is resistant and allows solid anchorage of the suture threads.[12-13] Perineural: dense multilamellar and very resistant sheath.[12] Endoneurium: connective tissue that supports the fascicles and forms a delicate sheath in them.[12] Epineural neurorrhaphy: It is the technique of choice.[12] There are four main steps to a primary end-to-end repair, the most widely used nerve repair technique. Preparation: The nerve ends are prepared so that they are visible and necrotic tissue is removed with blades, leaving two normal-looking ends.[12-13] Approach: the nerve endings are mobilized and brought together, leaving a minimum space by applying the appropriate tension. Any nerve repair will be to achieve a tension-free repair, since this gives rise to fibrosis that acts as an obstacle to the passage of the axons and therefore lacks recovery.[14] Alignment: Blood vessels must be aligned and in proper rotational alignment.[14] Maintenance: The nerve repair is maintained by sutures in the epineurium, commonly 9-0 or 10-0 nonabsorbable sutures.[14-16] Among the factors that influence nerve regeneration: anatomical and cellular factors, neuronal survival, neurotrophism and neurotropism, basal lamina, membrane receptor, genetic expressivity, integrity of end organs, CNS factors.10 Age is the most important factor. vital in determining the outcome of nerve repair and may account for 50% of the variation in success.[14] Nerve repairs should be protected by immobilization for 10 to 14 days. Since the regeneration rate time is an average of 1 mm/day, up to six weeks is necessary, depending on the severity and cause of the nerve injury. After this period, passive and active movements for rehabilitation begin.[14]

## CASE REPORT

A 7-year-old female patient with no chronic degenerative diseases. When she was playing with her brothers, she suffered a cutting injury at the level of flexor zone V with a window. She subsequently went to the HRVGF emergency room on 7 February 2023, evaluated by the plastic surgery service and underwent surgery that same day, finding the following surgical findings: complete section of the ulnar artery, ulnar nerve and superficial flexor of the 4th and 5th fingers and flexor. ulnar carpus. Tenorrhaphy was performed in Kessler points with 3-0 nylon and epitendinous points with 5-0 nylon.

**Figure 1: Injury to the ulnar nerve.**

**Figure 2: Repair of the ulnar nerve.**

**Figure 3: Repaired injury.**

Ulnar artery anastomosis with 8-0 prolene, neurorrhaphy with 8-0, dorsal rest splint is placed. Being discharged on February 8, 2023 with no data of vascular compromise, with an appointment for follow-up in the outpatient clinic on February 14, 2023 where she is found with the presence of a protective splint at the dorsal level with adequate coloring and capillary filling at the level of the affected hand. Subsequently, she was reassessed one month later, finding a surgical wound already healed with adequate filling and coloring, with the presence of positive Tinel at the level of the ulnar tract. Limited mobility ranges secondary to splint, so rehabilitation is sent to complete post-surgical protocol.

## DISCUSSION

Penetrating trauma to the upper extremity usually causes vascular, nerve and tendon injuries. About 40% of all peripheral vascular injuries occur in the upper extremities and 67% result from penetrating trauma. Ulnar artery injury affects 4%-36%.[1] The ulnar artery is usually the dominant arterial supply to the hand. Therefore, the repair of the lesions must be carried out immediately by performing autologous artery interposition and suturing with 8-0 nylon.[7] Peripheral nerve injury secondary to trauma has a prevalence of 1.3-2.8%.2 73.5% of nerve injuries are located in the upper extremities, with the ulnar nerve being the most frequently affected.[3-4]

The treatment of choice is early epineural neurorrhaphy 12 as it provides the best results. However, it is not the only determining factor in the recovery of peripheral nerve function. Some of the factors that can be associated are the level of injury, type of injury and age of the patient .9 After surgery, nerve repairs should be protected by immobilization for 10 to 14 days. After this period, passive and active movements for rehabilitation begin.[14] Ulnar nerve injuries have a detrimental impact on the patient's daily activities and professional life. Many patients with serious injuries are forced to change careers, while some have to deal with permanent disabilities.[8-9]

## CONCLUSION

Penetrating wounds usually cause vascular injuries that in most cases not only affect the irrigation, but also the nerves and tendons. These injuries cause serious consequences that force them to change professions, causing a decrease in purchasing power, while some must deal with permanent disabilities, so early and timely repair reduces the risk of consequences and the prompt integration of the patient into their family. daily life.

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