Bilateral Agenesis of the Extensor Carpi Ulnaris Muscle of a 70 Year-Old White Male Donor

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Received Date: 02 February, 2022; Accepted Date: 07 February, 2022; Published Date: 11 February, 2022

Abstract

Agenesis of one of the superficial forearm extensor muscles is rare and therefore, equally rarely reported in the anatomical literature. During routine anatomical dissection of sixty-three human donors in the 2020-2021 first-year medical gross anatomy course and 2021 graduate nursing advanced anatomy course at the Uniformed Services University of the Health Sciences, we discovered bilateral agenesis of the extensor carpi ulnaris muscle in a 70 year-old White Male donor. Knowledge of agenesis of the extensor carpi ulnaris muscle is important for orthopedic surgeons, hand surgeons, as well as anatomical instructors. Awareness of the failure of this muscle to develop during embryonic growth is significant since the extensor carpi ulnaris muscle is widely used in tendon transfer surgeries in cases of ulnar or median nerve palsy for restoring function and balance to the wrist and hand. The extensor carpi ulnaris tendon is an important structure that contributes to the dynamic stability of the wrist therefore its absence may contribute to wrist instability with the lack of support to the distal radioulnar joint.

Keywords: Bilateral agenesis of the extensor carpi ulnaris muscle; Extensor carpi ulnaris muscle; Forearm muscle anatomical variations

Introduction

The Extensor Carpi Ulnaris (ECU) muscle generally originates from the lateral epicondyle of the humerus, from the dorsal border of the ulna and from the deep fascia of the humerus. It generally inserts onto the prominent tubercle at the medial aspect of the base of the fifth metacarpal bone [1]. The ECU muscle plays a key role not only in active wrist extension movements and ulnar deviation, but also in providing stability to the ulnar aspect of the wrist [2]. The ECU muscle provides a variable contribution to wrist flexion and extension dependent on forearm position [2].

Agenesis of the ECU muscle is rare (0.55%) and bilateral agenesis is extremely rare (Figures 1a and 1b) [3-5]. Other more common anatomical variations involving the ECU muscle include the duplication of the muscle belly, partial attachment of its tendon to the base of the third or fourth metacarpal bone, an additional tendon replacing an absent extensor digiti minimi, providing origin from its tendon to the abductor digiti minimi, sending a slip to be inserted into the septum in the posterior annular ligament, sending an anomalous tendon slip to the tendinous extensor aponeurosis of the fifth finger (ulnaris quinti), or sending a tendinous extension from the ECU tendon to the fascia of the hypothenar eminence [1,3,6-14]. Anatomical variations involving the ECU muscle can facilitate dislocation and tendinopathy of the ECU muscle. These variations can cause functional impairment of the wrist and fifth
hand digit or disruption of the distal radioulnar joint, causing wrist instability [9,15].


Hand and orthopedic surgeons should be knowledgeable of ECU muscle variations, particularly when dealing with tendon transfer in cases of ulnar or median nerve palsy, as well as treating dorsoulnar wrist and hand ailments [9-11,14,16,17].

Case Description

During routine anatomical dissection of sixty-three human cadaveric donors in the 2020-2021 first-year medical gross anatomy course and 2021 graduate nursing advanced anatomy course at the Uniformed Services University of the Health Sciences, we found bilateral agenesis of the extensor carpi ulnaris muscle in a 70 year-old White Male donor with a cause of death of pneumonia (Figures 2, 3a, and 3b).

Discussion

Forearm Extensor Compartment Anatomical Variations

Some of the reported forearm extensor muscle variations are the brachioradialis tendon dividing into two to three slips, accessory brachioradialis (brachioradialis brevis) muscle, abductor manus muscle, trigastro extensor carpi radialis longus, extensor carpi radialis intermedius, and the extensor carpi radialis accessorius muscle. There are also splitting radial carpal extensors into two to three slips, additional slip of the extensor digitorum to the thumb, double belly of the extensor digitii minimi muscle, an ulnar slip of the extensor digitii minimi muscle going to the fifth metacarpal bone, ulnaris digitii minimi muscle, extensive cleavage of the tendon and belly of abductor pollicis longus muscle, and doubling of the extensor pollicis longus muscle. In addition, there are an additional extensor between extensor indicis and extensor pollicis longus muscles, abductor pollicis tertius muscle, double tendons of extensor indicis muscle, extensor brevis manus muscle and the extensor digitii medi proprius muscle [14,18]. The presence of additional muscles and tendons is common among the extensors of the forearm and can be misleading for clinicians and surgeons. Knowledge of such anatomical variations is key when diagnosing dorsal hand masses and planning tendon transfers [9-11,14,16,17].

Anatomical variations associated with the ECU muscle include the duplication of the muscle belly, partial attachment of its tendon to the base of the third or fourth metacarpal bone, an additional tendon replacing an absent extensor digitii minimi, providing origin from its tendon to the abductor digitii minimi, sending a slip to be inserted into the septum in the posterior annular ligament, sending an anomalous tendon slip to the tendinous extensor aponeurosis of the fifth finger (ulnaris quinti), or sending a tendinous extension from the ECU tendon to the fascia of the hypothenar eminence [1,3,6-14]. Agenesis of the ECU muscle is
The ECU muscle tendon, along with its fibroosseous tendon, are important structures that contribute to the dynamic stability of the wrist therefore their absence may contribute to wrist instability with the lack of support to the distal radioulnar joint [15,28,29]. The ECU muscle is a major component of the Triangular Fibrocartilage Complex (TFCC) and provides ulnocarpal stability, radioulnar stability (DRUJ), and cushioning of the radiocarpal joint. The ECU, in particular its subsheath, provide a significant degree of support to the TFCC as a whole as it is a longitudinal structure that crosses the wrist joint and connects the ulna with the carpal bones. TFCC pathology comes in two forms, degenerative and traumatic. Traumatic TFCC tears often need to be stabilized through either repair to the ulna or to stabilizing soft tissue structures (i.e. the ECU muscle). Ulnar sided wrist pain is common and can often be attributed to TFCC pathology. As a result, agenesis of the ECU and its subsheath (a major component of the TFCC) should be an important consideration in treating ulnar sided wrist pain.

Knowledge of ECU muscle agenesis, as well as other ECU and forearm muscle anatomical variation is incredibly important for orthopedic and hand surgeons performing tendon transfers in cases of ulnar or median nerve palsy, as well as treating dorsoulnar wrist and hand ailments [5,9-11,14,16,17]. Other anatomical variations involving the ECU muscle can also facilitate dislocation and tendinopathy of the ECU muscle [9].

Conclusions

Agenesis of the ECU muscle is infrequently encountered and bilateral agenesis is extremely rare. Knowledge of ECU muscle agenesis, as well as other ECU and forearm muscle anatomical variations, is incredibly important for orthopedic and hand surgeons performing tendon transfers in cases of ulnar or median nerve palsy, as well as treating dorsoulnar wrist and hand ailments. Other anatomical variations involving the ECU muscle, including agenesis, can cause functional impairment of the wrist and fifth hand digit, disruption of, or lack of support to the distal radioulnar joint, causing wrist instability. In particular, the ECU muscle is a major component of the TFCC and provides ulnocarpal stability, DRUJ, and cushioning of the radiocarpal joint.

References


