

# Unorthodox Ulnar Nerve Arborization at the Distal Metadiaphyseal Humerus: An Insight into the Neuroanatomical Oddity and its Surgical Implication

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## Abstract

**Introduction:** Anatomical variations of the ulnar nerve, particularly involving its course and branching pattern near the distal humerus, are exceedingly rare. Such anomalies may pose significant risks during surgical procedures around the elbow due to their potential for entrapment, mechanical stretch, or iatrogenic injury.

**Case Report:** We report a case involving a 59-year-old male with a distal humerus fracture, managed surgically through a posterior paratricipital approach. Pre-operatively, there was no neurological deficit. Intraoperatively, a rare anatomical variant of the ulnar nerve was observed: It exhibited two bifurcations approximately 40 mm and 20 mm proximal to the medial epicondyle. Notably, both aberrant branches pierced the medial intermuscular septum to enter the anterior compartment. In addition, the main trunk of the ulnar nerve was tethered by a dense fascial band extending between the medial intermuscular septum and the medial epicondyle. The fracture was stabilized using bicolumnar plating.

**Results:** Despite meticulous dissection, the patient developed a post-operative ulnar nerve deficit, likely due to traction or compression injury to the aberrant branches. This unusual branching pattern increased the risk of intraoperative nerve compromise.

**Conclusion:** This case underscores the importance of considering rare ulnar nerve anatomical variations during surgical planning for distal humerus fractures. Pre-operative vigilance and careful intraoperative dissection are essential to prevent nerve injury.

**Keywords:** Ulnar nerve, distal humerus fractures, peripheral nerves, nerve compression.

## Introduction

The ulnar nerve, a terminal branch of the medial cord of the brachial plexus, typically descends within the posterior compartment of the arm, traversing the medial intermuscular septum to course behind the medial epicondyle. It then passes through the cubital tunnel before entering the forearm. Although variations in ulnar nerve communication with other nerves (e.g., Martin-Gruber or Riche-Cannieu anastomoses) are well documented [1,2], anomalous branching or course deviations in the arm are exceedingly rare.

Entrapment neuropathy at the elbow – especially within the cubital tunnel – is the second most common compressive neuropathy of the upper limb [3]. Awareness of rare anatomical variations is critical, particularly for orthopedic and neurovascular surgeons, as these may alter clinical presentations or complicate surgical procedures involving the distal humerus [4].

## Case Report

A 59-year-old male presented with a closed distal humerus fracture of the left arm (Fig. 1) without pre-operative neurovascular deficit. He underwent an open reduction and internal fixation through posterior paratricipital approach. Intraoperatively, the ulnar nerve displayed an unusual anatomy. At

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Figure 1

**Figure 1:** Pre-operative anteroposterior (on left) and lateral (on right) radiographs of the left elbow demonstrating a comminuted intra-articular distal humerus fracture. The fracture involves both columns with disruption of the articular surface, indicative of a complex injury pattern requiring surgical fixation.



Figure 2

**Figure 2:** Intraoperative image taken during a posterior paratricipital approach to the distal humerus, demonstrating the main trunk of the ulnar nerve and an aberrant branch (indicated by black arrows) bifurcating proximally and coursing anteriorly through the medial intermuscular septum. This rare anatomical variant highlights the need for meticulous dissection to avoid iatrogenic nerve injury.

approximately 40 mm proximal to the medial epicondyle, the nerve bifurcated, with one branch piercing the medial intermuscular septum and entering the anterior compartment (Fig. 2). It was later confirmed on an ultrasound scan (Fig. 3). A second bifurcation occurred around 20 mm proximal to the epicondyle, with this branch also traversing the septum. Proximally, the main trunk of the ulnar nerve was tethered to a fibrous fascial band extending between the medial intermuscular septum and medial epicondyle.

Attempts were made to identify, preserve, and mobilize the aberrant branches. The fracture was stabilized by bicolumnar plates (Fig. 4). The patient had a diminished sensation in the ipsilateral little finger and medial half of ring finger and developed ulnar clawing post-operatively which gradually recovered in the next 3 weeks.

### Discussion

This case demonstrates an unreported variant of the ulnar nerve featuring double bifurcation and anterior migration proximal to the medial epicondyle, accompanied by fascial tethering. Such a configuration not only predisposes the nerve to entrapment but also poses a significant risk of iatrogenic injury during posterior

surgical approaches to the elbow as seen in our case.

