

## **Additional Muscle Slip of Flexor Carpi Ulnaris Associated with Anomalous Ulnar Nerve and Ulnar Artery in the Distal Forearm**

**Fascículo Adicional del Músculo Flexor Ulnar del Carpo Asociado con una Variación del Nervio Ulnar y Arteria Ulnar en la Parte Distal del Antebrazo**

**Venkata Ramana Vollala; Seetharama Bhat; Vincent Rodrigues; Deepthinath Prasad & Narendra Pamidi**

---

**RAMANA, V. V.; BHAT, S.; RODRIGUES, V.; PRASAD, D. & PAMIDI, N.** Additional muscle slip of flexor carpi ulnaris associated with anomalous ulnar nerve and ulnar artery in the distal forearm. *Int. J. Morphol.*, 26(2):373-376, 2008.

**SUMMARY:** During routine dissection classes to under graduate medical students, we observed an anomalous flexor carpi ulnaris muscle associated with abnormal ulnar nerve and ulnar artery in the distal part of forearm. There was an additional belly arising from the lower part of the flexor carpi ulnaris muscle and crossed ulnar nerve and vessels, median nerve and ended in a broad aponeurosis which crossed the tendons of flexor digitorum superficialis and merged with the deep fascia and flexor retinaculum. The ulnar nerve and ulnar artery divided into their terminal branches in the lower part of the forearm. However, the distribution of the terminal branches of both ulnar nerve and artery were normal. An understanding of these unusual findings may be clinically relevant in describing the anterior compartment of the forearm.

**KEYWORDS:** Flexor carpi ulnaris; Ulnar nerve; Ulnar artery.

---

### **INTRODUCTION**

Flexor carpi ulnaris muscle is the most medial muscle of the superficial forearm flexors. It arises by two heads, humeral and ulnar, connected by a tendinous arch. The small humeral head arises from the medial epicondyle via the common tendon. The ulnar head has an extensive origin from the medial margin of the olecranon process and proximal two-thirds of the posterior border of the ulna, an aponeurosis (which it shares with the extensor carpi ulnaris and flexor digitorum profundus), and from the intermuscular septum between it and flexor digitorum superficialis. A thick tendon forms along its anterolateral border in its distal half. The tendon is attached to the pisiform, and thence prolonged to the hamate and fifth metacarpal bone by pisohamate and pisometacarpal ligaments. Acting with the flexor carpi radialis, it flexes the wrist and acting with the extensor carpi ulnaris it adducts the wrist (Standring 2005).

Flexor carpi ulnaris muscle is innervated by the ulnar nerve (C7, C8 and T1). The line between the medial humeral epicondyle and the pisiform, along the anterior palmar margin of the muscle, is used as a reference point for locating the ulnar neurovascular bundle. The ulnar artery reaches the

muscle in its middle third, whereas the ulnar nerve is covered by the muscle throughout its entire course running under the tendon in the wrist region.

The ulnar artery, the larger of the two terminal branches of the brachial, begins a little below the bend of the elbow, and, passing obliquely downward, reaches the ulnar side of the forearm at a point about midway between the elbow and the wrist. It then runs along the ulnar border to the wrist, crosses the transverse carpal ligament on the radial side of the pisiform bone, and immediately beyond this bone divides into two branches, which enter into the formation of the superficial and deep palmar arches.

The ulnar nerve, after descending in the forearm between the flexor digitorum profundus and flexor carpi ulnaris muscles, pierces the deep fascia and enters the wrist through the Guyon's canal. In the distal canal, the ulnar nerve bifurcates into a superficial sensory branch and a deep motor branch, which supplies the hypothenar muscles and then passes across the palm, distributing to other intrinsic hand muscles.

## MATERIAL AND METHOD

The study involved the upper limb dissections of a 45 years old male cadaver of South Indian origin in the Department of Anatomy, Melaka Manipal Medical College, Manipal, India. The dissections of upper limbs were carried out according to the instructions by Cunningham's manual of practical anatomy (Romanes GJ 2003). Both upper extremities (right and left) of the body were dissected. The dissections took place during 2005–2006. The body was preserved by the injection of a formalin - based preservative (10% formalin) and stored at - 4°C.

## RESULTS

The present variations were found in the left upper extremity. However, the right upper extremity was normal. The specimen revealed an unusual anomalous flexor carpi ulnaris (FCU) muscle.

There was an additional muscle slip from the flexor carpi ulnaris in the lower part of anterior compartment of forearm. These muscle fibers separated from the lower part of the flexor carpi ulnaris and formed a small muscle belly, which crossed ulnar nerve and vessels, median nerve and ended in a broad aponeurosis which crossed the tendons of flexor digitorum superficialis and merged with the deep fascia and flexor retinaculum (Fig. 1).

In the same specimen we also observed ulnar nerve and artery dividing into their terminal branches in the lower part of the forearm (Fig. 2). The distribution of the terminal branches of both ulnar nerve and artery were normal.

The FCU muscle and ulnar nerve and ulnar artery were studied in detail and were photographed.