Biomechanical studies, such as those by Wright et al., show that elbow flexion can increase intraneural pressure by over 29%, especially when the nerve's excursion is limited [5]. In our case, the fascial tether likely restricted mobility and added strain, potentially mimicking or precipitating cubital tunnel syndrome. The arcade of Struthers is a known fibrous structure that may compress the ulnar nerve; however, the fibrous band encountered in this case was anatomically distinct. Karatas et al. reported a similar septo-epicondylar fascial band, but without associated nerve branching anomalies [6]. Chow et al. also noted an aberrant branch arising approximately 40 mm proximal to the elbow, from the radial aspect of the ulnar nerve and passing anterior to the medial epicondyle but without penetrating the fascia of the flexor muscles origin [7]. Ferre-Martinez et al studied possible points of ulnar nerve entrapment in the arm and forearm [8]. As per their research, the Osborne's fascia at the elbow, the Arcuate ligament of Osborne and the intermuscular aponeurosis between the flexor carpi ulnaris and the flexor digitorum superficialis were identified as the potential sites of compression. In addition, a fourth head of triceps brachii muscle was also found to compress ulnar nerve in some

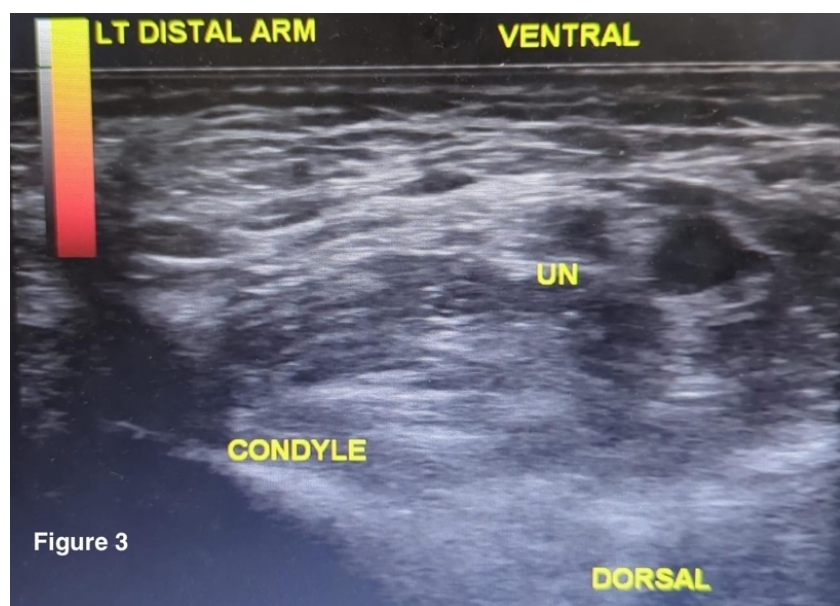


Figure 3

**Figure 3:** High-resolution axial ultrasound scan of the left distal arm demonstrating the ulnar nerve positioned atypically in the ventral aspect of the arm, approximately 4 cm proximal to the medial epicondyle. This aberrant location suggests an unusual anterior course of the ulnar nerve, which has important implications for surgical approaches to the distal humerus.

variation that carries high surgical relevance as failure to recognize such a variant intraoperatively could lead to iatrogenic injury, especially during distal humerus fixation, cubital tunnel release, or anterior transposition procedures [11,12].

### Conclusion

This case highlights a rare but clinically significant anatomical variation of the ulnar nerve at the distal humerus. Surgeons must be cognizant of such aberrations, especially during exposure and handling of the nerve in elbow surgeries. Further cadaveric and imaging studies are warranted to assess the prevalence and clinical implications of this variant anatomy.

### Clinical Relevance

Fractures in the distal humerus usually require surgery. Due to close association with peripheral nerves, these are prone to having

specimens. The fibrous fascial band encountered in our case was different from the structures mentioned in their study. To our knowledge, there are no prior documented instances of this precise double variation as found in our case.

### Comparison with existing literature

Reported anatomical variations of the ulnar nerve include:

- Prefixed or post-fixed brachial plexus formations involving C7 or T2
- Anterior transposition across the medial epicondyle
- Communications with other nerves, such as:

1. Martin-Gruber anastomosis: median to ulnar connection [8-11]
2. Marinacci anastomosis: Reverse of the above [9,10]
3. Riche-Cannieu and Berrettini anastomoses: Sensory/motor communications in the hand [10,11].

While such connections affect nerve function, none of these relate directly to pre-cubital bifurcation with anterior compartment entry. Our case represents a previously undescribed neuroanatomical



Figure 4

**Figure 4:** Post-operative anteroposterior (on left) and lateral (on right) radiographs of the elbow joint demonstrating bicolumnar plating of the distal humerus. The fixation construct shows anatomically contoured plates.

neurodeficits. Pre-operative imaging and careful intraoperative dissection are of paramount importance in preventing

iatrogenic nerve damage and post-operative neurological complications.

**Declaration of patient consent:** The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the Journal. The patient understands that his name and initials will not be published, and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

**Conflict of Interest:** NIL; **Source of Support:** NIL

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