## DISCUSSION

Anatomical variations of the flexor carpi ulnaris that have been reported previously are (a) variations in musculo-tendinous junction of the flexor carpi ulnaris muscle (Grechenig *et al.*, 2000), (b) variant flexor carpi ulnaris causing ulnar nerve compression (Al-Qattan & Duerksen, 1992), (c) an additional slip of flexor carpi ulnaris (Bergman *et al.*, 1988) as in the present case.

The FCU acts as an anatomical guideline for finding

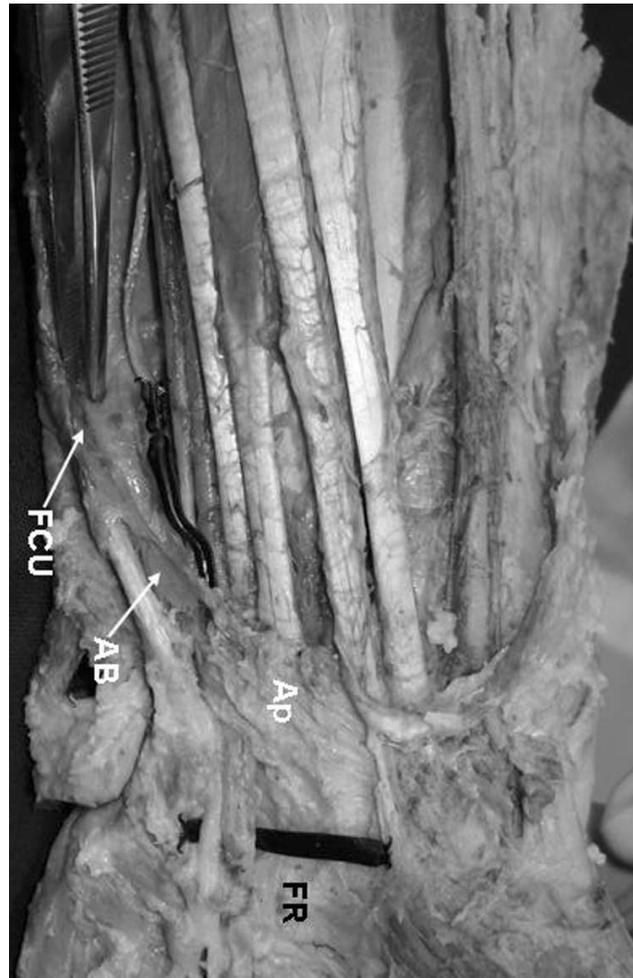


Fig. 1. Additional belly of flexor carpi ulnaris crossing ulnar nerve and vessels and forming an aponeurosis. FCU – flexor carpi ulnaris muscle, AB – additional belly, Ap – aponeurosis, FR – flexor retinaculum.

the neurovascular bundle (ulnar nerve, ulnar artery and accompanying venae comitantes), it can be easily palpated in its distal course if the wrist is flexed and adducted. The present variation need to be taken into account when interpreting ultrasound and MR images, as well as during dissection of the ulnar neurovascular bundle when using FCU as a guideline.

The flexor carpi ulnaris is a useful local muscle flap in the forearm and elbow. It is, however, an important palmar flexor and ulnar deviator of the wrist, and functional loss may arise from the use of this muscle in its entirety. The flexor carpi ulnaris is made up of two distinct neuromuscular compartments. This arrangement allows for splitting of the muscle and the potential use of the larger ulnar compartment as a local muscle flap while maintaining the humeral compartment as an ulnar deviator and palmar flexor of the wrist (Lingaraj *et al.*, 2007).

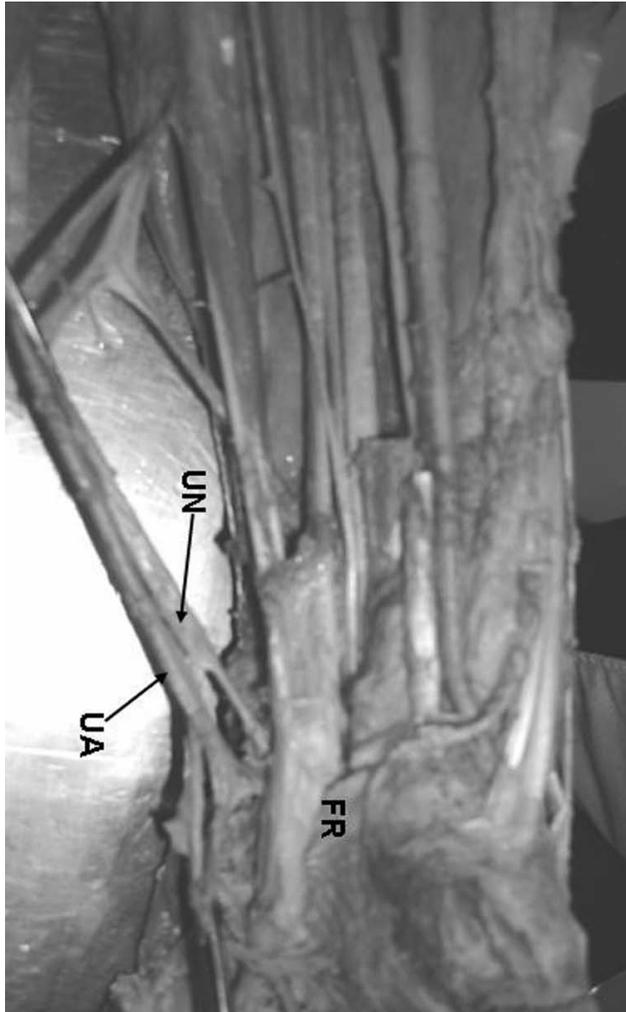


Fig. 2. Division of ulnar nerve and artery into their terminal branches in the lower part of the forearm. UN – ulnar nerve, UA – ulnar artery, FR – flexor retinaculum.

After multiple efforts to heal an infected nonunion of the proximal ulna, Meals (1989) has used a flexor carpi ulnaris muscle pedicle flap to improve blood supply and soft-tissue coverage at the nonunion site and observed promoted bone healing and restoration of useful elbow function.

Entrapment or compressive neuropathies are important and wide spread debilitating clinical problems. They are caused frequently as the nerve passes through a fibrous tunnel, or an opening in fibrous or muscular tissue. The most common is the median nerve entrapment in the wrist leading to carpal tunnel syndrome.

As in the present case, the crossing of accessory belly of the flexor carpi ulnaris muscle over the ulnar nerve and median nerve and compressing them might lead to numbness and tingling in the hand.

This variation may be clinically important because symptoms of median nerve compression arising from similar variations are often confused with more common causes, such as, radiculopathy and carpal tunnel syndrome.

The knowledge of course and distribution of ulnar nerve can assist the surgeon in the diagnosis and treatment of conditions associated with the ulnar aspect of the hand. Recognition and diagnosis of this problem will help ensure timely and effective management of the more common pain syndromes.

**RAMANA, V. V.; BHAT, S.; RODRIGUES, V.; PRASAD, D. & PAMIDI, N.** Fascículo adicional del músculo flexor ulnar del carpo asociado con variación del nervio ulnar y la arteria ulnar en la parte distal del antebrazo. *Int. J. Morphol.*, 26(2):373-376, 2008.

**RESUMEN:** Durante una disección de rutina en clases para estudiantes de Medicina, se observó una anomalía del músculo flexor ulnar del carpo asociado con una variación del nervio y arteria ulnar, en la parte distal del antebrazo. Un vientre adicional derivado de la parte inferior del músculo flexor ulnar del carpo cruzaba el nervio ulnar y vasos ulnares, nervio mediano y terminaba en una amplia aponeurosis la cual cruzaba los tendones del músculo flexor superficial de los dedos y se fusionaba con la fascia profunda y el retináculo flexor. El nervio ulnar y la arteria ulnar se dividían en sus ramas terminales, en la parte inferior del antebrazo. Sin embargo, la distribución de las ramas terminales tanto del nervio ulnar como de la arteria ulnar eran normales. La comprensión de estos inusuales hallazgos pueden ser clínicamente relevantes para describir el compartimiento anterior del antebrazo.

**PALABRAS CLAVE:** Músculo flexor ulnar del carpo; Nervio ulnar; Arteria ulnar.

## REFERENCES

- Al-Qattan, M. M. & Duerksen, F. A variant of flexor carpi ulnaris causing ulnar nerve compression. *J. Anat.*, 180:189-190, 1992.
- Bergman, R. A.; Thomson, S. A.; Afifi, A. K. & Saadesh, F. A. *Compendium of human anatomic variations*. Urban & Schwarzenberg, Baltimore – Munich, 13, 1988.
- Standring, S. *Gray's Anatomy*. 39<sup>th</sup> edn. Elsevier Churchill Livingstone, 2005. p 877.
- Grechenig, W.; Clement, H.; Egner, S.; Tesch, N. P.; Weiglein, A. & Peicha, G. Musculo-tendinous junction of the flexor carpi ulnaris muscle. An anatomical study. *Surg. Radiol. Anat.*, 22:255-60, 2000.

Lingaraj, K.; Lim, A. Y.; Puhaindran, M. E. & Kumar, P. V. The split flexor carpi ulnaris as a local muscle flap. *Clin Orthop. Relat. Res.*, 455:262-6, 2007.

Meals, R. A. The use of a flexor carpi ulnaris muscle flap in the treatment of an infected nonunion of the proximal ulna. A case report. *Clin. Orthop. Relat. Res.*, 240:168-72, 1989.

Romanes G. J. *Cunningham's Manual of Practical Anatomy*. 15<sup>th</sup> edn. Upper and lower limbs. Oxford University Press, 2003. V. 1. pp. 74-5.

Standring, S. *Gray's Anatomy*. 39<sup>th</sup> edn. Londres, Elsevier Churchill Livingstone, 2205. p. 877.

Correspondence to:

Venkata Ramana Vollala,  
Lecturer,  
Department of Anatomy,  
Melaka Manipal Medical College (Manipal Campus),  
International Centre for Health Sciences,  
Manipal-576104,  
Karnataka State,  
INDIA

Email: ramana.anat@gmail.com

Received: 18-06-2007

Accepted: 03-12-2007